U. S. NUCLEAR REGULATORY COMMISSION

REGION III

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License No:	NPF-58
Report No:	50-440/96008(DRS)
Licensee:	Cleveland Electric Illuminating Company
Facility:	Perry Nuclear Power Plant
Location:	P. O. Box 97, A200 Perry, OH 44081
Dates:	August 26 through September 11, 1996
Inspector:	E. Duncan, Lead Engineering Assessment Person
Approved By:	M. A. Ring, Chief Lead Engineering Branch Division of Reactor Safety

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EXECUTIVE SUMMARY

Perry Nuclear Power Plant
NRC Inspection Report 50-440/96008

This inspection report contains the findings and conclusions for a special inspection conducted from August 26 through September 11, 1996 to review Licensee Event Report (LER) 93-021, "Loss of Safety Function for Emergency Closed Cooling System A," and LER 94-005, "Loss of Both Trains of Control Room Emergency Recirculation Due to Low Emergency Closed Cooling Temperature."

Engineering

- From June 2 to July 2, 1993, two apparent violations of technical specifications occurred. One of these involved a 45 hour period when the Emergency Closed Cooling (ECC) system was inoperable, and the actions required by Technical Specification 3.0.3 were not completed.

- Identification of long-term corrective actions to address excessive leakage of motor-operated butterfly valve OP42-F295A was slow and failed to include periodic leak rate testing as required by the inservice testing program. An apparent violation of 10 CFR 50, Appendix B, Criterion XVI was identified.

- LER 93-021 failed to provide an adequate assessment of the safety consequences and implications of the event. A violation of 10 CFR 50.73 was identified.

- Corrective actions to address the inability to operate the control room complex chillers under certain environmental conditions were slow and failed to fully evaluate the design requirements of the ECC system against all potential plant configurations, including those present during periodic testing. The failure to perform an adequate post-modification test following installation of a design change to address the problem was a contributing factor. An apparent violation of 10 CFR 50, Appendix B, Criterion XVI was identified.

Summary of Open Items
Violations: Identified in Sections E1.1.b.7, E1.1.b.8, and E1.2.b.7
Unresolved Items: None Identified
Inspector Follow-up Items: None Identified
Non-cited Violation: None Identified

INSPECTION DETAILS

III. Engineering

E1 Conduct of Engineering

E1.1 LER 93-021, "Loss of Safety Function for ECC System A"

a. Inspection Scope

The inspector reviewed LER 93-021, "Loss of Safety Function for Emergency Closed Cooling (ECC) System A."

b. Observations and Findings

1. Description of the Event

On July 1, 1993, during testing to verify ECC "A" heat exchanger performance, 10-inch butterfly motor-operated valve (MOV) OP42-F295A was identified as leaking 250 gallons per minute (gpm). An initial review also determined that the allowable ECC "A" train leakage was 6.6 gpm. The valve limit switches and mechanical stops were subsequently re-adjusted on July 2, and a condition report (CR) was written to document the event.

On December 17, the licensee determined that maintenance was last performed on the valve on March 19, 1993, and therefore the leakage existed from March 19 until July 2. A review of operating logs also determined that the division 2 diesel generator (DG) was out-of-service (OOS) from June 14 to June 15 for about 45 hours.

Given a loss-of-offsite-power (LOOP) with the division 2 DG OOS, the OP42-F295A valve would fail to close on a loss of power and the "B" ECC train would also fail to function due to the loss of the division 2 DG. Given the leak rate of the OP42-F295A valve, within 1 minute of receipt of the surge tank low level alarm, the ECC "A" surge tank and suction standpipe would have drained to a point where the ECC "A" pump would cavitate and fail. This scenario would result in a complete loss of ECC.

2. Emergency Closed Cooling (ECC) System Description

The purpose of the ECC system is to provide safety-related components with a reliable source of cooling water, ensuring proper operation of these components during normal, as well as accident conditions.

The ECC system is divided into two independent loops designated loop A and loop B. Each loop consists of a pump, heat exchanger, 660-gallon surge tank, motor-operated valves, and interconnecting piping. The ECC heat exchangers are cooled by the Emergency Service Water (ESW) system.

The ECC system consists of two identical loops. Each ECC pump takes a suction on its loop suction header and discharges through the shell of an ECC heat exchanger to the system loads. After serving the system heat loads, the cooling water returns to the pump suction. The suction header of each pump is provided with a surge tank to ensure that an adequate suction head is available to facilitate system fill and make-up.

The ECC system provides cooling to the following loads:

Loop A

- Low Pressure Core Spray (LPCS) Room Cooler
- Reactor Core Isolation Cooling (RCIC) Room Cooler
- Residual Heat Removal (RHR) "A" Room Cooler
- Residual Heat Removal "A" Pump Seal Cooler
- Hydrogen Analyzer Cooler "A"
- Control Complex Chiller Unit "A"

Loop B

- Residual Heat Removal "B" Room Cooler
- Residual Heat Removal "B" Pump Seal Cooler
- Residual Heat Removal "C" Room Cooler
- Residual Heat Removal "C" Pump Seal Cooler
- Hydrogen Analyzer Cooler "B"
- Control Complex Chiller Unit "B"

During Loss-of-Offsite-Power (LOOP)/Loss-of-Coolant Accident (LOCA) conditions, cooling water supply to the control complex chillers is transferred from the Nuclear Closed Cooling (NCC) system to the ECC system. Automatic isolation between the NCC and ECC systems is provided by valves OP42-F295A/B and OP42-F290.

3. Sequence of Events

7/1/93 During performance of Periodic Test Instruction (PTI) P42-P0001, "Emergency Closed Cooling System A Heat Exchanger Performance Test," while transferring the "A" control complex chiller cooling water supply from NCC to ECC, the "A" ECC surge tank overflowed.

7/1/93 Temporary Instruction (TXI) TXI-162 was written to determine the source and rate of valve leakage.

7/2/93 Motor-operated butterfly valve (MOV) OP42-F295A was identified as leaking in excess of 250 gallons per minute (gpm). Work Order (WO) 93-2502 was initiated to determine and correct the cause of the 250 gpm seat leakage. Subsequent investigations under WO 93-2502 identified OP42-F295A to be stroking past its full closed position as a result of mis-positioned limit switches and mechanical

stops. The limit switches and mechanical stops were re-adjusted in accordance with GEI-014, "Limitorque Limit/Torque Switch Adjustment." The valve was satisfactorily re-tested per surveillance instruction (SVI) SVI-P42-T2001, "ECC System Pump and Valve Operability Test." In addition, TXI-162 was then re-performed and verified no significant seat leakage existed.

7/2/93 Field Clarification Request (FCR) 17843 was initiated and requested the allowable ECC system leakage rate. Based on initial indication of a problem upon receipt of an ECC surge tank low level alarm and a 15-minute operator response time to establish makeup from the safety-related emergency service water (ESW) system, the maximum allowable OP42-F0295A valve leakage rate was determined to be 6.6 gpm.

7/6/93 Condition Report (CR) 93-132 was initiated to document the "as-found" 250 gpm leakrate on OP42-F295A. Shift Supervisor review section of CR 93-132 notes no Technical Specification (TS) violation. Remarks section of CR 93-132 indicates that the Licensing and Compliance Section (LCS) to determine reportability.

7/7/93 CR 93-132 review by LCS concluded that the event was not reportable and that ECC could have performed its intended function if required. Subsequently, a request to a contractor, Gilbert/Commonwealth, was initiated to evaluate the effects of the 250 gpm leakage condition of OP42-F295A for reportability.

8/25/93 CR 93-132 root cause investigation completed and forwarded for approval. Root cause investigation incorrectly concluded that maintenance had not been performed on the valve since initial plant construction and that instructions for initially setting MOVs did not contain sufficient detail to adequately perform the activity.

12/1/93 CR 93-132 approved.

12/15/93 Gilbert/Commonwealth evaluation completed and concluded that the condition was reportable because it would have resulted in a condition that could have prevented the fulfillment of the safety function of the ECC system. In the event of a LOOP with a single active failure of the division 2 diesel generator (DG), ECC "A" would have lost fluid at a rate greater than 250 gpm. Within 1 minute the ECC "A" surge tank and suction standpipe would have drained down to a point where the ECC "A" pump would begin to cavitate on low net positive suction head (NPSH). Within a few minutes, the ECC pump would probably fail from cavitation. In addition, with a LOOP and a division 2 DG failure, ECC "B" would also be inoperable, resulting in a loss of the entire ECC system.

In addition, Gilbert/Commonwealth reviewed the licensee's allowable leak rate calculation and extended the operator response time from 15 minutes to 30 minutes in accordance with ANSI/ANS 58.8 - 1984, "Time Response Design Criteria for Nuclear Safety-Related Operator Actions." As a result, the allowable leak rate was reduced from 6.6 gpm to 3.3 gpm.

12/17/93 A review of the work history for OP42-F295A as part of a compliance review of CR 93-132 identified that the limit switches and mechanical stops had been adjusted on March 19, 1993 under WO 92-0495 contrary to CR 93-132 findings. A post-maintenance test which consisted of manual and remote valve strokes to ensure proper operation with no binding was performed satisfactorily. A leak rate test was not performed.

Since no other work had been performed on the valve until the date of this event, OP42-F295A was considered to have been leaking from March 19, 1993, to July 2, 1993.

12/23/93 The allowable ECC "A" system leakage was formally revised from 6.6 gpm to 3.3 gpm.

12/30/93 The licensee determined that the event was reportable since the inoperable valve could have prevented the fulfillment of the safety function of the ECC system. A 10 CFR 50.72 report was initiated.

1/23/94 LER 93-021, "Loss of Safety Function for Emergency Closed Cooling System A," was issued in accordance with 10 CFR 50.73.

4. Root Cause

The licensee attributed the root cause of this event to personnel error in incorrectly setting the limit switches and mechanical stops for OP42-F295A on March 19, 1993.

5. Safety Significance

In the event of a LOOP/LOCA with a single active failure of the division 2 diesel generator (DG), ECC "A" would have lost fluid at a rate greater than 250 gpm. Within 1 minute of receipt of the low level alarm on the ECC "A" surge tank, the tank and suction standpipe would have drained down to a point where the ECC "A" pump would begin to cavitate on low net positive suction head (NPSH). Within a few minutes, the ECC pump would probably fail from cavitation. In addition, with a LOOP and a division 2 DG failure, ECC "B" would also be inoperable, resulting in a loss of the entire ECC system.

The inspectors also determined that from June 2, 1993, to July 2, 1993, Unit 1 was in operational condition 1, 2, or 3 and vulnerable to the

event as described above. In addition, from June 14 to June 15, for about 45 hours, the division 2 DG was OOS. Therefore, in the event of a LOOP/LOCA during this period, the ECC system and the systems supported by ECC may have been unable to mitigate the consequences of the accident.

6. Licensee Corrective Actions

As part of the licensee's immediate corrective actions for this event, the limit switches and mechanical stops were re-adjusted on valve OP42-F295A and post-maintenance leak testing was performed to verify that the valve would function as required.

The following long-term corrective actions were also accomplished:

- An engineering evaluation was initiated to determine if the potential for an incorrectly set butterfly valve limit switch or mechanical stop on other systems could cause a similar problem.

  As a result of that review, the licensee determined that although incorrectly setting limit switches could cause leakage in other systems, none were identified that would cause an adverse impact on safety.

- A review of maintenance instructions and vendor information was performed to determine a positive means to identify when a butterfly valve is full open or full closed in order to ensure that the limit switches and mechanical stops are properly set.

  As a result of that review, the licensee determined that a post-maintenance seat-leakage test is the only positive method to ensure that butterfly valve limit switches and mechanical stops are properly set. Therefore, GEI-0014, "Limitorque Limit/Torque Switch Adjustment," was revised on January 27, 1996, to require that a post-maintenance leakage test be performed on those butterfly MOVs which have an established seat leakage limit. In addition, GEI-0014 was revised to clarify instructions for setting limit switches and checking mechanical stop nut settings.

- A review of safety-related butterfly valves was performed to determine if further adjustment or testing was required to verify proper butterfly valve closure.

  As a result, the licensee determined that OP42-F295A/B and OP42-F325A/B fell into a unique category to isolate ECC to prevent draining of a surge tank and required that a leak rate criteria be established. All other safety-related butterfly valves were evaluated and the licensee concluded that leakage during an accident was not a safety concern.

- Training was provided to maintenance and system engineering personnel on this event and the necessity of verifying proper butterfly valve closure.

7. Inspector Review

The inspectors reviewed the events and corrective actions discussed above. The following concerns were identified:

a) Corrective Actions

The inspectors reviewed the corrective actions taken as a result of this event as well as the priority placed on fully understanding the implications of the event to develop the corrective actions. The following issues were identified:

1) Corrective Action Timeliness

The inspectors concluded that following the overfill of the ECC "A" surge tank, the subsequent identification and repair of OP42-F295A was prompt and complete.

The inspectors also concluded that the licensee had missed prior opportunities to identify ECC system operability concerns and initiate corrective actions in a more timely manner. These opportunities included:

- Condition Report (CR) 93-132 which documented that butterfly valve OP42-F295A was leaking in excess of 250 gpm was initiated on July 6, 1993, although the condition was identified on July 2, 1993. The inspectors concluded that the licensee's action to document this significant condition adverse to quality was slow.

- The initial Licensing and Compliance review of CR 93-132 on July 7, 1993, concluded that the event was not reportable and that ECC could have performed its intended function if required, although a calculation was performed on July 2 which indicated an allowable leakrate of 6.6 gpm. The inspectors concluded that the licensee's review of this event was slow and the conclusions were incorrect although information with regard to leakage limits was available.

- The root cause investigation for CR 93-132 was not completed until August 25, 1993, and was not reviewed until December 1, 1993. The inspectors concluded that the investigation and review process was not timely.

- The results of an external followup review of the safety significance of the event was not completed until December 15, 1993, when the licensee received the report from Gilbert/ Commonwealth documenting their conclusions. The inspectors

concluded that the followup review of the event, which required greater than 5 months to complete, was not timely.

- The Gilbert/Commonwealth report indicated that the event was reportable because it would have resulted in a condition that could have prevented the fulfillment of the safety function of the ECC system. However, a 10 CFR 50.72 report was not made until 15 days later on December 30, 1993. In light of the implications of this event, the inspectors concluded that the licensee's review of the Gilbert/Commonwealth report and subsequent NRC notification was slow.

The inspectors concluded that the licensee's response to the event was not timely and negatively impacted the corrective action process.

2) Corrective Action Scope

The inspector concluded that the licensee's corrective action to perform post-maintenance seat-leakage testing following maintenance on butterfly MOVs was a good initiative.

However, the inspectors noted that although valves OP42-F295A/B and OP42-F325A/B had specific maximum allowable leak rate limits assigned, they were classified as Category B valves in the In-Service Testing (IST) program. Category B valves are defined in American Society of Mechanical Engineers (ASME) Section XI, 1983, Article IWV-2000, as "valves for which seat leakage in the closed position is inconsequential for fulfillment of their function," and do not require periodic leak rate testing. Category A valves are defined in ASME Section XI as, "valves for which seat leakage is limited to a specific maximum amount in the closed position for fulfillment of their function."

When this concern was identified by the inspectors, the licensee subsequently determined that the valves should have been re-classified as Category A valves following identification of allowable leak rate criteria on July 2, 1993. The licensee also determined that this concern was previously identified on January 20, 1994, however the recommendations were never incorporated into the planned corrective actions for the event. At the end of the inspection, the licensee was in the process of re-classifying the subject valves as Category A valves in the IST program and establishing periodic leak rate testing in accordance with ASME Section XI requirements.

The inspectors concluded that the licensee had not implemented an important corrective action to prevent recurrence of this event since periodic leak rate testing is one method to trend and/or identify excessive valve leakage.

b) Licensee Event Report Review

The inspectors reviewed LER 93-021, "Loss of Safety Function for Emergency Closed Cooling System A," and identified the following concerns:

- The cover letter and title of LER 93-021 indicated only a loss of safety function for ECC "A" although ECC "B" was also inoperable for about 45 hours during the event.

- The main body of the LER only explicitly discussed a loss of ECC "A". Although the OOS condition of the division 2 DG on June 14 and 15 was discussed, neither the impact on the operability of ECC "B" nor the consequences of a total loss of ECC were mentioned.

The inspector also noted that the 10 CFR 50.73(a)(2)(v) block was checked which indicated that the event was reported as a loss of safety function (both ECC trains inoperable).

10 CFR 50.73 requires that the Licensee Event Report contain an assessment of the safety consequences and implications of the event. The inspectors concluded that LER 93-021 failed to provide an adequate assessment of the safety consequences and implications of the event since the impact of the OOS condition of the division 2 DG on ECC "B" was not explicitly discussed. This was a violation (50-440/93008-01).

8. Apparent Violations

The following regulatory concerns were identified:

From June 2, 1993, to July 2, 1993, the plant was in operational conditions 1, 2, or 3. In addition, from 3:13 a.m. on June 14, 1993, to 11:05 p.m. on June 15, 1993, a period of about 45 hours, the division 2 DG was inoperable. As a result, the following apparent violations were identified:

- Technical Specification 3.0.3 requires that when a limiting condition for operation (LCO) is not met, except as provided in the associated action requirements, within 1 hour action shall be initiated to place the unit in an operational condition in which the specification does not apply by placing it, as applicable, in:

  1. At least startup within the next 6 hours;
  2. At least hot shutdown within the following 6 hours, and
  3. At least cold shutdown within the subsequent 24 hours.

  From June 14 to June 15, for about 45 hours, with the ECC system inoperable which required entry into TS 3.0.3, the licensee failed to initiate action within 1 hour to place the unit in at least startup within the next 6 hours, at least hot shutdown within the following 6 hours, and at least cold shutdown within the subsequent 24 hours. This is an apparent violation.

- Technical Specification 3.7.1.2 requires, in operational conditions 1, 2, 3, 4, and 5, that with an emergency closed cooling loop inoperable, declare the associated systems or components inoperable and take the action required by the applicable specification.

- Technical Specification 3.3.7.5 requires in operational condition 1, 2, and 3, with only one primary containment hydrogen concentration analyzer operable, restore the inoperable channel to operable status within 7 days or be in at least hot shutdown within the next 12 hours and in cold shutdown within the following 24 hours.

- Technical Specification 3.7.3 requires in operational conditions 1, 2, and 3, with the reactor core isolation cooling (RCIC) system inoperable, restore the RCIC system to operable status within 14 days or be in at least hot shutdown within the next 12 hours and reduce steam dome pressure to less than or equal to 150 pounds per square inch gauge (psig) within the following 24 hours.

- Technical Specification 3.7.2 requires that in operational conditions 1, 2, or 3, with one control room emergency recirculation system inoperable, restore the inoperable subsystem to operable status within 7 days of be in at least hot shutdown within the next 12 hours and in cold shutdown within the following 24 hours.

- Technical Specification 3.5.1 requires, in operational condition 1, 2, and 3, with ECCS division 1 inoperable and ECCS divisions 2 and 3 operable, with the LPCS system inoperable and LPCI subsystem "A" inoperable, restore at least the inoperable LPCI subsystem "A" or the inoperable LPCS system to operable status within 72 hours, otherwise be in at least hot shutdown within the next 12 hours and in cold shutdown within the following 24 hours.

From June 2 to July 2, 1993, ECC "A" was inoperable, which rendered primary containment hydrogen concentration analyzer "A", control room emergency recirculation subsystem "A", LPCI "A", RCIC, and LPCS inoperable. However, the licensee failed to take the actions required by TS 3.7.1.2 and declare the associated systems inoperable and take the action required by the associated specification. This is an apparent violation.

- 10 CFR 50, Appendix B, Criterion XVI, "Corrective Actions," requires that measures shall be established to assure that conditions adverse to quality, such as deficiencies and nonconformances, are promptly identified and corrected. In the case of significant conditions adverse to quality, the measures shall assure that the cause of the condition is determined and corrective action taken to preclude repetition.

The inspectors concluded that the licensee's identification of long-term corrective actions to address the leakage of OP42-F295A was slow and failed to include periodic leak rate testing, an important corrective action to prevent recurrence of this event and a corrective action required by the IST program. As a result,

an apparent violation of 10 CFR 50, Appendix B, Criterion XVI was identified.

The inspectors determined that from March 19, 1993, to June 2, 1993, the plant was in operational conditions 4 or 5 and that fuel movements were not in progress. Following a review of applicable technical specifications, the inspectors concluded that no regulatory concerns existed during this period.

c. Conclusions

From June 2 to July 2, 1993, two apparent violations of technical specifications occurred including one in which for a 45 hour period with the ECC system inoperable, the actions required by TS 3.0.3 were not completed.

In addition, identification of long-term corrective actions to address excessive leakage of OP42-F295A was slow and failed to include periodic leak rate testing as required by the inservice testing program and previously identified as a necessary corrective action in January 1994. As a result, an apparent violation of 10 CFR 50, Appendix B, Criterion XVI was identified.

Finally, the inspectors concluded that LER 93-021 failed to provide an adequate assessment of the safety consequences and implications of the event. As a result, a violation of 10 CFR 50.73 was identified.

E1.2 LER 94-005 "Loss of Both Trains of Control Room Emergency Recirculation Due to Low Emergency Closed Cooling Temperature"

a. Inspection Scope

The inspector reviewed LER 94-005, "Loss of Both Trains of Control Room Emergency Recirculation Due to Low Emergency Closed Cooling Temperature."

b. Findings and Observations

1. System Description

As discussed in section E1.1, the ECC system is designed to provide safety-related components, including control complex chillers, with a reliable source of cooling water. Each division of ECC is cooled by a division of the Emergency Service Water (ESW) system. The ESW system water supply is Lake Erie.

The design of the control complex chillers requires that inlet condensing water temperature from ECC be greater than 55°F. At temperatures below 55°F the control complex chillers may trip on low refrigerant temperature causing the associated train of control room heating, ventilation, and air conditioning (CRHVAC) emergency recirculation mode to be rendered inoperable. The CRHVAC system

provides cooling, heating, ventilation, and when required, smoke removal, for the control room. In addition, the emergency recirculation mode of CRHVAC provides the necessary particulate and gaseous filtration of the air supplied to the control room areas during emergency and other abnormal conditions to reduce the radiation dose for personnel protection.

When lake temperature dropped below 55°F, ESW system flow to the ECC heat exchanger was transferred from a 14-inch supply line to a 3-inch bypass line (winter mode) to ensure that ECC water temperature would not decrease to below 55°F during accident conditions. This bypass was a modification installed as a result of licensee identification of concerns in 1986 that ECC temperature may decrease below 55°F under accident heat load conditions with ESW temperatures significantly less than 55°F. However, the calculations and procedural modifications to support this design change only considered accident heat loads with ECC initially secured and not conditions where ECC would be initially supporting minimum heat loads prior to an accident.

The control complex chillers provide chilled water to the cooling coils of their respective CRHVAC train. Normal cooling water to the control complex chillers is supplied by the nuclear closed cooling (NCC) system. During accident conditions, cooling water supply to the control complex chillers is transferred from the NCC system to the ECC system and the CRHVAC transfers from normal operation to emergency recirculation mode.

Control complex chillers comprise about 90 percent of the total system heat load during accident conditions.

2. Description of the Event

During preparation for Residual Heat Removal (RHR) heat exchanger testing on February 5, 1994, with ESW "A" and ECC "A" running and supplying a minimal heat load (only RHR "A" running), ECC "A" temperature was observed to be below 55°F.

A review was performed to determine if this condition could have existed at any time where both trains of ECC were affected. It was determined that from January 28, 1994 to January 29, 1994, for about 11 hours, both trains of ECC were affected. Therefore, during this period both trains of the CRHVAC emergency recirculation mode were inoperable. During this period, the plant was in operational condition 3, Hot Shutdown, however Technical Specification (TS) 3.0.3 was not entered as required.

3. Root Cause

The licensee determined that the root cause of the event was inadequate design. When a similar problem was identified in 1986, the corrective actions considered only accident heat loads with ECC initially secured and failed to consider operation of ECC with minimum heat loads at low ESW temperatures.

4. Safety Significance

The time for which both trains of the CRHVAC emergency recirculation mode were inoperable did not exceed TS 3.0.3 action requirements to place the plant in operational condition 4 from operational condition 3. However, since the completion of the design change to install the 3-inch ESW bypass line in 1986, the potential existed that a situation similar to the January 28 and 29, 1994, condition may have occurred.

5. Corrective Actions

As part of the licensee's immediate corrective actions, control complex chiller "A" was re-aligned to the NCC system and all testing was suspended. In addition, the associated CRHVAC emergency recirculation mode was declared inoperable until appropriate operating procedures were revised to provide for throttling ESW flow to ensure that ECC temperature was maintained above 55°F.

As part of the licensee's long-term corrective actions, the following was accomplished:

- Procedure changes were implemented to avoid operating ECC with ESW. In those operations or system initiations where ECC and ESW were required to be run together, an operator was stationed at the ESW bypass valve to manually control ECC temperature.

- Engineering investigated a reduction in the vendor prescribed ECC minimum temperature for the control complex chillers.

  As a result of that investigation, the chiller vendor issued a report on October 28, 1994, in which they could not confirm that the control complex chiller would start at temperatures lower than 55°F.

- Design change package (DCP) 94-0027 was prepared to install a bypass line around each of the ECC heat exchangers utilizing a three-way electro-hydraulic modulating temperature control valve (TCV) to control the flow between the heat exchanger and the bypass line based on the ECC water temperature downstream of the heat exchanger. Both modifications were installed in Spring 1996. Procedures were subsequently revised to remove references to winter mode operations since the modification was designed to operate with full ESW flow under all ESW temperature conditions.

6. Inspector Review

The inspectors reviewed the events and corrective actions discussed above. The following concern was identified:

Temperature Control Valve Modification

The inspectors conducted a walkdown of design change package (DCP) 94-0027 which installed a bypass line around each of the ECC heat exchangers utilizing a three-way electro-hydraulic modulating temperature control valve (TCV) to control the flow between the heat exchanger and the bypass line based on the ECC water temperature downstream of the heat exchanger.

During subsequent discussions with licensee personnel concerning the modification, the following was identified:

On March 7, 1996, ESW "A" and ECC "A" were in operation with no heat load (ECC "A" pump running) in preparation for RHR "A" shutdown cooling. In about 45 minutes, ECC "A" temperature decreased from about 64°F to 56°F at which point ESW "A" was secured to prevent ECC "A" from decreasing below the 55°F control complex chiller operability limit.

In response to this observation, the licensee determined that although the system was designed to maintain ECC at 70°F with minimum heat loads and a worst case ESW temperature of 33°F, the system was not designed to maintain temperature above 55°F under no heat load conditions.

In addition, operating data was collected which indicated that at minimum heat load conditions at an ESW temperature of 37°F, ECC temperature decreased and stabilized at about 57.5°F, much lower than the design setpoint of 70°F, but greater than the 55°F chiller low temperature limit.

The inspectors reviewed the licensee post-modification testing program and determined that although the modification was designed to maintain ECC temperature above 55°F with low lake temperature and under low heat load conditions, the licensee had not performed a functional test to verify that the installed modification would perform this function.

As part of the licensee's immediate corrective actions, appropriate procedures were revised to ensure ECC temperature was maintained above 55°F in all environmental conditions. At the end of the inspection, the licensee was in the process of determining the root cause and long-term corrective actions.

7. Apparent Violation

10 CFR 50, Appendix B, Criterion XVI, "Corrective Actions," requires that measures shall be established to assure that conditions adverse to quality, such as deficiencies and nonconformances, are promptly identified and corrected. In the case of significant conditions adverse to quality, the measures shall assure that the cause of the condition is determined and corrective action taken to preclude repetition.

The inspectors concluded that the licensee's corrective actions to address the inability to operate the control complex chillers under all

environmental conditions were slow and failed to fully evaluate the design requirements of the ECC system against all potential plant configurations, including those present during periodic testing. In addition, the inspectors concluded that the licensee failed to perform an adequate post-modification test as part of DCP 94-0027 which contributed to slow identification of the problem. As a result, an apparent violation of 10 CFR 50, Appendix B, Criterion XVI was identified.

c. Conclusions

The licensee's corrective actions to address the inability to operate the control complex chillers under all environmental conditions were slow. Corrective actions failed to fully evaluate the design requirements of the ECC system against all potential plant configurations, including those present during periodic testing. The inspectors identified that the failure to perform an adequate post-modification test following installation of DCP 94-0027 was a contributing factor. As a result, an apparent violation of 10 CFR 50, Appendix B, Criterion XVI was identified.

V. Management Meetings

The inspectors presented the preliminary inspection results to members of licensee management on August 30, 1996. In addition, the final inspection results were presented on September 11, 1996. The licensee acknowledged the findings presented.

The inspectors asked the licensee whether any materials examined during the inspection could be considered proprietary. No proprietary information was identified.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

N. Bonner	Engineering Director
D. Phillips	System Engineering Supervisor
D. Drevay	Component Performance Unit Supervisor
G. Oates	Design Engineer
P. Roney	Design Engineer
J. Bridgens	ECC System Engineer
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NRC

D. Kosloff	Perry Senior Resident Inspector
R. Twigg	Perry Resident Inspector

LIST OF ACRONYMS USED

AC	Alternating Current
ARI	Alarm Response Instruction
CFR	Code of Federal Regulations
CR	Condition Report
CRHVAC	Control Room Heating, Ventilation, and Air Conditioning
DCP	Design Change Package
DG	Diesel Generator
ECC	Emergency Closed Cooling
ESW	Emergency Service Water
°F	Degrees Fahrenheit
FCR	Field Clarification Request
GPM	Gallons Per Minute
IST	In-Service Testing
LCO	Limiting Condition for Operation
LCS	Licensing and Compliance Section
LPCS	Low Pressure Core Spray
MOV	Motor-Operated Valve
NCC	Nuclear Closed Cooling
NPSH	Net Positive Suction Head
PAP	Perry Administrative Procedure
PIF	Potential Issue Form
PSIG	Pounds Per Square Inch Gauge
PTI	Periodic Test Instruction
RCIC	Reactor Core Isolation Cooling
RHR	Residual Heat Removal
SVI	Surveillance Instruction
TCV	Temperature Control Valve
TS	Technical Specification
TXI	Temporary Instruction
UFSAR	Updated Final Safety Analysis Report
WO	Work Order

INSPECTION PROCEDURES USED

IP 37550	Engineering
IP 40500	Effectiveness in Licensee Controls in Identifying, Resolving, and Preventing Problems

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

96008-01	VIO	Inadequate Licensee Event Report