ENCLOSURE

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

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Report No.:	50-382/98-15
Licensee:	Entergy Operations, Inc.
Facility:	Waterford Steam Electric Station, Unit 3
Location:	Hwy. 18 Killona, Louisiana
Dates:	September 6 through October 17, 1998
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ATTACHMENT: Supplemental Information

EXECUTIVE SUMMARY

Waterford Steam Electric Station, Unit 3
NRC Inspection Report 50-382/98-15

This routine, announced inspection included aspects of operations, maintenance, engineering, and plant support activities. The report covers a 6-week period of resident inspection.

Operations

- The licensee performed forced outage activities in a very controlled manner. Overall performance was very good (Section O1.2).

- While conducting a plant cooldown, control room operators inappropriately determined that a procedural step to cycle atmospheric dump valves with the plant in Mode 3 was not applicable and did not have to be performed. This was a result of operators not adequately resolving the discrepancy between a procedure that required the atmospheric dump valves to be cycled in Mode 3 and a procedure that did not allow the valves to be cycled unless the plant was in Mode 5 or 6 (Section O1.3).

Maintenance

- A noncited violation was identified concerning the failure to maintain at least one train of shield building ventilation operable as required by Technical Specification (TS) 3.6.6.1. Electrical technicians inadvertently performed work on a Train B shield building ventilation valve while the Train A valve was tagged out for planned maintenance. The work performed rendered Train B inoperable and required entry into TS 3.0.3. Ineffective communication between electrical and operations personnel resulted in a delay in retesting of the valve and returning it to operability. In addition, the technicians conducted work on energized equipment, placing themselves and plant equipment at risk (Section M1.1).

- The licensee made a conservative decision to replace Main Transformer B. Supervisors and technicians demonstrated excellent system and component knowledge. Work planning and scheduling was very good (Section M1.2).

- The licensee performed a thorough investigation of the broken capscrews on Hotleg Injection Check Valve SI-512A. The engineering evaluation was complete and thorough. Corrective actions were very good (Section M2.1).

Engineering

- The licensee's response to the failure of three containment isolation valves, as a result of solenoid operator problems, during cold shutdown testing was very good. The short-term corrective actions to restore the valves to operable status were reasonable and based on good engineering judgement (Section E2.1).

- The licensee's evaluation to confirm the operability of the nitrogen/air supply tubing to refueling water storage pool outlet isolation valves was very good. The installation

resulted in no physical separation between the tubing for the Trains A and B valves. No concerns with the safety function of the tubing were identified (Section E2.2).

Plant Support

- The licensee's preparations for the approach of Hurricane Georges were conservative and extensive. Licensee management in charge of the hurricane response maintained continuous focus on minimizing damage to vulnerable plant equipment and maintained continuous communications and provided instructions to personnel regarding personnel safety in the event of severe weather (Section O1.4).

Report Details

Summary of Plant Status

The plant operated at essentially 100 percent power from the beginning of this inspection period until September 10, 1998, when power was reduced to approximately 25 percent to take the main generator off line and disconnect Main Transformer B. See Section M1.2 for details. On September 12, the main generator was placed on the grid and power was returned to approximately 52 percent, with only Main Transformer A in service. On September 18, the plant was shut down and cooled to Mode 5 conditions to facilitate replacement of a leaking pressurizer code safety valve. The outage was extended several days because of the threat of Hurricane Georges. On October 1, the plant was started up and connected to the grid. Power was increased to 100 percent on October 2 and remained at 100 percent for the remainder of this inspection period.

I. Operations

O1 Conduct of Operations

O1.1 General Comments (71707)

The inspectors performed frequent reviews of ongoing plant operations, control room panel walkdowns, and plant tours. Observed activities were performed in a manner consistent with safe operations of the facility. The inspectors observed operators using self-checking and peer-checking techniques when manipulating plant equipment. Operators consistently used three-way communication techniques, both in the control room and in external communications with auxiliary operators and maintenance personnel. On September 14, revised emergency operating procedures to incorporate a new methodology were issued and implemented.

O1.2 Forced Shutdown to Replace the Pressurizer Code Safety Valves

a. Inspection Scope (71707)

The inspectors observed operations during power changes, plant cooldown, and control of repair activities during the forced shutdown.

b. Observations and Findings

On September 10, 1998, control room operators identified that the quench tank was experiencing slight in-leakage. Operations implemented a plan of action to identify the source of in-leakage. The leakage was determined to be coming from a pressurizer code safety valve. The leak was determined to be less than the TS reactor coolant system leakage limit and the parameters of the quench tank could be maintained with minimal impact on control room operations.

On September 17, the licensee determined that the pressurizer code safety leakage was increasing and that it would be prudent to shut down, cool down, and replace the safety valves. On September 19, the plant entered Mode 5 (cold shutdown).

On September 21, the pressurizer code safety valves were replaced using Work Authorizations (WA) 01169228 and 01169558. Additional work within the forced outage scope was worked in a timely fashion such that plant startup was originally scheduled for September 26. However, the startup was delayed due to Hurricane Georges. The delay allowed time for Main Transformer B replacement to be completed to facilitate return to full power. On October 1, the plant was started up and 100 percent power was attained on October 2. See Section M1.2 for details.

The inspectors observed that the forced outage was conducted in a very controlled manner. Work was performed within the scope of the outage with very few emergent items. Despite the challenges presented by the weather, the licensee's performance was very good.

c. Conclusions

The licensee performed forced outage activities in a very controlled manner. Overall performance was very good.

O1.3 Control Room Observations During Plant Cooldown

a. Inspection Scope (71707)

During a tour of the control room on September 18, the inspectors observed control room operators perform portions of Operating Procedure OP-010-001, "General Plant Operations," Revision 19. Operators were conducting a plant cooldown and preparing to place shutdown cooling in service. At the time of the observations, the plant was in Mode 3 and was being cooled down to replace the pressurizer safety relief valves.

b. Observations and Findings

The inspectors observed control room operators conduct a prejob briefing for placing shutdown cooling in service. Operators discussed the remaining actions that needed to be performed, including placing shutdown cooling in service and monitoring the reactor coolant system cooldown rate. Use of procedures and verification of proper system alignment were emphasized by the shift superintendent.

With the plant in Mode 3, the operators were conducting a plant cooldown in accordance with Procedure OP-010-001, "Cooldown to Hot Shutdown (Mode 3 to Mode 4)," Section 8.7. The inspectors reviewed the completed steps of Procedure OP-010-001 and found that Step 8.7.12 was marked as "not applicable" and thus had not been performed. Step 8.7.12 required operators to stroke the main steam atmospheric dump valves in accordance with Procedure OP-903-033, "Cold Shutdown IST Valve Tests," Revision 13, Section 7.5. A note written below Step 8.7.12 stated, in part, that Procedure OP-903-033 states to verify plant in Modes 5 or 6. The inspectors reviewed Procedure OP-903-033 and found that it required the plant to be in Modes 5 or 6 prior to cycling the valves. Thus, the operators had marked the step as "not applicable" because the plant was not in the proper mode required by Procedure OP-903-033 for cycling the atmospheric dump valves. Since Section 8.7 provided instructions to cool

down the plant from Mode 3 to Mode 4, the inspectors questioned whether Step 8.7.12 would ever be applicable since the plant would be in Mode 3 and Procedure OP-903-033 required the plant to be in Modes 5 or 6 to stroke the atmospheric dump valves. In initial discussions, operations management stated that they believed stroking the atmospheric dump valves in Mode 3 was no longer required due to modifications to the valve and that Procedure OP-010-001 had not been changed to reflect the modification. The inspectors asked if this had been formally documented and were informed that it had not been. The inspectors asked if formal resolution was required prior to entering Mode 4 and were informed that it was not required.

The inspectors then discussed the issue with the shift superintendent. He stated that the step was determined to be not applicable by a previous crew and was not certain of the basis for not performing the step. Following discussions with other licensee personnel, the shift superintendent learned that Procedure OP-903-033 was in error in that it should have been written to allow cycling the valves with the plant in Modes 3 and 4. The inspectors concluded that marking Step 8.7.12 as "not applicable" by control room operators was inappropriate. Prior to entering Mode 4, control room operators successfully cycled the atmospheric dump valves.

On September 23, the licensee issued Revision 14 to Procedure OP-903-033. The revision added Section 7.19, which states to test the atmospheric dump valves in either Mode 3 or 4. The inspectors noted that Procedure OP-010-001, Revision 19, Step 8.7.12, was not revised and still referred operators to Section 7.5 to cycle the valves. The licensee indicated that Procedure OP-010-001 would be changed to refer operators to the correct section of Procedure OP-903-033.

c. Conclusion

While conducting a plant cooldown, control room operators inappropriately determined that a procedural step to cycle atmospheric dump valves with the plant in Mode 3 was not applicable and did not have to be performed. This was a result of operators not adequately resolving the discrepancy between a procedure that required the atmospheric dump valves to be cycled in Mode 3 and a procedure that did not allow the valves to be cycled unless the plant was in Mode 5 or 6.

O1.4 Response to Hurricane Georges

a. Inspection Scope (93702)

The inspectors provided 24-hour site coverage during the threat of Hurricane Georges and provided continual information updates to Region IV incident response personnel.

b. Observations and Findings

At 11:24 p.m. on September 26, 1998, the licensee declared a Notice of Unusual Event due to St. Charles Parish declaring a hurricane warning. The licensee, in preparation for the hurricane, had previously entered Procedure OP-901-521, "Severe Weather and Flooding," Revision 3. The licensee was in Mode 3 at normal operating temperature and

reactor coolant system pressure at the time the hurricane warning was issued. Operations personnel verified that both emergency diesel generators were started within the past 48 hours and that maximum diesel fuel oil was available. All loose items were secured or stored indoors to minimize the potential for missiles. The licensee retained 115 personnel on site as a core emergency response team to provide around-the-clock coverage for designated operations, maintenance, radiation protection, chemistry, and security positions. Food, cots, blankets, and other essential supplies were brought in and rest areas were established for the off-duty personnel. As a conservative decision, on September 27 at approximately 1:30 p.m., the licensee commenced a reactor coolant system cool down to Mode 4.

On September 25, two NRC Region IV personnel were dispatched to the site and, on September 27 at 12 p.m., the Region IV incident response center was activated in the monitoring phase of the normal mode of operation because of the potential for Hurricane Georges to make land fall near New Orleans, Louisiana, and affect the Waterford 3 site.

The approach of Hurricane Georges was closely monitored at the site by the licensee. Measured wind speed and a 15-minute average wind speed were graphically trended in the control room and various areas throughout the plant. The licensee had issued instructions to onsite personnel that in the event sustained wind speeds reached 30 miles per hour, all personnel were required to enter and stay inside the power block.

No severe effects of the storm occurred at the site since Hurricane Georges made landfall on September 28 in Biloxi, Mississippi, rather than New Orleans, Louisiana. Subsequently, on September 28 the hurricane warning was terminated and Waterford 3 exited the Notice of Unusual Event. The emergency response personnel who had been previously retained onsite were released from their duties.

The licensee's preparations for the approach of Hurricane Georges was found to be conservative and extensive. Emergency supplies, personnel, and equipment were available as needed. Licensee management in charge of the hurricane response maintained continuous focus on minimizing damage to vulnerable plant equipment and maintained continuous communications and instructions to personnel regarding personnel safety in the event of severe weather.

c. Conclusions

The licensee's preparations for the approach of Hurricane Georges were conservative and extensive. Licensee management in charge of the hurricane response maintained continuous focus on minimizing damage to vulnerable plant equipment and maintained continuous communications and instructions to personnel regarding personnel safety in the event of severe weather.

O8 Miscellaneous Operations Issues (92901)

O8.1 (Closed) Licensee Event Report (LER) 50-382/97-030-00 and -030-01: TS 3.6.3 noncompliance because of a design error associated with the containment atmosphere release system (CARS) containment isolation valves

While performing a recently revised surveillance procedure to test safety-related logic circuits, the licensee determined that the normally closed inside and outside containment isolation valves for the CARS were subject to a single failure. The containment isolation valves would not automatically close or remain closed upon receipt of a containment isolation actuation signal (CIAS) under certain conditions.

On November 14, 1997, operators performed stroke time testing of Valve CAR-201B (containment atmosphere release suction) and Valve CAR-202B (CARS exhaust Header B upstream isolation), which isolate Containment Penetration 47, as part of a subgroup relay test. During actuation of Relay K209 (CIAS) subgroup, Valve CAR-201B closed as expected but immediately reopened with the CARS exhaust fan in operation. Additional reviews identified that an energized ONX relay, which simulated exhaust fan operation, continued to provide an open signal in the presence of the CIAS. This was the first time that this contact on Relay K209 had been tested since this was one of three contacts identified as overlooked during the Generic Letter 96-01, "Testing of Safety-Related Logic Circuits," review and reported in LER 50-382/97-29.

The licensee attributed the root cause to inadequate original design of the control circuit for Valves CAR-201A and -201B with a contributing cause of inadequate design reviews during development of a station modification. Specifically, personnel failed to recognize that a single failure of the Relay K210 subgroup would prevent both the outboard and inboard containment isolation valves from closing. In addition, the original design did not consider it credible that both the inboard and outboard containment isolation valves would fail since they received Train B CIAS signals from two different subgroup relays, K209B and K210B, respectively. The licensee indicated that the design problem would not have resulted in a potentially unisolable containment penetration had the Train A power and Relay K210A subgroup been routed to Valve CAR-202B.

The inspectors determined that operators immediately close the affected containment isolation valves, as specified in TS 3.6.3. The long-term corrective actions to prevent recurrence of this problem involved a design modification to use the Relays K209A(B) subgroups to open the circuit to the ONX relay after Valves CAR-201A and -201B close and to eliminate the containment isolation valve override capability for these valves. Further, the licensee indicated that the modification process today has controls and checklists in place to help prevent these types of errors in the future. The licensee only places CARS B in this susceptible configuration for approximately 10 minutes during TS-required testing. In addition, the CARS is used late in the accident after containment pressure has been reduced by other systems. The licensee failed to maintain the design of CARS in compliance with the requirements for containment integrity as required by 10 CFR Part 50, Appendix B, Criterion III. However, this nonrepetitive, self-identified and corrected violation is a noncited violation, consistent with the Section VII.B.1 of the Enforcement Policy (50-382/9815-01).

II. Maintenance

M1 Conduct of Maintenance (61726, 62707)

The inspectors observed all or portions of the following maintenance and surveillance activities as specified by the referenced WA or surveillance procedure numbers:

- OP-903-030 Safety Injection Pump Operability Verification
- WA 01174001 Replacement of Main Transformer B
- OP-005-007 Main Turbine Trip Test

In general, the inspectors considered the observed work activities to have been performed in an acceptable and effective manner. The technicians were knowledgeable and conducted the work as required by the applicable procedures. Appropriate support personnel, including health physics, quality control, and supervisory personnel, were at the work site when required.

M1.1 Shield Building Ventilation (SBV) System Maintenance

a. Inspection Scope (62707)

The inspectors reviewed the actions of the licensee concerning maintenance personnel performing work on the wrong SBV system component. Maintenance was planned on Train A of the system, but electrical maintenance personnel inadvertently performed work on a Train B component.

b. Observations and Findings

On September 1, 1998, the licensee tagged out Train A of the SBV system in preparation for performing planned maintenance on various components located within the tagging boundaries. A prejob briefing was conducted by the electrical maintenance supervisor concerning the work to be performed on Valves SBV-110A and -114A. The planned work included preventive maintenance, lubrication, testing, and replacement of missing hardware. The operations support center supervisor opened WAs 01168038 and 01153010 to authorize work to commence on Valve SBV-110A. One of the electrical maintenance technicians verified that the proper tag was hung on the motor control center for Valve SBV-110A and the output of the breaker was checked to ensure that there was no voltage supplied to the motor operator.

The electrical maintenance personnel began work on what they believed to be Valve SBV-110A, a Train A valve. In reality, the technicians were working on Valve SBV-110B, a Train B valve. Operators in the control room received an annunciator indicating a ground on Battery B, but could not immediately determine the cause for this alarm. Operations also received incorrect indications for Valve SBV-110B and questioned the electrical maintenance personnel assigned to work on

Valve SBV-110A as to whether they were working on the correct valve. The initial indication from the electricians was that they were on the wrong valve but that only the cover had been removed from Valve SBV-110B. The electricians indicated that the cover had been replaced and operations personnel determined that removing and replacing the cover did not affect the operability of the valve. To ensure that no wires had been pinched during cover removal and installation, Train B of SBV was started to stroke Valve SBV-110B. The valve stroked open and closed with proper indications.

Later in the day, operations personnel were reviewing the computer alarm history and had questions concerning the alarms received on Valve SBV-110B and Battery B. When questioned again, the electrical maintenance personnel indicated that they had performed work on Valve SBV-110B beyond simply removing and replacing the cover. They believed that this work did not affect the operability of the valve since the valve had been cycled after the cover had been reinstalled. Operations subsequently determined that the work performed by the electricians did make the valve inoperable and that a surveillance test would be required to restore the component to operability. The valve was declared inoperable and TS 3.0.3 was entered as required with both trains of SBV inoperable. The effective time for entry into TS 3.0.3 was determined by the licensee to be when the work was first started on Valve SBV-110B (11:20 a.m. on September 1). A satisfactory retest was performed on Valve SBV-110B and the valve was declared operable at 5:42 p.m. on September 1 and TS 3.0.3 was exited. This represented a total time of 6 hours and 22 minutes. A total time of 7 hours was allowed by TS 3.0.3 to be in Hot Standby. This requirement was not exceeded.

The inspectors reviewed the actions of the licensee during this event and identified several concerns. When questioned the first time by operations personnel, the electrical technicians who were assigned to perform work on Valve SBV-110A were not completely open and accurate when describing the work that had been inadvertently performed on Valve SBV-110B. The technicians did not supply sufficient information to operations personnel that would allow a correct determination as to the required actions to return the system to operable status. The inspectors considered this lack of communication between maintenance and operations personnel to be of significant concern in that proper decision making must be based on complete and accurate information. In this case, the lack of accurate information resulted in a delay in entering TS 3.0.3 and subsequent retest of the component. In addition, the electrical technicians verified that the component that they were to work on was deenergized at the breaker, but failed to confirm this condition at the component. As a result, the technicians were inadvertently working on energized equipment when they went to the wrong valve. The inspectors were concerned that this practice could easily result in serious personnel injuries and damage to plant equipment.

Another consequence of this event was that the error committed by the electrical technicians caused a significant delay in returning both trains of the SBV system to operable status. At the time, Tropical Storm Earl was being forecast to become a hurricane and make landfall at or near the site. Under these conditions, it was desired to return the SBV system to operable status as soon as possible.

The root cause of this event was identified by the licensee as human error. The licensee initiated corrective actions to include additional training for the electrical department on Procedure UNT-005-018, "Control of Work on Electrical Equipment," Revision 6. In addition, the electrical technicians involved in this event were scheduled for retraining on the use of the STAR (Stop, Think, Act, Review) program. The inspectors considered these corrective actions to be adequate.

The failure to maintain at least one train of the SBV system operable while in Mode 1 as required by TS 3.6.6.1 is identified as a violation. This nonrepetitive, licensee-identified and corrected violation is being treated as a noncited violation consistent with Section VII.B.1 of the NRC Enforcement Policy. Specifically, this violation was identified by the licensee, it was not willful, actions taken as a result of a previous violation should not have corrected this problem, and appropriate corrective actions were completed by the licensee (50-382/9815-02).

c. Conclusions

A noncited violation was identified concerning the failure to maintain at least one train of shield building ventilation operable as required by Technical Specification 3.6.6.1. Electrical technicians inadvertently performed work on a Train B shield building ventilation valve while the Train A shield building ventilation valve was tagged out for planned maintenance. The work performed rendered Train B inoperable and required entry into Technical Specification 3.0.3. Ineffective communication between electrical and operations personnel resulted in a delay in retesting of the valve and returning it to an operable status. In addition, the technicians conducted work on energized equipment placing themselves and plant equipment at risk.

M1.2 Replacement of Main Transformer B

a. Inspection Scope (62707)

The inspectors periodically observed the replacement of Transformer B, reviewed the work documents, and interviewed the personnel involved with the work activity.

b. Observations and Findings

On September 8, 1998, the licensee identified that routine oil samples taken on Main Transformer B showed a substantial increase in impurities. Additional oil samples were taken and analyzed. The new samples indicated further degradation of the oil, a prediction of transformer failure. Based on the samples, the licensee made the decision to reduce power and remove the main transformers from service.

On September 10, power was reduced to approximately 25 percent and both main transformers were removed from service. Main Transformer B was disconnected in accordance with WA 01174001. On September 12, the main generator was returned to the grid using Main Transformer A only. Power was increased to approximately

52 percent and removal of Main Transformer B continued. A spare main transformer was available on site. Work began on the spare transformer in preparation for replacing Transformer B. A contractor was hired to perform the replacement.

On September 23, Main Transformer B was removed and the spare transformer was moved in for the replacement. The spare transformer was connected to replace Main Transformer B. Work on reconnection was completed on September 29.

On October 1, the plant was restarted and the main generator was placed on the grid with both main transformers available. On October 2, the plant reached 100 percent power with no indication of problems on the main transformers.

The inspectors observed that the work was conducted on schedule even though Tropical Storm Frances brought heavy rains and Hurricane Georges produced high winds in the area. Work was also interrupted by several tornado warnings and a toxic gas release. All phases of the replacement were well coordinated. The supervisors and technicians demonstrated excellent work techniques and knowledge of the systems and components.

c. Conclusions

The licensee made a conservative decision to replace Main Transformer B. Supervisors and technicians demonstrated excellent system and component knowledge. Work planning and scheduling was very good.

M2 Maintenance and Material Condition of Facilities and Equipment

M2.1 Repair of Safety Injection Valve SI-512A

a. Inspection Scope (92902)

The inspectors reviewed the repair activities, work packages, and engineering evaluation and interviewed personnel.

b. Observations and Findings

On September 18, 1998, an initial containment entry was made following shutdown and cooldown to Mode 5. Hot Leg Injection Check Valve SI-512A was found leaking from the bonnet. Valve SI-512A is a pressure-seal, tilt-disc check valve, which provides positive sealing of the valve bonnet at system operating pressure because the sealing forces increase with an increase in reactor coolant system (RCS) pressure. The bonnet retainer capscrews align the bonnet-seal assembly, but are not considered pressure boundary bolting and do not provide any safety-related function. The bonnet is torqued during valve assembly to provide body-to-gasket-to-bonnet seal contact before sealing pressure from the RCS is applied. Closer inspection revealed that all four capscrews had been sheared, which allowed the bonnet to shift sufficiently to cause leakage

around the seal. The capscrews were replaced and tightened to stop the leak until the problem could be evaluated. Condition Report 98-1236 was written to address the issue.

The licensee identified 21 additional Anchor/Darling valves of the same design and issued WA 01174575 to inspect the other valves for evidence of broken fasteners or leakage. No discrepancies were identified on the other valves.

The engineering evaluation stated that RCS depressurization appeared to be the catalyst for capscrew failure. It was postulated that the capscrews had mistakenly been hot-torqued with the RCS at normal pressure. Interviews with mechanical maintenance technicians indicated that additional torque had been applied to prevent leakage at low RCS pressure.

The broken capscrews were evaluated and found to have broken under tensile stress. The licensee determined that, with the assumption that the screws had been hot-torqued when RCS pressure was reduced, relaxation of the metal-to-metal seal provided sufficient tensile stress to cause the capscrews to fail. The engineering evaluation reviewed all plausible mechanisms in detail and this appeared to be the most likely.

A representative from Anchor/Darling Valve Company was contacted. He concurred with the engineering evaluation and stated that it would be acceptable to substitute commercial grade studs and nuts for the capscrews to provide additional strength, if necessary.

The valve was repaired in accordance with WA 01174552. The capscrews were replaced with SA-193-B7 studs and SA-194-2 nuts. Maintenance Procedures MM-006-053 and MM-006-054 were revised to prevent overtorquing the bolts.

c. Conclusions

The licensee performed a thorough investigation of the broken capscrews on Hotleg Injection Check Valve SI-512A. The engineering evaluation was complete and thorough. Corrective actions were very good.

M8 Miscellaneous Maintenance Issues (92902)

M8.1 (Closed) LER 50-382/98-018: TS 3.0.3 Entry Due to Redundant Shield Building Ventilation Trains Being Inoperable

This LER was generated as a result of having both trains of SBV out of service simultaneously due to a maintenance error, which required entry into TS 3.0.3. This event is described in detail in Section M1.1 of this report. This LER is closed.

III. Engineering

E2 Engineering Support of Facilities and Equipment

E2.1 Failure of Safety-Related Valves to Close During Cold Shutdown Testing

a. Inspection Scope (37551)

The inspectors reviewed the licensee's actions regarding the failure of three safety-related containment isolation valves to go to the closed/safe position during Inservice Testing (IST).

b. Observations and Findings

On September 20, 1998, while the plant was in cold shutdown (Mode 5), the licensee was conducting IST valve testing in accordance with Operating Procedure OP-903-033, "Cold Shutdown IST Valve Test," Revision 4. During this test three containment isolation valves failed to close, as required. These valves were:

- Instrument Air Valve IA-909 - Instrument air header outside containment flow control valve.
- Reactor Coolant Valve RC-606 - Reactor coolant pump control bleedoff inside containment isolation valve.
- Chemical and Volume Control Valve CVC-401 - Reactor coolant pump bleed off outside containment isolation valve.

The inspectors were particularly concerned with the failures of Valves RC-606 and CVC-401. These two valves are the inside and outside containment penetration valves for a single penetration (Penetration 44). The failure of these two valves under actual accident conditions could result in a release path through that penetration.

In response to these failures, the licensee formed a Significant Event Response Team to perform a root cause analysis and recommend a course of action to correct the condition. The team considered various modes of failure and eliminated those that were not credible based on tests, inspections, or plant conditions.

The root cause of the failures was identified as an accumulation of silicon gel on the top of the core and subassembly housing of the American Switch Company (ASCO) Series 206 solenoid valves. This caused the valves to stick in the energized position after the solenoid was deenergized, thereby not allowing the associated valve to change position. The source of the silicon gel was identified as Dow Corning 550 silicon compound, which was used by ASCO in the assembly of the Series 206 solenoids. The silicon gel development was identified as occurring in an environment where the Dow Corning fluid was exposed to prolonged high temperatures without stroking the solenoid

valve. From this, the licensee identified three conditions that could lead to this failure mechanism: (1) high wattage solenoid coil, (2) continuously energized coil, and (3) infrequently cycled solenoid.

The licensee concluded that all three of these conditions were present for all of the failed containment isolation valves. The ASCO Series 206 solenoids had high wattage coils. These valves were normally-open, fail-closed components, which required a continually energized coil on the solenoid. These valves were stroked only during cold shutdown conditions, which was infrequent.

To determine the extent of the potential problem throughout the plant, the licensee used these three criteria and identified a total of seven valves, including the three containment isolation valves that failed the IST, that had the same potential failure mechanism. The remaining four valves were Feedwater Regulating Valves FW-173A and -173B and Startup Feedwater Regulating Valves FW-166A and -166B. The four feedwater regulating valves were stroked satisfactorily during this period.

To correct the condition and return the three containment isolation valves to operable status, the licensee replaced the original ASCO Series 206 solenoid valves with new ASCO Series 206 solenoid valves. A detailed evaluation was performed to determine the projected gel time for Dow Corning 550 in these new valves given the three criteria identified, which applied to Valves RC-606, CVC-401, and IA-909. Using historical data, it was determined that the lubricant would not gel for a period of 15 months. Conservatively, the licensee determined that an operating period of 8 months could be achieved without failure of the solenoid valves. This would provide confidence that the containment isolation valves would remain capable of performing their safety function until the next scheduled refueling outage in February 1999. A long-term corrective action plan was being developed based on further study and failure analysis.

The inspectors reviewed the licensee's findings and conclusions concerning these failures. In addition, the inspectors examined the disassembled ASCO Series 206 solenoid valves with the silicon gel residue in place. The three criteria identified by the licensee were reasonable based on the available evidence. The licensee's efforts to determine the extent of the condition were adequate to identify other potential problem areas. The short-term corrective action was adequate and the time limit of 8 months on the service life of the replacement ASCO solenoid valves was based on reasonable engineering judgement. No concerns were identified with the licensee's actions in response to the containment isolation valve failures.

c. Conclusions

The licensee's response to the failure of three containment isolation valves, as a result of solenoid operator problems, during cold shutdown testing was very good. The short-term corrective actions to restore the valves to operable status were reasonable and based on good engineering judgement.

E2.2 Confirmation of Operability for Instrument Air/Nitrogen Tubing

a. Inspection Scope (37551)

The inspectors reviewed the licensee's evaluation to confirm the operability of instrument air/nitrogen tubing for Safety Injection Valves SI-106A and -106B that were identified as being routed through the same tube track.

b. Observations and Findings

On September 22, 1998, the licensee identified that the instrument air/nitrogen tubing for Refueling Water Storage Pool Outlet Isolation Valve SI-106A was not routed in accordance with the applicable instrument location drawings. Specifically, the tubing should have been routed through Tube Track T-241, but was instead routed through Tube Track T-242. The instrument air/nitrogen tubing for Valve SI-106B was also routed through Tube Track T-242 as shown on the applicable drawing. As a result of this installation error, the tubing for both Trains A and B valves was not physically separated as originally intended on the drawings.

This condition constituted a nonconformance in that the plant as-built configuration differed from that depicted by the applicable instrument location drawing. The licensee performed an evaluation to confirm the continued operability of Valve SI-106A in accordance with Procedure W4.101, "Operability Confirmation Process," Revision 2. The routing of the tube track and the safety function of the tubing were considered in this evaluation. No jet impingement loads, high energy lines, or credible missiles were identified in the area of the tubing that could impact the tubing and cause a pipe break. The licensee concluded that the tubing, although not physically separated, was protected from postulated pipe break events by its location. The operability of the components was therefore confirmed. A long-term action was identified to reroute the tubing as shown on the applicable drawing.

The inspectors reviewed the evaluation and considered it reasonable. The conclusions were based on good engineering judgement and factual data gathered from document reviews and in-plant walkdowns. No concerns were identified.

c. Conclusions

The licensee's evaluation to confirm the operability of the nitrogen/air supply tubing to refueling water storage pool outlet isolation valves was very good. The installation resulted in no physical separation between the tubing for the Trains A and B valves. No concerns with the safety function of the tubing were identified.

IV. Plant Support

R1 Radiological Protection and Chemistry Controls

During routine plant tours, the inspectors observed that radiation measurements had been posted in accordance with NRC requirements and licensee's procedures. During the forced outage, the inspectors observed that special postings had been made in areas of elevated radiation from operation of shutdown cooling and gaseous activity. ALARA (as low as reasonably achievable) postings were considered to be especially effective. Plant workers were observed complying with all postings.

P1 Conduct of EP Activities

The inspectors observed implementation of emergency preparedness for Tropical Storm Frances and for Hurricane Georges (See Section O1.4). Also, challenges from toxic chemical releases and tornado warnings were experienced during this inspection period. All activities related to emergency response were excellent.

V. Management Meetings

X1 Exit Meeting Summary

The inspectors presented the inspection results to members of licensee management on October 19, 1998. The licensee acknowledged the findings presented.

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

ATTACHMENT

SUPPLEMENTAL INFORMATION

PARTIAL LIST OF PERSONS CONTACTED

Licensee

R. F. Burski, Director Site Support
C. M. Dugger, Vice-President, Operations
E. C. Ewing, Director, Nuclear Safety & Regulatory Affairs
C. Fugate, Operations Superintendent
T. J. Gaudet, Manager, Licensing
J. G. Hoffpauir, Manager, Operations
T. R. Leonard, General Manager, Plant Operations
D. C. Matheny, Manager, Operations
G. D. Pierce, Director of Quality
D. W. Vinci, Superintendent, System Engineering
A. J. Wrape, Director, Design Engineering

INSPECTION PROCEDURES USED

37551	Onsite Engineering
61726	Surveillance Observations
62707	Maintenance Observations
71707	Plant Operations
71750	Plant Support Activities
92700	Onsite LER Review
92901	Followup-Plant Operations
92902	Followup-Maintenance
92903	Followup-Engineering
92904	Followup-Plant Support
93702	Prompt Onsite Response to Events

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-382/9815-01	NCV	TS 3.6.3 noncompliance because of design error in CARS valve circuitry (Section O8.1)
50-382/9815-02	NCV	Failure to maintain at least one train of the SBV system operable while in Mode 1 as required by TS 3.6.6.1 (Section M1.1).

Closed

50-382/9815-01	NCV	TS 3.6.3 noncompliance because of design error in CARS valve circuirty (Section O8.1)
50-382/97-030-00 and -030-01	LER	TS 3.6.3 noncompliance because of design error in CARS valve circuirty (Section O8.1)
50-382/9815-02	NCV	Failure to maintain at least one train of the SBV system operable while in Mode 1 as required by TS 3.6.6.1 (Section M1.1).
50-382/98-018	LER	TS 3.0.3 Entry Due to Redundant Shield Building Ventilation Trains Being Inoperable (Section M8.1).

LIST OF ACRONYMS USED

ALARA	as low as reasonably achievable
ASCO	American Switch Company
CARS	containment atmosphere release system
CIAS	containment isolation actuation signal
CFR	Code of Federal Regulations
IST	inservice testing
LER	licensee event report
NRC	Nuclear Regulatory Commission
NRR	Office of (NRC) Nuclear Reactor Regulation
PDR	Public Document Room
RCS	reactor coolant system
SBV	shield building ventilation
TS	Technical Specification
WA	work authorization