APPENDIX

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Inspection Report: 50-382/94-21

License: NPF-38

Licensee: Entergy Operations, Inc.
P.O. Box B
Killona, Louisiana 70066

Facility Name: Waterford Steam Electric Station, Unit 3 (Waterford 3)

Inspection At: Waterford 3

Inspection Conducted: November 13 through December 24, 1994

Inspectors: Troy W. Pruett, Resident Inspector

Vincent Gaddy, Reactor Inspector, RIV

Dave Pereira, Reactor Inspector, RIV/WCFO

Kathy Weaver, Reactor Inspector, RIV

Approved: _____ 12-29-94
C. A. VanDenburgh, Chief, Project Branch D — Date

Inspection Summary

Areas Inspected: Routine, unannounced inspection of plant status, plant operations, maintenance and surveillance observations, plant support activities, onsite engineering, on-line maintenance, followup on corrective actions for violations, management meetings, and review of licensee event reports (LERs).

Results:

Plant Operations

- The failure to implement formal guidance for control of loose items in the plant contributed to the inspectors observation of an unattended ladder in Safeguards Room A and was an example of a poor housekeeping practice (Section 2.2).

- The licensee's response to their identification of the failure to adequately perform the largest single load reject test of the emergency diesel generators (EDGs) was proactive and thorough and is not being

cited because the criteria in paragraph VII.B.1 of Appendix C to 10 CFR Part 2 of the NRC's "Rules of Practice" were satisfied (Section 2.3.1).

- Design engineering's evaluation to determine if the difference between EDG shut down load and actual load could impact the intent of the Technical Specifications (TS) will be reviewed as an inspection followup item (Section 2.3.2).

- Station logs accurately reflected abnormal operating conditions and operators were responsive to the adverse conditions affecting the feedwater and pressurizer systems (Section 2.4).

Maintenance

- Implementation of cleanliness and foreign material controls for maintenance on Component Cooling Water (CCW) Pump A/B indicated a significant improvement from concerns documented in NRC Inspection Report 94-20. Specifically, the craftsmen removed loose debris from the work area on a periodic basis and ensured that openings to the CCW system were appropriately covered (Section 3.1.1).

- Craftsmen showed excellent judgement by seeking the assistance of planning personnel when work on a valve in the CCW system could not be accomplished as described in the work authorization (WA) (Section 3.1.2).

- Instrumentation and control technicians exhibited excellent judgement and awareness by not installing a manometer that could have affected the crankcase pressure readings of the EDG (Section 3.1.3).

- The scheduling department implemented several good practices which ensured the probability of being able to mitigate core damage remained high and provided a conservative approach to probabilistic risk assessment. Specifically, on-line maintenance scheduling practices were effective in preventing work on opposite safety trains, several components within one safety train, and balance-of-plant activities during maintenance periods on safety-related components (Section 3.2).

- Independent verifications performed by instrumentation and control personnel were excellent; however, the licensee should consider whether independent verifications are needed for valve manipulations during performance of surveillance test procedures (Sections 4.1.1 and 4.1.3).

Plant Support

- Health physics technicians were knowledgeable of the presence and levels of radioactivity, directed personnel to wear the appropriate levels of protective clothing, instructed personnel to discontinue work until

radiological data was obtained and analyzed, informed workers of survey results, and installed leakage collection devices (Section 5.1).

Engineering

- The delay in initiating a condition report for cloudy oil in High Pressure Safety Injection Pump B and leaving the oil in the pump without determining the cause of the cloudiness are examples of poor engineering judgement (Section 8.1).

Summary of Inspection Findings:

A noncited violation was identified (Section 2.3.1).
Inspection Followup Item 382/9421-01 was opened (Section 2.3.2).
Violation 382/9332-01 was closed (Section 7.1).
Unresolved Item 382/9415-02 was closed (Section 7.2).
Inspection Followup Item 382/9419-04 was closed (Section 8.1)
Violation 382/9310-01 was closed (Section 9.1).
Violation 382/9405-01 was closed (Section 9.2).
Violation 382/9408-01 was closed (Section 9.3).
Licensee Event Report 93-006 was closed (Section 10.1).
Licensee Event Report 94-014 was closed (Section 10.2).
Licensee Event Report 94-006 was closed (Section 11).
Licensee Event Report 94-004 was closed (Section 12.1).

Attachments:

- Persons Contacted and Exit Meeting
- Meeting Attendees
- Presentation Slides

DETAILS

1 PLANT STATUS

The plant operated at essentially 100 percent power during the inspection period.

2 PLANT OPERATIONS (71707)

The objectives of this inspection were to ensure that the facility was being operated safely and in conformance with regulatory requirements, to ensure that the license's controls were effective in achieving continued safe operation of the facility, to independently verify the status of the plant, and to evaluate the effectiveness of the licensee's self-assessment programs.

2.1 Control Room Observations

2.1.1 Operator Turnover

The inspectors observed operations personnel perform several shift turnovers. The observations indicated that on-shift personnel walked down the boards with the relieving shift personnel and discussed important issues, impending work, and tagouts. Additionally, personnel reviewed the night order and shift logs and discussed out-of-operation equipment with their reliefs. The inspectors determined that turnovers were effective in preparing personnel to relieve the shift.

2.2 Plant Tours

On December 6, 1994, during a routine tour, the inspectors observed an unattended 4-foot step ladder in Safeguards Room A. The inspectors noted that the ladder was approximately 8-10 feet from High Pressure Safety Injection (HPSI) Pump A/B and directly under the HPSI Pump A/B Minimum Flow to Recirc Line A Stop Valve MVAA205AB. The licensee indicated that the ladder should not have been left unattended and that it was most likely left in the pump room after completion of an evolution to align the HPSI pumps the previous night.

The inspectors questioned the licensee about the requirements for controlling ladders. The licensee stated that Safety Policy 004, "Safety Belts, Ladders and Scaffolding Use," provided guidance on the control of ladders. However, the inspectors noted that the policy addressed personnel safety applications for ladder use, rather than control requirements. The inspectors also reviewed a summary of individual plant examination of external events recommendations documented in a licensee interoffice correspondence, dated April 11, 1994, entitled "Loose Items In Plant." The correspondence provided examples of loose items in the control room and made recommendations to improve the licensee's control of loose materials in the plant. Item 6 recommended that ladders which could fall and potentially damage

safety-related equipment be restrained or placed flat on the floor when unattended. Items 2 and 7 recommended that material not be stored within 10 inches of a safety-related component. Even though the ladder was not within 10 inches of a safety-related component, the inspectors concluded that leaving the ladder unattended in the pump room was a poor housekeeping practice.

The failure to implement corrective actions for the control room loose item deficiencies described in the correspondence was cited as a violation in NRC Inspection Report 50-382/94-20. The inspectors questioned the licensee to determine if the recommendations in the correspondence were being incorporated into licensee procedures. The licensee stated that design engineering was initiating a revision to Fire Protection Procedure FP-001-017, "Transient Combustibles and Designated Storage Areas," and Administrative Procedure UNT-007-006, "Housekeeping," which would provide guidance for the storage of loose items in the plant. Design engineering personnel stated that the revised procedures should include the recommendations described in the interoffice correspondence. The inspectors will review these procedures upon revision.

2.3 Review of EDG Surveillance Test Requirements

In accordance with LER 94-012, "Noncompliance with EDG Surveillance Requirements Due to Inadequate Procedures," Corrective Action Item 5, the licensee reviewed selected procedures to assure that TS surveillance requirements were being met. The licensee completed a review of the EDG surveillance requirements and noted discrepancies associated with the largest single load reject test and the synchronizing of emergency loads with offsite power test. At the end of the inspection period, the licensee was continuing its evaluation of a statistical sampling of remaining surveillance requirements.

2.3.1 Surveillance Test Requirements 4.8.1.1.2.d.1 (Largest Single Load Reject)

TS Surveillance Requirement 4.8.1.1.2.d.1 required that a verification be performed at least once per 18 months to ensure the EDG's capability to reject a load of greater than or equal to 498 KW (i.e., HPSI pump) while maintaining voltage and frequency. On November 22, 1994, during a review of surveillance procedures, the licensee determined that the 18-month surveillance test used to verify the EDG's capability to reject the largest single load was inadequate because the load rejected from the EDG was approximately 230 KW instead of 498 KW. Additionally, the licensee noted that Final Safety Analysis Report (FSAR) Table 8.3-1, "EDG Loading Sequence," indicated that the high pressure safety injection (HPSI) pump load under accident conditions was 372.50 KW and not 498 KW.

In response to this finding, the licensee declared the EDG operable and entered Site Directive W4.101, "Operability/Qualification Confirmation Process," to verify the operability of the EDG. The licensee based the EDG's operability on: (1) startup test data which demonstrated the ability of the

EDG to maintain voltage and frequency during a largest single load reject of 600 KW; (2) testing performed during Refueling Outage 6 which verified the ability of the EDG to maintain voltage and frequency during the loss of 230 KW; and (3) satisfactory completion of EDG full load reject testing during Refueling Outage 6.

The inspector noted that there are two different modes of EDG operation--droop and isochronous. In the isochronous mode, the governor maintains frequency regardless of load. In the droop mode, frequency is a function of the load. As load increases on the EDG the frequency decreases, conversely, as load decreases, the frequency increases. Although the voltage regulator functions the same in either the droop or isochronous mode, the inspector was concerned that a larger frequency change should occur by rejecting a load from the EDG while it is operating in the droop mode. Nevertheless, the licensee concluded that Surveillance Requirement 4.8.1.1.2.1.d.1 could be satisfied by performing the largest single load reject test while the EDG was operating in either the isochronous or droop modes. The licensee normally performs the EDG test by running the EDG in the isochronous mode and tripping the HPSI pump. As corrective action, the licensee rejected 600 KW from each EDG while they operated in the droop mode on November 22 and 23, 1994. The load was rejected by synchronizing the EDG with off-site power and tripping the EDG output breaker, thereby, leaving no load on the EDG. The test voltages and frequencies were within the allowable TS margin. Based on this testing, the inspectors concluded that testing the EDG in the droop mode instead of the isochronous mode were acceptable.

The inspectors were also concerned that their review of FSAR Table 8.3-1 determined that the essential chiller (430 KW) provided the largest single load on the EDG. The licensee confirmed the inspectors' finding and stated that the essential chiller only provided the largest single load during the tornado missile mode. The licensee also stated that the TS mistakenly referenced the HPSI pump because it supplied the largest average load during accident conditions.

The failure to originally test the EDG to assure that all components will perform satisfactorily in service in accordance with written test procedures which incorporate the requirements and acceptance limits contained in applicable design documents was a violation of 10 CFR Part 50, Appendix B, Criterion V. However, the inspectors concluded that the licensee's response to the inadequate testing of the EDG was proactive and thorough, in that it included prompt notification of the event to the resident inspectors and licensee management, thorough review of regulatory guides and industry standards to determine the appropriate method of testing, timely implementation of corrective actions to test the EDG, and commencement of revisions to amend the TS. This violation is not being cited because the criteria in paragraph VII.B.1 of Appendix C to 10 CFR Part 2 of the NRC's "Rules of Practice" were satisfied.

2.3.2 Surveillance Requirement 4.8.1.1.2.d.8.a (Synchronize EDG with Offsite Power)

Surveillance Requirement 4.8.1.1.2.d.8.a required the licensee to verify the EDG's capability to synchronize with the offsite power source upon a simulated restoration of offsite power, while the EDG is loaded with its emergency loads. On November 22, 1994, during a review of surveillance procedures, the licensee determined that all safety injection, containment spray, and emergency feedwater actuation signal loads were not energized when performing Surveillance Requirement 4.8.1.1.2.d.8.a. The licensee initiated Condition Report 94-1109 to evaluate what "emergency loads" meant with respect to satisfying the surveillance requirement. The condition report indicated that the surveillance requirement would be met if only the shutdown loads were used during performance of the test. Nevertheless, design engineering was evaluating the difference between shut down load and actual load to ascertain any possible impact on meeting the intent of the TS. Design engineering's evaluation of the surveillance item will be reviewed as an Inspection Followup Item (382/9421-01).

2.4 Examples of Improvement in Attention to Detail and Operator Actions

The inspector noted the following three examples of improved operator responsiveness to adverse plant conditions. In addition, entries into the station logs for these events indicated an improvement in log keeping practices.

2.4.1 Operator Response to Steam Generator Level Control System

In response to a steam generator high/low alarm on October 24, 1994, control room operators noted that the Main Feedwater Regulating Valve (MFWRV) 1 and Startup Feedwater Regulating Valve (SUFWRV) 1 positions differed from MFWRV 2 and SUFWRV 2, in that MFWRV 1 and SUFWRV 1 were not changing positions and that there was a long-term decrease in feedwater flow. The operators contacted the instrumentation and control (I&C) technician who determined that the +/- 18 vdc power supply for Feedwater Control Station Cabinet 1 was -10 volts. The operators placed the feedwater controls in manual while the I&C technician replaced the faulty power supply.

2.4.2 Congealed Hydraulic Fluid

On November 2, 1994, operations personnel noted that the oil in the upper region of Feedwater Isolation Valve Reservoir 2 contained a congealed substance. The initial inspection of the oil samples taken from the reservoir indicated that the oil from the bottom of the reservoir did not exhibit the abnormalities that were present at the top of the reservoir. Because the accumulator is filled using hydraulic pumps that take a suction from the bottom of the reservoir, the licensee determined that the operation of the valve would not be affected.

The licensee drained and refilled the accumulators and reservoir. Maintenance engineering contacted the supplier and determined that water and heat could produce a gelling effect on the hydraulic fluid. The licensee concluded that the gelling effect occurred as a result of a high heat environment combined with moisture entering the reservoir's atmospheric vent.

2.4.3 Pressurizer Control Malfunction

On November 11, 1994, Channel (Y) of Pressurizer Pressure Control Circuit RC-IPR-0110 failed high. The failure resulted in the pressurizer spray valves opening and all pressurizer heaters deentergizing. Operators entered Off Normal Procedure OP-901-120 "Pressurizer Control Malfunction," and selected the alternate pressure control channel. Actual reactor coolant system pressure decreased to 2190 psia, which was within the allowable TS range of 2025-2275 psia.

3 MAINTENANCE OBSERVATION (62703)

The station maintenance activities affecting the safety-related structures, systems, and components listed below were observed and the documentation was reviewed to ascertain that the activities were conducted in accordance with approved WAs, procedures, TS, and appropriate industry codes or standards.

3.1 Maintenance Observations

WA	Task
WA 01128422	Replacement of CCW AB Mechanical Seals
WA 01129904	Nitrogen Accumulator 4 Outlet Header Vent Valve Repack
WA 01129904	Replacement of EDG Manometer

3.1.1 CCW Pump AB Mechanical Seals

Between November 30 and December 2, 1994, the inspectors observed the replacement of mechanical seals on CCW Pump AB in accordance with WA 01128422. The craft removed loose debris from the work area on a periodic basis and ensured that openings to the CCW system were appropriately covered. The inspectors noted that the craftsmen's implementation of cleanliness and foreign material controls for this task indicated a significant improvement from previously identified concerns documented in NRC Inspection Report 50-382/94-20.

3.1.2 Nitrogen Accumulator 4 Outlet Header PS Vent Valve Repack

The inspectors observed the repack of the Nitrogen Accumulator 4 outlet header vent valve in accordance with WA 01129904. The inspectors noted that the work instructions directed technicians to remove the valve bonnet and to inspect/rework the valve internals. However, the technicians stopped work because the close proximity of a solenoid valve prevented the removal of the bonnet. The technicians placed the valve in a safe configuration and returned

the work package to the planning department. Planning department personnel amended the work instructions to direct only repacking the valve. The inspectors noted that good maintenance practices were used and that the technicians satisfied all required prerequisites.

3.1.3 Replacement of EDG Manometer

The inspectors observed the replacement of a manometer which measured the crankcase pressure of EDG B in accordance with WA 01129653. The technicians removed the manometer without any difficulty using good work practices. During the installation of the new manometer, the technicians noted that the mounting holes were not drilled in the same location as those of the manometer being replaced. Had the new manometer been installed using the new mounting holes, it would have resulted in the sensing element being installed lower than the crankcase outlet port. This could potentially allow excess fluid from the crankcase to penetrate the manometer and affect pressure readings. Due to the difference, the technicians stopped work and contacted their supervisor and the system engineer for assistance. The system engineer suspended the maintenance until the differences could be resolved. The inspectors noted that the technicians exhibited excellent judgement and awareness by recognizing that, if the manometer was installed as received, crankcase pressure readings could potentially be affected.

3.2 Temporary Instruction 2515/126, "Evaluation of On-line Maintenance

The inspectors used the guidance in Temporary Instruction 2515/126 to evaluate the licensee's procedures and practices regarding the removal of equipment from service for on-line maintenance. Items reviewed by the inspectors included planning and scheduling procedures, Waterford 3's individual plant examination results, and completed and forecasted maintenance schedules. In addition, the inspectors interviewed several individuals involved in probabilistic risk assessment (PRA), maintenance rule implementation, and scheduling of tasks.

The inspectors reviewed 3 months of completed and scheduled maintenance activities and determined that the licensee did not perform or schedule opposite train maintenance or multiple components within one train for maintenance during the same period. Additionally, the licensee did not perform or schedule balance-of-plant activities during safety-related equipment unavailability. The licensee narrowed the scope of planned activities such that only one-half of the allowed outage time described in the TS was scheduled for on-line maintenance of safety-related equipment. Even though these good scheduling practices were not proceduralized, they collectively ensured that the probability of being able to mitigate core damage remained high and provided a conservative approach to PRA.

The inspectors noted that the licensee was developing an on-line risk monitor software program which would enable scheduling and operations personnel to evaluate the risk associated with on-line maintenance. The software should be available to scheduling personnel in the first quarter of 1995. The software

program uses plant specific data to provide personnel with a daily plant safety index. The safety index is based, in part, on scheduled maintenance activities which are evaluated to determine the risk associated with initiating an event or not being able to mitigate core damage. Additionally, the software program may be utilized by the safety and analysis group to evaluate the risk over time. This evaluation could then be used to evaluate the licensee's PRA model.

The inspectors determined that the licensee did not evaluate whether an opposite train safety component could be at a higher risk of failure based on scheduled maintenance backlog, condition reports, and condition identifiers prior to removing a safety-related component from service. Scheduling department personnel stated that this item could be integrated into the component outage planning process since a data base existed which would allow the licensee to review all deficient items on each component.

The inspectors determined that the increased on-line component allowed outage times resulting from moving Operating Mode 5 and 6 maintenance items to any operating mode were not compared to the individual plant examination. Specifically, the licensee's quality action team removed items from Refueling Outage 6 which could be performed in any plant mode, but did not evaluate the added risk resulting from increased allowed outage times. The licensee trended outage times for the emergency feed water system, HPSI system, and the EDGs, but did not trend the remaining safety-related systems. The safety and analysis group stated that an evaluation and validation of plant specific data was in progress, but that a comparison to the individual plant examination had not been performed. The inspectors compared the allowed outage times for EDGs to the individual plant examination. Even though the current allowed outage times were slightly higher, they remained consistent with the assumptions made in the individual plant examination. The licensee agreed that an evaluation of risk with respect to increased outage times would strengthen the existing program.

The inspectors noted that an individual could perform a maintenance task or evolution without placing the item on the daily schedule. The approval of performing the item remained solely with the operations shift supervisor. This could create instances where unscheduled items increase the overall risk associated with the performance of all scheduled activities. The safety and analysis group stated that the developing risk monitor software would enable operations personnel to evaluate the increased risk from performing unscheduled items.

The inspectors questioned several personnel to determine the licensee's familiarity of PRA concepts. The inspectors concluded that personnel involved with maintenance rule implementation or safety and assessment were knowledgeable of PRA. However, interviews with scheduling and operations personnel indicated that more training in PRA concepts may be needed. The safety and assessment group indicated that a corporate level program was being developed to provide licensee personnel with an improved understanding of PRA concepts.

4 SURVEILLANCE OBSERVATION (61726)

The inspectors observed the surveillance testing of safety-related systems and components addressed below to verify that the activities were being performed in accordance with the licensee's approved programs and the TS.

4.1 Surveillance Observations

Procedure	Title
ME-003-200	Station Battery Bank and Charger Weekly
MI-003-504	Calibration and Functional Check of the A and B Broad Range (HVCIA 5510 A or B) Gas Detection Systems
OP-903-006	Reactor Trip Breaker Test
OP-903-030	Operability Verification on HPSI Pump A
OP-903-035	Containment Spray Pump Operability Check

4.1.1 Calibration and Functional Check of Broad Ranges A and B

The inspectors noted that I&C personnel performed the calibration and functional check in accordance with the procedural requirements and that their independent verifications were excellent.

4.1.2 Operability Verification on HPSI Pump A

The inspectors observed operations personnel perform an operability reverification on HPSI Pump A due to an earlier failure of outboard pump bearing Vibration Point Data 4V. The new vibration data indicated that HPSI Pump A was in specification. Vibration Data Point 4V was 0.57 mils instead of the 2.02 mils obtained earlier in the day. The acceptance criteria for Vibration Data Point 4V was 1.5 mils. The operations, maintenance, and engineering personnel reasoned that the handling of the test probe caused the discrepancy between the two vibration readings.

4.1.3 Containment Spray Pump Operability Check

The inspectors observed the quarterly inservice tests of Containment Spray Pump B in accordance with Surveillance Procedure OP-903-035, "Containment Spray Pump Operability Check." The inspectors noted that adequate communication and good coordination existed between local test personnel and the control room. During testing, fluid began to leak near Containment Spray Pump B Suction Root Valve CS-104. The exact location of the leak could not be determined during the test due to piping insulation and leakage collection devices. The licensee later determined that improper installation of a test gauge caused the leak.

The inspectors noted that valve manipulations to restore the system did not require independent verification. Although no problems were encountered during this test evolution, independent verification of valve manipulations could decrease the probability of error.

5 PLANT SUPPORT ACTIVITIES (71750)

The objectives of this inspection were to ensure that selected activities in the different areas of plant support were implemented in conformance with the facility policies and procedures and in compliance with regulatory requirements.

5.1 Improved Health Physics Job Coverage

During maintenance performed on CCW Pump AB, the inspectors noted a significant improvement in health physics coverage prior to and during lifting of the pump casing. The technician providing the coverage was knowledgeable of the presence and levels of radioactivity within the system, directed personnel to wear the appropriate levels of protective clothing, and instructed personnel to discontinue work until radiological data was obtained and analyzed. Additionally, the inspectors noted improvement in health physics coverage during surveillances involving the containment spray and HPSI systems. During the surveillances, the technicians informed workers of survey results, installed leakage collection devices, and analyzed leakage from the containment spray system. The inspectors concluded that the performance in the health physics area had greatly improved from the previous two inspection periods.

5.2 Security

During routine tours of the facility, the inspectors noted that access to vital areas was properly maintained and that lighting of spaces was sufficient for security personnel to maintain visual surveillance of the protected area.

6 ONSITE ENGINEERING (37551)

The objectives of this inspection were to provide periodic engineering evaluations for Regional assessment of the effectiveness of the onsite engineering staff.

6.1 Air in Emergency Cooling Systems

The inspectors continued to review data from the licensee related to air in sensing lines (Unresolved Item 382/9420-04) and the October 1994 low pressure safety injection system hydraulic event (Inspection Followup Item 382/9420-01). At the end of the inspection period the licensee was continuing its review of the two issues.

7 FOLLOWUP - PLANT OPERATIONS (92901)

7.1 (Closed) Violation 382/9332-01: Condensate Transfer Pump to Condensate Storage Tank Recirculation Isolation Valve CMU-1131 Left in Open Position

This violation involved the failure to close Valve CMU-1131 after filling the condensate storage tank, a low level in Wet Cooling Towers A and B, and entry into TS 3.0.3 for ultimate heat sink Trains A and B being declared inoperable. The licensee believed the wet cooling tower water basin low level occurred due to a loss of siphon effect from the demineralized water storage tank to the wet cooling tower water basins. The loss of siphon resulted from leaving Valve CMU-1131 in the open position, less than 60 percent water level in the demineralized water storage tank, and nitrogen entrainment in the make-up line which restricted or prevented gravity feed make-up.

The licensee's corrective actions included: (1) initiating LER 93-006, "TS 3.0.3 Entered due to Both Wet Cooling Tower Basins Less Than 97 Percent Full;" (2) briefing of operating crews on the event; (3) revising the shift logs to reflect a greater minimum demineralized water storage tank level; and (4) plant configuration changes (Design Change 3382) to add wet cooling tower water basin alarm inputs to the plant monitoring computer and remove wet cooling tower water basin high alarms from Control Room Panel 8. The inspectors concluded that the licensee's corrective actions for this violation were adequate.

7.2 (Closed) Unresolved Item 382/9415-02: Valve SI-502B Electrical Breaker Found in the Off Position

This unresolved item involved the breaker for Hot Leg 2 Injection Isolation Valve SI-502B being in the open position between June 10 and 21, 1994. Valve SI-502B is opened for simultaneous injection to the hot and cold legs 2-4 hours after a loss-of-coolant accident to avoid precipitation of boric acid in the reactor vessel. The item was considered unresolved until the licensee completed a review of how the open circuit breaker could affect the ability to align the HPSI system for simultaneous hot and cold leg injection following a loss-of-coolant accident.

The licensee determined the root cause to be personnel error in that the operators failed to follow Operating Procedure OP-100-010, "Equipment Out of Service," which required an equipment out-of-service checklist be completed for equipment taken out of service for greater than one shift. During the review of LER 94-014, "Hot Leg Injection Isolation Valve Circuit Breaker Left in the Open Position," the inspectors noted that inattention to detail by the operations staff contributed to the circuit breaker being left open for an extended period. Specifically, two open/close status lights for Valve SI-502B were available on Control Room Panel 8. The normal indication is powered from a 480 volt motor control center and the alternate from a 120 VAC power distribution panel. The loss of valve position lights from the motor control center indicated an open circuit breaker for the valve and that the valve could not be operated from the control room. The failure of plant operators

to notice that the motor control center valve position indicating lights were not energized between the period of June 10 and 21, 1994, was an example of poor attention to detail.

Even though the Valve SI-502B circuit breaker remained open, it appeared that the licensee would have been able to align the HPSI system for simultaneous hot and cold leg injection within 2-4 hours following a loss-of-coolant accident. Specifically, Valve SI-502B does not receive any automatic signal to open during or after a loss-of-coolant accident. Emergency Operating Procedure OP-902-002, "Loss of Coolant Accident Recovery Procedure," required remote manual manipulation of Valve SI-502B, thus, the motor control center indicating lights would have informed the operators of the open circuit breaker, an operator could have been dispatched to the switchgear room to close the breaker within a reasonable amount of time, and no significant personnel radiation exposure would have been accrued while closing the breaker. The inspectors concluded that the incorrect positioning of the breaker for Valve SI-502B did not have an adverse effect on the operability of the system.

8 FOLLOWUP - ENGINEERING (92903)

8.1 (Closed) Inspection Followup Item 382/9419-04: Review of Licensee Condition Report and Evaluation of the Discolored Lubricating Oil used in HPSI Pump B

This item involved lubricating oil used in HPSI Pump B despite the oil's cloudy appearance. Based on a simplified viscosity test performed by the licensee's lubrication engineer, the licensee determined that the use of the discolored oil did not affect the operability of the pump. The inspectors were concerned that the oil could have been contaminated with a different lubricant, thereby affecting the operability of the pump.

The inspectors questioned the licensee to determine if the lubricating oil was contaminated and if the lubricating properties of the oil could break down, causing pump bearing degradation. The licensee maintained that, even though the oil was potentially contaminated, it would not affect the operability of the pump. The inspectors reviewed the licensee's condition reporting system and determined that no previous problems related to lubricant use had been identified. Additionally, the licensee's lubrication engineer stated that no prior examples of cloudy oil had been noted during receipt analysis of lubricating oils.

Due to the inspectors concerns, the licensee initiated Condition Report 94-858, disposed of the remainder of the cloudy oil, and sent oil samples from the oil transfer containers to a laboratory for analysis. The inspectors questioned the licensee to determine if a condition report would have been initiated to determine the cause of the lubricant's cloudy appearance had the inspectors not questioned the acceptability of the oil for use. Licensee personnel stated that a condition report would probably not have been written to evaluate the cloudy oil. The inspectors concluded that

the licensee should have initiated a condition report to evaluate the oil's cloudy appearance when they initially identified the potentially adverse to quality discrepancy.

The inspectors monitored HPSI Pump B performance periodically throughout the inspection period. The pump appeared to operate properly and no abnormal bearing temperatures occurred. Nevertheless, the inspectors concluded that the licensee used poor engineering judgement by deciding to leave the oil in the HPSI pump without first determining the cause of the cloudy oil.

9 FOLLOWUP - PLANT SUPPORT (92904)

9.1 (Closed) Violation 382/9310-01: Inadequate Fire Watch Patrols

This violation involved the failure of personnel to perform adequate fire patrols in the valve operating enclosure bay and EDG Rooms A and B. The licensee's corrective actions included an operability determination of the controlled ventilation area system, briefing of security officers on conduct of fire patrols, performing a survey of industry fire watch practices, inclusion of survey results into the fire watch program, addition of fire patrol items to the management observation program, and monthly surveillances of the effectiveness of corrective actions by the quality assurance group.

During routine tours of the plant, the inspectors noted that personnel were knowledgeable of fire watch requirements and devoted an adequate amount of time in performing fire patrols. The inspectors concluded that the licensee's corrective actions for this violation were adequate.

9.2 (Closed) Violation 382/9405-01: Temporary Shielding Construction

This violation involved the placement of temporary shielding within 1 inch of safety-related piping and components. The licensee's corrective actions included removal/relocation of lead shielding located within 1 inch of safety-related components, seismic evaluations by design engineering, training for health physics personnel, and a revision to Health Physics Procedure HP-001-114, "Installation of Temporary Lead Shielding."

The inspectors walked down several temporary lead shielding structures in the plant and determined that the minimum distance to safety-related piping and components was greater than 1 inch. The inspectors concluded that the licensee's corrective actions for this violation were adequate.

9.3 (Closed) Violation 382/9408-01: Failure to follow Radiation Work Permit Requirements

This violation involved the failure of one individual to wear protective clothing specified in the radiation work permit. The licensee's initial corrective actions included removing the affected individual from the area, counseling the individual, and providing training to health physics personnel.

The inspectors noted during routine plant tours that personnel were adhering to the protective clothing requirements of radiation work permits. The inspectors concluded that the licensee's corrective actions for this violation were adequate.

10 MANAGEMENT MEETING

A management meeting was conducted at the Waterford 3 site on December 20, 1994, during which the licensee discussed their root cause investigation and corrective actions implemented to address issues identified from recent reactivity management events. A list of licensee and NRC attendees is provided in Attachment 2 of this report.

Entergy's Licensing and Quality Assurance (QA) Manager, R.F Burski, began the meeting with an update on their corrective action program. He stated that the human performance trending and root cause analysis reviews have been consolidated recently within the QA Department. In an attempt to stay ahead of problems, problem and causal factor coding practices have also recently been put into effect. These practices are intended to promptly identify adverse trends and bring them to management attention in an expedient manner. Mr. Barkhurst also stated that improvements in the licensee's root cause analysis process are planned to ensure that fundamental causes of events are identified and corrected and that QA will conduct assessments to ensure that corrective actions are effective when applied to these trends. He concluded by mentioning that the safety culture is developing to a high level and that the corrective program is providing significant results.

Greg Davie, leader of the Reactivity Management Root Cause Team, discussed the followup being conducted on recent reactivity management incidents. The licensee's investigation of the events included a review of the individual events to identify contributing factors, categorization of problems types, further investigation via interviews and analysis, and development of a list of common causes and corrective actions. The common causal factors of the events were determined to be perceived operating limits, procedural inaccuracies, communication deficiencies, and training inadequacies.

With regard to perceived operating limits, the licensee found that the operators increased the number of reactivity manipulations due to the narrow operating band imposed by the $T_{\bar{a}}$ limit (used for steam generator tube preservation). Procedural inadequacies included the procedures not being readily at-hand and inconsistency in the batch and blend methods. With regard to teamwork deficiencies, the review team found that there was an excessive level of administrative work in the control room, a hesitance of new staff to complain, and overemphasis of the blackboard concept for annunciator response. There was also not enough routine evolution training for the operators to recognize the problems with the power limit.

Corrective actions for the aforementioned causes were the establishment of Operator Daily Instructions on maintaining 100 percent power; the review of expectations regarding operating limits, procedure use, teamwork, command and

control; and annunciator response via SS/CRS meetings and crew briefs. A policy addressing the roles and responsibilities of operators has been developed, and management has begun to observe simulator and control room activities. Reactivity operating procedures and training are being reviewed and updated. Additionally, a shift support group is being developed to reduce the administrative burden on operators, and an orientation program is being developed to give shift supervisors time working with experienced staff and management.

In addition to reactivity management events, the licensee made presentations on particular strengths and successes at Waterford 3. The licensee pointed out strong operator performance in handling plant challenges, such as a feedwater control system power supply failure, pressurizer pressure control malfunction, atmospheric dump valve failure PAC card failure, and toxic chemical release. The licensee also discussed its work-around reduction program, which has identified 68 items since its inception in October 1993. Thirty-one out of 33 initial items have been closed, and 26 currently remain open. Additional discussions involving the use NPRDS, plant material condition, and the ALARA program ensued. The licensee pointed out that plant material condition is at its best level since commencement of commercial operation, and that the effectiveness of its ALARA program has resulted in a sustained reduction in collective radiation exposure.

Mr. Barkhurst closed the meeting stating that plant operations has the lead role in the corrective action process and that the root causes of the reactivity events have been corrected. He also pointed out the plant's low maintenance backlog and good reliability record.

11 ONSITE REVIEW OF LERs (92700)

11.1 LER 93-006: TS 3.0.3 Entered due to Both Wet Cooling Tower Basins Less Than 97 Percent Full

This LER was reviewed as part of the closure of Violation 382/9332-01 (Section 7.1).

11.2 LER 94-014: Hot Leg Injection Isolation Valve Circuit Breaker Left in the Open Position

This LER was reviewed as part of the closure of Unresolved Item 382/9415-02 (Section 7.2).

12 IN-OFFICE REVIEW OF LERS (90712)

The inspectors verified that reporting requirements had been met, causes had been identified, corrective actions appeared appropriate, generic applicability had been considered, and that the LER forms were complete. The inspectors confirmed that unreviewed safety questions and violations of TS, license conditions, or other regulatory requirements had been adequately described. The Region IV staff determined that an onsite inspection followup

of the event was not appropriate. The following LER was reviewed by the inspectors. The actions taken or planned by the licensee were considered adequate.

LER	Title
94-006	Error in RCS Mass Balance Equation

13 FOLLOWUP ON CORRECTIVE ACTIONS FOR LERs (92702)

(Closed) LER 94-004: Degraded CCW Heat Exchanger Due to Biological Fouling

On March 7, 1994, the licensee conducted performance testing which determined that CCW Heat Exchanger A had degraded. The CCW system is designed to provide cooling water to safety-related components at a maximum temperature of 115°F under accident conditions. During an evaluation of test results, an extrapolation to design accident conditions predicted a CCW outlet temperature of 117.2°F. The licensee concluded that biological fouling caused the degraded condition of the heat exchanger, thereby reducing the heat transfer capability to the wet cooling tower. Subsequent evaluations concluded that the heat exchanger would have performed its safety function because the heat removal capacity of the degraded heat exchanger would have been adequate to remove accident loads.

The licensee performed borescopic examinations of both CCW heat exchangers and found deposits and microbiological activity on the outside diameter of the tubes. The tubes were chemically cleaned and verified by a second borescopic examination. The licensee also identified critical system parameters and issued Revision 5 of Chemistry Procedure CE-002-003, "Maintaining Auxiliary Component Cooling Water Chemistry." The revised procedure included a new chemical treatment program for the auxiliary CCW system whenever certain critical parameters were outside of specification. No biological fouling was noted during borescopic examination of CCW Heat Exchanger A in November 1994. The inspectors reviewed data sheets of samples taken from the auxiliary CCW wet cooling towers during August and October 1994. The inspectors noted that some critical parameters dropped below the specified level and that the adjustment to the inhibitor concentration returned the parameters to normal. The inspectors determined that the actions taken by the licensee to improve the heat transfer capabilities of the CCW heat exchanger were adequate.

ATTACHMENT 1

1 PERSONS CONTACTED

1.1 Licensee Personnel

C. Fugate, Shift Supervisor, Operations
T. J. Gaudet, Licensing Supervisor
J. G. Hoffpauir, Maintenance Superintendent
J. D. Hologa, Manager, Mechanical and Civil Design Engineering
J. B. Houghtaling, Technical Services Manager
G. F. Koehler, Quality Assurance Supervisor
R. S. Starkey, Acting General Manager, Plant Operations
C. J. Toth, Construction Manager
D. W. Vinci, Licensing Manager

The personnel listed above attended the exit meeting. In addition to these, the inspectors contacted other personnel during this inspection period.

2 EXIT MEETING

An exit meeting was conducted on December 21, 1994. During this meeting, the inspectors reviewed the scope and findings of the report. The licensee did not express a position on the inspection findings documented in this report. The licensee did not identify as proprietary any information provided to, or reviewed by, the inspectors.

ATTACHMENT 2

MANAGEMENT MEETING ATTENDEES

1. Licensee Attendees

R. P. Barkhurst, Vice President, Nuclear Operations
R. F. Burski, Director, Nuclear Safety
R. G. Azzarello, Director, Design Engineering
R. S. Starkey, Acting General Manager, Plant Operations
J. B. Houghtaling, Technical Services Manager
D. W. Vinci, Licensing Manager
D. C. Matheny, Acting Operations Manager
J. G. Hoffpauir, Maintenance Superintendent
G. G. Davie, Quality Assurance Manager
T. J. Gaudet, Licensing Supervisor
M. J. Devlin, Control Room Supervisor
C. Fugate, Shift Supervisor
R. L. Williams, Plant Operations

2. NRC Attendees

T. P. Gwynn, Director, Division of Reactor Safety
C. A. VanDenburgh, Chief, Project Branch D, Division of Reactor Projects
C. P. Patel, Project Manager, Office of Nuclear Reactor Regulation
T. Pruett, Resident Inspector, Division of Reactor Projects

ATTACHMENT 3

Waterford 3

WATERFORD 3/NRC
Management Presentation
December 20, 1994

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AGENDA

- ***Introduction*** — R.P. Barkhurst

- ***Discussion Topics***

A.	Corrective Action Program Update	R.F. Burski
B.	Follow-up on Reactivity Management Events	G.G. Davie D.C. Matheny
C.	Strong Operator Performance in Response to Plant Challenges and Implementation of Emergency and Off-Normal Procedures	D.C. Matheny
D.	Operations Performance Leads the Way to Most Successful Outage at W3	D.C. Matheny
E.	W3 Operations Work Around Reduction	D.C. Matheny
F.	W3's Usage of NPRDS/CFAR Contributes to Safety and Reliability	J.G. Hoffpauir
G.	Plant Material Condition Best Since Commercial Operation	J.G. Hoffpauir
H.	Waterford 3 ALARA Program - Best in Class Exposure Level	J.G. Hoffpauir

- ***Closing Remarks*** — R.P. Barkhurst

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Corrective Action Program Update

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Corrective Action Program Update

- Human Performance Trending and Root Cause Analysis Reviews have been consolidated in Quality Assurance
- Developed Problem and Causal Factor Coding Practices to improve ability to promptly identify adverse trends
- Developed trend criteria and reports to regularly and effectively communicate adverse trends to management
- Improvements in the RCA process are planned to ensure that fundamental causes of events are identified and corrected
- QA will be conducting effectiveness assessments to ensure that corrective actions applied to adverse trends are effective

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Corrective Action Program Update

- Corrective Action Safety Culture continues to grow:
  - Failed Ty-Raps in SFP due to degradation of metal holding clips
  - Shipping angles on Expandable Bellows
  - Possible resin intrusion into CSP results in conservative measure to send diver for visual inspection
  - Identification of EDG surveillance testing deficiencies

CONCLUSION

- Safety Culture/Safety Assessment developing to high level
- Program providing significant results

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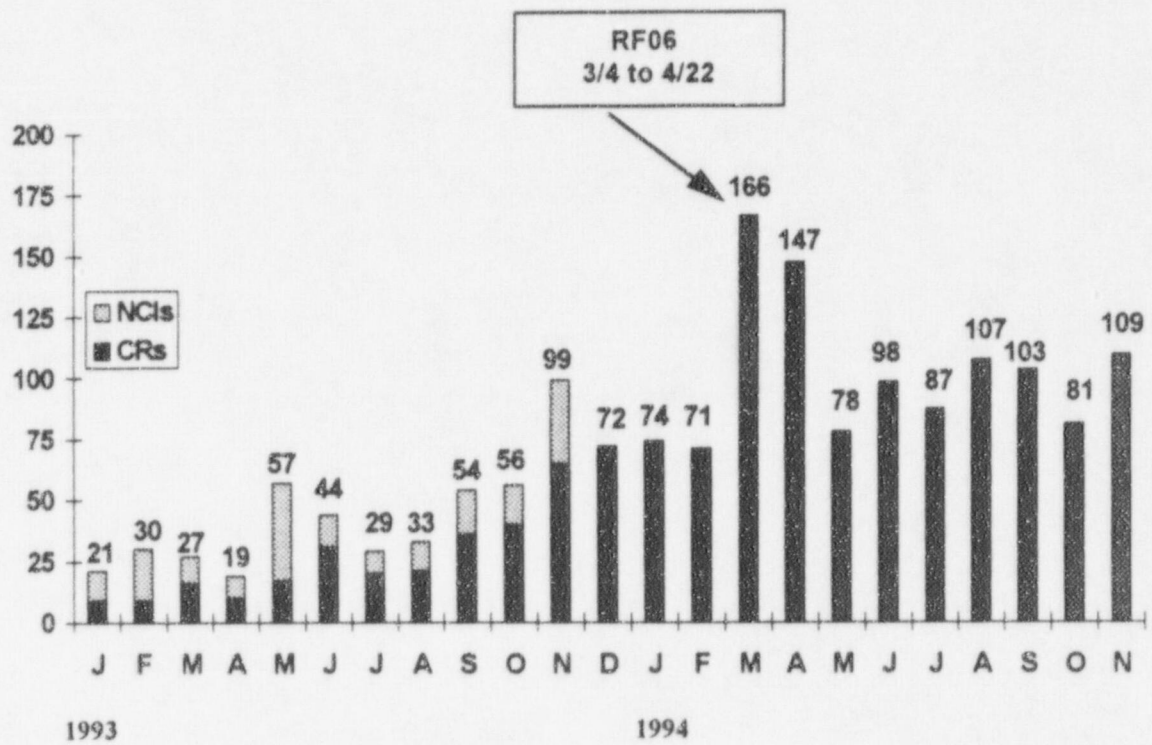
Corrective Action Program

Condition Reports Initiated Per Month



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Follow-up on Reactivity Management Events

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Follow-up on Reactivity Management Events

SCOPE OF REVIEW TEAM

- Chartered by GMPO to review recent Reactivity Management Events to identify common or underlying causes

- Team Leader: Quality Assurance Manager
  Members: Corrective Action Supervisor
  Operational Experience Engr. Rep.
  3 Nuclear Plant Operators (1 SRO)

- Requested INPO assistance in facilitation of Human Performance Trend Analysis

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Follow-up on Reactivity Management Events

PROCESS OF INVESTIGATION

- Reviewed the individual events to identify contributing activities or conditions
- Categorized the problem types to identify common elements
- Conducted further investigation (interviews/analysis) to validate the problems and identify the underlying causes
- Developed list of 4 common causes with recommended corrective actions

COMMON CAUSAL FACTORS

- Perceived Operating Limits
- Procedural Inadequacies
- Teamwork/Communication Deficiencies
- Training Inadequacies

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Follow-up on Reactivity Management Events

CORRECTIVE ACTIONS

- Operator Daily Instructions on maintaining 100% power established
- Reactivity Management/CVC Training, OP-002-005, "Chemical Volume Control", Revision and follow-up training
- Roles and Responsibilities of Operators policy has been developed
- Expectations regarding operating limits, procedure use, teamwork, command and control and annunciator response have been thoroughly reviewed via SS/CRS meetings and crew briefs
- Management observations in Simulator and Control Room
- Special Review initiated to review reactivity-related procedures

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Follow-up on Reactivity Management Events

CORRECTIVE ACTIONS (Cont.)

- Shift Support Group being developed to reduce administrative burden on Operating Crew
- Shift Supervisor Orientation Program

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Strong Operator Performance in Response to Plant Challenges and Implementation of Emergency and Off-Normal Procedures

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Strong Operator Performance

OPERATOR RESPONSE TO PLANT CHALLENGES

- Feedwater Control System Power Supply Failure
  - Operations personnel recognized impending failure of Feedwater Control System
  - Operators took prompt corrective action by placing the FWCS in manual
  - No plant transient
- Pressurizer pressure control malfunction
  - Pressurizer Spray Valve Began to Open and Pressurizer Heaters De-energized Due to Control Loop Failure
  - Operators took prompt corrective actions by placing the spray valve in manual and selecting the unaffected control channel
  - Actions taken by operations precluded plant depressurization and plant trip

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Strong Operator Performance

- Atmospheric Dump Valve PAC Card Failure
  - PAC Card for ADV failed low and valve began to open
  - Control Room personnel took prompt corrective actions by taking manual control of the valve and then closing it
  - Actions taken by operations prevented increase in reactor power

IMPLEMENTATION OF EMERGENCY AND OFF-NORMAL PROCEDURES

- Response to Toxic Chemical Release
  - Response was well coordinated by Control Room personnel
  - Appropriate emergency procedures were used
  - Appropriate and timely notification was made to required outside agencies

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Strong Operator Performance

- Plant responded conservatively to this event by requiring 1000 people on site to shelter and by suspending all fuel movement although wind conditions were such that the plant was not threatened

- Operations Response During EP Inspection Scenarios
  - Control room staff consistently demonstrates good overall command and control
  - Operations personnel classification of emergencies are timely and accurate
  - Inspection results positive - No weaknesses identified, no recommendations provided

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Strong Operator Performance

- Response to Instrument Air Event
  - Control Room indication of decrease in IA pressure (~ 10 psi below normal), Off-Normal Procedure OP-901-511, "Instrument Air Malfunction" immediately entered
  - Appropriate announcements were made and operability of compressors was verified
  - Operations coordinated with Maintenance and Engineering personnel to immediately address condition.

CONCLUSION

- Operators Alert
- Questioning Attitude
- Prompt and Effective Actions Taken
- Plant Safety and Reliability Maintained

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Operations Performance Leads the Way in Most Successful Outage at W3

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Operations Performance Leads the Way in Most Successful Outage at W3

- Safest Outage on record for W3
  - Defense-In-Depth Systems Maintained
  - Time at mid-loop conditions minimal (52% reduction from previous best)
- In house refueling
- All IST surveillances for non-worked IST pumps were completed prior to outage
  - Minimized testing during outage
  - Minimized surprises coming out of outage
- Four shift rotations used for operations
  - Minimized overtime required (7.7% reduction since RF4)

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Operations Performance Leads the Way in Most Successful Outage at W3

- Operations performed early borations
  - Proved effective in obtaining the desired crud burst (16% increase in curies removed over previous best)
  - Resulted in Reduced Dose
- Best and most efficient Mode 5 to Mode 4 startup in Operations (29% reduction from previous best)
- Safest, shortest, most efficient Outage

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W3 Operations Work Around Reduction

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Waterford 3 Operations Work Around Reduction

REDUCTION OF PLANT DEFICIENCIES

- 68 items identified since program inception in 10/93
  - 31 of initial 33 closed - 1 scheduled for forced outage and 1 scheduled for Refuel Outage (both considered low priority items)
  - 26 items remain open (10 outage related)

INCREASED MANAGEMENT ATTENTION TO PLANT DEFICIENCIES

- Open items are reviewed weekly by management
- Management assigns resources needed to resolve deficiencies

SIGNIFICANT ISSUES ADDRESSED

- Nitrogen Leak on MSIV Reservoir
- CEAC #2 High Intermittent Failure Rate
- Safety Injection Tank leakage issues

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W3's Usage of NPRDS/CFAR Contributes to Safety and Reliability

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Waterford 3 Usage of NPRDS/CFAR Contributes to Safety and Reliability

NUCLEAR PLANT RELIABILITY DATA SYSTEMS (NPRDS)

- 14,000 components monitored
- Benefits include:
  - Component failure analysis
  - Improved job plans
  - Industry experience
  - Industry-wide equipment locator database
- Hosted NPRDS coordinators conference in 1994
- INPO NPRDS Users Group is chaired by maintenance engineer
- W3 recognized as an industry leader in supporting NPRDS initiatives

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Waterford 3 Usage of NPRDS/CFAR Contributes to Safety and Reportability

WATERFORD 3 CFAR PROCESS

- Identify component types whose failure rate has exceeded the industry average
- Engineers address outliers

WATERFORD 3 CFAR RESULTS

- Waterford 3 has only 8 CFAR Outliers out of 325 component comparisons (4 out of 8 are the result of replacements to prevent failure)
- Outliers compare favorably to the industry (Industry Norm is 20)

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Plant Material Condition
Best Since Commercial Operation

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Plant Material Condition
Best Since Commercial Operation

SAFETY SYSTEM PERFORMANCE

	1994 YTD	1995 Industry Goal
HPSI UNAVAILABILITY	0.011	0.020
EFW UNAVAILABILITY	0.002	0.025
EMERGENCY AC UNAVAILABILITY	0.007	0.025

TOTAL NON-OUTAGE CM BACKLOG

- Goal 370
- Refuel 6 468
- To Date 234 (lowest ever)

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Plant Material Condition

UNIT CAPABILITY FACTOR (UCF)

→ December 1994 Goal	>77%
→ YTD Actual (12/20/94)	84.2%
→ 3 Year Average	87.8%
→ 3 year Industry top quartile thru 1993	83.3%

FORCED OUTAGE RATE (%)

→ Thru December 1992	1.7
→ Thru December 1993	0.8
→ Thru November 1994	0.5

STEAM LEAK REDUCTION

- → Steam leaks reduced by 75%

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Plant Material Condition
Best Since Commercial Operation

ZONE OWNERSHIP PROGRAM

- Reinforced Maintenance & Operations responsibility for the material condition of the plant
- Each zone has a maintenance foreman and operations SROs assigned
- Philosophy - if something does not look right or does not look like it belongs in the area, then it should be corrected
- Periodic tours are made by management and by other zone owners
- Zone inspection cards assist in identifying items and seeing that the responsible group is advised

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Waterford 3 ALARA Program
Best in Class Exposure Level

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W3 ALARA Program
Best in Class Exposure Level

- An effective ALARA program has resulted in sustained reduction in station collective radiation exposure.
  - 1993 performance - 13.8 REM (3rd lowest of industry top performers since 1986)
  - 3 year rolling average = 137 REM which puts W3 in top 10 of PWR Stations (Industry 3 year avg. = 155 REM)
  - Management support for exposure reduction that has created a strong ALARA culture amongst station personnel
  - An aggressive hot spot flushing program to reduce station exposure rates
  - Plant source term reduction via submicron filtration and cobalt reduction programs
  - Effective use of temporary shielding
  - Aggressive exposure goal set for station personnel

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W3 ALARA Program
Best in Class Exposure Level

- Station contaminated square footage maintained less than 5% of the controlled areas
- Radwaste generation minimized through reduction in non-launderable items and an effective waste segregation program

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Plant Material Condition
Best Since Commercial Operation

CONCLUSION

- Hundreds of minor deficiencies have been corrected
- Significant contribution to equipment performance and housekeeping

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Closing Remarks

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