ENCLOSURE

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

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Report No.:	50-458/99-03
Licensee:	Entergy Operations, Inc.
Facility:	River Bend Station
Location:	5485 U.S. Highway 61 St. Francisville, Louisiana
Dates:	March 7 through April 17, 1999
Inspectors:	G. D. Replogle, Senior Resident Inspector N. P. Garrett, Resident Inspector
Approved By:	C. S. Marschall, Chief, Project Branch C Division of Reactor Projects
Attachment:	Supplemental Information

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EXECUTIVE SUMMARY

River Bend Station
NRC Inspection Report No. 50-458/99-03

Tnis inspection report included aspects of licensee operation, maintenance, engineering, and plant support. The report covers a 6-week period of resident inspection.

Operations

- The conduct of operations was generally professional and safety-conscious (Section O1.1).

- The plant shutdown was well controlled. The control room supervisor provided good direction to the crew and properly anticipated entry into the emergency operating procedures (Section O1.2).

- The approach of operators toward resolving inclined fuel transfer system interlock problems was conservative and well controlled. Administrative controls were established to permit bypassing nonsafety-related valve interlocks. The interlocks helped to protect against a partial draindown of the reactor cavity. Operator training was thorough and engineering support was effective (Section O1.3).

- The licensee identified a Technical Specification 3.7.1 violation, in that the Division III standby service water pump was inoperable for more than 30 days. Inadequate refurbishment caused the breaker failure. During the investigation, the licensee also identified that operators had failed to implement procedural requirements to check the pump breaker weekly (Section O2.2).

- The inspector and the licensee identified two Technical Specification 5.4.1.a violation examples, failure to follow procures. First, the licensee identified that refueling operators failed to follow procedures and inadvertently overextended the refueling bridge mast and drove a new fuel bundle into the top core guide plate, bending the fuel bundle handle. Second, the inspector identified that refueling operators failed to follow procedures, when they did not have adequate indication of fuel bundle height, and continued to move a spent fuel bundle until it contacted the top of the portable radiation shield. The licensee's initial problem assessment of the second issue was not thorough or self- critical and failed to identify the procedural violation. The inspector determined that the violation examples met the criteria for a noncited violation. In addition, the inspector identified that emergency actions specified by one refueling procedure were overly restrictive, in that the document did not permit operators to return a fuel bundle to the core once it was withdrawn (Section O4.1).

- The inspector identified a violation of Technical Specification 5.4.1.a, in that a tagging official did not properly implement procedures when initiating a clearance order. The official inappropriately copied from an older, uncontrolled clearance order, which resulted in the inclusion of certain inappropriate fuses in the tagout. Two containment isolation valves closed when a bus de-energized, an engineered safety features actuation. The violation met the criteria for a noncited violation (Section M1.3).

Maintenance

- The inspector identified an unresolved item requiring further NRC review of the licensee's investigations of two problems. First, the Division I emergency diesel generator failed surveillance testing when the engine-driven fuel oil pump came apart. Inadequate maintenance was performed on the pump one month earlier. Short-term corrective actions included inspecting the Division II unit for the similar condition and resolving the nonconformances. The measures were acceptable. Second, the licensee identified that surveillance testing of the Divisions I and II diesel generators, without reliance on the nonsafety-related design control fuel oil pumps, was not previously performed. System testing was planned in the future (Section M1.2).

- In several instances, the licensee demonstrated poor coordination and control during outage preparation and implementation activities. Problems were manifested as: (1) three unplanned engineered safety features actuations; (2) damage to a secondary containment boundary, which resulted in an unplanned entry into a 4-hour Technical Specification Action Statement; and (3) two instances where the same scaffold was not properly erected in a safety-related area (Section M1.3).

- The inspector identified a violation of TS 5.4.1.a, in that an inadequate procedure instructed operators to perform steps that depressurized safety-related portions of the reactor plant component cooling water system, which auto started the standby service water pumps, an engineered safety features actuation. The violation met the criteria for a noncited violation (Section M1.3).

- The inspector identified a violation of Technical Specification 5.4.1.a, in that maintenance workers failed to follow plant procedures, on two occasions, when installing the same seismic scaffold. In the first instance, the scaffold was secured to an instrument air line. In the second instance, maintenance craftsmen had removed the inappropriately installed support piece, leaving the scaffold in a nonseismic configuration. The violation met the criteria for a noncited violation (Section M1.3).

- Plant material condition was acceptable, with some notable problems. Significant material condition concerns included seven fuel leaks, degraded first and second stage Recirculation Pump A seals, an inoperable diesel generator, and a degraded electrohydraulic controls pump (Section M2.1).

Engineering

- The inspector identified a violation of 10 CFR Part 50, Appendix B, Criterion III (Design Control), in that an engineering evaluation, intended to determine the design fouling rate for the Division I residual heat removal heat exchangers, was inadequate. The evaluation: (1) utilized an inappropriate method to predict the fouling rate; (2) relied on unvalidated and erroneous assumptions; and (3) failed to properly consider significant operational changes and instances where test data may have been affected by previous high temperature operations. Furthermore, sound recommendations made by an industry heat exchanger expert were not implemented. Although there was substantial

management oversight of the engineering evaluation, the oversight was ineffective in ensuring a quality engineering product. In response to the NRC concerns, the licensee performed testing in Refueling Outage 8 and found that the degradation rate was three times greater than the engineering evaluation predicted. The violation met the criteria for a noncited violation (Section E2.2).

Plant Support

- Housekeeping in most readily accessible areas was good. However, housekeeping in two contamination areas, the drywell and the Division II steam tunnel, was poor. Tools were scattered in each of the areas and debris was observed in several places on the floors (Section O2.1).

- Protected area illumination levels, maintenance of the isolation zones around protected area barriers, implementation of the extended protected area, and the status of security power supply equipment were acceptable (Section S2.1).

- The inspector identified a Facility Operating License violation, in that a security procedure was not properly implemented. The inspector observed a security officer at his post, leaning back in his chair with his eyes closed, mouth open, and right arm dangling freely at his side. The procedure required that the officer remain alert. The inspector determined that the violation met the criteria for a noncited violation (Section S4.1).

Report Details

Summary of Plant Status

At the beginning of the inspection period the plant was at 83 percent power. Power was limited to 83 percent due to operations late in the operating cycle, fuel burnup, and the insertion of several control rods for fuel leak suppression. Power was permitted to gradually coast down to 77 percent and on April 3 the plant was shut down to commence Refueling Outage (RF) 8.

Operations

O1 Conduct of Operations

O1.1 General Comments (71707)

The inspectors used Inspection Procedure 71707 to conduct frequent reviews of ongoing plant operations. The conduct of operations was generally professional and safety-conscious.

O1.2 Plant Shutdown

a. Inspection Scope (71707)

The inspector observed the April 3 planned shutdown.

b. Observations and Findings

The plant shutdown was well controlled. The control room supervisor (CRS) provided appropriate and timely briefings during the evolution. The CRS properly anticipated entry into the emergency operating procedures on reactor water low level when the plant was scrammed, per procedure, at approximately 30 percent power.

c. Conclusions

The plant shutdown was well controlled. The CRS provided good direction to the crew and properly anticipated entry into the emergency operating procedures.

O1.3 Operations Response to Inclined Fuel Transfer System (IFTS) Problems

a. Inspection Scope (71707)

The inspector observed Operations response to emergent IFTS problems.

b. Observations and Findings

Background: The IFTS is utilized to transfer fuel bundles, and other components, from the refueling floor to the refuel building and vice versa. During normal power operations, containment integrity is maintained by the use of a valve and a blind flange between the

containment and the refueling building. As such, some of the IFTS operational surveillances require a plant shutdown to complete, when the blind flange may be removed.

Observations: Following the plant shutdown, the licensee performed IFTS operational surveillances and found that one of the interlocks was not functioning properly. Operators could not open the lower gate valve, which permits IFTS travel into the refueling building. The subject interlock prevents the containment flap valve and the refuel building gate valve from opening at the same time, to preclude a partial reactor cavity draindown. The interlock did not function properly because two control circuit proximity switches failed. The interlock was not safety related because a reactor cavity design feature, the cattle chute, limited the water loss from the reactor cavity to the spent fuel pool.

The licensee stated that repairing the limit switches with the refueling cavity flooded was not practical. In lieu of completing repairs, the licensee established administrative controls to bypass the faulty switches and manually control the interlock function. Operators were required to visually check the position of the IFTS gate valve via a locally mounted camera each time the interlock was bypassed. Refueling operators were trained on the process and several practice runs were completed prior to moving items. Transfer of fuel was limited to new fuel at first. Spent fuel was moved after operators demonstrated a high level of proficiency at implementing the administrative controls. The inspector considered the approach conservative and well implemented. The inspector found the 10 CFR 50.59 safety evaluation, use of administrative controls in lieu of automatic actions, acceptable.

c. Conclusions

The approach of operators toward resolving IFTS system interlock problems was conservative and well controlled. Administrative controls were established to permit bypassing nonsafety-related valve interlocks. The interlocks helped to protect against a partial draindown of the reactor cavity. Operator training was thorough and engineering support was effective.

O2 Operational Status of Facilities and Equipment

O2.1 Engineered Safety Feature System Walkdowns (71707, 71750)

The inspectors walked down accessible portions of the following safety-related systems:

- High Pressure Core Spray
- Residual Heat Removal (RHR), Trains A, B, and C
- Reactor Core Isolation Cooling
- Division I, II, and III Switchgear and Battery Rooms
- Standby Gas Treatment System Trains A and B
- Standby Service Water (SSW) System Trains A and B

The systems were found to be properly aligned for the plant conditions and generally in good material condition.

During plant tours, housekeeping in most readily accessible areas was good. However, housekeeping in two contamination areas, the drywell and the Division II steam tunnel, was poor. Tools were scattered in each of the areas and debris was observed in several places on the floors.

O2.2 SSW Pump Breaker

a. Inspection Scope (71707)

An operator identified that the Division III SSW pump was inoperable. The inspectors observed the licensee's response to the finding.

b. Observations and Findings

On February 28, an equipment operator identified that the Division III SSW pump breaker charging coil was not charged and the breaker would not have closed in response to a safety signal. Operators declared the Division III SSW pump inoperable. Coil charging occurs following breaker operation and the last breaker operation was January 28, 31 days earlier. While the pump is powered from the Division III bus, it is physically part of the Division I service water system. The significance of the problem was mitigated because Division III components can receive service water from either Divisions I or II service water trains.

The licensee found that inadequate maintenance caused the breaker failure. The breaker was refurbished approximately one year earlier. During the refurbishment, contract workers inadequately installed solenoid spacers in the charging coil's electromechanical controls. The misinstallation of the spacers permitted the solenoid to over-travel and jam, preventing proper charging coil operation. The licensee replaced the faulty breaker with a properly refurbished breaker and inspected all other breakers to ensure the closing coils were charged. In addition, they planned to inspect the closing coil for each breaker after operation and to inspect the breakers for proper refurbishment as conditions permit.

The licensee also found that nuclear equipment operators missed prior opportunities to find the problem in that they failed to properly implement Procedure OSP 28, "Daily Log Report - Normal Switchgear, Control, and Diesel Generator Buildings," Revision 19. The procedure required a weekly charging coil status check. Three different equipment operators had initialed that the charging coil was checked. Based on the breaker's as-found condition and operational history, the licensee determined that the breaker checks were not properly performed. The licensee had not determined the procedural noncompliance root cause at the conclusion of the inspection period.

The Technical Specification (TS) 3.7.1 Action Statement permits standby service water (SSW) pump inoperability for no more than 30 days. Contrary to the above, the Division III SSW pump was inoperable for 31 days. As such, the condition was a

violation of TS 3.7.1. This Severity Level IV violation is being treated as an NCV, consistent with Appendix C of the NRC Enforcement Policy. The violation is in the licensee's corrective action program as Condition Report (CR) 99-0239 (NCV 50-458/9903-01).

c. Conclusions

The licensee identified a TS 3.7.1 violation, in that the Division III SSW pump was inoperable for more than 30 days. Inadequate refurbishment caused the breaker failure. During the investigation, the licensee also identified that operators had failed to implement procedural requirements to check the pump breaker weekly.

O4 Operator Knowledge and Performance

O4.1 Refueling Activities

a. Inspection Scope (71707)

The inspector monitored refueling activities.

b. Observations and Findings

The inspector noted two significant refueling activity problems.

Over Extension of Refueling Mast: A refueling operator inadvertently overextended the refueling bridge mast and drove a new fuel bundle into the top core guide plate, bending the fuel bundle handle. The bent handle was discovered when refueling floor operators found that they could not decouple the bundle into the core. The bundle was returned to the IFTS and returned to the spent fuel pool.

The refueling bridge operator believed that the spotter instructed him to extend the grapple to the 530 inch position, but the spotter recalled providing the instruction to move to the 350 inch position. Both operators stated that three-way communications were utilized. While the correct depth was written on the refueling mast in front of the operator, he did not review the information prior to extending the grapple. After providing the instruction to the refuel bridge operator, the spotter did not continue to follow the mast movement, which was contrary to his position requirements. Further, the refueling senior reactor operator, who was dedicated to supervise the operation, was not on the bridge and was not observing the activities. Since the core guide plate was actually at the 372 inch level, 22 inches from the required stop position, the SRO and spotter missed the opportunity to stop the operator's action prior to the damage. The bridge operator also stated that this was his first refueling outage as a bridge operator.

Procedure REP-0029, "Fuel Movement," Revision 7, states "the refuel SRO is responsible for . . . directly supervising the fuel handler [and] spotter . . . on the refuel platform. This activity includes enforcing the roles and responsibilities of each member . . ." Contrary to REP-0029, the refueling senior reactor operator provided

inadequate supervision of the fuel handler and spotter. The failure to properly implement Procedure REP-0029 was the first of two TS 5.4.1.a violation examples. TS 5.4.1.a requires the licensee to implement procedures recommended by Regulatory Guide (RG) 1.33, Revision 2, Appendix A. The RG, Section 2.I, recommends procedures for refueling and core alterations. This Severity Level IV violation is being treated as an NCV, consistent with Appendix C of the NRC Enforcement Policy. The violation is in the licensee's corrective action program as CR 99-0648 (NCV 50-458/9903-02).

Inadequate Bundle Height Indication: The inspector identified that refueling operators failed to follow procedures, in that they did not have adequate indication of fuel bundle height but continued to move a spent fuel bundle with the refueling bridge until it touched the top of the portable radiation shield. Refueling operators had identified an inconsistency between the zone computer and the grapple up light (both were indicators of fuel bundle height). The zone computer indicated that a bundle had been pulled out slightly too far while the grapple up light did not show indication (potentially indicating that the bundle was not far enough out of the core). Operators then proceeded to move the spent fuel bundle to the IFTS cavity, but the bundle contacted the top of the portable radiation shield. Consequently operators returned the bundle to its original location in the core. The refueling floor manager and the outage manager stated that the refueling operators had performed all their tasks in accordance with existing guidance and training. Further, the managers believed that the operators had properly implemented Procedure REP-0029, Section 6.7.1, Emergency Operations.

The inspector identified the following concerns:

- The refueling operators had implemented an inappropriate section of refueling Procedure REP-0029, Section 6.7.1, Emergency Operations, in that no emergency, as defined by the procedure (rapid pool level losses, inadvertent criticality), existed at the time. The procedure did not permit the operators to insert the bundle into the same location of the core once the bundle was removed.

- Procedure REP-0029 was inappropriately restrictive with respect to returning the fuel bundle to its original location in the core, a known safe position. Refueling engineers stated that the requirement was imposed to preclude inserting the bundle into the wrong location. However, the small potential for such an occurrence did not justify the procedural restriction.

- Operators failed to follow a different applicable refueling procedure. Procedure FHP-0003, "Refuel Platform Operation," Revision 11, Section 2.24, states "anytime fuel is being moved from the reactor vessel the GRAPPLE NORMAL UP light must be observed to preclude striking stationary objects with the fuel bundle." Contrary to the above, fuel was moved from the reactor vessel but the GRAPPLE NORMAL UP light was not observed. Consequently, the spent fuel bundle came in contact with the cattle chute. Additionally, Procedure FHP-0003, Section 2.9, specifies "any abnormalities that occur during

operation . . . should be investigated and explained prior to resuming use of the platform." However, refueling operators continued to utilize the refueling platform even though an abnormality existed (an inconsistency between the zone computer and the grapple up light) and they had not adequately explained the abnormality.

- The licensee's initial problem assessment was not thorough or self-critical. However, higher level site managers agreed with the inspector's observations and planned to address the inspector's concerns in response to CR 99-0496.

The failure to follow the Procedure FHP-0003 requirements was the second of two TS 5.4.1.a violation examples. This Severity Level IV violation is being treated as an NCV, consistent with Appendix C of the NRC Enforcement Policy. The violation is in the licensee's corrective action program as CR 99-0496 (NCV 50-458/9903-02).

c. Conclusions

The inspector and the licensee identified two TS 5.4.1.a violation examples of failure to follow procedures. First, the licensee identified that refueling operators failed to follow procedures and inadvertently overextended the refueling bridge mast and drove a new fuel bundle into the top core guide plate, bending the fuel bundle handle. Second, the inspector identified that refueling operators failed to follow procedures, when they did not have adequate indication of fuel bundle height, and continued to move a spent fuel bundle until it contacted the top of the portable radiation shield. The licensee's initial problem assessment of the second issue was not thorough or self-critical and failed to identify the procedural violations. The inspector determined that the NCV examples met the criteria for an NCV. In addition, the inspector identified that emergency actions specified by one refueling procedure were overly restrictive, in that the document did not permit operators to return a fuel bundle to the core once it was withdrawn.

O8 Miscellaneous Operations Issues (92901)

O8.1 (Closed) Licensee Event Report (LER) 50-458/99-05: SSW pump inoperable for more than 30 days. The events concerning this LER are discussed in Section O2.2 of this report.

II. Maintenance

M1 Conduct of Maintenance

M1.1 General Comments

a. Inspection Scope (61726, 62707)

The inspectors observed documentation reviews for the following surveillance activities, following observed plant problems.

- Procedure OSP-28, Daily Log Report-Normal Switchgear, Control, and Diesel Generator (DG) Buildings
- Procedure STP-309-0201, Division I DG Operability Test
- Procedure STP-256-6803, Division I Service Water Cold Shutdown Valve Operability Test

b. Observations and Findings

A problem implementing Procedure OSP-28 is discussed in Section O2.2, a Division I DG surveillance failure is discussed in Section M1.2, and problems implementing Procedure STP-256-6803 are discussed in Section M1.3. Additionally, general outage coordination and control problems are discussed in Section M1.3.

M1.2 Division I DG Failure

a. Inspection Scope (62707)

On March 24 the Division I DG failed the one-hour surveillance. After 55 minutes, the DG started experiencing power swings and operators secured the unit. The inspectors observed the licensee response to the problem.

b. Observations and Findings

The licensee identified that the engine-driven fuel oil pump had failed. The pump coupling key dislodged because craftsmen did not stake and lock-tite the key in place during maintenance approximately one month earlier. The work document did not require that this step be performed, but the vendor manual contained the recommendation. The licensee had not completed the root cause investigation at the close of the inspection period.

The licensee promptly checked the Division II DG to ensure that a common mode problem did not exist. The Division II engine-driven pump coupling was found to be secure and staked but lock-tite was not applied to the key. The coupling was very tight, however, and the DG had passed several surveillances since the maintenance was last performed. Based on the inspection results, the licensee determined that the Division II DG was operable. Corrective measures were taken to restore both Division I and II units to the required condition. The inspectors concluded that the short-term corrective measures were acceptable.

During investigation into the DG failure, the licensee also identified that appropriate testing of the DG safety function was not performed. Specifically, the nonsafety-related auxiliary direct current (dc) fuel oil pump normally started with each DG start, to prime the fuel injectors, but the licensee did not have documented evidence that the DG could perform a fast start without the aid of the dc fuel oil pump. Since the fuel oil pump was not safety related, it could not be relied upon to function in response to a design basis accident. The licensee planned to perform appropriate DG testing in the near future.

The DG failure and the noted surveillance testing deficiency are considered an unresolved item pending further NRC review of the licensee's investigations (50-458/9903-03).

c. Conclusions

The inspector identified an unresolved item requiring further NRC review of the licensee's investigations of two problems. First, the Division I DG failed surveillance testing when the engine-driven fuel oil pump came apart because of inadequate maintenance. The maintenance was performed approximately one month prior to the surveillance. Short-term corrective actions included inspecting the Division II unit for the similar condition and resolving the nonconformances. The measures were acceptable. Second, the licensee identified that surveillance testing of the Divisions I and II DGs, without reliance on the nonsafety-related dc-driven fuel oil pumps, was not previously performed. System testing was planned in the future.

M1.3 Outage Coordination and Control

a. Inspection Scope (62707)

The inspector assessed outage activities.

b. Observations and Findings

Outage-related activities were not consistently well controlled. Prior to the outage, during the plant shutdown, and shortly following the start of the outage, outage-related coordination, control, and procedural problems resulted in:

- **Damage to a Secondary Containment Boundary:** On April 2, workers notified the control room that the 95 foot elevation auxiliary building door, a secondary containment boundary, was damaged. The insulation strip at the bottom of the door was dislodged. The strip's function was to minimize leakage past the door. The licensee determined that the damage occurred when equipment, in support of the outage, was brought through the doorway.

  In response to the problem, operators declared secondary containment inoperable. TS 3.6.4.1 required that the secondary containment be restored to operable status within 4 hours or place the plant in shutdown within the following 12 hours. Shortly thereafter, engineering performed an evaluation and determined that the secondary containment was operable with the degraded door. The inspectors reviewed the evaluation and found it acceptable.

- **Unplanned Engineered Safety Features (ESF) Actuations:** Three ESF actuations occurred, including:

  1. On March 25, with the plant at 78 percent power, the suction valve for the nonsafety-related suppression pool cleanup (SPC) system closed and the

SPC system tripped. The auto-isolation occurred because water level in the reactor dryer pool unexpectedly lowered to below the trip setpoint. Dryer pool water was inadvertently siphoned to the reactor cavity pool. The function of the trip was to limit the amount of inventory loss in the dryer pool in the event that water was being removed by the SPC system. The pool has some limited fuel storage facilities but no fuel was in the pool when the ESF actuation occurred.

The event was caused by poor coordination between two contract workers. Prior to the event, the reactor cavity pool water level was lower than that in the dryer pool. A contract worker installed a vacuum rig to clean the bottom of the dryer pool. The hose was inserted in the dryer pool but the filter rig was placed in the separator pool, part of the reactor cavity pool. Since the contract worker knew that the hose was empty, there was no danger of siphoning water from one pool to the other. Later, a second contractor energized the pump to verify proper operation of the flow meter. Following the test, the pump was secured but the siphoning flow path was established and the dryer pool started to drain to the reactor cavity pool until the ESF actuation occurred at 23 feet 8 inches above the reactor vessel flange. While the event demonstrated poor coordination and control, the safety consequences were low.

2. On April 10, during the Division I outage, containment isolation Valves DER-AOV-127 and DFR-AOV-102, in the drywell drain lines, auto-isolated when the Division I bus was inappropriately de-energized. The licensee determined that ENS-SWG1A fuses were inappropriately included in Clearance Order 99-0064. The tagging official informed the inspector that he had copied the clearance order from an old uncontrolled computer version of a similar clearance order. Subsequent to the event, the tagging official checked the official records and found that the requirement to pull the two fuses was deleted from the official version of the older clearance order. Because of the ongoing Division I outage, the event safety consequences were low. The isolation valves were promptly opened when the bus was restored.

Procedure ADM-027, "Protective Tagging," Revision 16, Section 6.1, specifies "Clearances will be prepared using controlled . . . documents as references." Contrary to the above, the tagging official utilized an uncontrolled version of a previous clearance order to prepare Clearance Order 99-0064. Additionally, Procedure ADM-027, Section 7.5.3, states "Each CLEARANCE will be verified for adequacy by a Tagging Official other than the original preparer." Contrary to the above, the second tagging official did not effectively verify the adequacy of the clearance order. The failure to properly implement Procedure ADM-027 was a violation of TS 5.4.1.a. This Severity Level IV violation is being treated as an NCV, consistent with Appendix C of the NRC Enforcement Policy. The violation is in the licensee's corrective action program as CR 99-0510 (NCV 50-458/9903-04).

3. On April 6, the Division I SSW pump auto-started on a low reactor plant component cooling water (RPCCW) system pressure signal.

   Background: While most of the RPCCW system is nonsafety related, including the pumps, part of the system supplies safety-related components. Piping, isolation valves, and instrumentation are provided so that, upon a loss of RPCCW pressure, the SSW pumps auto-start and provide cooling water to the safety-related components.

   Event Details: At the time of the event, operators were performing STP-256-6803, "Div I Service Water Cold Shutdown Valve Operability Test," Revision 0. The test procedure was recently issued and prior tests were performed per a different procedure. The superceded procedure had sequenced the testing of the SSW valves to avoid the potential loss of RPCCW pressure and the corresponding ESF actuation. Procedure STP-256-6803 did not contain the same steps. During the testing, both SW and RPCCW pressure sources were isolated at the same time, resulting in the loss of RPCCW pressure. The inspector also observed that a similar event occurred on June 24, 1994.

   Procedure STP-256-6803, Revision 0, was inadequate in that it did not properly sequence valve testing to avoid the ESF actuation. The failure to provide an adequate surveillance testing procedure was a violation of TS 5.4.1.a. This TS requires that the licensee provide procedures for activities recommended by RG 1.33, Appendix A, Revision 2. RG 1.33, Appendix A, Section 8, recommends procedures for surveillance tests. This Severity Level IV violation is being treated as an NCV, consistent with Appendix C of the NRC Enforcement Policy. The violation is in the licensee's corrective action program as CR 99-0451 (NCV 50-458/9903-05).

- **Improper Scaffold Erection:** On March 26, the inspector identified that, on the 141 foot containment elevation, a seismic scaffold was inappropriately secured to the scram discharge vent valve instrument air line. The inspector reported the condition to the control room. The following day, the inspector identified that the problem was not appropriately corrected. Maintenance workers removed the subject support piece, rendering the scaffold in a nonseismic configuration.

  Procedure GMP-0101, "Scaffold Installation and Removal," Revision 6, Section 8, specifies requirements for scaffolding in safety-related areas. Section 8.2.1 requires that the scaffold be restrained in all lateral directions. Section 8.3.2 prohibits using piping to support scaffolding. Contrary to the above, on March 26 the scaffold was, in part, supported by instrument air piping, and on March 27 the scaffold was not restrained in all lateral directions. The failure to install the scaffold in accordance with Procedure GMP-0101 was a violation of TS 5.4.1.a. This TS requires that the licensee provide procedures for activities recommended by RG 1.33, Appendix A, Revision 2. RG 1.33,

Appendix A, Section 9, recommends procedures for maintenance activities that can affect the performance of safety-related equipment. This Severity Level IV violation is being treated as an NCV, consistent with Appendix C of the NRC Enforcement Policy. The violation is in the licensee's corrective action program as CR 99-0411 (NCV 50-458/9903-06).

c. Conclusions

In several instances, the licensee demonstrated poor coordination and control during outage preparation and implementation activities. Problems were manifested as: (1) three unplanned ESF actuations; (2) damage to a secondary containment boundary, which resulted in an unplanned entry into a 4-hour TS Action Statement; and (3) two instances where the same scaffold was not properly erected in a safety-related area.

The inspector identified a violation of TS 5.4.1.a, in that a tagging official did not properly implement procedures when initiating a clearance order. The official inappropriately copied from an older, uncontrolled clearance order, which resulted in the inclusion of certain inappropriate fuses in the tagout. Two containment isolation valves closed when a bus de-energized. The violation met the criteria for an NCV.

The inspector identified a violation of TS 5.4.1.a, in that an inadequate procedure instructed operators to perform steps that depressurized safety-related portions of the RPCCW system, which caused an ESF actuation by auto-starting the SSW pumps. The violation met the criteria for an NCV.

The inspector identified a violation of TS 5.4.1.a, in that maintenance workers failed to follow plant procedures, on two occasions, when installing the same seismic scaffold. In the first instance, the scaffold was secured to an instrument air line. In the second instance, maintenance craftsmen had removed the inappropriate support piece, leaving the scaffold in a nonseismic configuration. The violation met the criteria for an NCV.

M2 Maintenance and Material Condition of Facilities and Equipment

M2.1 Review of Material Condition During Plant Tours

a. Inspection Scope (62707)

During this inspection period, the inspectors conducted interviews and routine plant tours to evaluate plant material condition.

b. Observations and Findings

Overall plant material condition was acceptable with some notable exceptions. The following material condition problems were observed.

- **Degraded Recirculation Pump Seal:** The first and second stage Recirculation Pump A seals were degraded. During the drywell walkdown on April 3, the

inspector observed 1.5 to 2.0 gpm leakage coming from the seals. The inspector reviewed drywell sump leakage records for the past several months and determined that the leakage was relatively constant over the period (approximately 4.0 gpm). Therefore, the observed leakage rate was likely stable over the several month period.

- **Fuel Element Failures:** On September 17 the licensee identified an initial fuel element defect and subsequently identified six more potential fuel failures. In each case, engineering was prompt to perform testing, to identify the location of the fuel leaks, and to have operators insert control rods to minimize potential worsening of the damaged fuel. During the initial stages of the outage, the licensee verified that seven fuel bundles did contain leaking fuel pins. The licensee had not completed the root cause evaluation for the fuel problems at the close of the inspection period.

- **Division I DG Inoperable:** As noted in Section M1.2 of this report, the Division I DG was inoperable for approximately one month because of inadequate engine-driven fuel oil pump maintenance.

- **Electrohydraulic Controls (EHC) Pump:** The EHC A pump was in a degraded condition. The system engineer stated that the pump, if called upon to start, may only run for a short period of time. The redundant EHC B pump was in service and showed no signs of degradation. Failure of both pumps would result in a turbine trip.

c. Conclusions

Plant material condition was acceptable, with some notable problems. Significant material condition concerns included seven fuel leaks, degraded first and second stage Recirculation Pump A seals, an inoperable DG, and a degraded EHC pump.

M8 Miscellaneous Maintenance Issues (92902)

M8.1 (Closed) LER 50-458/99-03: Division I DG failure due to inadequate maintenance. The events concerning this LER were discussed in Section M1.2 of this report.

M8.2 (Closed) Licensee Event Report 50-458/99-04: auto-isolation of containment isolation valve due to low dryer pool level. The events concerning this LER were discussed in Section M1.3 of this report.

III. Engineering

E2 Engineering Support of Facilities and Equipment

E2.1 RHR Heat Exchanger Corrective Measures

a. Inspection Scope (37551)

During September-October 1997, the licensee identified excessive RHR heat exchanger biofouling. The inspector reviewed the licensee's root cause determination, plans for testing, and other corrective measures planned for Refueling Outage 8 (RF-8).

b. Observations and Findings

Background: During RF-7, the licensee performed RHR heat exchanger testing and found that the two Division II heat exchangers were fouled beyond design basis limits. The design heat exchange rate was 157.0 Mbtu/hr, the minimum acceptable rate was 126.4 Mbtu/hr, and the as-found rate was 121.8 Mbtu/hr. In response to the problem, the licensee chemically cleaned the heat exchangers prior to plant startup and performed additional testing in RF-8. The RF-8 testing demonstrated acceptable performance with good margin available.

Regarding the Division 1 heat exchangers, during RF-7 the heat exchangers were degraded, but in an acceptable condition. The as-found heat exchange rate was 136 Mbtu/hr, approximately 10 Mbtu/hr higher than the minimum permitted. Following the outage, the licensee performed an engineering evaluation (CR 97-1452) and determined that heat exchanger cleaning was necessary in RF-12, based on a degradation rate of 1.4 Mbtu/hr per cycle. The licensee planned to perform the next heat exchanger test in RF-10. Generic Letter 89-13, "Service Water System Problems Affecting Safety Related Equipment Operability," dated July 18, 1989, recommends testing, as a minimum, every three refueling outages, provided the interval is adequate to ensure operability.

NRC Assessment: The inspector observed that the assumed 1.4 Mbtu/hr per cycle degradation rate appeared overly optimistic when compared to past performance history. For example, the average degradation rate over the life of the plant was approximately 3.0 Mbtu/hr per cycle and the highest known degradation rate was approximately 9.0 Mbtu/hr per cycle. The inspector subsequently reviewed the engineering evaluation in detail and found the following problems.

1. **Trending Method:** The licensee utilized an inappropriate trending method to predict the fouling rate. ASME-S/G-OM-1977, "Inservice Performance Testing of Heat Exchangers in LWR [Light Water Reactor] Power Plants," was not reviewed or approved by the NRC. The publication provided one predictive trending example. The inspector observed that the trend method did not address data variability uncertainties. However, the test data utilized in the ASME example demonstrated a constant trend with no variability; all of the data points fell on the

trend line. Therefore there was no need to account for this uncertainty in this example. The licensee's test data, however, demonstrated significant variability. For example, in Cycle 6 performance improved while in Cycle 7 performance declined. Good Cycle 6 performance offset poor Cycle 7 performance, yielding a more optimistic trend line. None of the licensee's test points fell on the trend line.

The licensee requested that the inspector discuss utilization of the ASME method with three licensee recommended heat exchanger experts. One expert was on the ASME S/G-OM committee, another was associated with the Electrical Power Research Institute, while the third was an industry contractor that specialized in heat exchanger fouling. None of the experts would defend the licensee's utilization of the ASME trend method with the licensee's test data. The ASME S/G-OM committee member stated that the ASME method did not considered data variability uncertainties but the method was not intended for use in instances where test data varied significantly or where operational conditions had changed, as was the case of with the licensee's data. The inspector also noted that two of the licensee's experts were on-site during RF-7 but the licensee had not sought their guidance when utilizing the ASME trending method. Further, when it was clear that the licensee's test data did not match the general data profile utilized in the ASME example, and the method produced overly optimistic results, licensee engineers and managers failed to question the inconsistencies.

2. **Operational Changes:** The engineering evaluation failed to properly consider changes in operational conditions. For example, the RHR trains were in relatively frequent operation in Cycle 6, when test performance improved, and were rarely utilized in Cycle 7, when performance declined. While the licensee expected infrequent RHR operations in future cycles, similar to Cycle 7, this operational expectation was not considered in the engineering evaluation.

3. **Test Data Fidelity:** The engineering evaluation did not appropriately consider two operational occurrences that may have affected the RF-7 test data. The inspector observed that the Cycle 7 degradation rates for the Divisions I and II RHR heat exchangers were substantially different, 5 Mbtu/hr for Division I and 9 Mbtu/hr for Division II. The inspector further observed that the Division I heat exchangers were subjected to high temperatures, greater than 300°F, on two occasions (shutdown cooling) within 4 months of the RF-7 tests. The exposure to elevated temperatures likely killed the biological growth on the heat exchangers and potentially affected the RF-7 test results. Accordingly, the degradation rate of 5.0 Mbtu/hr for Cycle 7 was not likely representative of the fouling rate that heat exchangers would have experienced had the events not occurred. This important detail was not considered in the engineering evaluation.

4. **Unvalidated Assumptions:** The inspector identified two erroneous unvalidated assumptions in the engineering evaluation. First, engineers assumed that future

fouling rates should improve because the RHR trains were no longer frequently utilized in the suppression pool cooling mode. This assumption was in conflict with test data. For Cycle 6 the trains were utilized frequently in the suppression pool cooling mode but performance improved. For Cycle 7, the trains were rarely utilized in the suppression pool cooling mode but performance declined. Second, engineers assumed that monitoring of bacterial levels in the bulk suppression pool water was an effective means of predicting slime bacterial levels on RHR component surfaces. Because of SPC system operations, the free swimming bacteria levels were reduced by a factor of approximately 10. The inspectors reviewed industry documents and discussed the assumption with the licensee's three experts and an expert in the NRC's office of Nuclear Reactor Regulation. Based on the investigation, the inspector concluded that the licensee's assumption had no basis in fact and was erroneous. There was no known method to correlate bulk water bacterial activity to surface slime activity. The information from the industry experts, the NRC expert, and the industry documents was consistent on this matter.

5. **Failure to Implement Sound Recommendations:** The inspector further observed that the licensee's Electrical Power Research Institute expert had made sound recommendations to the licensee in a letter dated July 21, 1998. Recommendations included, but were not limited to: (1) culturing the slime bacteria to determine the identity; (2) monitoring and trending the slime bacteria levels immediately upstream and downstream of the heat exchangers; and (3) retesting heat exchanger performance at the first practical opportunity, possibly during RF-8. Engineers did not implement, or plan to implement, the above noted recommendations.

Based on the above, the inspector concluded that the licensee's engineering evaluation was inadequate and in violation of 10 CFR Part 50, Appendix B, Criterion III (Design Control). This regulation requires the licensee to appropriately demonstrate the adequacy of safety-related component design, either through an engineering evaluation or through testing. In this case, the licensee chose to demonstrate design adequacy through an engineering evaluation. The expected fouling rate was an important heat exchanger design factor. This Severity Level IV violation is being treated as an NCV, consistent with Appendix C of the NRC Enforcement Policy. The violation is in the licensee's corrective action program as CR 99-0560 (NCV 50-458/9903-07).

In addition to the above, the inspector considered management oversight of the issues ineffective. RHR heat exchanger degradation problems were well known, high profile issues, and resolution oversight included several layers of management involvement. Oversight teams included the corrective action review board and a significant event response team. Yet, the management presence was ineffective in ensuring a quality engineering product.

In response to the inspector's concerns, the licensee tested the Division I heat exchangers during RF-8 and found a 4.2 Mbtu/hr degradation rate for Cycle 8. This rate

was three times the rate predicted by the licensee's engineering evaluation. Based on the new test data, the licensee planned to test and clean the heat exchangers no later than RF-9, versus RF-10 and RF-12, respectively.

Upper plant managers emphasized that they had not previously ruled out testing the Division I RHR heat exchangers in RF-9. However, the official corrective action documents specified testing in RF-10.

c. Conclusions

The inspector identified a violation of 10 CFR Part 50, Appendix B, Criterion III (Design Control), in that an engineering evaluation, intended to determine the design fouling rate for the Division I RHR heat exchangers, was inadequate. The evaluation: (1) utilized an inappropriate method to predict the fouling rate; (2) relied on unvalidated and erroneous assumptions; and (3) failed to properly consider significant operational changes and instances where test data may have been affected by previous high temperature operations. Furthermore, recommendations made by an industry heat exchanger expert were not implemented. Although there was substantial management oversight of the engineering evaluation, the oversight was ineffective in ensuring a quality engineering product. In response to the NRC concerns, the licensee performed testing in RF-8 and found that the degradation rate was three times greater than the engineering evaluation predicted. The violation met the criteria for an NCV.

IV. Plant Support

S2 Status of Security Facilities and Equipment

S2.1 General Comments (71750)

During routine tours, the inspector observed protected area illumination levels, maintenance of the isolation zones around protected area barriers, implementation of the extended protected area, and the status of security power supply equipment. In most instances, no problems were observed.

S4 Security and Safeguards Staff Knowledge and Performance

S4.1 Inattentive Security Officer

a. Inspection Scope (71750)

The inspectors observed security personnel during normal rounds.

b. Observations and Findings

The inspector observed an inattentive armed security officer during one tour. On March 13, at 4:14 p.m., in the small bullet proof guard house west of the fuel building, the inspector observed the officer leaning back in his chair, with his eyes closed, mouth

open, and right arm dangling freely toward the ground. For over 2 minutes the inspector attempted to gain the officer's attention through the guard house windows, directly in front of the officer and to the side, but the guard did not acknowledge the inspector. The inspector was no more than 2 feet away from the officer at the time. The inspector left the area to report the observation to the security supervisor. When the inspector returned, approximately 10 minutes later, he observed the security officer sitting upright in his chair with his eyes open. Records indicated that the officer had completed his radio check-in at 4 p.m. Therefore, the inspector concluded that the individual's lapse in attention was short in duration, no more than 20 minutes. In response to the inspector's concern, the licensee immediately relieved the guard from his post and counseled the guard on appropriate surveillance methods.

Section 2.D of the Facility Operating License requires the licensee to implement and maintain in effect all provisions of the physical security plan. The River Bend Station Security Plan states that specific duties of security personnel are described in security procedures. Procedure SPI-02, "Patrol Officer," Revision 24, required the guard to remain observant of plant abnormalities. The guard was, by procedure, considered a "patrol officer." The guard's failure to remain alert was inconsistent with Procedure SPI-02 and was a violation of the Facility Operating License. This Severity Level IV violation is being treated as an NCV, consistent with Appendix C of the NRC Enforcement Policy. The violation is in the licensee's corrective action program as CR 99-0305 (NCV 50-458/9903-8).

c. Conclusions

The inspector identified a facility operating license violation, in that a security procedure was not properly implemented. The inspector observed a security officer at his post, leaning back in his chair with his eyes closed, mouth open, and right arm dangling freely at his side. The procedure required that the officer remain alert. The inspector determined that the violation met the criteria for an NCV.

V. Management Meetings

X1 Exit Meeting Summary

The inspectors presented the inspection results to members of licensee management at the conclusion of the inspection on May 3, 1999. 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. Edington, Vice President-Operations
B. Biggs, Licensing Engineer
P. Chapman, Superintendent, Chemistry
D. Dormady, Manager, Plant Engineering
J. Fowler, Director, Quality Programs
T. Hildebrandt, Manager, Maintenance
J. Holmes, Manager Radiation Protection and Chemistry
H. Hutchens, Superintendent, Plant Security
R. King, Director, Nuclear Safety and Regulatory Affairs
D. Lorfing, Supervisor, Licensing
D. Mims, General Manager, Plant Operations
J. McGhee, Acting Manager, Operations
D. Pace, Director, Design Engineering
A. Wells, Superintendent, Radiation Control

INSPECTION PROCEDURES USED

IP 37551:	Onsite Engineering
IP 61726:	Surveillance Observations
IP 62707:	Maintenance Observations
IP 71707:	Plant Operations
IP 71750:	Plant Support
IP 92901	Followup, Operations
IP 92902	Followup, Maintenance

ITEMS OPENED AND CLOSED

Opened

50-458/9903-03	URI	Division I diesel failure due to inadequate maintenance

Closed

50-458/99-03	LER	Division I DG failure due to inadequate maintenance.
50-458/99-04	LER	Auto-isolation of containment isolation valve due to low dryer pool level.
50-458/99-05	LER	SSW pump inoperable for more than 30 days.

Opened and Closed

50-458/9603-01	NCV	Inadequate maintenance causes Division III SSW pump breaker failure.
50-458/9603-02	NCV	Two failure to follow refueling procedures examples.
50-458/9603-04	NCV	Failure to follow clearance order procedures results in engineered safety features actuation.
50-458/9603-05	NCV	Inadequate procedure causes auto-start of SSW pumps, and engineered safety features actuation.
50-458/9603-06	NCV	Scaffold inadequately erected two times.
50-458/9603-07	NCV	Inadequate engineering evaluation of RHR heat exchanger fouling rate.
50-458/9603-08	NCV	Inattentive guard in violation of security procedures.

LIST OF ACRONYMS USED

ADM	administrative procedure
ASME	American Society of Mechanical Engineers
CFR	Code of Federal Regulations
CR	condition report
CRS	control room supervisor
DG	diesel generator
EHC	electrohydraulic controls
ESF	engineered safety features
GMP	general maintenance procedure
gpm	gallons per minute
IFTS	inclined fuel transfer system
LER	licensee event report
Mbtu/hr	millions of British thermal units per hour
NCV	noncited violation
NEI	Nuclear Energy Institute
NRC	U.S. Nuclear Regulatory Commission
OSP	operations section procedure
PDR	public document room
REP	reactor engineering procedure
RF	refueling outage
RHR	residual heat removal
RG	Regulatory Guide
RPCCW	reactor plant component cooling water
SPC	suppression pool cleanup
SPI	security position instruction
SSC	structure, system or component
SSW	standby service water
STP	surveillance test procedure
TS	Technical Specifications
URI	unresolved item