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U.S. NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR REACTOR REGULATION

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Operating License No.:	NPF-38
Licensee:	Entergy Operations, Inc. Waterford, P.O. Box B Killona, Louisiana 70066
Facility:	Waterford Steam Electric Station, Unit 3
Dates:	September 23-27 and October 7-10, 1996
Inspectors:	R.K. Mathew, Team Leader, NRR M. Branch, NRR T. D'Angelo, NRR C. Patel, NRR D. Acker, Region IV P. Eshleman, Contractor B. Sherbin, Contractor
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Enclosure

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EXECUTIVE SUMMARY

On September 23-27 and October 7-10, 1996, a team comprised of staff from the NRC's Office of Nuclear Reactor Regulation (NRR), as well as NRC Region IV personnel, and contractor representatives, conducted an engineering inspection at Waterford 3. The primary objective of this inspection was to conduct a safety system functional review of the component cooling water system (CCWS), auxiliary component cooling water system (ACCWS) and support systems. The inspection team also evaluated the plant's safety assessment and corrective action processes, design control programs and procedures, and engineering support for the station.

Overall, the inspection team determined that the Waterford 3 engineering staff demonstrated good technical competence and familiarity with plant operations. The licensee's System Engineering Program implementation functioned adequately. The engineering staff identified problems using a low threshold and the licensee event reports (LERs) reviewed were very detailed. The design changes and modifications sampled were, in general, technically adequate, and calculations performed in support of the modifications were acceptable. The inspection team also observed good communication and working relationships between the design engineers and system engineers, and between operations and engineering groups. However, the team noted an example of poor communication within the design groups concerning a diesel loading calculation.

By reviewing a sample of the design and test attributes for the Waterford 3 CCWS, ACCWS, and support systems, the inspection team determined that in some cases, the actual design was inconsistent with design values stated in the final safety analysis report (FSAR). For example, during postulated design basis events, CCWS piping for the dry cooling towers and the containment fan coolers received pressures in excess of design values. Several components were unable to attain their required CCWS design flows. The ACCWS and emergency feedwater (EFW) pump flows were also less than those stated in the FSAR. Despite these and other operability issues raised by the team during the course of the inspection, the licensee was able to demonstrate the operability of these systems. Moreover, the licensee is addressing these issues through the established corrective action process.

No technical evaluations had been conducted, and no basis had been established to show that some CCWS and ACCWS equipment was protected from tornado missiles as stated in the FSAR. Through its walkdown, the inspection team identified components that may not be protected from high trajectory tornado missiles. The team was concerned that the licensee's engineering staff had previously identified this issue but the corrective actions failed to adequately correct the conditions. The lack of attention to this issue by engineering management indicated a lack of understanding to the design basis of the plant. In response to the team's concerns, the licensee took actions to address this issue.

The 10 CFR 50.59 evaluations for the plant modifications were generally adequate. However, the team identified examples of inadequate 10 CFR 50.59 evaluations performed in support of calculations, licensing document changes and condition reports. Examples of inadequate safety evaluations included

crediting EFW flow control and isolation valves to fulfill the containment isolation requirements; changing the diesel fuel oil storage requirements; and changing the operation of the fuel pool cooling pumps and ACCWS.

The team identified weaknesses in both original design and recent engineering work. The inspection findings indicated that some technical evaluations or calculations to support the design basis information were not available. For example, EFW flows for the worst case heat load conditions were not evaluated, and no calculation or testing was performed to ensure that the wet cooling tower can be used as a source of EFW.

The inspection team also observed lack of rigor in some of the licensee's technical evaluations and use of incorrect assumptions in some of the calculations by the engineering staff. For example, evaluations concerning the condition report related to inadequate installation of the reactor building shield door failed to provide sufficient justification for its capability to withstand the anticipated load. Similarly, evaluations concerning the condition report related to incorrect fasteners did not consider qualification of bolts and torquing requirements.

The licensee's calculation control procedure was weak. For example, the procedure did not establish requirements for timely correction of omissions or errors and updating licensing documents, and conducting 10 CFR 50.59 evaluations if the assumptions and calculation conclusions changed the design bases documents.

In some cases, the licensee's followup and corrective actions for degraded or non-conforming conditions were not always timely or thorough in addressing the problem areas. Recent root cause evaluations and operational experience engineering evaluations reviewed were effective in identifying and correcting problems. However, earlier evaluations were weak in that regard. For example, in August 1994, the licensee identified that the EFW pumps would not deliver the flows specified in the technical specifications bases and FSAR, but did not perform a detailed engineering evaluation or safety evaluation to justify the degraded condition.

Past Quality Assurance audits of the licensee's corrective action process were programmatic and did not reveal problems that were identified by outside groups. The engineering staff also was not meeting the established timeliness goals for corrective action evaluation and implementation.

The licensee's recent self-assessments of the corrective action process, and engineering and technical support were good. Many good issues were identified through the safety system self-assessments of the ultimate heat sink and emergency feedwater (EFW), although they did not identify many of the issues raised by the team.

Report Details

III. Engineering

E1 Conduct of Engineering

E1.1 Component Cooling Water System (CCWS)

System Description

The function of the CCWS is to remove heat from reactor auxiliaries and transfer it to forced air vertical dry cooling towers (DCTs) for rejection to the atmosphere. During periods of high heat loads, high ambient conditions, or operator discretion, the CCWS also rejects heat to the auxiliary component cooling water system (ACCWS) heat exchanger. The DCTs are the ultimate heat sink (UHS) for the CCWS.

The CCWS is a closed cooling water system consisting of two redundant trains (A and B). The CCWS provides cooling water to essential and non-essential equipment. The primary components that make up CCWS trains include three 100-percent capacity pumps, two heat exchangers, two DCTs and one baffled surge tank. The CCWS provides an intermediate barrier between the reactor coolant and the ACCWS. This barrier reduces the probability of radioactivity leaking from the plant to the environment. Any leakage that may occur is diluted and monitored.

E1.1.1 Mechanical Design

a. Inspection Scope

The mechanical design review consisted of an assessment of thermal/hydraulic calculations, thermal performance testing, flow testing, and single failure review to determine if the CCWS is designed to remove the required heat load during a loss of coolant accident (LOCA) and certain natural events, including earthquakes and tornados. In addition, the inspection team reviewed the plant's final safety analysis report (FSAR), as well as various process flow diagrams, technical specifications (TS), and engineering evaluations associated with the closeout of condition reports (CRs), as they applied to the CCWS.

The inspection team also reviewed selected corrective actions and internal audits. In addition, the team reviewed the plant's vendor manual for the DCT and CCWS operating procedures, in order to determine if selected portions of the system were operated in accordance with the design bases.

b. Observations and Findings

The recent CCWS/ACCWS heat exchanger thermal performance test review indicated that, in general, the testing verified design performance of the heat exchanger. In addition, contrary to other testing discussed later in this report, the thermal performance test considered measurement instrument

uncertainty when evaluating test results. With the few exceptions noted below, the mechanical design calculations were adequate. The following paragraphs discuss the issues.

1. Adequacy of the Recent CCWS Flow Test

In August 1996, the licensee performed a CCWS flow balance test in accordance with procedure number STP 0115014, Revision 0, "CCW System Flow Balance." The purpose of the test was to verify that each component cooled by the CCWS receives the proper flow during simulated accident conditions. The team noted that the test did not consider CCWS flow alignment to the fuel pool heat exchanger and the chiller condenser. FSAR Figure 9.2-4 depicts the heat load dissipation of the UHS following a LOCA. In that depiction, fuel pool cooling was restored about 30,000 seconds after a LOCA. The figure also depicts the DCT handling the chiller load when the CCWS reaches 110°F, which occurs several days after a LOCA. These loads were not accounted for when the CCWS flow test was performed. In addition, the team noted the following instances in which the as-found flow rates were lower than the values listed in the FSAR Table 9.2-3 and the test acceptance criteria:

Component	FSAR Flow Req.	Test Accept. Crit.	As-Found
Containment Sp.Pp B	5 gpm	5 gpm	3.1 gpm
Shutdown HX A	3000 gpm	3000 gpm	2850 gpm
EDG A Lube Oil	not listed	350 gpm	202 gpm
Containment FC B	2700 gpm*	2700 gpm*	1240 gpm

* Denotes total CCWS flow to two fan coolers. Each fan cooler requires 1350 gpm.

Previous to this test, the licensee evaluated low flow to the containment fan coolers (1100 gpm vs 1350 gpm) and shutdown cooling heat exchanger (2600 gpm vs 3000 gpm), as documented in condition report CR-95-0955. The team noted that the licensee used incorrect assumptions in their evaluation. The evaluation incorrectly assumed that the reduction in heat removal was proportional to the flow reduction. One of the correct methods to evaluate the reduction in flow was to recalculate the overall heat transfer coefficient. In addition, the evaluation in this condition report did not consider the impact of flow reduction on potential boiling in the fan cooler. In response to these concerns, the licensee reevaluated the calculation, and showed that the results of the evaluation were still valid. The evaluation concluded that with the low flow conditions, the containment peak pressure in a LOCA or main steam line break is still below the analyzed design pressure. The evaluation further concluded that the reduced flow has a negligible effect on the long-term containment cooldown rate. The inspection team discussed the details of the analysis with the licensee and agreed with the conclusions. Regarding low flow to the containment spray pump B cooler, the licensee determined that the required flow specified in the pump vendor manual (number 457000074) is 2.5 gpm. Therefore, the as-found flow of 3.1 gpm to the containment spray pump cooler was sufficient. In addition, the licensee

had previously evaluated lube oil cooler CCWS flowrates as low as 179 gpm, as documented in the closeout of CR-96-0543. This evaluation showed that the cooler could dissipate the accident heat load and maintain oil temperature below the limit of 180°F. Consequently, the 202 gpm as-found flow to the EDG lube oil cooler was sufficient.

Therefore, even though as-found flows to some safety-related components were below the values specified in the FSAR and the test acceptance criteria, evaluations including 10 CFR 50.59 safety evaluations show that the heat removal requirements of the CCWS are maintained.

In response to the inspection team's concern regarding the lack of flow test data regarding long-term CCWS alignment in a LOCA, the licensee performed preliminary calculations. On the bases of those calculations, the licensee concluded that adequate heat removal to all safety-related components would be maintained when the fuel pool heat exchanger and essential chiller are being cooled by the CCWS. The licensee also concluded that there is no concern with CCWS pump runout in this alignment. The results of the preliminary calculations showed acceptable conditions.

2. CCWS Flow Test Instrument Uncertainty

During the flow test review mentioned above, the team noted that the acceptance criteria did not consider margin for errors such as flow instrumentation accuracy and other instrument uncertainties. In most cases, the plant's installed instruments or portable ultrasonic meters were used to measure the flow rates to safety-related components. When instrumentation errors are included, the actual flow rates could be less than those recorded in the test. The licensee stated that even though the instrument uncertainties are not included in the acceptance criteria for flow test, a reasonable amount of uncertainty was applied to the test results when validating the test data. However, the licensee could not provide any documentation to show the amount of uncertainties they considered when validating the test data. It is not uncommon to have several hundred gpm of flow uncertainty in these types of indicator loops.

As discussed in the previous section, some flow rates were lower than the acceptance criteria, without allowance for measurement uncertainty. In response to the team's concern regarding the lack of accounting for measurement uncertainty in test acceptance criteria, the licensee stated that they would review this issue and its generic implications. The team identified this issue as inspection follow-up item IFI-96-202-01.

3. Containment Fan Cooler (CFC) Thermal Relief Valve

The team reviewed the design pressure of the CCWS piping for the CFCs to determine if the safety thermal relief valve setpoint is adequate to protect the piping from exceeding the design pressure. FSAR Table 9.2-1 indicates that the design pressure for the CCWS piping is 125 psig, with portions of the system designed to 135-150 psig. The licensee determined from the line list that the piping going to and from the CFCs has a design

pressure of 125 psig. FSAR Table 9.2-1 further states that the piping code for the CCWS is the American Society of Mechanical Engineers (ASME), Boiler and Pressure Vessel Code, Section III, Class 3, 1971 Edition up to and including 1972 Winter addenda. ASME Section III, 1971, Section ND 3600 requires system design pressure to be based on the most severe conditions of pressure, temperature, and loading.

The team discussed with the licensee the basis for the setpoint associated with the CFC piping safety thermal relief valves. Containment pressure during a design basis accident can reach a maximum of 44 psig, as stated in FSAR Section 3.8.2.3, and the CFC safety thermal relief valve tailpipes are impacted by this backpressure. If a CFC is isolated and sufficiently heated during peak containment pressure, the piping system portion not exposed to containment pressure (i.e., the portion between the outside containment isolation valve and the containment penetration) could experience a pressure of 165 psig before the relief valve lifts. Therefore, the piping between the isolation valves could experience transient peak pressure greater than the design pressure of 125 psig specified for the piping. The team questioned the adequacy of this condition. To address this issue, the licensee issued CR-96-1555.

The licensee's initial evaluation showed that the piping bounded by the isolation valves is not expected to exceed its maximum allowable stress limits. The inspection team did not review the technical basis for this determination. That condition report stated that the CFC tube side design pressure is 200 psig, and the thermal relief valve pressure is 121 psig, as stated in the DCN-MP-981 valve list.

4. <u>CCWS Operating Pressure at the Dry Cooling Tower (DCT)</u>

The team reviewed the Architect/Engineer (A/E) calculation entitled "CCW Design Pressure," Revision 0, dated February 6, 1989, which determined the maximum pressure within the DCT piping. That calculation determined that the pressure in the DCT manifold could be as high as 144 psig when the CCWS pump is operating under low flow conditions (150 gpm). The maximum allowable working pressure for the DCT heat exchangers, as stated in A/E letter LW3-226-84, was 136 psig, which is less than the maximum pressure that could be expected during design basis events. The team questioned the adequacy of this condition. The team noted that the licensee did not issue any condition report in accordance with procedure W2.501, "Corrective Actions," Revision 5 to correct this condition. To address this concern, the licensee issued CR-96-1553, which led engineering to recommend that CCWS trains A and B be operated at flows greater than 4000 gpm until a final engineering evaluation is completed to determine acceptability of this condition. This flow rate would result in a pressure lower than design pressure at the DCT. In addition, the team noted that the DCT tube design pressure stated in FSAR Table 9.2-8 was 125 psig, which differed from the value of 136 psig used by the vendor. The licensee's preliminary evaluation indicated that piping is not expected to exceed its maximum allowable stress limits.

The licensee subsequently prepared CR-96-1622 on October 16, 1996, when a pressure spike occurred in the CCWS. The CR reported that the pressure in the system was momentarily about 150 psig. The pressure returned to normal (90 psig) in about 1 second. The licensee took immediate action to walk down the "A" DCT area. The CR reported that no leaks or signs of over-pressurization were found. The team identified this issue as unresolved item URI-96-202-02.

5. CCWS Surge Tank Vacuum Breaker Design

The team reviewed the A/E calculation entitled "CCW Pumps NPSH Available," dated November 4, 1983. When determining the available net positive suction head (NPSH), the licensee's calculation assumed atmospheric pressure in the CCWS surge tank. However, reviewing the CCWS drawings and component specifications, the team determined that the CCWS surge tank has a single 1-inch, non-safety related check valve providing vacuum relief protection.

The team questioned the adequacy of this single, non-safety-related vacuum breaker. Specific concerns that were discussed included the tank's structural capacity to withstand a vacuum, the capability of the level instruments to operate in a vacuum, and the NPSH available to the pumps.

In order to establish operability of the CCWS surge tank, the licensee performed a preliminary calculation to determine the maximum vacuum the tank can withstand. On the basis of this preliminary calculation, the licensee concluded that the tank can withstand a maximum negative pressure of 18.2 psi. Therefore, the tank will not collapse as a result of drain down with the failure of the vacuum breaker to open. In addition, the licensee evaluated the NPSH requirements for the CCWS pumps, and verified that there would be adequate NPSH available if the vacuum breaker failed to function. A review of the preliminary structural calculation indicated that the tank has sufficient structural capability to avoid a collapse under negative pressure if the vacuum breaker failed to function. The licensee also evaluated the level instrumentation for tank makeup, and alarms and determined that the low-pressure condition did not affect their performance. The licensee issued CR-96-1585 to track the corrective actions required to document the design basis of the CCWS surge tank vacuum breaker. The team considered this action appropriate.

c. Conclusion

The mechanical functions of the CCWS were generally acceptable. However, in some cases, the design values were not met as stated in the FSAR, and the design analysis to support the design basis information was not always available or had never been developed. For example, several components were unable to attain their required CCWS design flow and the instrument uncertainties were not accounted in the flow test; and CCWS piping exceeded the design pressures for the dry cooling towers and the containment fan coolers. The weaknesses mentioned above either have been, or are currently being evaluated through the licensee's condition report process.

E1.1.2 Electrical Design

a. Inspection Scope

The team reviewed the electrical circuit design drawings for normal and emergency operation of the CCWS pump motors, DCT fans, selected motor operated valves (MOVs), and emergency chillers. The team also compared the drawings to FSAR system descriptions, operating procedures, TS criteria, and test procedure results to verify that the circuits matched the system descriptions and were being tested in accordance with design requirements. In addition, the team reviewed the adequacy of the licensee's worst-case voltage calculations for selected CCWS components and coordination of electrical protective devices.

b. Observations and Findings

The team determined that the selected drawings matched the design and testing criteria, the worst-case voltages available to the CCWS components were adequate, the coordination of electrical protective devices was acceptable, and the testing results indicated that the devices were operating within the design limits. No unacceptable conditions were identified during this review.

c. Conclusions

For the items sampled, the team concluded that the design and testing were adequate.

E1.1.3 Instrumentation & Controls (I&C) Design

a. Inspection Scope

The team reviewed applicable sections of the FSAR, TS, Design Basis Document, system flow diagrams, installation details, and the setpoints and uncertainty calculations for selected instrumentation and controls.

b. Observations and Findings

The Design Engineering Guide (DEIC-I-502) and uncertainty calculations reviewed by the team followed the Instrument Society of America (ISA) standard ISA 67.04, Parts I and II, dated September 1994, which constitutes the current state-of-the-industry practice. The use of drift data for the instrumentation as random and independent was not discussed in the above design guide. The licensee stated that an addition to the design guide requiring the monitoring of instrument drift would be provided in the next revision.

The inspection team also reviewed several calculations that established the uncertainty values for the following instrumentation and controls:

- alarm and control functions for the CCWS heat exchanger outlet temperature

- level indication for the surge tank for instrument Loop CC IL17010

- CCWS flow indication Loop CC IF50770A

- alarm setpoint for Loop CC IP7072 which provided abnormal low pressure conditions in the CCWS

- alarm setpoint for abnormal CCWS flow to the Essential Chilled Water System

These calculations also presented the detailed development of the assumptions and requirements for instrument accuracy and calibration accuracy. The team found that these calculations had been performed in accordance with the I&C Design Engineering Guide (DEIC-I-502). The random uncertainties were combined using the Square Root-Sum-of-Squares, and non-random uncertainties were combined algebraically. The team also noted that the instrumentation design for CCWS flow meets the Category 2 instrumentation requirements of Regulatory Guide 1.97, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident," Revision 3.

c. Conclusions

The uncertainty calculations provided a valid basis for the loop uncertainties and margins for the alarm and logic input settings with respect to the TS setpoints and analytical limits. The licensee's setpoint program followed current industry practice and the I&C design was adequate to meet the requirements for CCWS operation.

E1.2 Auxiliary Component Cooling Water System (ACCWS)

System Description

The ACCWS is divided into two separate safety-related loops, each serving one of the redundant CCWS trains. The ACCWS provides cooling water to the shell side of the CCWS heat exchangers, when required, and pumps it to evaporative, mechanical draft wet cooling towers (WCTs) for heat dissipation to the atmosphere. The ACCWS pumps then take suction from the basin of their respective WCTs to complete the path to the CCWS heat exchanger. The ACCWS pumps are designed with sufficient NPSH to withstand a WCT basin water temperature of 105°F, and minimum water level. The ACCWS is required to operate whenever the heat rejection capacity of the CCWS (via the DCTs) is exceeded.

The WCTs and the associated basins comprise the ultimate heat sink (UHS) for the ACCWS. The WCT basin has the capability to store sufficient water to shut down the plant under accident conditions. The ACCWS also serves as a water source for the emergency feedwater (EFW) system, delivering water from the WCT basins to the EFW pumps. FSAR Section 9.2.5.3.3 credits the WCT inventory for 14 hours of EFW operation after depletion of the condensate storage pool, which is the normal source for the EFW system.

E1.2.1 Mechanical Design

a. Inspection Scope

The mechanical design review consisted of an assessment of thermal/hydraulic calculations, thermal performance testing, flow testing, and single failure review to determine if the ACCWS is designed to remove the required heat load during a LOCA and certain natural events, including earthquakes and tornados. The inspection team also reviewed calculations related to the alignment of the WCT basin to the EFW pumps. In addition, the team reviewed the plant's FSAR, TS, as well as various process flow diagrams and engineering evaluations associated with the closeout of CRs as they applied to the ACCWS.

The inspection team also reviewed selected corrective actions and internal audits. In addition, the team reviewed the plant's vendor manual for the WCT and ACCWS operating procedures, in order to determine if selected portions of the system are operated in accordance with the design bases.

b. Observations and Findings

In reviewing the thermal/hydraulic design of the ACCWS, the team noted that the recent addition of filtration equipment for the WCT inventory would improve the system's heat transfer capability. With few exceptions (discussed in the following sections), the mechanical design calculations were adequate. The following paragraphs discuss the issues.

1. ACCWS Flow Test

In reviewing the ACCWS flow test discrepancies identified in CR 96-0543, the team noted that the acceptance criteria failed to consider margin for errors such as flow instrumentation accuracy, measurement and test equipment inaccuracies, and other uncertainties. In addition, the test results addressed in the CR indicated that the ACCWS could not attain the required flow rate of 5000 gpm as stated in FSAR Table 9.2-1.

The licensee evaluated the acceptability of the as-found ACCWS flow of 4500 gpm, without allowance for instrument uncertainty. The licensee conducted a 10 CFR 50.59 safety evaluation for the apparent degraded condition of the ACCWS B train, and concluded that no unreviewed safety questions existed.

However, similar to the CCWS flow test, the licensee used the plant's installed instruments to measure the flow rates to safety-related components. When instrumentation errors are included, the actual flow rates could be less than those recorded in the test. The licensee stated that although the instrument uncertainties were not included in the acceptance criteria for flow test, a reasonable amount of uncertainty was applied to the test results when validating the test data. However, the licensee could not provide any documentation to show the amount of uncertainties they considered when validating the test data.

In response to the team's concern, the licensee agreed to address this matter and its generic implications. The team identified this issue as another example similar to inspection follow-up item IFI-96-202-01.

2. EFW/ACCWS System Interface Concerns

FSAR Section 9.2.5.3.3 discusses the requirement to maintain makeup water to the EFW system for 24 hours. Accordingly, the FSAR states that WCT basin inventory is credited with providing a source of water after the condensate tank is empty. The team reviewed EFW system Operating Procedure OP-902-006, Revision 7. Page 12, step 24, of that procedure states that when condensate storage pool level ≤ 20%, then transfer EFW pump suction to one side of the ACCWS.

The team requested hydraulic calculations to confirm that the ACCWS could deliver water from the WCT basin to the suction of the EFW pumps. Initially, the licensee told the team that there was no hydraulic calculation for this lineup, but that one would be performed. During preparation for the preliminary hydraulic calculation, the licensee discovered that there was an A/E calculation entitled "Emergency Feedwater Pump (Turbine Driven)," dated June 6, 1983, that calculated adequate NPSH at the EFW pumps when taking suction from the ACCWS pumps. The team requested that the licensee also demonstrate that the ACCWS pumps will not overpressurize the EFW system. The licensee performed a preliminary calculation and determined that the ACCWS pumps will not overpressurize the EFW system. The team concluded that there were no further concerns regarding the system hydraulics discussed above.

During the inspection, the team questioned the adequacy of the ACCWS inventory to support the UHS as well as the EFW system. The licensee stated that CR-96-1441 documented that there may not be adequate support of the basis for allowing the use of the WCT basins as the primary source of water for the EFW system. Technical Specification 3.7.1.3 allows the condensate storage pool (CSP) to be in a 7-day limiting condition of operation (LCO) if the WCT basins are demonstrated to be operable. However, during the investigation for this CR, the licensee determined that during a design basis LOCA, the WCT basin does not contain enough water to simultaneously supply the EFW system and fulfill its heat removal requirement for the UHS. It appeared that the ACCWS would be inoperable as a UHS if it were credited as the EFW supply. During the inspection, operations management implemented an interim action of administratively prohibiting entry into the TS action statement until the WCT basin is determined to be an acceptable alternative source.

The team was concerned that this TS action statement had been placed in effect without any technical evaluation of calculations to support EFW operation from the ACCWS. The team questioned the licensee as to whether any other TS action statements used for plant operations were not supported by any analysis. The licensee stated that they would review the generic implication as part of the corrective action for this condition report. However, their safety system self-assessments and corrective actions for the problems identified in previous NRC reports

for this system had not identified this issue. At the end of this inspection period, the licensee was still determining the past operability and the adequacy of TS action statement. The team identified this issue as unresolved item URI-96-202-03.

3. Cold Weather Operating Instructions

The team reviewed Vendor Technical Manual No. 457000142 for the WCTs, and noted that page 21 of the manual includes a caution statement regarding cold weather operation. Specifically, the tower should not be started or operated without at least 30% heat load when the inlet wet bulb temperature is below 35°F. The team then reviewed System Operating Procedure OP-002-001, "Auxiliary Component Cooling Water," Revision 10, and determined that the procedure did not incorporate any information regarding cold weather operation of the tower, as specified by the vendor. Furthermore, the licensee had no technical justification as to why cold weather operation of the tower is justified without the stated vendor specification. Also, discussions with design engineering and operations personnel indicated that they were not aware of this requirement. 10 CFR 50, Appendix B, Criterion III requires that applicable design basis are correctly translated into procedures. The licensee wrote CR-96-1506 to address this concern, and informed the team that the issue concerning cold weather operation of the WCT will be resolved prior to the onset of winter. The licensee's operability evaluation indicated that there were no operability concerns. The team identified this issue as unresolved item URI-96-202-04.

c. Conclusion

In general, all mechanical functions of the ACCWS were acceptable. However, the team identified weaknesses such as the instrument uncertainties were not accounted for ACCWS flow, and the ACCWS flow was less than those stated in the FSAR; no analysis or test was conducted to ensure that WCT can be used as a source of EFW; and vendor specification for cold weather operation of the WCT was not incorporated in operating procedure. The weaknesses mentioned above either have been, or are currently being evaluated through the licensee's condition report process.

E1.2.2 Electrical Design

a. Inspection Scope

The team reviewed the electrical circuit design drawings for normal and emergency operation of the ACCWS pump motors, WCT fans, and selected MOVs. The team also compared the drawings to FSAR system descriptions, operating procedures, TS criteria, and test procedure results to verify that the circuits matched the system descriptions and were being tested in accordance with design requirements. In addition, the team reviewed the adequacy of the licensee's worst-case voltage calculations for selected ACCWS components and coordination of electrical protective devices.

b. Observations and Findings

The team determined that the selected drawings matched the design and testing criteria, the worst-case voltages available to the ACCWS components were adequate, the coordination of electrical protective devices was acceptable, and the testing results indicated that the devices were operating within the design limits. No unacceptable conditions were noted during this review.

c. Conclusions

For the items sampled, the team concluded that the design and testing were adequate.

E1.2.3 I&C Design

a. Inspection Scope

The team reviewed applicable sections of the FSAR, TS, Design Basis Document, system flow diagrams, installation details, and setpoints and uncertainty calculations for selected instrumentation and controls.

b. Observations and Findings

During the inspection, the team reviewed Calculations EC-I91-005, Revision 0, which established the basis for the loop uncertainty values for the indication and alarm function of the WCT basin water level. The team also reviewed Calculation EC-I91-014, Revision 0, which established the loop uncertainty values for the indication, alarm, and control functions of the CCWS heat exchanger outlet temperature to start the ACCWS pump.

These calculations presented the detailed development of the assumptions and requirements for instrument accuracy and calibration accuracy. The team determined that these calculations had been performed in accordance with the I&C Design Guide (DEIC-I-502). The random uncertainties were combined using the Square Root-Sum-of-Squares, and non-random uncertainties were combined algebraically.

The licensee had identified a deviation from the Category 2 instrumentation requirements for the temperature loop as specified by Regulatory Guide 1.97, Revision 3.

c. Conclusions

The uncertainty calculations provided a valid basis for the loop uncertainties and margins for the alarm and interlock settings with respect to the TS setpoints and analytical limits. For the items sampled, I&C design was adequate for ACCWS operation.

E1.3 Other Related Electrical Systems Review

The inspection team reviewed several parts of the electrical distribution system, which supports operation of the CCWS and ACCWS equipment. The following paragraphs discuss the results for each of the areas selected for review.

E1.3.1 Degraded Voltage Relay Setpoint and Testing

a. Inspection Scope

The team reviewed the licensee's design and engineering controls for the switchyard, results of studies concerning worst-case grid conditions, degraded relay setpoint calculations, and supporting surveillance testing.

b. Observations and Findings

The licensee's switchyard had multiple incoming lines and a dual bus arrangement, with considerable flexibility to deal with line outages. The team noted that the licensee had used a computer model to calculate the required voltage to maintain operability of offsite power, under normal, abnormal, and shutdown conditions. Although the team did not review the computer program used to model the grid, the team considered that the results were reasonable on the basis of conservative input data and worst-case load assumptions.

The licensee had written agreements with offsite organizations for operation and maintenance of the switchyard. The licensee also furnished the team with sample documents that specifically limited switchyard work during past key plant evolutions, such as reduced inventory.

The degraded grid setpoint voltage was supported by the offsite power operability limits, in that licensee procedures directed that offsite power be declared inoperable before the setpoint would be reached under calculated worst-case conditions. The team determined that the licensee's degraded grid relay setting calculation was adequate. In addition, review of the associated surveillance procedure led the team to determine that the degraded grid relays were being tested within the design guidelines.

c. Conclusions

For the items sampled, the team concluded that the degraded relay setpoint design and testing were adequate.

E1.3.2 Emergency Diesel Generator (EDG) Fuel Oil Storage

a. Inspection Scope

The team reviewed fuel oil storage calculations for the EDG and compared these calculations to existing TS and FSAR requirements.

b. Observations and Findings

Technical Specification 3.8.1.1 requires, except for testing, that the licensee maintain a minimum of 38,760 gallons of fuel oil in each storage tank.

The TS 3/4.8 Bases state that each diesel generator storage tank contains fuel oil of a sufficient volume to operate each diesel generator for a period of 7 days. The TS Bases also state that the minimum required volume is based on the time-dependent loads of the diesel generator following a loss of offsite power and a concurrent design basis accident and includes the capacity to power the engineered safety features in conformance with Regulatory Guide (RG) 1.137.

Regulatory Guide 1.137, dated October 1979, "Fuel Oil Systems for Standby Diesel Generators," provides methods acceptable to the staff for complying with the Commission's regulations regarding fuel oil systems for standby diesel generators. Regulatory Guide 1.137 endorsed the fuel oil storage calculation methods defined in Section 5.4 of American National Standards Institute (ANSI) standard N195-1976, "American National Standard Fuel Oil Systems for Standby Diesel Generators." Specifically, Section 5.4, "Calculation of Fuel Oil Storage Requirements," discusses how to perform the time-dependent load calculation referenced in the TS bases. Section 5.4 also requires that a 10% minimum margin be added for the time dependent method.

The team noted that, although the licensee met the TS volume for fuel storage, this volume was less than the volume specified by RG 1.137, as discussed in the TS Bases. Specifically, the licensee did not include the 10% minimum margin in their time-dependent calculation for arriving at the TS value of 38,760 gallons. The licensee stated that the 10% margin was for original tank sizing, not the actual amount of fuel stored. The team did not agree with this assertion. The licensee's method of calculating fuel oil storage requirements was not in accordance with the accepted methods of RG 1.137 and ANSI STD N195-1976. The licensee did not provide any records indicating that the licensee had requested approval of an alternate calculation method for EDG fuel oil storage. TS fuel oil capacity requirement is therefore, incorrect.

The results of Calculation EC-E90-006, Revision 2, "Emergency Diesel Generator Loading and Fuel Oil Consumption," Section 6.1 demonstrated that the licensee's EDG fuel oil storage did not agree with FSAR statements. The team questioned the reason for this discrepancy, and the licensee replied that the FSAR had recently been revised and was now in agreement with the calculation. The team then reviewed the FSAR change and associated 10 CFR 50.59 safety evaluation, as well as Plant Operations Review Committee Meeting Number 93-038, Item III-A (for LDCR 93-0091). The team noted that the FSAR change deleted the commitment to ANSI STD N195-1976 for calculation of fuel oil storage. The licensee's 10 CFR 50.59 safety evaluation stated that the change did not affect the design as specified in TS Bases. However, the Bases stated that the minimum required volume of EDG fuel was based on conformance with Regulatory Guide (RG) 1.137, October 1979, that endorses the ANSI standard. Implementation of LDCR 93-0091 resulted in a 10% reduction in the required fuel oil storage capacity as specified in TS bases. The team considered this

deletion to be a 10% reduction in the required fuel storage capacity. Therefore, the licensee's 10 CFR 50.59 evaluation was inadequate to demonstrate that an unreviewed safety question did not exist.

The adequacy of EDG fuel oil volume including 10 CFR 50.59 evaluation is identified as unresolved item URI-96-202-05.

The licensee stated that their emergency operating procedures (EOPs) directed the monitoring of EDG fuel oil usage to ensure a 7-day supply. The team verified that the EOPs contained this monitoring requirement. The licensee also stated that they had the capability to cross-connect two independent EDG fuel oil tanks, but they did not take credit for this capability in their storage capacity calculations because the cross-connect capability did not meet single failure-criteria. The licensee also discussed their ability to obtain offsite fuel in less than 7 days, including the capability to obtain and receive fuel by barge during a postulated flood.

c. Conclusions

The licensee had not conservatively demonstrated fulfillment of the commitment concerning EDG fuel oil storage. In addition, the team determined that the licensee's 10 CFR 50.59 safety evaluation for the FSAR change did not adequately address the 10% reduction in the required fuel storage capacity from that discussed in TS Bases. Consequently, this change may constitute an unreviewed safety question. Nonetheless, because of the licensee's administrative controls, the team did not have an immediate safety concern with regard to these issues.

E1.3.3 EDG Loading Calculations

a. Inspection Scope

The team reviewed the licensee's EDG loading calculations and compared these calculations to the TS, FSAR, and system operating requirements.

b. Observations and Findings

The team observed that Licensing Document Change Request (LDCR) 96-0161 added the manual start of a fuel pool cooling pump 12 hours after a loss-of-offsite power (LOOP) with a safety injection activation signal (SIAS). However, starting the pump for a LOOP without an SIAS was not included in either the licensee's LOOP EDG loading Calculation EC-E90-006 or the FSAR EDG loading Table 8.3-1. The team considered that manual starting of the fuel pool cooling pump would also be required for a LOOP. The licensee agreed that this load needed to be added to the calculation and initiated condition report CR-96-1586 to correct the calculation and FSAR table. Furthermore, the team noted that the 10 CFR 50.59 evaluation did not consider the additional diesel loading.

The team observed that Electrical Calculation EC-E90-006 and FSAR Table 8.3-1 indicated that wet cooling tower (WCT) fans would operate not more than 25 hours into a LOOP with an SIAS. However, this was inconsistent with

Mechanical Calculation MN(Q)-9-9, Revision 3, Change 1, "Wet Cooling Tower During a LOCA," Paragraph 5.2, which showed that half of the fans operated for 5 days and the other half operated for 27 hours. The team questioned which calculation was correct. The licensee determined that Calculation MN(Q)-9-9 was correct and Calculation EC-E90-006 and FSAR Table 8.3-1 needed to be revised to match. The licensee initiated condition report CR-96-1586 to correct the calculation and FSAR Table. As discussed in Section E1.7, mechanical engineering personnel had previously noted the difference between the mechanical calculation assumptions and electrical EDG loading calculation, but reported this information only informally, and the licensee had not acted upon the discrepancy. The licensee performed a preliminary calculation and determined that the change would require only a minor revision in their EDG loading and fuel oil calculation. The team determined that this was an example of poor communication between the mechanical and electrical groups.

The team reviewed the licensee's 10 CFR 50.59 evaluation associated with Calculation MN(Q)-9-9, Revision 3, Change 1. The team noted that the 10 CFR 50.59 evaluation, Plant Operations Review Committee Meeting Number 96-037, Item III-D (for LDCR 96-0161) changed FSAR page 9.2-16 to indicate that the ACCWS was not required after 5 days (rather than the previous 7-day requirement) following a large break LOCA. In addition, Calculation MN(Q)-9-9, Revision 3, Change 1, showed that half of the WCT fans operated for 5 days and the other half operated for 27 hours following a large-break LOCA. The team noted that the large-break LOCA represented potential worst-case EDG LOOP/SIAS loading. During the inspection, the licensee was unable to identify exactly which document had originally specified the 25-hour operation of the WCT fans used in FSAR Table 8.3.1. The team determined that EDG loading changes for the calculated equipment operating times were not properly considered in the 10 CFR 50.59 evaluation. Therefore, the team concluded that this 10 CFR 50.59 review was incomplete and inadequate to demonstrate that an unreviewed safety question did not exist. The adequacy of EDG loading including 10 CFR 50.59 evaluation is identified as unresolved item URI-96-202-06.

c. Conclusions

The team concluded that the licensee's EDG loading and fuel oil calculations had errors and were not adequately controlled for changes in operation. The 10 CFR 50.59 evaluation for the FSAR change also was inadequate.

E1.3.4 18-Month Integrated EDG Testing

a. Inspection Scope

The team reviewed the licensee's 18-month integrated EDG surveillance testing and compared the testing to design documents and TS criteria.

b. Observations and Findings

Technical Specifications 4.8.1.1.2.d.3.a and 5a require that each diesel generator shall be demonstrated operable at least once per 18 months during

shutdown by simulating a loss-of-offsite power(LOOP) and LOOP in conjunction with an SIAS actuation test signal and verifying deenergization of the emergency buses and load shedding from the emergency buses.

The team reviewed the testing procedures used by the licensee to accomplish the above tests, including Surveillance Procedure OP-903-115, Revision 3, "Train A Integrated Emergency Diesel Generator/Engineering Safety Features Test." Through this review, the team identified that certain non-emergency 480-Vac loads on safety-related buses were shown as being shed upon loss of voltage to the 480-volt buses but were not being tested. The team discussed these loads with the licensee. The licensee stated that the design of the supply devices (mostly contactors) was to open upon loss of holding voltage and hence required no verification. The licensee asserted that they were only required to verify that devices shed by the LOOP or LOOP/SIAS sequencer, were in fact deenergized. The team did not agree with this position.

Some of the 480 Vac Train A loads that were not verified by testing as being shed during LOOP/SIAS testing were Switchboard 3A311 supplied Fan S-3, Boric Acid Makeup Tank Heaters, Hydrogen Analyzer Unit A Pump, Switchboard 3AB311 supplied Compressor WC-1, and Switchboard 3A313 supplied Hydrogen Recombiner Power Supply A.

For a LOOP, loads not verified as being shed included all of the non-safety-related loads on Switchboard 3A32, a potentially large load of plant heaters and motors. The team observed that Procedure OP-903-028, "Pressurizer Heater Emergency Power Supply Functional Test," Revision 3, deenergized Switchboard 3A32 and stated that all loads would be deenergized, but did not require observation or verification that some of the loads were deenergized as stated. The licensee reviewed the information and stated that they considered the procedure adequate because operators would initiate a condition report if the circuit breakers did not trip.

The team determined that Air Handling Units AH-3 (Shutdown Heat Exchanger A Cooler) and AH-24 (CCW Heat Exchanger A Cooler), which were shed and re-energized by a LOOP or LOOP/SIAS, were not part of the integrated test. The licensee stated that emergency operation of these units was verified by normal operation via a normally closed contact. The licensee also furnished the team with records showing that the relays associated with these devices had been replaced during the last outage and the individual contacts had been verified to operate properly.

In addition, the team determined that Control Room Heater EHC-34 and Switchgear Room Heater EHC-36, which were shed and reenergized by a LOOP or LOOP/SIAS, were not part of the integrated testing. The licensee stated that these heaters were not needed during any accident and, therefore, did not need to be tested.

The team informed the licensee that any loads that were not verified as being shed during a LOOP or LOOP/SIAS test should be considered as part of the diesel loading. In addition, applicable calculations (including the diesel fuel oil calculation) needed to be updated because the existing calculations assumed that these loads were shed. The adequacy of 18 month TS integrated

tests to verify deenergization of the emergency buses and load shedding from the emergency buses, and the adequacy of diesel loading and fuel oil consumption calculations to ensure that untested loads were properly considered in the calculations were identified as unresolved item URI-96-202-07.

The licensee stated that they had reviewed the items identified by the team and considered that their dynamic analysis demonstrated the capability of the EDGs to carry loads during LOOP or LOOP/SIAS scenarios. Furthermore, the licensee stated that they would review the adequacy of their existing test as part of their commitment in response to Generic Letter (GL) 96-01, "Testing of Safety-Related Logic Circuits."

c. Conclusions

The team identified weaknesses in the licensee's 18 month integrated tests to verify EDG design and operation. In addition, the diesel loading and fuel oil consumption calculations did not ensure that untested loads were properly considered in the calculations.

E1.3.5 Battery Loading and Testing

a. Inspection Scope

The team reviewed the technical adequacy of the licensee's Battery A loading profile calculations, and compared the calculations to existing EOPs, surveillance procedures, and TS requirements.

b. Observations and Findings

The licensee had installed new batteries with larger capacity in 1992. The team determined that the licensee's Battery A loading profile calculation methods were adequate, with large margins for uncertainties and long-term battery degradation, except as noted below. In addition, the surveillance data met design and TS 4.8.2.1 requirements.

During the review of the licensee's battery calculations, Calculation EC-E91-061A,"Battery 3A-S Cell Sizing," Revision 1C, and Calculation EC-E91-058,"Battery 3A-S ("A" Train) Calculation for Station Blackout," Revision 1, the team determined that the licensee took credit for manually deenergizing selected loads during a station blackout (SBO) event. The team compared the loads credited by the calculation as being deenergized with Emergency Operating Procedure OP-902-005, "Loss of Offsite Power/Station Blackout Recovery Procedure," Revision 9, and determined that this procedure directed that the credited manual loads be deenergized. However, during review of an updated input calculation for loads on a specific battery-supplied motor control center (MCC), Calculation EC-E91-183, "Load Study for PDP 3MC-S," Revision 2, the team determined that this calculation credited manual deenergization of load from Circuit No. 3, that was left energized in OP-902-005.

The licensee noted that this calculation was in error, but that the results of this calculation had not yet been included in the overall battery load calculations or in the FSAR. The licensee stated that they would correct the error and review associated calculations for similar errors. The licensee subsequently informed the team that they had not identified any additional errors. The licensee initiated condition report CR-96-1510 to investigate and correct the error. The team reviewed a calculation for another MCC and did not identify any additional errors.

c. Conclusions

The licensee's Battery A loading calculation methods were adequate and contained large margins for uncertainties and long-term battery capacity loss. However, the team identified an error in the MCC load calculation and the licensee initiated condition report to address this issue. The team determined that the testing met the design and TS criteria.

E1.4 Permanent and Temporary Modifications

a. Inspection Scope

The team reviewed Design Change (DC) packages and temporary alterations for completeness, adequacy of the technical description of the system, consistency with procedural requirements, and post-modification testing requirements. The team also reviewed the licensee's design control procedures to ensure that adequate guidance was provided for controlling design changes.

b. Observations and Findings

On the basis of a sample of design control procedures reviewed, the team determined that the licensee's procedures provided adequate guidelines and requirements for controlling permanent plant design changes and temporary alterations. The eight DC packages reviewed were technically adequate and were appropriately reviewed and approved in accordance with licensee's procedures. The design changes were closed out with appropriate drawing revisions, calculation revisions, and procedure updates, and were conducted in accordance with established procedures. The post-modification tests reviewed were adequate to verify the design changes. The design engineering personnel, who prepared the DC packages, were familiar with the packages and knowledgeable with regard to applicable design control processes. The team also reviewed five temporary alterations that were implemented in accordance with administrative procedures. The specific 10 CFR 50.59 evaluations for the design changes and temporary alterations reviewed provided an adequate basis for determining that the modification did not involve any unreviewed safety question.

Except in one case, the licensee prepared appropriate changes to update design basis documents (DBDs) and the facility FSAR. Specifically, the design change package (DCP 3311, Revisions 0, 1, and 2) regarding the addition of a non-safety-related CCWS corrosion rate monitoring system was inadequate and needed redesign 3 times. The licensee identified that the system had the potential to drain down the ACCWS wet tower basin if a break was postulated in the

corrosion monitoring system. The licensee showed the extensive review undertaken to prevent the drain down. The drain down was prevented by the addition of a siphon break hole in the filter system suction, and specific testing had been completed to verify the design. This review was documented in the licensee's safety analysis, and the safety evaluation contained in the DC package also had an extensive discussion on the interface of the safety and non-safety-related systems. However, neither the FSAR nor the DBD updates contained a discussion on the specific design of the siphon break hole. The team noted that procedure for updating the licensing bases documents (such as the FSAR and DBDs) provided no guidance to ensure that these documents included an appropriate level of detail and specific attributes.

c. Conclusions

The team concluded that the design changes and modifications sampled were, in general, technically adequate, and calculations performed in support of the modifications were acceptable. The design engineers interviewed by the team were knowledgeable and familiar with the design changes. Nonetheless, the guidance for updating the licensing bases documents (such as the FSAR and DBDs) appeared to be weak in that no guidance was in place to ensure that these documents included an appropriate level of detail and specific attribute.

E1.5 10 CFR 50.59 Evaluation Process

a. Inspection Scope

The team reviewed the licensee's 10 CFR 50.59 evaluations (screening and safety evaluations) for design changes, drawing change notices (DCNs), condition reports, and plant procedures to ensure that changes, tests, and experiments to the facility did not result in an unreviewed safety question. In addition, the team reviewed 10 CFR 50.59 training requirements and procedures.

b. Observations and Findings

The licensee had taken initiatives to improve the 10 CFR 50.59 evaluation process, in response to weaknesses identified in the root cause analysis report for CR 96-0471. The new process and procedure were implemented on September 30, 1996. The team determined that the revised process and procedure met the requirements of 10 CFR 50.59. The 10 CFR 50.59 evaluations sampled for the plant modifications were generally adequate. However, the team identified examples of inadequate 10 CFR 50.59 evaluations performed in support of calculations, licensing design changes and condition reports. These are discussed in the following paragraphs as well as in Sections E1.3.2, E1.3.3, and E2.3 of this report. In addition, some of the evaluations reviewed could have been more detailed so that the evaluations would stand alone without reference to initiating documents. For example, for the safety evaluation prepared for the FSAR changes for the fuel pool cooling system (LDCR-95-0117), the team had to refer to the applicable calculations to understand the scope and the basis for the change.

By LDCR-95-0071, the licensee implemented a change to FSAR Table 6.2-32 which credited the EFW flow control and isolation valves EFW-223A/B and EFW-224A/B as containment isolation valves. This change adds clarification to the FSAR Table to address the operability requirements associated with emergency feedwater system control and isolation valves. There are eight control and isolation valves (EFW 223 A/B, EFW 224A/B, EFW 228 A/B and EFW 229A/B). This change will allow either the EFW flow control or the EFW isolation valve to perform the containment isolation function should one of these series valves become inoperable. Previously, FSAR, Table 6.2-32, Note U, indicated that no credit was taken for these valves with regard to meeting the requirements of General Design Criteria (GDC) 55 through 57. The team determined that for these valves to be considered as containment isolation valves, they should have either qualified position indications in the control room, or some alternative way of verifying the valve position indications. These valves do not have such position indications or any approved alternative method of determining the valve positions. Thus, these valves are not acceptable containment isolation valves in their safety evaluation. The team concluded that 10 CFR 50.59 evaluation was inadequate to demonstrate that an unreviewed safety question did not exist.

By implementing this change, the licensee could have violated TS 3.6.3, "Containment Isolation," if certain other containment isolation valves had been inoperable. The licensee wrote a condition report on October 23, 1996, to address this issue after the team questioned the adequacy of this change. In the interim, the licensee provided instructions to the operating staff stating that no credit should be taken for the above valves as containment isolation valves. Subsequent to the inspection, the licensee was evaluating the past operability issues associated with this change.

In addition, the safety evaluation for LDCR-95-035, "Removal of Valves CAP-102, CAP-205, EFW-223A&B, EFW-224A&B from FSAR Table 7.5-3 and clarification in Table 6.2-32," referenced the above safety evaluation to delete valves EFW-223A&B and EFW-224A&B from the list of Regulatory Guide 1.97 Category 1 valves. The team noted that licensee's Regulatory Guide 1.97 submittals identified the above containment valves as having qualified containment isolation valve position indications. This evaluation was also inadequate in that it failed to recognize the need for qualified position indications in the control room for the above containment isolation valves.

The acceptability of EFW-223A/B and EFW-224A/B valves as containment isolation valves including 10 CFR 50.59 and past operability evaluations is identified as unresolved item URI-96-202-08.

The Design Engineering Procedure NOECP-011, Revision 2, for controlling the implementation of calculation changes did not provide adequate guidance to ensure that design changes were implemented with proper 10 CFR 50.59 evaluations. The team noted that through root cause analysis for condition report CR 95-12[illegible], the licensee identified that Calculation EC-M95-008, "Ultimate Heat Sink Design Basis," was approved, as "final," and was used, as a design basis for evaluation of the CCWS heat exchanger test results before the corresponding changes were approved for the setpoint analysis, FSAR and TS. The team also identified some calculation packages that were marked as

"final" without undergoing the 10 CFR 50.59 evaluation process. However, these changes were not yet implemented by the licensee. Examples include calculation EC-S96-006,"Radiological Doses Due to Failure of a WGDT and FHA," Revision 0, and Calculation EC-S96-004, "Cycle 9 Safety Analysis Groundrules," Revision 0. The team acknowledges that the licensee's management has provided interim guidance to perform 10 CFR 50.59 evaluations for calculations that affect the design bases. The licensee stated that the above engineering procedure is expected to be revised shortly. The licensee also stated that they performed a sample review of calculation changes and did not identify any problems.

All individuals performing 10 CFR 50.59 reviews were required to undergo a refresher training before September 30, 1996, to ensure that they were familiar with the revised process. The team reviewed the training procedure and determined that it covered the necessary information to perform 10 CFR 50.59 evaluations adequately, and the design engineers interviewed were knowledgeable of the new process requirements.

c. Conclusions

The inspection team determined that the revised process and procedure met the requirements of 10 CFR 50.59. The 10 CFR 50.59 evaluations for the plant modifications were generally adequate. However, the team identified examples of inadequate 10 CFR 50.59 safety evaluations performed in support of licensing document changes such as crediting EFW flow control and isolation valves to fulfill the containment isolation requirements.

E1.6 Design Basis Document (DBD) Program

a. Inspection Scope

The team reviewed the licensee's implementation, upkeep, and maintenance of the DBD program to reflect the present plant configurations.

b. Observations and Findings

The team reviewed the DBDs for the CCWS and ACCWS to assess the degree of fidelity between the DBDs and the current system configuration. The DBDs contained system configurations and design parameters for all major equipment. The DBDs were frequently used by both design and system engineers as a source of design information. To date, the licensee has completed 29 DBDs for systems. However, the licensee had not implemented a formal reconstitution effort to challenge the original design assumptions and assess the accuracy of the design analyses.

The team also determined that the licensee did not have procedural guidance regarding the level of detail the design engineers should incorporate into the DBDs for design changes and modifications. For example, in reviewing the modifications associated with the corrosion rate monitoring system (DCP 3311) for the UHS, the engineers did not modify the DBD to properly capture key

design information regarding the feature provided to prevent the potential drain down of the ACCWS WCT basin and the interaction between safety-related and non-safety-related corrosion rate monitoring system.

c. Conclusions

The guidance for updating the DBDs appeared to be weak in that the licensee did not have any procedural guidance to assist design engineers in ensuring that the DBDs are modified with an appropriate level of detail and specific required attributes. In addition, the licensee had not implemented a formal reconstitution effort to challenge the original design assumptions and the accuracy of design analyses.

E1.7 Calculation Control

a. Inspection Scope

The team compared the control and issuance of selected calculations to the requirements of the licensee's calculation control procedure, Design Engineering Procedure NOECP-011, "Performance of Calculations," Revision 2. In addition, the team reviewed the licensee's administrative procedure for instrument setpoint change control, UNT-007-014, Revision 7, that is used to identify and approve changes to the setpoint calculations.

b. Observations and Findings

The team noted that calculation EC-E90-006B, "Emergency Diesel Generator Loading and Fuel Oil Consumption," Revision 1B, Change 1, issued as pending on February 5, 1996, was not included in Revision 2, which was issued on March 22, 1996. Revision 1B, Change 1, was issued to correct an omission in the calculation and to incorporate the changes associated with manual start of the spent fuel pool cooling pump for a LOOP/SIAS, which was identified on November 30, 1995, by condition report CR 95-1242. The need to start this pump also required an FSAR change.

The licensee's calculation control process directed that calculations for planned modifications be issued as pending and reissued as final when the modifications were completed. Pending calculation changes should not be included in calculation revisions, and were not required to be listed on the revision as outstanding. In addition the process allows calculation changes that correct errors or omissions to be issued as pending when licensing changes were required, with no timeliness requirements for completing the licensing actions or finalizing the calculations. The team pointed out to the licensee that with the existing process there is a potential for the latest revisions of the calculations to be issued with incorrect information. The licensee stated that they would review the procedure and take appropriate actions.

As discussed in Section E1.3.3, the licensee's mechanical engineering personnel recognized that the EDG loading calculation and related FSAR sections were required to be updated to match calculation changes associated with operation of the CCWS and ACCWS. The licensee also stated that

mechanical engineering personnel had informed electrical engineering personnel of the need for the changes, but no changes had been made. The team observed that the licensee's calculation control procedure required the originator of a calculation change to consider the impact of the calculation on other design documents, but did not require a listing of these affected documents or verification that the documents were updated.

The licensee's setpoint calculation control procedure provided adequate guidance to identify, review, approve, and issue changes to the setpoint calculations. The team examined the work control document sheets used for each I&C setpoint calculation sampled. The documentation control sheets for each calculation were completed in accordance with the licensee's established procedure.

c. Conclusion

The team concluded that the licensee's calculation control procedure was weak in that it did not require timely correction of omissions or errors, or timely completion of associated licensing documents. The procedure also did not require a listing of changes not incorporated in calculation revisions, and provided no management control to ensure that documents affected by a calculation change or revision were identified and updated. However, the setpoint calculation control procedure was adequate.

E1.8 Plant Walkdown

a. Inspection Scope

The team performed a plant walkdown of the accessible areas for the train A CCWS, ACCWS, and support systems. The team also compared a sample of installed components to the FSAR and design drawing requirements and assessed the overall material condition.

b. Observations and Findings

The team determined that the overall material condition of the plant areas was good; however, a few issues needed licensee attention. For example, a level gauge for the CCWS surge tank was badly corroded, and the sight glass protection rods were no longer attached at the sight glass base. The licensee's staff stated that they would take appropriate measures to correct this problem. The team also observed that the WCT basin level indicating meter in the control room was very difficult to read, since the level was indicating normally at 99.8% with a low level alarm reading identified by plant procedures at 99.2%. This low level is annunciated as an alarm, but the design as installed did not follow good engineering or human factors design. The team determined that the equipment sampled matched the design requirements except for the tornado missile protection installations and reactor building shield door installation. These issues are discussed in detail in Sections E2.3 and E2.4.

c. Conclusions

The walkdown indicated that, in general, adequate measures were in place to effectively control the system configuration. The team observed that equipment conditions were generally adequate and the general area housekeeping was good.

E2 Engineering Support of Facilities and Equipment

E.2.1 Engineering Work Activities

a. Inspection Scope

The team reviewed the engineering work activities to determine the effectiveness of engineering support for the station.

b. Observations and Findings

Engineering support for the station was primarily provided through technical evaluations, operability confirmation evaluations, and corrective actions for issues documented through condition reports and design changes. The team noted that approximately 56% of site-wide overdue responses for CRs belonged to engineering. The team also reviewed the total backlog of engineering action items, which included design changes, substitute part equivalency evaluation reports, temporary alterations, and condition reports. The total backlog of engineering action items was 1143 as of August 1996; however, most of the backlog is attributable to a recent increase in the number of CRs as a result of the Waterford 3 policy to maintain a low threshold for problem reporting. The licensee's recent engineering self-assessments indicated that the management of the CR backlog, workload and timeliness of evaluations was one of the areas that needed improvement. The team noted that engineering management was aware of the existing backlog and overdue responses for CRs and was taking actions to correct it.

c. Conclusions

The team concluded that, in general, the engineering support provided to the station appears to be adequate.

E2.2 Review of Licensee Event Reports (LERs)

a. Inspection Scope

The team reviewed three recent LERs (96-04, 96-05, and 96-07) and associated root cause analyses (RCAs) for the CCWS and ACCWS. In addition, the team assessed the thoroughness of the licensee's identification, evaluation, and tracking of open items as well as correction of identified issues.

b. Observations and Findings

All of the LERs reviewed were very detailed and met the requirements of 10 CFR 50.73, with regard to the statement of problems, immediate corrective

measures, actions to prevent recurrence, and safety significance. The root cause analyses for the above LERs were adequate in identifying and correcting the problems.

c. Conclusions

All of the LERs reviewed provided good detail and met the requirements of 10 CFR 50.73.

E2.3 Technical Evaluations

a. Inspection Scope

The team reviewed specific engineering evaluations that the licensee performed to support condition reports. The intent of this review was to determine the depth and completeness of engineering evaluations performed in support of plant operations.

b. Observations and Findings

The team's review of the design change packages and temporary alterations were discussed in section E1.4. As stated earlier, the licensee's 10 CFR 50.59 evaluations in the modifications programs appears to have been generally complete and detailed. The team identified the following issues during the review of condition reports (CRs).

1. Shield Door Installation Issue (CR-96-1486)

This CR was written to document an observation made by the team during the plant walkdown regarding a "chain fall," that was placed on a building column and attached to the reactor building shield door (outer maintenance hatch door). In addition, the drive mechanism for the maintenance hatch appeared to be non-functional. The team questioned the adequacy of this condition. The licensee stated that the "chain fall" and the drive mechanism were not required for the shield door operation. During subsequent evaluation for this CR, the licensee discovered that the design of the shield door had required installation of four 1-1/4" bolts to hold the door in place during the design basis seismic event. The bolts were never installed in accordance with design drawings 5817.7129 and 5817.7130 and calculation EC-C-90-038, and no procedure had been written to incorporate the design requirement to install the bolts when the door was closed. The licensee's actions do not meet the requirements of 10 CFR 50, Appendix B, Criterion V and TS 6.8.1. The team identified this issue as unresolved item 96-202-09.

The licensee conducted an operability assessment regarding the condition described above since the door would be required to be operable for TS action statements 3.6.6.1, 3.6.6.2, and 3.6.6.3. In addition, the licensee took immediate action to install the missing bolts to match the design drawings.

The team then reviewed the licensee's preliminary engineering analysis to determine if the door would remain in place after the design basis seismic event. The analysis assumed that there would be sufficient friction between the door and an inflated rubber bladder between the door and the reactor building to hold the door in place. This analysis calculated the friction and concluded that the door would remain in place during a seismic event. However, the team noted that this analysis did not consider the load transmitted from the door, during the postulated seismic event, to the rubber bladder that must be transmitted through the rubber bladder to the reactor building structure.

Specifically, the licensee should have evaluated the bladder for shear load so that this load could then be transmitted to the reactor building. During discussion with the team, the licensee's engineering personnel stated that they had evaluated the shear load, but had not documented the load in their evaluation. In addition, the team questioned how the bladder was attached to the reactor building and whether the attachment was capable of transmitting the required load. The licensee's staff later reviewed the drawings, performed additional analysis, and concluded that the door would have remained in place during the design basis seismic event. The team determined that the licensee's evaluation neither documented the bladder shear load in the analysis nor evaluated the bladder anchorage in the analysis. Subsequent to the inspection the licensee completed the calculation EC-C90-038,"Design Calculation for Door Maintenance Hatch," Revision 1 which showed that they would have met the intended design function and there was no past operability concerns.

2. Valve Fasteners (CR-96-1528)

This CR was written to address incorrect fasteners used on safety-related valves. The team reviewed engineering evaluations for safety injection valves SI-415A/B. These valves were discovered by the licensee to contain lower strength stainless steel bolts rather than high strength carbon steel bolts as required by the drawings between the valve bracket and the valve operator connections. The licensee performed a stress analysis to determine if sufficient capability exists in the as-found bolts until the correct fasteners could be installed.

The licensee's stress analysis was performed using analysis input from the seismic qualification analysis and specific dynamic testing done for GL 89-10. That analysis concluded that the as-found bolt material could sustain the required load. The team noted that the stress analysis was sound, but the justification for the as-found bolts was lacking in that no review demonstrated that the as-found bolts were properly torqued. The team pointed out to the licensee that if the as-found bolts (lower strength) were torqued to the same values as a high strength carbon steel bolt, then they would have been stretched very close to their yield strength.

The licensee stated that it had not evaluated the torque requirements since the maintenance documentation for this valve did not specify a torque requirement. The lack of a bolt torque requirement was not a

sufficient engineering justification to neglect the potential impact on the as-found bolt installation. However, the team noted that licensee's Administrative Procedure MM-001-068, "General Torquing and Detensioning Practices," provided guidance for bolt torque requirements. In addition, the licensee did not conduct an evaluation to ensure that the bolts were qualified (safety grade) for their application. Since the bolt material was not correct (per the valve drawing) and the licensee did not adequately justify the as-found material, the team determined that the licensee did not ensure that the as-found bolt material could sustain the design load. The review of design and installation of bolt fasteners for safety related valves is identified as inspection follow-up item IFI-96-202-10.

3. EFW Pump Evaluation (CR-95-0656)

The team identified a concern with CR-95-0656, dated August 4, 1995. The review of pump curves indicated that the motor-driven EFW pumps would not deliver the flows (350 gpm/pump) specified in the TS 3/4.7.1.2 Bases and Section 10.4 of the FSAR. At the time of discovery, engineering presented operations with an outdated Calculation EC-S89-003, Revision 1, dated October 9, 1989, to demonstrate that the EFW System (EFS) was still operable. This calculation was a mass-and-energy balance to determine the minimum EFW flow requirements to prevent steam generator (SG) dryout. The calculation determined that a total minimum EFW flow of 450 gpm from two motor-driven pumps was required to prevent SG dryout, but no inventory margin was provided. Additionally, the calculation used the best estimate from the American Nuclear Society (ANS) Decay Heat Standard Curves, with no uncertainty factors being applied. Operations made their operability call based on this calculation and determined that the condition was not reportable.

Part of the engineering response to CR-95-0656 documented that the above calculation (EC-S89-003) would be superseded by a new calculation. The new calculation was to provide a basis for revising TS Bases, design specifications, FSAR, DBDs, and design specifications, if necessary. The stated intent of the new calculation was also to document all inputs and assumptions used as a basis for the calculation. The scheduled delivery date for the new calculation from ABB Combustion Engineering Nuclear Power (CE) was December 29, 1995. The new calculation (EC-M96-004, "Design Basis Reconstitution for EFW Flow Rate," Revision A) was approved by Waterford engineering on June 28, 1996, approximately 10 months after discovery of the nonconforming condition. The new calculation determined that when reasonable decay heat uncertainties and SG back-pressure were considered while maintaining a reasonable SG inventory margin, the original calculation was non-conservative. The new calculation determined that both motor-driven EFW pumps delivering 575 gpm into the SG was needed to provide a 4980 lbm SG liquid margin while using a 10% decay heat uncertainty value. This new calculation was used as the bases for changing the FSAR and TS bases for EFW required flows.

The team's review of the above issue identified several concerns. First, the licensee did not perform an operability confirmation review as

required by licensee's procedure W4-101 when CR-95-0656 was written on August 4, 1995. The team determined that the licensee's action did not meet the requirements of 10 CFR 50, Appendix B, Criterion V. Secondly, delaying resolution of this non-conforming condition for 10 months while waiting for confirmation from CE was not timely resolution of a non-conforming condition as required by Appendix B to 10 CFR Part 50 and Section 16 of the licensee's Operational Quality Assurance Manual. The team identified this issue as unresolved item URI-96-202-11.

The team also identified a concern involving the technical adequacy of the new CE calculation (EC-M96-004), that determined the heat removal capability of the EFW system assuming that a LOOP removed the heat input of the reactor coolant pumps (RCPs). This assumption was not conservative in that there were no provisions established by emergency operating procedures (EOPs) to ensure that the RCP heat loads were removed. However, EOPs OP-902-004 and OP-902-006 contained instructions to remove two of the four RCPs under certain conditions. The licensee's engineering group stated that worst-case conditions need not be considered when performing transient or accident analyses. The team pointed out to the licensee that General Design Criterion 34 requires that certain systems be designed and analyzed considering that offsite power is available and not available. The team determined that the licensee's design control measures did not ensure that the GDC 34 requirement was considered in the flow calculation in accordance with 10 CFR 50, Appendix B, Criterion III. The licensee wrote a condition report (CR-96-1593) to document the team's concern. As part of the immediate actions taken, CE was requested to re-review the results of their calculation considering RCPs were running. Written results of this re-review were not available at the conclusion of the teams inspection. However, the licensee informed the team that, although the margin was reduced, the EFW system was still capable of removing heat from the reactor coolant system (RCS) while maintaining a SG level inventory margin. The new minimum EFW flow values were determined to be 615 gpm with RCPs running. This new value was below the 630-gpm capability of the EFW pumps. The team identified this issue as unresolved item URI-96-202-12.

4. <u>Waterhammer Issue (CR-95-0567, CR-95-1300, and CR-95-1332)</u>

The ACCWS waterhammer issue was initially identified on July 3, 1995, due to air inleakage in the ACCWS and due to a heat exchanger relief valve lifting. The team noted that waterhammer, column separation and air inleakage issues were discussed in numerous condition reports. The team reviewed licensee's engineering evaluations, operability evaluations and root cause analysis which established the continued operability of the ACCWS as a result of the waterhammer concerns raised in condition reports CR-95-0567, CR-95-1300, and CR-95-1332. The root cause evaluations for these CRs were very detailed, and of good quality. The engineering evaluation (based on a hand calculation) was thorough in establishing adequate justification for continued operation. The licensee later completed a more detailed computer analysis and determined that the hand calculation was more conservative. The team also reviewed the licensee's

design change package DC-3470, which is scheduled for installation during the next refueling outage. This design change addresses the potential waterhammer problems.

c. Conclusions

In general, the team concluded that the licensee's technical evaluations and corrective actions were weak in their support of plant operations.

E2.4 Ultimate Heat Sink (UHS) Tornado Protection

a. Inspection Scope

The team reviewed applicable sections of the FSAR, design basis documents, condition reports (CRs), test data and performed plant walkdown to verify the adequacy of tornado protection for the UHS.

b. Observation and Findings

The UHS consists of two independent and physically separate DCTs supplemented by WCTs and its basins. One dry tower and one wet tower form one train of the UHS and are located mostly below grade where they are protected behind two concrete walls. The dry and wet towers are required for the design basis LOCA heat removal function. For a postulated design basis tornado, however, only 60% of the dry towers are required to remove the hot-shutdown heat loads as shown in FSAR Sections 3.5 and 9.2. The remaining 40% are not protected from vertical missiles. A postulated puncture of the unprotected dry tower (40%) is assumed, and isolation valves are provided to isolate the leak. Both the dry and wet towers contain electrically powered fans for operation, but the wet tower fans are assumed to fail during a postulated tornado. The missile protection for the protected towers (60%) consists of heavy grating and concrete walls for the portion above grade. No grating is provided above the fan motors, but the concrete walls extend approximately 30 feet high and form a well around the motors.

On December 12, 1995, during the service water self-assessment, the licensee's engineering staff wrote a condition report (CR-95-1345) documenting a concern regarding the adequacy of tornado missile protection of the UHS. The concern involved protection of the DCT cells and the fan motors on the DCT since no grating was provided above the motors of the protected dry towers. Engineering reviewed the concern and determined that the CR identified a documentation issue only and not an operability issue for the following reasons:

1. LOCA is not concurrent with tornado.

2. The NRC's safety evaluation has accepted the Waterford 3 UHS design.

3. Each cell of a dry tower (a cell is 20% of a dry tower) is protected by concrete walls that resist the design basis missile to one cell.

4. The tornado protection for the motor is not valid because the protection concern for the dry towers is loss of the CCWS flow, and loss of fans does not prevent a loss of this safety function.

Therefore, the licensee determined that no further action was required by engineering regarding this CR.

On October 3, 1996, the licensee generated another condition report (CR-96-1563) again addressing the issue of tornado missile protection of the DCTs. The CR referenced the FSAR sections on missile protection (FSAR 3.5.1) and the ultimate heat sink (FSAR 9.2.5.3) as the bases for concern over the adequacy of missile protection. This CR did not specify any specific corrective actions.

The team expressed a concern that the licensee failed to perform an adequate engineering review and implement adequate corrective actions for missile protection in response to either of the above mentioned CRs in accordance with the requirements of 10 CFR 50, Appendix B, Criterion III and XVI. The team based this assertion on the factors discussed in the following paragraphs.

FSAR Section 9.2 states that 60% of the DCTs are protected from multiple tornado missiles and that is sufficient to remove hot-shutdown heat loads. The NRC's safety evaluation report (SER) regarding Amendment No. 6 to the FSAR (questions and answers) considered 60% of all equipment for UHS protected from the tornado missiles. The heat removal capacity of the DCTs is substantiated by vendor testing done with the operation of all 60% of the protected tower fans running.

During the walkdown of the CCWS and ACCWS, the team raised a number of concerns regarding the adequacy of tornado protection. Specifically, the team questioned whether components such as fan motors for the DCTs, electrical cables, portions of the piping for the B train, most of the control circuits for the CCWS, and the ACCWS spray header piping were protected from high-trajectory tornado missiles.

The team pointed out to the licensee that if 60% of all DCT equipment was not protected from tornado missiles, the ability to achieve hot-shutdown needs to be analyzed. The licensee's statement that the safety function of the dry tower is only to contain the fluid and that the fans are not necessary to remove hot-shutdown heat loads did not have an engineering basis. Furthermore, the licensee performed a probabilistic risk assessment (PRA) approach to resolve this issue, but the approach was inconsistent with the tornado missile protection features specified in the FSAR.

The licensee did not attempt to establish technical evaluations or any basis for the tornado missile protection features as stated in the FSAR until the team raised questions.

On October 10, 1996, in response to the team's concern, the licensee performed an extensive walkdown and identified cables and conduits that were potential targets of tornado missiles. The licensee generated condition report CR-96-1591 to document this issue. The licensee also implemented immediate

compensatory measures and performed operability evaluations to justify continued operation. The licensee has committed (as described in the licensee's correspondence W3F1-96-0188 to the NRC dated October 21, 1996) to implement plant modifications to address the unprotected cables and conduit installations by December 16, 1996, and to perform a comprehensive review of the design and licensing bases for tornado missile protection by January 31, 1997. The team identified the tornado protection for the UHS as unresolved item URI-96-202-13.

c. Conclusion

The team concluded that the licensee did not clearly understand the licensing and design bases protection features for the UHS equipment and did not adequately document the design bases in the FSAR with regard to missile size, type, and trajectory. In addition, the licensee did not attempt to establish technical evaluations or any basis for the tornado missile protection features as stated in the FSAR until the team raised questions.

E2.5 System Engineering Program Implementation

a. Inspection Scope

The team reviewed the system engineering procedure, interviewed system engineers, and performed a plant walkdown in order to assess the system condition, system engineers' knowledge and responsibilities, interfaces, and involvement in plant modification activities.

b. Observations and Findings

The team reviewed Administrative Procedure UNT-007-054, "System Engineering Program," Revision 2, that defined the qualification requirements, responsibilities, and expectations for the system engineers. The team also conducted a plant walkdown with the respective system engineers to assess the system condition, system engineers' knowledge and responsibilities, interfaces, and involvement in plant modification activities.

b. Observations and Findings

The team reviewed Administrative Procedure UNT-007-054, "System Engineering Program," Revision 2, that defined the qualification requirements, responsibilities, and expectations for the system engineers. The team also conducted a plant walkdown with the respective system engineers to assess the CCWS, ACCWS, electrical systems and portions of the air/nitrogen system. The system engineers were knowledgeable of their systems and were aware of in-process and future proposed modifications and condition reports on their systems. The engineers also had a good working relationship with plant operations and maintenance personnel, and have been involved with surveillance, maintenance, and troubleshooting activities. A good working relationship also exists between the design and system engineers, as evidenced during the design review of the CCWS and ACCWS. The system engineers actively participated in the modification and post-modification test processes, as

evidenced during the team's review of plant modifications. The system engineers interviewed stated that they have completed their systems walkdown and can complete their assigned duties in a reasonable time.

However, the licensee's recent self-assessment indicated that the workload of the system engineers should be reevaluated to determine if sufficient time is available to allow the engineers to conduct more "hands-on" inspection and oversight of their assigned systems. Material condition of systems was good. The system engineers were maintaining system logs containing information useful for system trending.

c. Conclusion

System engineers were knowledgeable and effectively interfaced with other plant departments. The team concluded that the system engineering program was functioning adequately.

E2.6 FSAR and DBD Review

a. Inspection Scope

The team reviewed the FSAR and the DBDs for CCWS, ACCWS and support systems.

b. Observations and Findings

The following discrepancies were identified during the review of FSAR and DBDs:

FSAR Review

1. FSAR Table 9.2-1, Sheet 1 of 5 showed CCWS pump motor capacity as 3000 horsepower (hp) instead of 300 hp.
2. The CCWS as-found flow rates for components such as containment spray pump B, shutdown heat exchanger A and containment fan cooler B were lower than the values listed in the FSAR Table 9.2-3.
3. FSAR Table 9.2-1 stated that the design pressure for the CCWS piping was 125 psig, but the containment fan cooler piping not exposed to containment pressure (i.e., the portion between the outside containment isolation valve and the containment penetration) could experience a pressure of 165 psig.
4. FSAR Table 9.2-8 stated that the dry cooling tower (DCT) tube side design pressure was 125 psig, but the licensee's A/E calculation dated February 6, 1989, determined that the pressure in the DCT manifold could be as high as 144 psig when the CCWS pump is operating under low flow conditions.
5. FSAR Section 9.2 stated that 60% of the DCTs were protected from multiple tornado missiles and that was sufficient to remove hot-

shutdown heat loads. However, several conduits and cables were not protected from tornado missiles.

6. FSAR Table 9.2-1 stated that the ACCWS flow rate was 5000 gpm, but the train B actual flow was 4500 gpm as shown in procedure STP 0014732, Revision 0.

7. FSAR page 8.1-2 had incorrect numbers for circuit breakers connecting the swing AB bus to the A or B bus.

8. FSAR Table 8.3-1 did not agree with licensee's calculations MN(Q)-9-9 and EC-E90-006.

9. FSAR Section 10.4.9.2 stated that the motor-driven EFW pump flows were 700 gpm, but the licensee's revised calculation (EC-M96-004) showed that the calculated flows were 615 gpm.

DBD Review

The normal horsepower (hp) values for the ACCWS pump motors (300 hp) and DCT fan motors (38.1 hp) contained in the DBD were higher than those assumed in Calculation EC-E90-006, "Emergency Diesel Generator Loading and Fuel Oil Consumption," Revision 2, which showed 295 hp and 37 hp, respectively.

c. Conclusions

The team concluded that in several instances the actual design values were inconsistent with those stated in the FSAR and the FSAR was not revised in accordance with 10 CFR 50.71(e) requirements. The weaknesses mentioned above either have been, or are currently being evaluated through the licensee's condition report process. However, only minor problems were identified during the DBD review. The team identified the above issues as unresolved item URI-96-202-14.

E7 **Quality Assurance in Engineering Activities**

E7.1 Problem Identification and Corrective Action Process

a. Inspection Scope

The team reviewed the licensee's corrective action process and applicable procedures associated with timely identification, evaluation, and correction of conditions adverse to quality. During this review, the team conducted a walkdown of the CCWS and ACCWS to verify that material condition problems were properly identified. Approximately twenty five CRs for 1996, associated with recent safety system functional inspection (SSFIs) or the CCWS or ACCWS, were reviewed for engineering involvement in specific corrective actions. The list of operator work-arounds was also reviewed to assess the effectiveness of the licensee's corrective action process in resolving long-standing problems.

b. Observations and Findings

1. Problem Identification

The current corrective action program described in the licensee's procedure W2.501, Revision 5, specifies a single-document system. The vehicle used to initiate corrective action and to document nonconformances or conditions adverse to quality is the condition report (CR). In 1995, 1400 CRs were initiated to identify problems at Waterford 3. As of October 1, approximately 1525 CRs had been initiated in 1996. On the basis of data reviewed and the results of the walkdown, with the exception of the items identified by the team, the licensee demonstrated a low threshold for problem identification.

As of September 24, 1996, there were 940 open action items as a result of the CR process. These open action items represented responses due as well as tracked open corrective action items. There were 276 CRs with responses due, of which 64% were assigned to engineering. Engineering also was responsible for 56% of the overdue responses. The CR categorization/prioritization criteria and evaluation of timeliness goals contained in the procedure W2.501 appeared reasonable.

A review of the CR trending data indicated that the backlog was being reduced. Currently, formal generic reviews of certain design related CRs are not required, and similar design-related issues on other systems may go undetected. Delaying discovery of generic issues not categorized as significant masks the identification of nonconforming conditions.

There have been several changes to the licensee's CR system over the last 2 years. The most recent change in August 1996 was an attempt to streamline the process and provide better prioritization of items to ensure timely evaluation and correction. Additionally, to reduce the CR backlog, the recent revision allows closure of minor CRs by directing them to other programs for implementation of corrective actions. The CR data is then used for tracking and trending purposes only.

2. Instrument Air Concerns

During the plant walkdowns, the team identified a concern with the installation of local instrument air (IA) accumulators for several CCWS valves. The licensee had not identified this condition during their previous UHS SSFI walkdowns. The valves in question were CC-134A, CC-134B, CC-135A, and CC-135B. Fail-safe operation of these valves upon a loss of non-safety IA is necessary for the CCWS to perform its intended safety function during certain design basis events. The air accumulators in question were mounted horizontally, and there were no drain valves installed to allow periodic draining or blowdown of any water collected from the accumulators. The team questioned the licensee's design of this installation, and requested further demonstration as to how the licensee's design and operating practices met the intent of GL 88-14, "Instrument Air Supply System Problems Affecting Safety-Related Equipment."

The licensee's engineering group responded to the team's questions regarding requirements for blowdown valves on the IA accumulators. Specifically, the engineering group determined that there were no generic industry or Waterford 3 specific construction or design requirements to install drain assemblies on IA accumulators even though all of the vertically mounted accumulators inspected had drains assemblies installed. Additionally, no periodic inspection, cleaning, or blowdown of IA accumulators was occurring at Waterford 3.

The stated intent of GL 88-14 was for the licensees to perform a design and operations review of their IA system to include (1) verification of air quality through testing; (2) verification that maintenance practices, EOPs, and training ensures functionality of safety-related equipment serviced by the IA system; and (3) verification that the design of the entire IA system including accumulators is in accordance with its intended function, including verification by test that air-operated safety-related components would function during all design basis events, including a loss of normal IA.

The licensee furnished the team with portions of the Waterford 3 response to GL 88-14 contained in letters dated February 21, 1989, and July 8, 1991. In their initial response to GL 88-14, the licensee indicated that valve CC-620 was the only valve in the CCWS or ACCWS that had to change state on a loss of IA to perform its safety function. The GL responses did not contain any commitments for periodic maintenance of the IA accumulators. The responses did, however, describe the licensee's air quality testing of the IA system for moisture and particulates. The letter dated July 8, 1991, corrected the licensee's statement regarding the safety function of the IA accumulators, and stated that 9 IA accumulators were being added to the test program to satisfy the GL. The team noted that valves CC-134 A/B and CC-135A/B were included in this group of 9 accumulators.

The inspection team also reviewed Surveillance Procedure OP-903-118, which addressed quarterly testing of the CCWS valves, to determine if the procedure specified testing of the accumulators to verify the IA system design. This procedure did not cover testing of the CCWS valves to ensure that they would function during all design basis events, including a loss of normal IA. ASME Section XI testing requirements for fail-safe valves (in Article IWV-3415) mandate that these valves be tested by observing operation upon loss of actuator power. The licensee indicated that the testing described in their GL 88-14 response was a periodic leakage test of the IA accumulators per licensee's procedure STA-001-005 to ensure that there was sufficient volume in the accumulators for valve operation. The licensee did not interpret the ASME quarterly test specified in the ASME Code Section XI, Article IWV-3415 for fail-safe valves, to include valves that relied on air accumulators to change position on loss of normal non-safety IA. The licensee's position conflicted with ASME requirements. The team noted that TS Section 4.05 delineates the surveillance requirements for inservice testing of ASME Code Class 1,2, and 3 pumps and valves in accordance with Section XI of

the ASME Boiler and Pressure Vessel Code and applicable Addenda as required by 10 CFR 50, Section 50.55a(g). The team identified this issue as unresolved item URI-96-202-15.

3. Problem Evaluation

The licensee's evaluations for 25 CRs were reviewed. The team noted that those CRs designated as Category 1 CRs required performance of a root cause analysis. Category 2 and 3 CRs required performance of a barrier analysis as part of the evaluation. The CR process also stipulates guidance for evaluation of immediate reportability and operability, as well as specifying the immediate corrective actions taken upon discovery. The team reviewed Procedure UNT-006-010, Revision 14, the controlling procedure for Event Notification and Reporting and did not identify any problems with implementation of this procedure. The initial operability declaration on the CR also required a determination as to whether an operability confirmation is warranted.

Operability confirmation is described in the licensee's procedure identified as Site Directive No. W4-101, Revision 1. This procedure contains instructions and guidelines to address situations where the quality or status of plant equipment is in question for various reasons. The team noted that section 5.2 of this procedure specifies time limits for the operability confirmation review and allows up to 24 hours with provisions to extend this time limit. The team informed the licensee that the procedural statement addressing missed surveillance testing appeared to conflict with TS 4.0.3, which requires that the missed surveillance be performed, not reviewed, within 24 hours. The team identified this issue as inspection follow-up item IFI-96-202-16.

The team noted that the licensee's recent corporate assessments of the CR process (which sampled a large population of CRs) identified weaknesses in the quality of the line organization's proposed corrective actions. The assessment stated that QA involvement was generally adequate; however, the assessment recommended that QA re-evaluate their involvement in the CR process and the need for accountability of line organizations. The team was concerned with a recent change made to the CR process to eliminate the original QA function of monitoring the line organization's proposed corrective actions. This change was inconsistent with the above recommendations. The licensee stated that, although there was no longer a program requirement, the inhouse event analysis group would continue to closely monitor the effectiveness of CR corrective actions, and additional changes to the process would be proposed if necessary. The team's CR reviews are discussed in Sections E2.3 and E2.4.

4. Problem Correction

During this inspection, the team became aware of several planned modifications to resolve identified hardware deficiencies in the CCWS and ACCWS. Until these modifications are implemented, the potential for ACCWS waterhammer and CCWS pressure surges exist during testing. On the basis of CRs reviewed by the team, operations personnel are required to

enter abnormal and alarm response procedures when the CCWS valves are tested. The procedure entries will continue to be needed until the modifications are implemented. Additionally, to prevent ACCWS waterhammer events, the system is being operated as the normal (versus standby) UHS system. This alignment has created another set of problems. During cold weather operation, increased ACCWS pump vibrations are observed whenever the temperature control valves throttle system flow. The licensee determined that, although vibrations have increased, the pump remains operable.

GL 89-13, Service Water Corrective Actions

The team reviewed the corrective actions in place as a result of the internal audit of the Waterford 3 submittal in response to GL 89-13. In particular, the team noted that the heat exchanger thermal performance testing has only been performed for the CCWS/ACCWS heat exchanger, with testing of the other safety-related heat exchangers yet to be completed. The team also noted that audit identified several weaknesses in the implementation of GL 89-13 program and the licensee scheduled the corrective actions for implementation.

However, the team the audit did not discover that infrequently used lines, such as the WCT basin lineup to the EFW system, are required to be tested to ensure that the full design flow would pass through the lines. When the team questioned the licensee on the capability of this line to achieve full design flow, the licensee stated that no flow testing has been performed for this lineup. The lack of testing of the above lines and most of the safety-related heat exchangers is a weakness in the licensee's implementation of GL 89-13 program.

The team determined that the licensee was not timely in its actions to address GL 89-13 issues. Since the GL 89-13 was written, 7 years have passed and procedures were not yet in place for important actions regarding flow testing of infrequently used lines and heat exchanger thermal performance verification, despite evidence that fouling was occurring in the CCWS. For example, CR-95-0955 discusses the CCWS pressure drop across DCT A being "significantly greater than design value." This apparent fouling has been attributed to mixing of the CCWS and ACCWS fluids when the safeguard chillers are aligned from the WCT to the CCWS.

c. Conclusions

There is a low threshold for problem identification at Waterford 3. Problem identification was generally good. However, timeliness goals for corrective action evaluation and implementation were not being met. The licensee's corrective actions for certain GLs were not thorough and timely.

E7.2 Quality Assurance (QA) Audits

a. Inspection Scope

The inspection team reviewed recent audits of the licensee's corrective action process and design engineering organization. The team also reviewed the QA audit matrix, that had recently been relocated from TS to the QA manual, to ensure that audits were scheduled and performed as required.

b. Observations and Findings

The licensee's design control audit SA-95-006.1 was thorough and provided several good recommendations for improvement. The audit pointed out both strengths and weaknesses, and evaluated the effectiveness of improvements implemented on the basis of previous audits in this area.

Audits SA-95-004.1 and SA-96-004.1 associated with evaluation of the corrective action process were programmatic. These audits concentrated on verifying implementation of committed corrective action but did not focus on the effectiveness of the corrective actions in preventing recurrence. The audits did not completely evaluate the problem identification process and threshold. The audits also did not identify problems with generic reviews of CRs and the CR backlog that was identified by this team as well as by the licensee's corporate self-assessment of the corrective action process.

c. Conclusions

Audits performed in the corrective action area satisfied the minimum requirements of the licensee's QA plan. However, these audits were programmatic and were not effective in causing improvements in this area.

E7.3 Engineering Department Self-Assessments

a. Scope

The inspection team reviewed the licensee's self-assessments associated with the EFW and UHS SSFIs, Engineering and Technical Support, and the Corrective Action Process.

b. Observations and Findings

Self-assessment of system functional performance utilizes a SSFI approach. The licensee has performed this type of review for the EFW, UHS, portions of the EDG, and high head safety injection systems. Although the assessments identified many items, the EFW and UHS system assessments did not identify all of the problems with the ability of the system to adequately perform its functions. The EFW assessment did not identify issues such as weaknesses in the ACCWS backup water source and the failure to assume worst-case heat input loads in the EFW pump capacity calculations. The UHS assessment did not identify issues such as tornado missile protection issues and the lack of calculations for degraded flows. The team was informed by the licensee that performance of this type of assessment presents resource and logistics problems since "borrowed" people were used to conduct the assessments. The

assessment team prepares draft reports for the licensee before disbursing. This process limits the amount of system review time available to the assessment teams.

c. Conclusion

Recent corporate self-assessments of the Corrective Action Process and Engineering and Technical Support function were properly focused and resulted in several good recommendations for improvement. Many good issues were identified for resolution through the licensee's self assessments of the EFW and UHS systems. However, the safety system self assessments did not identify many of the issues raised by the team.

E7.4 Operational Experience Engineering (OEE) Evaluations

a. Scope of Inspection

The inspection team reviewed OEE evaluations of NRC Information Notices (INs) that dealt with Crosby relief valves, EFW system overpressurization events, EDG testing methods, and overpressurization of containment air cooler piping.

b. Observation and Findings

1. Crosby Relief Valves (IN 92-64)

The OEE review of IN 92-64 regarding Crosby relief valve blowdown ring setting resulted in recommended corrective action to maintenance engineering. Because the OEE review did not pursue additional information associated with the industry event (as indicated in root cause analysis (RCA) 96-463), the wrong corrective actions were taken by maintenance. This incorrect action resulted in the improper setting of the blowdown ring affecting when the relief valves would reseat. This condition was recognized after several CCWS relief valves associated with containment fan coolers lifted and were difficult to reseat. The licensee therefore wrote condition report CR-96-429 to document the CCWS relief valve problem. After investigation, the licensee wrote another condition report CR-96-463, which indicated that the CCWS relief valve problem was caused by an improper blowdown ring setting that resulted from information provided by the OEE review of IN 92-64. A formal RCA was performed to determine the exact cause and the extent of the problem.

RCA 96-463 identified that 12 valves had been improperly adjusted using the wrong blowdown ring settings. Of those valves, 6 were properly readjusted and the operability determination for the condition report accepted the degraded condition of the other 6 valves until they too could be readjusted. These 6 remaining valves were in the safety injection and reactor coolant systems. The team noted that the operability decision was not supported by a detailed analysis in accordance with licensee's procedure W4.101 to justify continued operation until the valves could be repaired. At the request of the team, the licensee performed a 10 CFR 50.59 safety evaluation to confirm valve operability. The safety evaluation confirmed that unit operation

with the improperly set blowdown rings was acceptable until readjustments could be performed. The team identified this issue as unresolved item URI-96-202-17.

2. EFW Overpressurization (IN 90-45)

In 1991, the OEE reviewed IN 90-45, which documented several early-1990 events in which the governor or overspeed trip device for the turbine-driven EFW pumps malfunctioned. This malfunction resulted in a turbine overspeed event and the resultant overpressurization of the EFW pump discharge piping. The OEE review led to a recommendation for personnel training and improved periodic testing to verify that the trip mechanism and valve were free to move and would trip the turbine at the end of the normal quarterly pump test. However, the OEE review did not recognize that the failure of a control circuit could result in the overpressurization of code piping. During recent operations of the turbine-driven EFW pump, piping overpressurization occurred as documented in CRs 96-0841 and 96-0819. Based on the recurrence of the piping overpressure events documented in CRs, the team determined that the licensee exhibited weaknesses in its original OEE review of industry events.

3. IN 96-49 and Other Recent INs

For the most part, recent OEE reviews of industry operating experience were of better quality than the older reviews. OEE review of IN 96-22, "Improper Equipment Setting Due to the Use of Non-temperature-Compensated Test Equipment," was thorough and provided excellent detail. The OEE review of IN 96-49, "Thermally Induced Pressurization of Nuclear Power Facility Piping," was the only example identified involving a marginal quality review. Specifically, the OEE review did not recognize the potential impact of post-LOCA containment pressure on the setpoints of containment fan cooler CCWS relief valves. The inspection team identified this condition as a potential equipment problem and was the subject of CR-96-1555. The OEE file for the IN was still open, and there was a recommendation for Design Engineering to perform a more detailed review of the issue. It was unclear as to whether Design Engineering would have identified the potential setpoint problem during their followup review of the issue.

The team questioned the licensee with regard to plans to re-evaluate the older OEE reviews of industry events. The team was informed that actions contained in the licensee's Focus Plan will result in a "Look Back" at a sample of older OEE reviews to determine any additional corrective action that may be warranted. This approach appeared appropriate for resolving this concern.

c. Conclusions

The team determined that the earlier OEE reviews of industry events were ineffective in correcting equipment problems and preventing similar failures

or events from occurring at Waterford 3. For the most part, however, recent OEE reviews of industry operating experience were of better quality than the older reviews.

E7.5 Root Cause Analysis (RCA)

a. Scope

The inspection team reviewed RCAs performed for the CCWS or ACCWS. The team selected several recent or older RCAs to determine trends in the quality of the analyses.

b. Observations and Findings

The licensee performed RCAs for six CRs over the past 3 years dealing with waterhammer events and air in the ACCWS. The earlier RCAs attributed the problem to improper venting after maintenance. It was not until the completion of the latest RCA performed for CRS 95-1300 and 95-1331 that the licensee determined the actual root cause (column separation of the fluid). The team was informed that Waterford 3 performed a "Look Back" of older RCAs as part of their corrective actions for violations described in IR 50-382/95-23. The effectiveness of this "Look Back" was not reviewed by the team.

The RCA for CR-96-0463, "Control of Safety Valve Blowdown Ring Setting," was reviewed and found acceptable. This RCA identified human performance issues and a lack of detailed procedures as the causes of the improper blowdown ring setting. The RCA also recommended that the licensee improve its post-maintenance testing method for safety and relief valves. To accomplish this, the RCA recommended that the licensee procure new test equipment.

c. Conclusions

Older RCAs were ineffective in identifying and correcting problems. In contrast, the most recent RCA performed was detailed and of good quality.

E7.6 Corrective Action Trending

a. Scope

The team reviewed the licensee's Global Trend Program including data for the first and second quarter of 1996 and interviewed several managers to assess their knowledge of the trend data.

b. Observations and Findings

The Global Trend Program is a computer-based system that is made available to selected managers. The system was designed to be an online trending program, and external or simplified reports are not routinely generated for use by upper-level management. The computerized system is still in development, and current trending of problem barriers (i.e., root causes) are not yet being

performed. Access to the system is limited because of computer memory limitations, and several of the managers interviewed either did not know how to use the system or did not use it routinely.

c. Conclusions

The licensee's computerized trending system is still in development, and current trending of problem barriers (i.e., root causes) are not yet being performed. Access to the system is limited, and several managers were not familiar with the system or did not use it routinely.

V. MANAGEMENT MEETINGS

XI Exit Meeting Summary

At the exit meeting on October 10, 1996, the team summarized the scope and findings of the inspection. The licensee did not identify as proprietary any information provided to, or reviewed by, the team.

APPENDIX A

LIST OF OPEN ITEMS

This report categorizes the inspection findings as unresolved items and inspection follow-up items in accordance with the NRC Inspection Manual, Manual Chapter 0610. An unresolved item is a matter about which more information is required to determine whether the issue in question is an acceptable item, a deviation, a nonconformance, or a violation. The NRC Region IV office will issue any enforcement action resulting from their review of the identified unresolved items. An inspection follow-up item is a matter that requires further inspection because of a potential problem, because specific licensee or NRC action is pending, or because additional information is needed that was not available at the time of inspection.

Report Number	Finding Type	Title
50-382/96-202-01	IFI	Instrument uncertainties for CCWS and ACCWS flow tests (Sections E1.1.1 and E1.1.2)
50-382/96-202-02	URI	CCWS DCT piping design pressure issue (Section E1.1.1)
50-382/96-202-03	URI	Adequacy of EFW operation from ACCWS (Section E1.2.1)
50-382/96-202-04	URI	Adequacy of cold weather operating instruction for ACCWS (Section E1.2.1)
50-382/96-202-05	URI	Adequacy of EDG fuel oil volume including 10 CFR 50.59 evaluation (Section E1.3.2)
50-382/96-202-06	URI	Adequacy of EDG loading including 10 CFR 50.59 evaluation (Section E1.3.3)
50-382/96-202-07	URI	Adequacy of TS EDG surveillance test (Section E1.3.4)
50-382/96-202-08	URI	Adequacy of EFW containment isolation valve changes including 10 CFR 50.59 and past operability evaluations (Section E1.5)
50-382/96-202-09	URI	Adequacy of maintenance hatch door installation (Section E2.3)
50-382/96-202-10	IFI	Adequacy of valve fastener installation (Section E2.3)
50-382/96-202-11	URI	EFW flow discrepancies (Section E2.3)
50-382/96-202-12	URI	Adequacy of EFW flow calculation (Section E2.3)

50-382/96-202-13	URI	Adequacy of tornado protection for UHS (Section E2.4)
50-382/96-202-14	URI	FSAR/DBD discrepancies (Section E2.6)
50-382/96-202-15	URI	Adequacy of ASME Section XI testing for CCWS fail-safe valves (Section E 7.1)
50-382/96-202-16	IFI	Adequacy of operability confirmation procedure (Section E7 1)
50-382/96-202-17	URI	Evaluations for non-conforming Crosby relief valve installations (Section E7.4)

APPENDIX B

EXIT MEETING ATTENDEES

Entergy Operations, Inc.

Mike Sellman, Vice-President, EOI
Fred Titus, Vice-President, Engineering
James Fisicaro, Director, Nuclear Safety
A.J. Wrape III, Director, Design Engineering
Larry Rushing, Design Engineering Manager
Bob Thweatt, Design Engineering Supervisor
C. Jeff Thomas, Licensing Supervisor, EOI
Greg Scott, Licensing Engineer
Dale Gallodoro, Engineering Supervisor, Procurement Engineering
Robert Kullman, Licensing Engineer
Bruce Proctor, Supervisor, Systems Engineering
David Viener, Sr. Engineer, Mechanical
Paul Gropp, Supervisor, Design Engineering, Mechanical
Jerry Holman, Manager, Safety Analysis
G. Singh Matharu, Supervisor, Electrical and I&C
William Day, System Engineer, Mechanical
Paul Ola, Design Engineer, Mechanical
Robert Porter, Plant Modifications & Construction
Gary Payne, Design Engineer, Mechanical Systems
Joseph Reese, Design Engineer, Mechanical Systems
Thomas R. Hempel, Design Engineer, Mechanical Systems
Gerald M. Wood, Lead Sr. Engineer, Design Engineering
Richard H. O'Donnell, Supervisor, Design Engineering
Robert E. Aila, Manager, Operational Experience Engineer
P.V. Prasankumar, Manager, Electrical and I&C, Design Engineering
J.E. Howard, Procurement/Programs Engineering Manager
Mark Ferri, EOI
Jason Laque, System Engineer, Electrical
Gary Bundick, ABB CENO
Sheliah Di John, Licensing, EOI
George Wilson, Quality Assurance
Jeffrey Hologa, Technical Support Coordinator
Paul M. Melancon, Senior Engineer, Programs Engineering
Glenn W. Robin, Supervisor, Programs Engineering
John Halbrook, Systems Engineer
Michael J. Kliebert, Systems Engineer
Paul L. Caropino, Licensing Coordinator
Nara Ray, Design Engineering
Eddy Beckendorf, Superintendent, Plant Security
T.H. Smith, Technical Coordinator, Nuclear Safety
Tim Gaudet, Licensing Manager
Greg Fey, Supervisor, In House Events Analysis
Walter Wittich, Manager, Raytheon Engineering
John Houghtaling, Technical Assistant, Design Engineering

U.S. Nuclear Regulatory Commission

Lee Keller, RIV
Morris Branch, NRR
Chandu Patel, NRR
Roy Mathew, NRR
Don Norkin, NRR
Ken Brockman, RIV
Dyle Acker, RIV
Tony D'Angelo, NRR
Troy Pruett, RI
William Sherbin, NRC Consultant
Paul Eshleman, NRC Consultant

APPENDIX C

LIST OF ACRONYMS

ACCWS	Auxilary Component Cooling Water System
A/E	Architect/engineer
ANS	American Nuclear Society
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
CCWS	Component Cooling Water System
CE	ABB Combustion Engineering Nuclear Power
CEDM	Control Element Drive Mechanism
CFC	Containment Fan Cooler
CR	Condition Report
CSP	Condensate Storage Pool
DBD	Design Basis Document
DC	Design Change
DCN	Drawing Change Notices
DCT	Dry Cooling Tower
EDG	Emergency Diesel Generator
EFW	Emergency Feedwater
EFS	Emergency Feedwater System
EOP	Emergency Operating Procedure
FSAR	Final Safety Analysis Report
GL	Generic Letter
GDC	General Design Criteria
HP	Horsepower
IA	Instrument Air
I&C	Instrumentation & Controls
IFI	Inspection Follow-up Item
IN	Information Notice
ISA	Instrument Society of America
LER	Licensee Event Reports
LCO	Limiting Condition of Operation
LDCR	Licensing Document Change Request
LOCA	Loss of Coolant Accident
LOOP	Loss of offsite Power
MCC	Motor Control Center
MOV	Motor Operated Valve
NC	Noncompliance
NRR	Office of Nuclear Reactor Regulation
OEE	Operational Experience Engineering
PASS	Post Accident Sampling System
PRA	Probabilistic Risk Assessment
QA	Quality Assurance
RCA	Root Cause Analyses
RCP	Reactor Coolant Pump
RCS	Reactor Coolant System
RG	Regulatory Guide
SIAS	Safety Injection Activation Signal
SBO	Station Blackout
SER	Safety Evaluation Report

SG	Steam Generator
SSFI	Safety System Functional Inspection
TS	Technical Specifications
UHS	Ultimate Heat Sink
URI	Unresolved Item
WCT	Wet Cooling Tower