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SUBJECT: Responds to NRC 980304 ltr re violations noted in insp rept 50-261/98-03.Corrective actions:developed & analyzed SI sys flow model to ensure SI NPSH requirements were adequately identified for 3 SI pumps.

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10 CFR 2.201

CP&L

Carolina Power & Light Company
Robinson Nuclear Plant
3581 West Entrance Road
Hartsville SC 29550

Robinson File No: 13510E
Serial: RNP-RA/98-0062

APR 03 1998

United States Nuclear Regulatory Commission
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H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261/LICENSE NO. DPR-23
NOTICE OF VIOLATION
NRC INSPECTION REPORT NO. 50-261/98-03, EA 98-043 and EA 98-050

Gentlemen:

The attachment to this letter provides the Carolina Power & Light (CP&L) Company response to Notice of Violation 56-201/98-03, EA 98-043 and EA 98-050, dated March 4, 1998, for the H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2.

Should you have any questions regarding this matter, please contact Mr. H. K. Chernoff.

Very truly yours,

John S Keenan

J. S. Keenan
Vice President

RTW/rw
Attachment

c:

Mr. L. A. Reyes, Regional Administrator, USNRC, Region II
Mr. J. W. Shea, USNRC Project Manager, HBRSEP
USNRC Senior Resident Inspector, HBRSEP

Ie01

REPLY TO A NOTICE OF VIOLATION

Violation 50-261/98-03 EA 98-043 and EA 98-050 Item A

10 CFR 50 Appendix B, Criterion III, in part, requires that "design control measures shall provide for verifying the adequacy of design such as by the performance of design review, by use of alternate or simplified calculational methods, or by performance of a suitable testing program." Design changes shall be subject to design control measures commensurate with those applied to the original design."

Technical Specification 3.3.1.1.c requires two safety injection (SI) pumps to be operable.

Section 3.4.3 of CP&L Corporate Quality Assurance Manual, Revisions 11 through 18, dated January 29, 1988 through September 29, 1995, states that 'sufficient design verification shall be performed by one or more methods to substantiate that final design documents meet the appropriate design inputs." It further states that a design verification should confirm that "the design is technically adequate with respect to the design basis."

Contrary to the above, between March 24, 1988, and June 27,1997, the licensee failed to verify the adequacy of design to substantiate that final design documents met the appropriate design inputs and were technically adequate for a design change affecting SI pumps B and C. Specifically, the licensee implemented Modification M-951, which disabled the automatic start feature for one of the three SI pumps but failed to verify that SI pumps B and C had sufficient NPSH in the event that a large break loss of coolant occurred and one of the two remaining SI pumps failed to operate due to a single failure. As a result, the SI system failed to meet the operability requirements of Technical Specification 3.3.1.1.c. the TS in effect in June 1997 when the violation was discovered.

This is a Severity Level III violation (Supplement I)

Reply

CP&L agrees that the violation occurred as described.

1. The Reason for the Violation

The reason for the violation was an incorrect design input assumption used for ensuring the net positive suction head (NPSH) requirements were satisfied for the Safety Injection (SI) pumps. A chronological discussion of events is provided.

The original SI design provided for three SI pumps to automatically start on an ECCS initiation. This design aligned the 'A' SI pump to the 'A' electrical train, the 'C' SI pump to the 'B' electrical train, and the 'B' SI pump was powered via an automatic bus transfer which would transfer to the 'A' or 'B' electrical train if power was lost to the electrical bus to which it was originally aligned. In January 1988, H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2, was shut down when it was identified that a single electrical failure could affect both

'A' and 'B' electrical trains via the automatic bus transfer. In March 1988 a plant modification deleted the automatic bus transfer of the 'B' SI pump. The 'B' SI pump became a "swing" pump allowing it to be used as the 'A' or 'B' train SI pump should either 'A' or 'C' SI pump be removed from service. The 'B' SI pump would then be manually aligned to the appropriate electrical train. Following this modification, only 2 SI pumps would auto-start upon receipt of an ECCS signal and as a result, a single failure could result in only one SI pump running during an ECCS actuation. Although the modification effort was primarily focused on electrical issues, a calculation was performed by the NSSS vendor, in April 1988, to ensure Large Break (LB) Loss of Coolant Accident (LOCA) flow and NPSH requirements remained satisfied. The vendor NPSH calculation assumed the 'A' SI pump was limiting. This was considered a reasonable assumption since 'A' SI pump had the highest flowrate and its suction is physically located furthest from the source.

In March 1989 a CP&L SI Safety System Functional Inspection (SSFI) questioned the adequacy of the available NPSH for the SI pumps. The question was resolved based on review of the April 1988, vendor calculation.

In June 1989, NRC Inspection Report (IR) 50-262/89-02-02 identified a concern for SI pump runout. In September 1990 SI pump runout flow testing was performed resulting in runout flows greater than expected. In November 1990 additional testing was performed to verify runout flows and also to perform NPSH testing. Test development referenced the April 1988 vendor calculation. Flow testing was performed using the 'A' and 'B' SI pump since the 'C' SI pump had been removed from service for repairs. The NPSH testing focused on the 'A' pump since it demonstrated the greatest runout flow and was assumed to be limiting for NPSH since it was also physically the furthest from the source. Evaluation of the test results showed the 'A' SI pump to have adequate NPSH.

On April 22, 1997 an NRC design inspection requested to review the SI NPSH calculation. HBRSEP, Unit No. 2, personnel initiated a document search but did not identify the April 1988 NPSH vendor calculation as it was as an addendum to a calculation. Based on the November 1990 NPSH testing, HBRSEP, Unit No. 2, believed adequate NPSH was available, but since the April 1988 vendor calculation was not identified or located, a contract was initiated with an engineering consultant on May 20, 1997 to model SI flow and calculate NPSH.

Previous calculations, testing, and the initial results of the modeling efforts initiated on May 20, 1997 provided reasonable assurance that NPSH was adequate. However, as a prudent measure, modifications were initiated on June 7, 1997 to increase NPSH margin by providing increased refueling water storage tank (RWST) level. On June 27, 1997, based on preliminary modeling results, the 'C' SI pump was identified as the limiting pump for NPSH. Although the 'C' SI pump had demonstrated less flow capacity and is physically closer to the suction source, the suction piping configuration results in an effective length from the source greater than that of the 'A' SI pump. Based on those preliminary calculations, it appeared that 'C' SI pump NPSH may have been inadequate and this condition was reported to the NRC on June 27, 1997. On

July 3, 1997, vendor calculations were transmitted for HBRSEP, Unit No. 2, review. On August 14, 1997, the review of the SI pump flow model was completed. The 'B' SI pump was also found to have NPSH requirements greater than the 'A' SI pump, however the 'C' SI pump remained limiting. The calculations performed for the 'B' and 'C' SI pump NPSH indicated that prior to implementation of the increased level requirements initiated on June 7, 1997, NPSH requirements for the 'B' and 'C' SI pump may not have been satisfied for larger, low probability LOCA scenarios coincident with an unavailability of the 'A' SI pump. Since the 'A' SI pump availability is high, the probability of occurrence for a LB LOCA coincident with 'A' SI pump unavailable is small. For smaller, more probable LOCA scenarios, or for LB LOCAs when the 'A' SI pump is available, there was no safety significance.

2. <u>The Corrective Steps That Have Been Taken and the Results Achieved</u>

An SI system flow model was developed and analyzed to ensure SI NPSH requirements were adequately identified for each of the 3 SI pumps. The results of this model were transmitted by the vendor on July 3, 1997 and their review was completed on August 14, 1997.

Several plant modifications were performed to increase the available NPSH by raising the RWST level. These modifications were completed on June 27, 1997. This increased RWST level satisfied the NPSH requirements calculated for the limiting SI pump on July 3, 1997.

3. <u>The Corrective Steps That Will Be Taken to Avoid Further Violations</u>

The suction piping configuration for 'B' and 'C' SI pumps will be modified during refuel outage (RO) 18 to further increase NPSH margin.

An Architect Engineer (AE) type inspection will be performed on the Component Water Cooling (CCW) system in 1998. This inspection will verify NPSH requirements associated with the CCW system are satisfied.

4. <u>The Date When Full Compliance Will Be Achieved</u>

Adequate NPSH requirements were satisfied on June 27, 1997, with the completion of the modifications that resulted in an increased RWST level. This increased RWST level restored NPSH requirements for the 'B' and 'C' SI pumps. Verification of design adequacy was completed on August 14, 1997, when the SI system flow model review was completed.

Violation 50-261/98-03 EA 98-043 and EA 98-050 Item B

10 CFR 50 Appendix B, Criterion III, in part, requires that "design control measures shall provide for verifying the adequacy of design such as by the performance of design review, by use of alternate or simplified calculational methods, or by performance of a suitable testing program."

Section 3.4.3 of CP&L Corporate Quality Assurance Manual, Revisions 11 through 18, dated January 29, 1988 through September 29, 1995, states that 'sufficient design verification shall be performed by one or more methods to substantiate that final design documents meet the appropriate design inputs." It further states that a design verification should confirm that "the design is technically adequate with respect to the design basis."

Contrary to the above, as of April 7, 1997, the licensee failed to verify the adequacy of design in certain calculations. Specifically, the licensee failed to consider appropriate design parameters or failed to utilize appropriate design inputs to ensure the design was technically adequate in the calculations listed below:

1. Calculation number RNP-I/INST 1023. "Refueling Water Storage Tank Level Indicator Accuracies," Revision 0, dated June 28, 1994 did not consider potential vortexing in the Refueling Water Storage Tank above the nozzle.

2. Calculation number RNP-I/INST-1109, "Containment EOP Setpoint Parameters", Revision 0, dated November 29, 1994, did not determine the correct containment water level required for post accident residual heat removal (RHR) pump recirculation operation (EOP setpoint No. 20).

3. Calculation number RNP-I/INST-1058, "Containment Water Level Instrument Uncertainty", Revision), April 4, 1994, used an incorrect value for the containment water level above the containment floor.

4. Calculation number RNP-I/INST-1040, "Main Steam Flow Accuracy and Scaling Calculation", Revision 0, dated May 16, 1994, and RNP-I/INST-1043, "Main Steam Pressure Channel Accuracy and Scaling Calculation", Revision 1, dated April 15, 1994, did not include seismic uncertainty factors specified in Section 10 of Design Guide DG-VIII.50, Engineering Instrument Setpoints.

5. Calculation number RNP-M/MECH-1620, "Evaluations of Effects of High Energy Pipe Rupture on the CCWS", Revision 0, dated July 18, 1996, excluded the design inputs for high energy line breaks in Reactor Coolant System piping and their jet impingement effect on adjacent component cooling water (CCW) piping and supports.

6. Calculation number RNP-M/MECH-1362, "SW Screen Wash Piping Flow Analysis", Revision 1, dated September 5, 991, did not include rupture of the non-seismic piping that supply the instrument and station air compressors.

7. Calculation number RNP-E-6.020, "Load Profile and Battery Sizing Calculation for Battery B", Revision 2, dated November 24, 1993, incorrectly referenced a time period of

"2 minutes to 59 minutes", instead of "1 minute to 59 minutes. The calculation did not consider some of the connected non-safety loads and referenced an incorrect battery cell type (MCT instead of MCX) in Attachment U to the calculation.

8. Calculation number RNP-E-6.23, "Minimum Inverter Voltage Verification", Revision 2, dated December 1, 1993, did not consider the increased inverter current at reduced battery voltage.

9. Calculation number RNP-E-6.004, "DC Short Circuit Study", Revision 2, dated May 19, 1993, did not consider a small DC motor that was connected to the system. The battery open circuit voltage used in the calculation was less than the voltage measured during testing. This calculation along with RNP-E-018, "Ampacity Evaluation of Safety Related 125VDC and 120V AC Power Cables", Revision 4, dated March 16, 1994, analyzed cables rated at 75°C, whereas cables rated at 60°C were installed.

10. Calculation number RNP-E-6.018, "DC Control Circuit Loop Analysis", Revision 0, dated April 19, 1994, used incorrect solenoid valve power values for design input.

11. Calculation number RNP-E-8.016, "Emergency Diesel Generator Static and Dynamic Analysis", Revision 5, dated September 19, 1994, used an incorrect reference and only modeled SI pump motor B.

12. Calculation number RNP-M/MECH-1460, "NPSH vs. CST Level for SDAFW Pump"' Revision 0, dated June 19, 1992, a value for the condensate storage tank (CST) water temperature of 100°F was used, instead of the 115°F temperature value listed in the Plant Parameter Document for Cycle 18.

13. Calculation number RNP-M/MECH-1394, "AFW Pump Recirculation Flowrates for RNP-2", Revision 2, dated August 21, 1995, used and incorrect specific gravity for the CST water.

14. Discrepancies were identified in calculation numbers RNP-I/INST-1015, Revision 0, dated December 22, 1990, and 84065-M-06-F, Revision 3, dated January 14, 1991, for the condensate storage tank level at which to change the auxiliary feedwater (AFW) pump suction supply to the service water system. Calculation RNP-I/INST-1015 shows a 10 percent level, whereas calculation 84065-M-06-F shows a 15 percent level. (02014)

This is a Severity Level IV Violation (Supplement I)

Reply

CP&L agrees with the violation in that certain calculations did not verify the adequacy of design. However, CP&L disagrees with several of the examples cited. A discussion for each of the cited examples is provided.

1. The Reason for the Violation

Inadequate reviews were identified as the cause for five of the cited calculations. These cited violations include Items 1, 2, 3, 5, and 7.

The error cited for calculation RNP-I/INST 1109 (Item 2) involved use of an incorrect containment water level. Design verification should have revealed the correct containment water level which was specified in the UFSAR.

RNP-I/INST-1058 was cited as having used an incorrect containment water level similar to the citation for RNP-I/INST-1109. RNP-I/INST-1058 determines instrument channel uncertainties for the containment water level instrumentation but does not use containment water level as an input in the calculation. RNP-I/INST-1058 has been revised however, because the calculation did not include seismic uncertainties which should have been identified during verification review.

RNP-I/INST-1023 (Item 1) was cited because this calculation did not consider vortexing in the Refueling Water Storage Tank (RWST). Consideration of vortexing and its effect, if any, should have been included in the calculation. Verification review should have questioned this omission.

RNP-E-6.020 (Item 7) was cited for several discrepancies. These discrepancies included an incorrect profile time, reference to an incorrect battery cell type, and failure to consider some connected non-safety loads. These discrepancies should have been identified during verification review.

Calculation RNP-M/MECH-1620 (Item 5), performed to evaluate the effects of high energy pipe rupture on the CCWS was based on the use of ANSI/ANS-58.2-1988, and NRC standard review plan 3.6.2, "Determination of pipe rupture, locations, and dynamic effects associated with postulated rupture of piping." The engineer performing the evaluation assumed these documents were sufficient to envelope the issues and therefore did not consider some required input assumptions. These design input omissions were not identified by the design verifier.

Investigation revealed that verifications for the above examples tended to be validations of internal consistency within the calculation and did not include adequate verification using external reference reviews to ensure that data being used in the calculation was correct and complete.

Three of the errors cited were attributed to the use of incorrect assumptions. The error cited in calculation RNP-E-6.023 (Item 8) resulted from the use of a design value which had not accounted for the effect of increased inverter current at reduced battery voltage. In calculation RNP-E-6.004 (Item 9), the use of 75°C cable was assumed based on the purchase records that a class of cables was purchased to this specification, however a field verification of cables missing receipt documentation revealed cables rated at 60°C. In calculation RNP-E-6.018 (Item 10) the various DC powered solenoids are listed with the power requirement for each type provided. Calculations RNP-E-6.020 and RNP-E-6.021, which calculate station battery load profiles, incorrectly used 17.4 watts for solenoid power although solenoids with greater power requirements had been identified in RNP-E-6.018.

Two errors were identified in calculation RNP-E-8.016 (Item 11). These two errors included the use of an incorrect reference and only modeling one of the three SI pump motors. The use of an incorrect reference resulted from personnel error. The criteria section of the calculation listed reference 4.6 as the source for obtaining load information. The reference section of the calculation stated that reference 4.6 was unused. The criteria section of the calculation should have listed reference 4.11. This calculation only modeled 'B' SI pump motor. The 'A' and 'C' SI pump motors should have been included in the model, however, since these motors have no significant differences from the 'B' SI pump motor, their omission did not impact the results of the calculations.

Section 10 of Design Code DG-VIII.50 required that seismic effects be included in setpoint calculations for instruments which are required to be operable during and after an earthquake. Calculation RNP-I/INST-1040 (Item 4), did not include seismic uncertainty factors. The design basis for HBRSEP, Unit No. 2, does not require a design basis accident coincident with an earthquake. The setpoint calculation was based on the bounding main steam line break (MSLB) accident which bounded the seismic uncertainty factors. Although seismic uncertainty factors were not required to be included in the calculation, a brief basis for their exclusion should have been provided in the calculation.

Calculation RNP-M/MECH-1362 (Item 6), "SW Screen Wash Piping Flow Analysis," Rev. O dated September 5, 1991, was performed as part of a modification to replace piping to the travelling screens. The purpose of this calculation was limited to evaluating the effect of a rupture of the specific piping to be replaced. RNP-M/MECH-1362 established the maximum service water flow loss through the screen wash piping to ensure the calculated flow would be less than the maximum permissible service water leak for continued operation. RNP-M/MECH-1362 was not intended to evaluate the rupture of other non-seismic piping but was limited to a specific portion of the service water system. The evaluation of non-seismic service water piping was performed in a separate analysis (EE 89-108) and was referenced in RNP-M/MECH-1362. This cited example is therefore not considered to be a failure to verify adequacy of design.

Calculation RNP-M/MECH-1460 (Item 12), "NPSH VS. CST Level for SDAFW Pump," Revision 0, dated June 19, 1992, is not considered to be an example of failure to verify design adequacy. The 115°F temperature limit discussed in UFSAR Section 15.2.7.3 is a conservative assumption used for ensuring adequate decay heat removal available following a loss of normal feedwater flow, with the steam-driven auxiliary feedwater (SDAFW) pump disabled and one motor-driven auxiliary feedwater pump available. Therefore use of 115°F as the upper temperature limit for calculating SDAFW pump NPSH limit is not necessary. The use of 100°F for determining NPSH limits for the SDAFW pump is conservative since the procedurally controlled maximum CST temperature for SDAFW pump operability is 89°F. This cited example is therefore not considered to be a failure to verify adequacy of design.

Calculation RNP-M/MECH-1394, "AFW Pump Recirculation Flowrates for RNP-2," Revision 2, dated August 21, 1995 (Item 13) uses a specific gravity (SG) for the condensate storage tank water of 1.00. The temperature range for the CST could theoretically vary from a minimum of 32°F to a maximum temperature limit (UFSAR Section 15.2.7.3) of 115°F, this would allow SG to vary from a maximum of 1.00088 (max density for water at 40°F) to a minimum of less than 1.00 at 115°F. The purpose of calculation RNP-M/MECH-1394 is to demonstrate that there is adequate recirculation flow for the AFW pumps. Higher SG results in greater pressure drops in the recirculation line and a subsequent decrease in calculated recirculation flow. If the most conservative SG (1.00088) had been used with two decimal places (which is the consistent with other inputs used in the calculation), the result would have been a SG of 1.00. Therefore the use of 1.00 as the specific gravity value for calculation RNP-M/MECH-1394 is not considered a calculational error.

Item 14 states that an inconsistency exists between calculation 84065-M-06-F and RNP-I/INST-1015. Calculation 84065-M-06-F determined the physical tank water levels, while RNP-I/INST-1015 establishes instrument alarm setpoints for two conditions. The first condition is the CST level at which 20 minutes will be available for operator action to switch auxiliary feedwater (AFW) to an alternate feedwater (FW) source. Per calculation 84065-M-06-F, this level is calculated to be 14.116%. For conservatism additional water level was provided by requiring 15% CST level. RNP-I/INST-1015 establishes 15% CST level as the low level alarm (used to notify operators to begin CST suction switchover). The second condition is when the CST level has lowered to a level where AFW suction must be terminated from the CST. Calculation 84065-M-06-F calculated that termination must occur prior to 6.873%. For conservatism, the low-low level setpoint alarm is set at 10% which is the instrument calibration information determined in RNP-I/INST-1015. There is no discrepancy between the 10% CST level and 15% CST level since each level is for a different purpose.

A summary of the errors identified reveals that 5 of the cited examples were due to inadequate reviews, 3 resulted from the use of incorrect assumptions, and 1 was attributed to a human performance error. The remaining 5 examples were determined not to be discrepancies.

2. <u>The Corrective Steps That Have Been Taken and the Results Achieved</u>

Although RNP-I/INST-1023 had not considered vortexing, an evaluation was performed and determined that vortexing would have no significant impact.

Calculation RNP-I/INST-1109 was revised using the containment water level specified in the UFSAR. In addition this calculation was revised to incorporate the revised instrument uncertainty values of RNP-I/INST-1058. The revised calculation did not affect the EOP setpoint.

RNP-I/INST-1058 was revised to include seismic uncertainties. The revised calculation did not affect the EOP setpoint.

Calculations RNP-I/INST-1040 and RNP-I/INST-1043 were revised to include seismic uncertainty factors.

Calculation RNP-M/MECH-1620, "Evaluation of Effects of High Energy Pipe Rupture on the CCWS," has been voided. Calculation ESR 97-00014 was revised to include the information to support classification of the CCW System inside the containment as a closed system.

Calculations RNP-E-6.020 and RNP-E-6.021 were revised to correctly reference a time period of 1 minute to 59 minutes. In addition RNP-E-6.020 was revised to correctly reference the MCX battery type.

Calculations RNP-E-6.021 and RNP-E-6.023 were revised to include inverter operation at reduced voltage.

A design change backup form (DCBF) was implemented for calculation RNP-E-6.004 to clarify assumptions involving the connection of DC motors. The DCBF provides clarification by stating "No large DC motors (i.e., valve motors) greater than 1 hp are connected to the DC system." This DBCF was approved on May 19, 1997.

The bases and assumptions of RNP-E-6.004 have been revised to address the use of 120V as the open circuit voltage.

The impact on Calculation RNP-E-6.018 as a result of the discovery a 60°C rated cable in lieu of the 75°C analyzed was performed and determined to be minimal. Since the calculation had assumed 500 MCM classified cables were rated at 75°C, other 500 MCM cables were reviewed to determine if additional 60°C rated cables were installed. A random sample of 71 similar cables was chosen and the temperature ratings were verified. No cables were identified with a temperature rating less than 75°C.

RNP-E-6.018 contains a listing of installed solenoids. The power ratings for these solenoids varies from a low of 10 watts to a maximum of 35.1 watts. RNP-E-6.020 which calculates the load profile for the 'A' station battery has been revised to conservatively use the maximum wattage of 35.1 watts. RNP-E-6.021 which calculates the load profile for the 'B' station battery has been revised to incorporate the specific solenoid loading connected.

Calculation RNP-E-8.016 was reviewed to determine the impact of only modeling the 'B' SI pump motor. Since the 'A' and 'C' SI pump motors have no significant differences from the 'B' SI pump motor, their omission did not impact the results of the calculations.

Several common causes were identified among the cited errors and discrepancies. The most significant of these causes was inadequate reviews. To renew engineering's awareness of design review requirements, the Engineering Manager issued a memorandum directing that the procedure governing design reviews, EGR-NGGC-0003, "Design Review Requirements," would become a "continuous use" procedure for a limited time. This memorandum was issued on February 18, 1998. The duration for imposing continuous use of the design procedure will be determined based on results of monitoring the quality of engineering products.

Engineering has instituted a periodic review process that monitors the quality of engineering products. These periodic reviews are currently being performed quarterly. These periodic reviews generate reports that provide a tool that allows management to quantify engineering performance. The results of these periodic reviews can then be used to develop corrective actions by targeting management focus on correcting repetitive or significant problems.

The use of incorrect input assumptions was identified as the cause for 3 of the cited examples. To provide improved access to historical calculations, an open purchase order with the NSSS vendor was initiated. This will reduce the burden associated with reviewing historical documentation by allowing onsite reviews rather than requiring remote reviews at the vendor's office.

Design and Licensing Basis training was provided to engineers, qualified safety reviewers and appropriate technical reviewers as identified by plant management. The purpose of this training was to enhance the understanding of design bases, engineering design bases, and licensing bases of the facility and the importance of preserving these bases. This training was provided to approximately 375 personnel. The training of appropriate personnel was completed on March 17, 1998.

3. <u>The Corrective Steps That Will Be Taken to Avoid Further Violations</u>

Calculation RNP-I/INST-1023 will be revised to include potential for vortexing by April 15, 1998.

Design review training will be provided to engineering personnel. This training will address the selection of design inputs and design verification responsibilities. Included in this training will be a definition of management expectations associated with reviews. This training will be completed by November 16, 1998.

Management will evaluate "review technology" training. This evaluation will determine if the training of particular review methods would result in an appreciable improvement in review quality. Evaluation of review technology training will be completed by June 15, 1998.

4. <u>The Date When Full Compliance Will Be Achieved</u>

Full compliance will be achieved on April 15, 1998 following revision of calculation RNP-I/INST-1023.

<u>Violation 50-261/98-03 EA 98-043 and EA 98-050 Item C</u>

10 CFR 50 Appendix B, Criterion III, in part, requires that "design control measures shall provide for verifying the adequacy of design such as by the performance of design review, by use of alternate or simplified calculational methods, or by performance of a suitable testing program."

Section 3.4.3 of CP&L Corporate Quality Assurance Manual, Revisions 11 through 18, dated January 29, 1988 through September 29, 1995, states that 'sufficient design verification shall be performed by one or more methods to substantiate that final design documents meet the appropriate design inputs." It further states that a design verification should confirm that "the design is technically adequate with respect to the design basis."

Contrary to the above, as of April 7, 1997, the licensee failed to verify the adequacy of design in that inputs were not correctly translated into other design documents such as drawings or procedures for the examples listed below:

1. A design change was implemented in 1990 to provide for isolation of the RHR pumps by closure of valve numbers SW-906, SW-907, CC-927, and CC-928 as discussed in LER 89-008-01. The licensee failed to incorporate the effects of this design change in the ASME Section XI inservice testing (IST) program. These valves were incorrectly classified as passive valves in the IST program when in fact they should have been classified as active valves as a result of the design change.

2. The design basis for CCW thermal relief valve numbers CC-747 A and B, CC-774, and CC-791G was incorrectly translated into the installation drawings. Consequently, the valves were installed in locations which resulted in the 10 psig back pressure values specified in Westinghouse E-spec No. 676257 being exceeded by 5 psig.

3. The design basis for performance of testing on station batteries (IEEE Standard 450-1980, Recommended Practice for Maintenance, Testing, and Replacement of Large Storage Batteries for Generating Stations and Substations) was incorrectly translated into MST-920, Station Battery Performance Capacity Test, Revision 6, dated September 28, 1995, and MST-921, Station Battery Service Test, Revision 7, dated April 20, 1995. Step 7.5.10 of procedure MST-921 accepted voltages less than the minimum value of 1.0 volt DC specified in IEEE Standard 450-1980. The duration of capacity testing of station battery B specified in MST-920 was different from that used by the battery manufacturer. The minimum acceptance criteria of 107 volts specified in MST-921 for the station battery load profile test was less than the value of 109.8 volts evaluated in Calculation RNP-E-6.018.

4. The design basis for performance of maintenance on station batteries was incorrectly

translated into procedures PM-410, Installation of Battery Bank and Cell Connections, Revision 6, dated November 2, 1995 and PM-411, Disassembly, Cleaning, Assembly, and Testing of A and B Station Batter Cell Connections, Revision 6, dated October 6, 1995. The procedures stated the acceptance criteria criteria was 50 micro-ohms whereas the vendor calculations specified that the B station battery may not exceed 50 micro-ohms and the A station battery may not exceed 34 micro-ohms. The requirements for installation (torque) of intercell connections and mechanical cable connections and the thickness of the intercell connectors specified in PM-411 conflicted with requirements specified in vendor technical manuals and the A station battery

Reply

1. The Reason for the Violation

Item 1 involves the classification of valves into the ASME Section XI inservice testing (IST) program. These valves (SW-906, SW-907, CC-927, and CC928) are manual valves which were categorized as passive valves. ASME Section XI defines a passive valve as "a valve that does not perform a mechanical motion during the course of accomplishing a system safety function." These valves are normally open in order to provide cooling to loads which support RHR pump operation during a design basis accident but also provide leak isolation capability to mitigate RHR pump room flooding in the event of a piping failure. NRC guidance provided in NUREG 1482, "Guidelines for Inservice Testing at Nuclear Power Plants," section 4.4.6 states that manual valves that are included in the actions of emergency operating procedures, but not credited in the safety analysis, do not fall within the scope of the IST program. Testing of passive valves is not required unless the valve is considered to be a Category 'A' valve (a valve which must limit leakage to within a specific maximum amount to fulfill its safety function). These valves did not meet the criteria for Category 'A', therefore, they had been classified as Category 'B' passive valves. In 1989, LER 89-008 credited SW-906, SW-907, CC-927, and CC-928 with performing leak isolation for the lines that supply RHR pump seals and fan cooling units. Since closing of these valves was credited for leak isolation in docketed correspondence, they should have been categorized as "passive"/"active" per ASME Section XI and exercised quarterly.

Item 2 questioned the installation of 4 relief valves in a system location that results in their design back pressure being exceeded. The relief valve design back pressure limit of 10 psig was contained in a Westinghouse specification for auxiliary relief valves, E-Spec. No. 676257 Rev 0, dated February 16, 1966. Review of the system configuration revealed that four relief valves were installed in the component cooling water (CCW) system locations with back pressures of approximately 15 psig. Investigation revealed that these relief valves are not required by the ASME Boiler and Pressure Vessel Code to protect either system vessels or piping for overpressurization. Although no safety issue resulted, the reason the design requirements for these valves were not correctly implemented into the plant design during plant construction could not be determined.

Item 3 contains three separate issues. The first issue was that station battery procedures contained minimum voltage acceptance criteria less than that recommended in IEEE Standard 450-1980. IEEE Standard 450-1980 is identified in the Design Basis Document (DBD) as one of the design criteria applicable to the station batteries. This discrepancy resulted from a failure of the responsible engineer to implement this design requirement into a maintenance procedure.
The second issue identified is that the test duration specified for battery capacity testing is different from that used by the manufacturer. Section 5.2 of IEEE 450-1980 states that for comparison testing it is desirable that performance tests be similar in duration to the battery acceptance test. The reason for the difference in test duration, is that the battery manufacturer had not been notified that HBRSEP, Unit No. 2, procedures for capacity testing used a 2 hour discharge test. The battery manufacturer unaware of the 2 hour discharge test method performed an 8 hour discharge test to determine the capacity of the new 'B' station battery. Following battery installation, the battery test procedure (MST-920) performed a 2 hour discharge test which was then compared to the 8 hour manufacturer discharge test. Engineering personnel were aware of the differences in test duration, but failed to revise MST-920 or document the basis for the comparison of capacity between tests of differing duration.

The third issue identified in this example involved an acceptance criteria in a test procedure that was less than that provided in calculation RNP-E-6.018. As a result of a revision to RNP-E-6.018 , the minimum battery voltage was increased from 107 volts to 109.8 volts. Revision to this calculation did not identify that a required change to MST-921 was required. This discrepancy resulted from a failure of the responsible engineer to identify affected documents.

Item 4 identified a discrepancy in the intercell resistance measurements for the 'A' station battery. The vendor technical manual for station battery installation specified that a benchmark should be established by taking the average intercell resistance for similar connections at installation. If any connection resistance exceeds these values by 10% or 5 micro-ohms, whichever is greater, the connection should be remade so a valid benchmark is established. Subsequent connection readings should not exceed the benchmark by more than 20%. A review of the procedure completed following battery installation, revealed that a few of the benchmark connections exceeded the average by more than 10% and the intercell connections were not remade. In addition the average intercell resistance value for the 'A' station battery was calculated to be 31 micro-ohms, however the maintenance procedures, PM-410 and PM-411, referenced an acceptance criteria of 50 micro-ohms. This discrepancy involved a failure of the responsible engineer to incorporate the new vendor information into existing preventative maintenance procedures.

2. <u>The Corrective Steps That Have Been Taken and the Results Achieved</u>

Valves SW-906, SW-907, CC-927, and CC-928 were reclassified as "Active"/"Passive" and testing for these valves was incorporated into procedures on July 30, 1997.

MST-921 acceptance criteria was revised to require individual cell voltages to be greater than 1.25VDC.

MST-920 has been revised to compare battery capacity for discharges performed for similar duration. The comparison is based on the two hour discharge rate.

MST-921 acceptance criteria for minimum battery voltage has been revised to meet or exceed the minimum battery voltage calculated in RNP-E-6.0018. Calculation RNP-E-6.020 "Load Profile and Battery Sizing Calculation for Battery B" and RNP-E-6.021 "Load Profile and Battery Sizing Calculation for Battery B" have been revised to identify that the minimum battery voltage acceptance criteria applicable to MST-921.

Design and Licensing Basis training was provided to engineers, qualified safety reviewers and appropriate technical reviewers as identified by plant management. The purpose of this training was to enhance the understanding of design bases, engineering design bases, and licensing bases of the facility, and the importance of preserving these bases. This training was provided to approximately 375 personnel. The training of appropriate personnel was completed on March 17, 1998.

The average intercell connection resistance acceptance criteria specified in PM-410 and PM-411for the 'A' station battery has been revised to be consistent with the vendor technical manual requirements.

3. <u>The Corrective Steps That Will Be Taken to Avoid Further Violations</u>

Lessons learned training for the discrepancies identified in this violation will be provided to engineering personnel. This lessons learned will be included with design review training identified in response to Violation 50-261/98-03 EA 98-043 and EA 98-050 Item B.

4. <u>The Date When Full Compliance Will Be Achieved</u>

Full compliance was achieved with the implementation of the corrective actions identified in section 2 above.

Violation 50-261/98-03 EA 98-043 and EA 98-050 Item D

10 CFR 50 Appendix B, Criterion III, in part, requires that "design control measures shall provide for verifying the adequacy of design such as by the performance of design review, by use of alternate or simplified calculational methods, or by performance of a suitable testing program."

Section 3.4.3.9 of CP&L Corporate Quality Assurance Manual, Revision 18, dated January 29, 1988 through September 29, 1995, states that "A design verification shall be performed to verify the appropriate design verification has been performed for applicable documents contained in the package."

Section 3.4.5 of CP&L Corporate Quality Assurance Manual, Revisions 12 through 16, dated June 1, 1989, through December 17, 1992, states that "design change documents shall provide for identification of necessary revisions to existing design documents."

Contrary to the above, the licensee failed to verify the adequacy of design in that:

1. A calculation in ESR 96-00474, Revision 0, dated August 19, 1996, which evaluated whether failure of a non-seismic pipe would affect water supply to the SI pumps, was not design verified.

2. Calculation number 789M-M-02, Revision 0, dated December 15, 1989, 789M-M-05, Revision 0, dated December 18, 1989, and RNP-E-6.002, Revision 0, dated December 1, 1987, were not identified as voided or superseded when replaced by other design calculations.

This is a Severity Level IV Violation (Supplement I).

Reply

1. The Reason for the Violation

Calculation ESR 96-00474, Revision 0, dated August 19, 1996 is not considered to be an example of the cited violation. ESR 96-00474, Revision 0, was performed to address an Operational Experience feedback request and was used to confirm engineering judgement that sufficient time was available for operators to take corrective action in the event the spent fuel cleanup line failed. The procedure that governs the processing of Engineering Service Requests (ESRs) states, "In cases where an ESR requiring engineering evaluation for a suspected non-conforming or degraded SSC is assessed by the RE (responsible engineer) as clearly not required, and ED (engineering disposition) should be used to disposition the request upon Supervisor concurrence." The RE for the cited ESR referenced two previous ESRs which together had confirmed the engineering judgement applied to the review of the Operational Experience. This assessment was concurred with by the supervisor. This example is therefore not considered to be a violation of design verification adequacy.

A self-assessment performed in December 1996 identified that many computer models for the service water (SW) system existed and some were outdated. A recommendation was made to incorporate the calculations into one hydraulic model and void the outdated calculations. Implementation of this recommendation had been delayed due to higher work priorities and was therefore not completed prior to NRC Inspection 97-201. As a result calculations 789M-M-02, Revision 0, dated December 15, 1989, 789M-M-05, Revision 0, dated December 18, 1989, and RNP-E-6.002, Revision 0, dated December 1, 1987, were not voided although they had been superceded by calculations RNP-M/MECH 1362 "SW Screen Wash Piping Flow Analysis" and RNP-M/MECH-1128, "Reduced SW Flow to EDG."

2. <u>The Corrective Steps That Have Been Taken and the Results Achieved</u>

Calculations 789M-M-02, 789M-M-05, and RNP-E-6.002 were voided on September 11, 1997, September 16, 1997, and May 19, 1997, respectively.

3. <u>The Corrective Steps That Will Be Taken to Avoid Further Violations</u>

A self assessment of the SW system will be completed by September 30, 1998. Calculations identified as outdated or superceded during that assessment will be voided by December 31, 1998.

4. <u>The Date When Full Compliance Will Be Achieved</u>

Full compliance will be achieved by December 31, 1998, with the completion of actions identified in Section 3 above.