ENCLOSURE 2

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

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Licensee:	Entergy Operations, Inc.
Facility:	Arkansas Nuclear One, Units 1 and 2
Location:	1448 S. R. 333 Russellville, Arkansas
Dates:	April 27 through June 7, 1997
Inspectors:	K. Kennedy, Senior Resident Inspector S. Burton, Resident Inspector J. Melfi, Resident Inspector
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ATTACHMENT: Supplemental Information

EXECUTIVE SUMMARY

Arkansas Nuclear One, Units 1 and 2
NRC Inspection Report 50-313/97-03; 50-368/97-03

Operations

- Operators performed well during operation at reduced reactor coolant system (RCS) inventory. The monitoring of RCS level, communications, and control of the evolutions was very good. Operators demonstrated a good questioning attitude and delayed commencing RCS draindown in response to a drifting level transmitter. Training of crews on the simulator prior to midloop operations was a strength (Section 01.2).

- The reload of fuel into the reactor was conducted in accordance with procedures and operators demonstrated strong attention to detail, the use of three-way communications, second verifications, and peer checking. Operators were conscientious and focused on safety (Section 01.3).

- The licensee's walkdown and cleanup of the Unit 2 containment building was effective in preparing the building for plant operation following Refueling Outage 2R12 (Section 02.1).

- The performance of the Unit 2 integrated engineered safety feature (ESF) test, involving maintenance, engineering, and operations personnel, was well coordinated and controlled. Personnel were well prepared and very knowledgeable of their assigned tasks (Section 04.1).

- The licensee failed to properly align an emergency feedwater (EFW) pump suction pressure switch resulting in one train of EFW being inoperable for approximately 28 days. This was determined to be a violation. Operators demonstrated a good questioning attitude which led to identification of the misalignment and the licensee took appropriate corrective actions upon discovery (Section 08.1).

Maintenance

- Instrumentation and control technicians demonstrated a thorough knowledge of the automatic closure interlock (ACI) circuitry during troubleshooting and correction of an identified problem (Section M1.2).

- The cleaning of the service water (SW) return line to the emergency cooling pond (ECP) was well controlled, with appropriate supervisory oversight and engineering support. The cleaning process resulted in a decrease in piping losses (Section M1.4).

- The licensee failed to properly align the upper guide structure (UGS) lift rig with the reactor vessel guide pins, resulting in damage to a lift rig bushing. Temporary

procedure changes to allow reinstallation were properly evaluated and provided good instructions to ensure alignment. The reinstallation of the UGS was deliberate and well controlled (Section M1.5).

- Testing of the Unit 2 main steam safety valves (MSSVs) was performed well. The prejob brief was thorough, with strong emphasis on lessons learned from previous errors. Effective controls were established to minimize the potential for personnel experiencing heat stroke during the performance of the testing. The inspectors noted strong management involvement in the testing of the MSSVs (Section M1.7).

  As a result of eight of the ten MSSVs lifting above their Technical Specification (TS) allowed lift setpoint during testing, the licensee determined TS requirements were not met for some period during the previous operating cycle. This issue remains unresolved pending further inspection of the licensee's past operability determination, root cause evaluation, corrective actions for the test failures, and corrective actions taken as a result of MSSV test failures identified at the beginning of Refueling Outage 2R11 (Section M1.7).

Engineering

- The potential for a leak in the Unit 1 makeup tank level instrumentation reference leg to cause an erroneous indication on both level transmitters and lead to damage of high pressure injection (HPI) pumps, an event which occurred at another plant, was very unlikely based on design and operational differences between the plants (Section E1.1).

- A design engineer demonstrated a good questioning attitude in identifying a TS which would allow operators to place a recirculation actuation signal (RAS) channel in a tripped condition for an indefinite period, rendering the function vulnerable to a single failure and placing the plant outside of its design basis. The licensee took appropriate short-term corrective actions to address this issue (Section E1.2).

- Reactor engineers failed to utilize a procedure for determining the proper placement of fuel assemblies in the spent fuel pool (SFP), resulting in the misclassification of 42 fuel assemblies and the placement of one in a location prohibited by TS. Multiple barriers, such as clear procedures and requirements for the conduct of independent review of fuel assembly classification determinations, failed to prevent or identify the calculation errors. This was determined to be a violation (Section E1.3).

- Performance tests conducted on the emergency diesel generator (EDG) SW heat exchangers revealed that the heat exchangers were capable of removing the required heat from the diesel generators (Section E1.4).

Plant Support

- Very good radiation protection work practices were observed during the Unit 2 refueling outage. Radiation protection technicians displayed a strong questioning attitude and a good awareness of plant activities (Section R.1).

- The inspectors walked down portions of the reactor coolant pump (RCP) lube oil collection system and found that the installation met regulatory requirements (Section F2.1).

- Fire watches were well qualified and knowledgeable of their duties and responsibilities (Section F4.1).

Report Details

Summary of Plant Status

Unit 1 began the inspection period at 100 percent power. Power was reduced to 95 percent for 3 hours on May 6, 1997, for main condenser repairs and to 85 percent for 2 1/2 hours on May 16-17, 1997, for routine turbine valve/governor valve testing. The unit was at 100 percent power at the end of the inspection period.

Unit 2 began the inspection period at 97 percent power. On May 6, operators began reducing power in preparation for the start of Refueling Outage 2R12. On May 9, the plant was shutdown and remained so through the end of the inspection period.

I. Operations

O1 Conduct of Operations

O1.1 General Comments (71707)

The inspectors observed various aspects of plant operations, including compliance with Technical Specifications; conformance with plant procedures and the safety analysis report; shift manning; communications; management oversight; proper system configuration and configuration control; housekeeping; and operator performance during routine plant operations, the conduct of surveillances, and plant power changes.

The conduct of operations was professional and safety conscious. Evolutions such as surveillances and plant power changes were well controlled, deliberate, and performed in accordance with procedures. Shift turnover briefs were comprehensive and were typically attended by a chemistry technician, a health physics technician, and a representative from system engineering. Housekeeping was generally good and discrepancies were promptly corrected. Safety systems were found to be properly aligned. Specific events and noteworthy observations are detailed below.

O1.2 Unit 2 - Operations with RCS at Reduced Inventory

a. Inspection Scope (71707)

On May 13 and 14 and again during the week of June 1, 1997, the inspectors observed the licensee drain the RCS to reduced inventory, operate at reduced inventory, and refill the RCS. The inspectors observed control room activities and verified that the proper conditions were established for these evolutions.

b. Observations and Findings

On May 13, Unit 2 operators commenced a draindown of the RCS in accordance with Procedure 2102.011, Revision 23, "Draining the Reactor Coolant System." The inspectors verified that the licensee had established the proper initial

conditions and prerequisites for operation at reduced inventory as described in Procedure 2103.011 and Procedure 1015.008, Revision 13, "Unit 2 SDC Control." The inspectors attended an abbreviated prejob brief and found it to be thorough. A more detailed brief was performed with the crew on the previous day.

Prior to commencement of the draindown, operators observed that one of the two RCS level instruments had drifted low and stabilized with a reading approximately 3 inches lower than the other instrument. Although this difference was within the tolerance allowed by Procedure 2103.011, operators delayed the start of the draindown while instrumentation and control technicians vented and drained the level transmitter sensing lines. The instrument was returned to service and operators verified that it responded appropriately to level changes. Operators demonstrated a good questioning attitude with regard to the level transmitter and properly resolved differences in level indication prior to draining the RCS.

Procedure usage, communications, and control of the drain to midloop was very good. A licensed operator was assigned in the control room as the draindown operator. Additionally, a dedicated operator was stationed inside containment to monitor the tygon tube level indication, and an operator was stationed at the shutdown cooling pump to monitor for unusual pump noises, which could indicate pump cavitation. Operators closely monitored RCS level throughout the draining process and while in reduced inventory. The draindown was stopped at levels established in the procedure to verify that the various level indicators were tracking properly and within the allowed deviation. The operators accurately predicted level transition points such as the elapsed time it would take for the steam generators to fully drain.

The inspectors noted that the crews previously received simulator training on midloop operations in preparation for the activity. This contributed to the ability of the operators to perform this task with the efficiency that was demonstrated.

c. Conclusions

Operators performed well during operation at reduced RCS inventory. The monitoring of RCS level, communications, and control of the evolutions were very good. Operators demonstrated a good questioning attitude and delayed commencing RCS draindown in response to a drifting level transmitter. Training crews on the simulator prior to midloop operations was a strength.

O1.3 Unit 2 - Refueling Operations

a. Inspection Scope (71707)

On May 18 and 20, 1997, the inspectors observed refueling operations on Unit 2. Procedural compliance, the prejob briefing, refueling floor activities, operator knowledge, and training requirements were reviewed.

b. Observations and Findings

Inspectors attended the prejob brief and noted a good discussion of upcoming activities. Ample opportunity was given for questions and discussion, and the assistant operations manager provided insights from lessons learned from previous outages. The inspectors found that the watch bill was developed with sufficient rotation of personnel to ensure that operators did not become stressed with the repetition that occurs with refueling activities. The refueling activities were conducted in accordance with procedures and the inspectors verified that prerequisites were met prior to the commencement of fuel movement. The inspectors noted good self- and peer-checking, adherence to procedures, and system knowledge by the operators. Proper three-way communications were observed between local operators, control room operators, and the refueling bridge.

c. Conclusions

The reload of fuel into the reactor was conducted in accordance with procedures. Personnel demonstrated a strong attention to detail, good communications, second verifications, and peer-checking. Operators were conscientious and were focused on safety.

O2 Operational Status of Facilities and Equipment

O2.1 Unit 2 - Tour of Containment Building During Plant Heatup

a. Inspection Scope (71707)

A tour of the Unit 2 containment building was conducted on June 7 during the plant heatup following completion of maintenance activities performed during Refueling Outage 2R12. This tour was conducted following the licensee's preheatup walkdown of the building but prior to their precriticality walkdown.

b. Observations and Findings

The inspectors found that equipment in the building was properly secured and, with a few exceptions, that debris had been removed. Radiological postings and scaffolding remaining in the building were scheduled to be removed prior to plant criticality. The inspectors identified a small feedwater leak in an area where

maintenance had been performed during the outage. The licensee was aware of the leak and was preparing to send people into the building to stop the leak. The inspectors identified minor equipment material condition discrepancies during the walkdown and informed the licensee of these findings for resolution.

c. Conclusions

The licensee's walkdown and cleanup of the containment building was effective in preparing the building for plant operation.

O4 Operator Knowledge and Performance

04.1 Unit 2 - Performance of Integrated Engineering Safeguards Test

a. Inspection Scope (61726, 71707)

The inspectors observed the licensee perform Procedure 2305.001, Revision 13, "Integrated Engineering Safeguards Test," on June 5.

b. Observations and Findings

The inspectors found that the performance of this complex test involving maintenance, engineering, and operations personnel was well coordinated and controlled. A test coordinator was assigned to prepare and coordinate the test activities. During the prejob brief, the test coordinator discussed individual duties and responsibilities and ensured that everyone was aware of their roles. Personnel appeared to be very familiar with their assigned tasks. Communications and chain of command were also discussed.

The inspectors found that equipment inoperability was properly documented and the appropriate TSs entered prior to the commencement of the test. In addition, there was good coordination and communication with Unit 1 operators prior to the start of the test.

The inspectors observed good communications during the performance of the test. The ESFs actuation system was initiated from the control room. With a few exceptions, equipment functioned as expected and within the allowed time. Condition reports were written to document discrepancies and initiate corrective actions prior to retesting those functions.

c. Conclusions

The performance of the Unit 2 integrated ESF test, involving maintenance, engineering, and operations personnel, was well coordinated and controlled. Personnel were well prepared and very knowledgeable of their assigned tasks.

O8 Miscellaneous Operations Issues

08.1 (Closed) Licensee Event Report (LER) 50-368/97-002, "Inadequate Configuration Control Resulted in Closed Pressure Switch Isolation Valves that Could Have Prevented One Train of Emergency Feedwater from Automatically Switching the Pump Suction to Service Water and Caused Operation Prohibited by Technical Specifications"

a. Inspection Scope (92700)

LER 50-368/97-002 documented the licensee's discovery that Unit 2 had operated with one train of EFW inoperable for approximately 28 days. The train was inoperable due to the isolation of the EFW pump suction pressure switch root valves. The pressure switch is designed to automatically transfer the pump suction to the alternate supply in the event that the normal supply is lost. The licensee identified that the other train of EFW was inoperable for short periods during the 28 days due to maintenance activities.

b. Observations and Findings

The EFW pumps are designed to supply the steam generators in the event that normal feedwater is unavailable. The normal suction for the EFW system is the condensate storage tank (CST) with alternate supply from the SW header. The EFW pump suction was designed to automatically transfer from the normal supply CST to the SW header in the event that an automatic demand signal (steam generator low water level) in conjunction with an EFW pump low suction pressure existed. The purpose of this design ensures that the EFW pumps have a Seismic Category I supply available from the SW header in the event that a seismic event would render the Seismic Category II CSTs unavailable. The isolated pressure switch provides a signal at 5 psig to transfer the pump suction source from the CST to the SW system.

On February 4, 1997, during routine surveillance testing of motor-driven EFW Pump 2P-7B, the control room operator observed a momentary EFW pump low suction pressure alarm. The control room dispatched an operator to investigate the cause of the alarm. The plant operator discovered that the suction pressure switch, which provided the signal to transfer EFW pump supply sources on low suction pressure, was isolated with pressure locked in on the pressure switch. It was subsequently determined that vibrations induced while starting the pump caused an intermittent low suction pressure alarm.

The licensee determined that the low suction pressure switch was isolated on either January 6, 1997, during the performance of an 18-month pressure switch calibration or on January 7 during the performance of a routine monthly surveillance test. The licensee identified two possible explanations for the valving error. First, a possible error occurred on January 6 during the performance of the associated

pressure switch 18-month calibration in that the instrument and control technicians failed to properly unisolate and independently verify the position of the isolation valve upon completion of the calibration. Second, an auxiliary operator improperly isolated valves for an instrument not associated with the normal monthly EFW surveillance on January 7. In the second case, the auxiliary operator was required to manipulate root valves on local EFW pump suction and discharge pressure gages. All of the root valves were unmarked and there existed a potential for the inplant operator to isolate the wrong instrument. The licensee's root cause evaluation determined that the affected instrument root valves were not procedurally controlled in a manner that would ensure they are maintained fully open at all times when the EFW pump is required to be operable.

The licensee also determined that, during the approximately 28 days that the pressure switch was isolated, the turbine-driven emergency feedwater pump was inoperable, on four independent occasions, due to the pump or the opposite train emergency diesel generator being out of service for surveillance testing or maintenance. The total time that both emergency feedwater pumps were simultaneously inoperable during the 28 day period was approximately 5 hours.

The inspectors reviewed procedures and conducted interviews to determine if operators would have been alerted to a failure of the EFW pump suction to transfer from the CST to the SW header had there been a valid demand signal.

The inspectors concluded that indications and alarms were available to the operators which would alert them of the need to secure the affected EFW pump protecting the pump from failure upon a loss of supply water. Also, the turbine-driven EFW Pump 2P-7A low suction pressure alarm would alert the operators that a transfer of suction from the CST to the SW header was required. The inspectors concluded that, subsequent to indications of abnormal conditions at the EFW pump, sufficient time existed for the operators to initiate investigations that would result in the operator manually shifting EFW pump suction to the SW system. Additionally, the emergency operating procedures and system operating procedures provide instructions to align the seismically qualified Units 1 and 2 shared CST as the suction source for the EFW pumps. Although available to mitigate this event, credit is not taken for the seismically qualified CST in analysis.

Unit 2 TS 3.7.1.2 requires that two EFW pumps and associated flow paths shall be operable in Modes 1, 2, and 3. The inoperability of one train of EFW, due to the isolation of the suction pressure switch for Pump 2P-7B for a period of approximately 28 days, was determined to be a violation of TS 3.7.1.2 (50-368/9703-01).

Although this violation satisfied the criteria to be noncited pursuant to Section VII.B.1 of the NRC's Enforcement Policy, it is being cited to emphasize the importance of ensuring effective administrative controls to ensure the proper

alignment of risk significant safety systems. The inspectors found that LER 50-368/97-002 provided a description of the licensee's corrective actions taken and planned to correct the violation and prevent recurrence.

c. Conclusions

The licensee failed to properly align an EFW pump suction pressure switch, resulting in one train of EFW being inoperable for approximately 28 days. Operators demonstrated a good questioning attitude which led to identification of the misalignment and the licensee took appropriate corrective actions upon discovery.

II. Maintenance

M1 Conduct of Maintenance

M1.1 General Comments

a. Inspection Scope (62707)

The inspectors observed all or portions of the following maintenance activities:

- Unit 2 - Job Order (JO) 00963312, "EFW Speed Controller Maintenance," performed on May 13, 1997.
- Unit 2 - JO 00964748, "Drain and Flush 2K-4A Engine Oil System," performed on May 27 and 28.
- Unit 2 - Construction Work Package 96-2001/953299-2, "2R12 Electrical Modification 2WR25-5 (2E-8)," observed between May 15 and 20.
- Unit 2 - Performance of Outage Related Maintenance Activities on Both EDFs Observed at Various Times during the Outage.
- Unit 2 - JO 00961161 and Procedure 2409.552, "Cleaning the ECP Return Lines," observed on May 25.
- Unit 1 - JO 00964257 used to troubleshoot and repair the ACI module, performed on May 16.
- Unit 2 - JO 00962235 used to install a lube oil pump on EDG 2K4A, performed on May 28.
- Unit 2 - Procedure 2505.006, Revision 7, "Unit 2 Upper Guide Structure Removal," performed on May 18.

- Unit 2 - Procedure 2505.007, Revision 6, "Unit 2 Upper Guide Structure Installation," performed on May 29.

b. Observations and Findings

The inspectors found the work performed in these activities to be professional and thorough. All work was performed in accordance with procedures and the workers were knowledgeable on their assigned tasks. When applicable, appropriate radiological work permits were followed. The inspectors observed supervisory involvement in the activities and adequate foreign material exclusion controls.

In addition, see the specific discussions of maintenance observed under Sections M1.2 through M1.5, below.

M1.2 Unit 1 - Failure of ACI Module

a. Inspection Scope (62707)

The inspector observed licensee activities following their identification during a routine surveillance that an RCS pressure module was out of tolerance. This out-of-tolerance condition affected the closure logic for Decay Heat Suction Valve CV-1050 and rendered the ACI circuit inoperable. This placed the unit in a 12-hour shutdown limited condition of operation per TS 3.5.1.2. The ACI circuit provides over-pressure protection for the decay heat removal system suction piping by closing the suction valve on a high RCS pressure condition preventing high pressure water from entering a low pressure system.

b. Observations and Findings

During performance of Procedure 1304.162, "Unit 1 Decay Heat Channel 1 Test," on May 16, technicians found that the RCS Pressure Buffer Module C88-8-4 was slightly out of tolerance and had difficulty adjusting the module to be within the required specification. Based on the unexpected difficulty in adjusting the module, the licensee initiated troubleshooting activities under JO 00964257 to adjust the module or replace as necessary. The inspector observed portions of this JO, observed management involvement in the process, and noted that the technicians were knowledgeable on the circuit. The technicians identified dirty contacts on the buffer module connector and cleaned the contacts. After cleaning the contacts, the technicians were able to make the required adjustments and returned the module to service.

c. Conclusions

Instrumentation and control technicians demonstrated a thorough knowledge of the ACI circuitry during troubleshooting and correction of an identified problem.

M1.3 Unit 2 - EDG Lube Oil Pump Failure

a. Inspection Scope (62707)

On May 24, 1997, during a postmaintenance test of EDG 2K4A, the gear-driven lube oil pump failed catastrophically, resulting in an automatic shutdown of the diesel generator. Inspectors reviewed the circumstances surrounding the pump failure and observed portions of the installation of the replacement lube oil pump.

b. Observations and Findings

Following the failure, the licensee found that the drive gear shaft to the lube pump sheared and a pump gear had many broken teeth. The licensee had replaced the lube oil pump during maintenance under JO 00962235 due to a crack on the suction flange. The lube oil pump had been purchased from another utility with the same diesels. However, the licensee discovered that the broken gear on the replacement lube oil pump had a different finish, was of a larger diameter, and had 46 teeth instead of 44 teeth. The licensee installed another lube oil pump with the correct gear via JO 00964748 on May 28, 1997. The broken gear shaft and damaged gear were sent to an offsite laboratory for failure analysis.

The procurement of the failed lubricating oil pump, the work instructions used to install the pump, and the results of the laboratory failure analysis will be the subject of further inspection of this event (IFI 50-368/9703-03).

M1.4 Unit 2 - Observation of SW Return Line Cleaning

a. Inspection Scope (62707)

The SW return line to the ECP was cleaned to reduce line losses. The inspectors observed portions of the return line cleaning on May 25. This activity was performed in accordance with JO 00961161 and Procedure 2409.552, "Cleaning the ECP Return Line."

b. Observations and Findings

The licensee constructed a special launcher to insert a cleaning device into the return line. The licensee would drain the line, install the cleaning device, then refill the line and use SW pressure to move the device through the lines and scrape the sides.

The inspectors noted that the activity was well controlled and observed appropriate engineering and supervisory oversight of the process. The cleaning process resulted in a reduction of line losses from 24 psi to 15 psi.

c. Conclusions

The cleaning of the SW return line to the ECP was well controlled with appropriate supervisory oversight and engineering support. The cleaning process resulted in a decrease in piping losses.

M1.5 Unit 2 - Removal and Replacement of Reactor UGS

a. Inspection Scope (71707)

The inspectors observed the removal of the UGS from the reactor vessel on May 18 and the reinstallation of the UGS into the reactor vessel on May 29. The UGS aligns and supports the upper end of the reactor fuel assemblies to prevent movement during expected transients. A special lift rig is used to remove and install the UGS to ensure that it is properly positioned over the reactor vessel. Reactor vessel guide pins fit into bushing on the lift rig to ensure proper alignment.

b. Observations and Findings

The inspectors observed the removal and the second reinstallation of the UGS. The licensee used Procedure 2505.006, Revision 7, "Unit 2 Upper Guide Structure Removal," for the removal of the UGS. The prejob brief was thorough, foreign material exclusion controls were in place, and the licensee followed their procedures.

During their initial attempt to reinstall the UGS on May 26, the licensee damaged one bushing on the UGS lift rig. Due to improper alignment of a lift rig bushing with a reactor vessel guide pin, the bushing was damaged as the lift rig was lowered onto the guide pin. Neither the UGS or the reactor vessel sustained any damage. The licensee returned the UGS and lift rig to their storage location within the refueling canal. The licensee believed this misalignment was caused by parallax error while lowering the lift rig bushings over the guide pins.

The licensee removed the damaged bushing from the lift rig and made a temporary change to Procedure 2505.007, Revision 6, "Unit 2 Upper Guide Structure Installation," to allow installation of the UGS with only one alignment bushing on the lift rig. The inspectors attended a meeting of the plant safety committee, during which the procedure changes were discussed, and reviewed the procedure, which included additional actions to ensure the proper alignment of the lift rig. The inspectors found that the procedure changes provided sufficient controls to ensure the proper alignment of the UGS during installation.

The inspectors attended the prejob brief for the installation of the UGS and found it to be thorough. The UGS was installed in a deliberate, controlled manner to ensure he proper alignment of the UGS with the reactor vessel. The licensee identified two

items on the UGS, a bolt and a piece of tie wrap, which they removed before installation. The licensee initiated a condition report to document the finding and evaluate the source of the foreign material.

c. Conclusions

The licensee failed to properly align the UGS lift rig with the reactor vessel guide pins, resulting in damage to a lift rig bushing. The reinstallation of the UGS was deliberate and well controlled. Temporary procedure changes to allow reinstallation were properly evaluated and provided good instructions to ensure alignment.

M1.6 General Comments on Surveillance Activities

a. Inspection Scope (61726)

The inspector observed all or portions of the following surveillance activities:

- Unit 2 - Procedure 2306.006, "Unit 2 Main Steam Safety Valve Test," performed on May 7 and 8, 1997.
- Unit 2 - Procedure 2402.049, Revision 8, "Unit 2 Main Steam Safety Valve Maintenance," performed on June 6.
- Unit 2 - Procedure 2305.006, Revision 13, "Cold Shutdown Valve Testing," Supplement 2, "Emergency Boration Flow Path Verification," performed on May 10.
- Unit 2 - Procedure 2307.003, Revision 7, "Testing of Time Delay Relays," completed under JO 956316, on May 19.
- Unit 2 - Procedure 2305.001, Revision 13, "Integrated Engineering Safeguards Test," performed on June 5.
- Unit 2 - Procedure 2305.049, Supplement 2, "2EDG2 18-Month Operational Test," performed on June 5.
- Unit 1 - Procedure 1105.009, Supplement 2, "Exercising CRDMs Above Cold Shutdown," performed on June 6.

b. Observations and Findings

The inspectors found that the surveillance activities were performed according to the licensee's procedures by knowledgeable workers. When applicable, calibrated test equipment was used, personnel demonstrated good technical knowledge of the

components being tested, there was an awareness of both procedural requirements and safety while working with energized equipment, and appropriate radiological work permits were followed.

In addition, see the specific discussions of maintenance observed under Sections 04.1 through M1.7.

M1.7 Unit 2 - MSSV Insitu Testing

a. Inspection Scope (62707)

On May 8 and 9, 1997, the inspectors observed portions of MSSV testing performed on Unit 2 with the plant at normal operating temperature and pressure. This testing was conducted in accordance with Procedure 2306.006, "Unit II Main Steam Safety Valve Test."

b. Observations and Findings

The prejob was thorough, with strong emphasis on lessons learned from previous errors. The licensee performed required precalibration and postcalibration checks of the test equipment used during the MSSV testing to ensure accuracy of the results. The inspectors noted strong management involvement in the testing of the MSSVs. The licensee established effective controls to minimize the potential for personnel experiencing heat stroke during the performance of the testing.

The licensee tested 7 of the 10 MSSVs. The remaining 3 valves were removed following the plant cooldown and tested at an offsite facility. The licensee found that 8 of the 10 MSSVs lifted at setpoints higher than allowed by TSs ($\pm$1 percent of setpoint).

The licensee performed extensive testing to determine the root cause of the valve test failures and identify required corrective actions. The licensee evaluated the following areas which could potentially effect the setpoint of the MSSVs: inplant testing issues such as seat adhesion and the air motor test method; valve maintenance issues such as valve refurbishment, leakage, internal friction, clearances and tolerances, and valve spring "set" or hysteresis; and offsite testing issues such as initial steam header pressure, quantity, and repeatability of valve lifts, valve component temperatures, and stabilization of valve temperatures. The licensee determined that a combination of factors contributed to the high as-found lift setpoints and did not identify a single cause.

The licensee identified 11 short-term corrective actions and 5 potential long-term corrective actions that addressed the causal factors. Corrective actions included full valve inspections, increased scope of testing, increased testing and test

environmental controls, and verification of internal specifications and tolerances. The licensee completed their short-term corrective actions, which included modifications to the valves as required, and verified that the valves lifted at the proper setpoints.

The licensee evaluated the as-found MSSV lift setpoints with respect to the most limiting overpressurization event, a loss of condenser vacuum, and determined that the MSSVs would have performed their safety functions during the previous operating cycle. However, the licensee determined that, for some undetermined period during the previous operating cycle, the MSSVs lift setpoints did not satisfy the requirements of TS 3.7.1.1. This issue remains unresolved pending further inspection of the licensee's past operability determination, root cause evaluation, corrective actions for the test failures described in this report, and corrective actions taken as a result of MSSV test failures identified at the beginning of Refueling Outage 2R11 (URI 50-368/9703-02).

The licensee briefed the Office of Nuclear Reactor Regulation and Region IV on their findings and corrective actions during a conference call conducted on June 4. Based on the information provided by the licensee, the inspectors determined that the licensee's short-term actions were appropriate to address the MSSV issues.

c. Conclusions

Testing of the Unit 2 MSSVs was performed well. The prejob was thorough with strong emphasis on lessons learned from previous errors. Effective controls were established to minimize the potential for personnel experiencing heat stroke during the performance of the testing. The inspectors noted strong management involvement in the testing of the MSSVs.

As a result of 8 of the 10 MSSVs lifting above their TS allowed lift setpoint, the licensee determined that the requirements of TSs were not met for some period during the previous operating cycle. This issue remains unresolved pending further inspection of licensee's post operability determination, root cause evaluation, corrective actions for the test failures, and corrective actions taken as a result of MSSV test failures identified at the beginning of Refueling Outage 2R11.

III. Engineering

E1 Conduct of Engineering

E1.1 Unit 1 - Makeup Tank Level Transmitter Reference Legs

a. Inspection Scope (92903)

On May 3, 1997, Oconee Unit 3 sustained damage to two HPI pumps as a result of a loss-of-pump suction from the letdown storage tank. A leaking instrument fitting

in a shared reference leg resulted in an erroneous level indication. During this inspection period, the inspectors reviewed the applicability of this event to ANO Unit 1.

b. Observations and Findings

The inspectors interviewed the cognizant system engineer and reviewed instrumentation isometrics and found differences between the configuration of ANO Unit 1 and Oconee Unit 3. The units are similar in that they have two level taps into the tank, but Unit 1 has two reference legs, one for each instrument. Therefore, draining one reference leg should not affect the other reference leg. The licensee also assures that the reference legs are full by refilling them quarterly.

The licensee also operates the suction to the HPI pumps differently than Oconee, in that the suction sources are split between the makeup tank and the borated water storage tank.

c. Conclusions

The potential for a leak in the makeup tank level instrumentation reference leg to cause an erroneous indication on both level transmitters and lead to a damage of HPI pumps, an event which occurred at another plant, was very unlikely, based on design and operational differences between the plants.

E1.2 Unit 1 - TS Error Associated with Operation of One Channel of Refueling Water Tank (RWT) Level in the Tripped Condition

a. Inspection Scope (37551)

On May 12, the licensee discovered a configuration allowed by TSs which would place the plant outside of its design basis. Specifically, the licensee discovered that TS 3.3.2.1 allows operation with one channel of RAS, associated with RWT level, in a tripped condition for an indefinite period. With one channel of RAS in a tripped condition, a single failure of another RWT level instrument would result in an inadvertent initiation of RAS (RAS initiation occurs when two of the four RWT level transmitters reaches the low level setpoint). If this occurred during a loss-of-coolant accident, suction for the emergency core cooling systems pumps could transfer prematurely from the RWT to the containment building sump and result in inadequate flow to the reactor or damage to the pumps. The licensee reported the condition to the NRC in accordance with 10 CFR 50.72. The inspectors reviewed the licensee's findings and corrective actions.

b. Observations and Findings

The inspectors found that the TS error was identified by a design engineer during a review of plant modifications to address a previously identified discrepancy

associated with the indefinite bypass of plant protection system channels. Condition Report 2-97-0168 was initiated to document the finding and identify corrective actions. The engineer demonstrated a good questioning attitude in identifying this condition.

In response to the finding, the operations department issued night orders to administratively prohibit placing an RAS channel in a tripped condition. A failed channel in a tripped condition would have to be bypassed within 1 hour. The licensee also began work to amend the TSs to delete the allowance to continuously operate with a channel of RAS in the tripped condition.

The inspectors attended a corrective action review board during which additional actions were initiated. Steps were taken to inform other plants of this condition, night orders were to be amended to prohibit placing all ESF actuation system channels in a tripped condition pending further review of these functions, and operations was tasked to develop intermediate administrative controls pending issuance of the TS revision. The inspectors also found that ABB-CE issued a bulletin to plants with an ABB-CE designed nuclear steam system supplier to inform them of the ANO finding.

c. Conclusions

A design engineer demonstrated a good questioning attitude in identifying a TS, which would allow operators to place a RAS channel in a tripped condition for an indefinite period, rendering the function vulnerable to a single failure and placing the plant outside of its design basis. The licensee took appropriate short-term corrective actions to address this issue.

E1.3 Unit 2 - Placement of a Fuel Assembly in an SFP Location Prohibited by TS

a. Inspection Scope (92903)

On May 18, 1997, the licensee commenced moving fuel from the reactor to the SFP at 3:43 p.m. At 8:12 p.m., fuel movement was stopped due to the discovery of an error in a calculation used to determine fuel bundle burnup and classify fuel assemblies for proper placement in the SFP. The licensee determined that a calculation error resulted in the misclassification of fuel assemblies being moved from the reactor to the SFP. It was determined that the first of seven assemblies transferred to the SFP from the reactor was located in a position not authorized by TS 3.9.12.B. The inspectors reviewed the event to determine the safety significance, the cause, and the requirements associated with the misplaced fuel assembly.

b. Observations and Findings

TS 3.9.12 specifies the requirements and restrictions for the placement and configuration of fuel assemblies in the SFP. The limits provided in TS 3.9.12 ensure that SFP will remain in a subcritical array with $k_{eff} \leq 0.95$ in unborated water. The placement of fuel assemblies in the SFP is a function of the fuel enrichment and the fuel assembly average burnup. Fuel assemblies are classified as Restricted A, B, C, or Nonrestricted depending on their enrichment and burnup. Procedure 1022.012, Revision 18, "Storage, Control & Accountability of Special Nuclear Material," provides instructions for calculating enrichment and burnup and classifying fuel assemblies. The classification for each assembly is documented on Form 1022.012U, "Unit 2 Nuclear Fuel Location Record." The information from Form 1022.012U is used to complete Form 1022.012B, "Nuclear Fuel Transfer Report," which documents the location that each fuel assembly is to be placed in the SFP. The procedure requires that the information on these forms be independently verified.

On May 18, during movement of fuel from the reactor vessel to the SFP, a reactor engineer discovered that an error had been made in the classification of a fuel assembly. It was determined that a correction factor was not applied to the fuel burnup calculation as required by Procedure 1022.012, which resulted in a nonconservative burnup calculation and a misclassification of some fuel assemblies. As a result, the first fuel assembly moved into the SFP was misclassified and placed in a location which was prohibited by TS. The licensee suspended moving fuel, recalculated the fuel burnup for the fuel assemblies to determine the proper storage location in the SFP, placed the first fuel assembly in an acceptable location, and resumed offloading the core on May 19. The licensee determined that the calculation error resulted in 42 of the 177 fuel assemblies being misclassified. This would have resulted in the placement of 14 fuel assemblies in SFP locations prohibited by TS. Subsequent evaluation by the licensee revealed that the SFP would have remained in a subcritical array had the 14 fuel assemblies been placed in the wrong locations.

The inspectors identified several examples in which the requirements of Procedure 1022.012 were not followed, resulting in the initial calculation error and missed opportunities to identify and correct the original error.

Procedure 1022.012, Step 6.3.1, requires, prior to the movement of fuel to the SFP, that two qualified individuals perform independent reviews to determine the classification of the fuel assemblies using Attachment 5 of the procedure and documenting the results on Form 1022.012U, "Unit 2 Nuclear Fuel Location Record." Procedure 1022.012, Attachment 5, Step 2.0, used to calculate the fuel assembly average burnup, requires that an adjustment factor of 0.93 be applied to the measured fuel assembly burnup to account for measurement uncertainties. The inspectors identified that an engineer performing the initial classification of the fuel assemblies failed to apply the burnup adjustment factor when calculating fuel

assembly burnup, resulting in the wrong classification of 42 of 177 fuel assemblies. In addition, the engineer failed to document the results of the classifications on Form 1022.012U. This is the first example of a violation of TS 6.8.1 (50-368/9703-04).

The inspectors found that an independent review of the classification of the fuel assemblies was not performed prior to the movement of the fuel assemblies into the SFP as required by Procedure 1022.012, Step 6.3.1. This is the second example of a violation of TS 6.8.1 (50-368/9703-04). As a result of communications problems, incomplete understanding of the importance of completing the independent verification of Form 1022.012U prior to fuel movement, and the time required to complete independent verification, the independent verification on the first bundle already moved into the SFP was not completed until over 3 hours after the commencement of fuel movements. Upon discovery that the first bundle was in error, fuel movements were halted until corrections in the process were completed.

Another opportunity to identify the misclassification of the fuel assemblies occurred when a reactor engineering supervisor discovered that the independent review signature on Form 1022.012Us was not completed. When he noted that the forms were not signed after fuel movements were authorized, he made an assumption that the error was due to paperwork/administrative delays, not an actual failure to complete the task, and failed to question the reason for the incomplete forms. A more thorough investigation of the unsigned forms could have resulted in the identification of the classification error.

Procedure 1022.012, Step 6.3.4, requires that Form 1022.012B, "Nuclear Fuel Transfer Report," be independently reviewed by a qualified individual to verify special nuclear material storage in locations in compliance with Steps 6.3.1, 6.3.2, and 6.3.3. Form 1022.012B is used to document where each fuel assembly removed from the core is to be placed in the SFP. Information for each fuel assembly contained on Form 1022.012U is needed to complete the nuclear fuel transfer report. The inspectors found that the independent reviewer failed to verify compliance with Steps 6.3.1 and 6.3.2 in that completed Form 1022.012Us did not exist at the time this step was completed. This is the third example of a violation of TS 6.8.1 (50-368/9703-04).

c. Conclusions

Reactor engineers failed to utilize a procedure for determining the proper placement of fuel assemblies in the SFP, resulting in the misclassification of 42 fuel assemblies and the placement of one in a location prohibited by the TS. Multiple barriers, such as clear procedures and requirements for the conduct of independent review of fuel assembly classification determinations, failed to prevent or identify the calculation errors.

E1.4 Unit 2 - EDG Heat Exchanger Performance Testing

a. Inspection Scope (37551)

The Unit 2 EDGs are cooled by SW flow through external heat exchangers. To verify that these heat exchangers can remove the heat after a design basis accident, the licensee conducts performance testing and extrapolates test results to design basis conditions. The inspector observed portions of the performance testing and reviewed the test results.

b. Observations and Findings

The licensee conducts EDG heat exchanger performance testing using guidelines contained in Procedure 2311.008, "EDG Heat Exchanger Performance Tests." The licensee does this test to meet Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment," commitments and to verify that heat exchangers can remove design basis heat loads. Each EDG has three heat exchangers in series to remove heat generated by the engine. Each heat exchanger has a minimum required capacity that the licensee evaluates from extrapolated test results. The licensee tested and verified that the EDG A heat exchangers met heat performance requirements. The licensee found that EDG B Heat Exchanger 2E63B did not meet projected worst case requirements by approximately 1 percent of the total heat load. The licensee has not experienced the worst case SW temperatures that would affect heat exchanger performance. The licensed cleaned the heat exchangers and reran the test to verify heat exchanger performance.

The inspectors observed placement of the temperature elements and reviewed the data following the test. Subsequent testing by the licensee verified that the as-left results met the performance requirements. The licensee uses computer calculations to verify that the heat exchangers can remove the heat capacity as calculated by Engineering Calculation 91-D-2003-01, Revision 2. The inspector reviewed the results and concluded that the heat exchangers could remove the required heat loads.

c. Conclusions

Performance tests conducted on the EDG SW heat exchangers revealed that the heat exchangers could remove the required heat from the emergency diesel generators.

IV. Plant Support

R1 Radiological Protection and Chemistry Controls

R1.1 General Comments (71750)

During routine tours of the plant and observations of plant activities, the inspectors found that access doors to locked high radiation areas were properly locked, areas were properly posted, and personnel demonstrated proper radiological work practices. The following observations were made during tours of the plant.

- The inspectors observed radiation protection technicians verbally questioning radiation workers entering a controlled access area to determine their awareness of their responsibilities. The process was designed to heighten radiation awareness and determine if deficiencies existed. The inspectors reviewed records associated with the interviews and concluded that the technicians questioned a wide variety of personnel with questions that resulted in an increased awareness of the requirements for working within a radiation environment. Additionally, radiation workers missed a minimal number of questions, with no specific deficiencies noted in radiation worker knowledge.

- The inspectors observed the radiation protection technicians monitor personnel entering and inside the controlled access area. Technicians were aggressive with questioning personnel about their radiation work practices. One example was observed when the technicians questioned a worker who appeared to be chewing. The inspectors concluded that radiation protection technicians demonstrated a strong questioning attitude and good attention to detail while observing personnel entering and inside the controlled access area.

- The inspectors observed workers who were supporting the performance of tasks inside containment. Personnel were conscientious of local dose rates and stood in low dose areas when appropriate.

- The inspectors noted that both radiation protection personnel and their management were acutely aware of active and emergent maintenance inside controlled access.

R1.2 Conclusions

Very good radiation protection work practices were observed during the Unit 2 refueling outage. Radiation protection technicians displayed a strong questioning attitude and a good awareness of plant activities.

F2 Status of Fire Protection Facilities and Equipment

F2.1 Unit 2 - RCP Lube Oil Collection System

a. Inspection Scope (71750)

During tours of containment to plant startup, the inspectors walked down portions of the RCP lube oil collection system to verify that the collection system met the requirements of 10 CFR Part 50, Appendix R.

b. Observations and Findings

The inspectors walked down portions of the RCP lube oil system and found that the oil collection system was properly installed and adequately supported. The inspectors also verified that the lube oil collection system for the RCP D motor, which was replaced during the outage, was properly installed with shrouds covering the high pressure portions of the system lift oil system. The inspectors verified that both lube oil drain tanks were empty.

c. Conclusions

The inspectors walked down portions of the RCP lube oil collection system and found that the installation met regulatory requirements.

F4 Fire Protection Staff Knowledge and Performance

F4.1 Fire Watch Knowledge and Performance

a. Inspection Scope (71750)

Due to the magnitude of work occurring during the outage and the large number of fire watches assigned to perform fire inspections and tours, the inspectors interviewed personnel assigned as fire watches to determine if the individuals were cognizant of their assigned responsibilities.

b. Observations and Findings

The inspectors questioned fire watches with respect to their assigned duties and responsibilities and found them to be knowledgeable of their assigned areas of responsibilities. Additionally, fire watches demonstrated a strong concern for the safety of personnel.

c. Conclusions

Fire watches were well qualified and knowledgeable of their duties and responsibilities.

ATTACHMENT

PARTIAL LIST OF PERSONS CONTACTED

Licensee

C. Anderson, Plant Manager, Unit 2
B. Bement, Radiation Protection and Chemistry Manager
M. Cooper, Licensing
D. Denton, Director, Support
P. Dietrich, Maintenance Manager, Unit 1
C. Eubanks, Mechanical Superintendent, Unit 2
D. Fowler, Supervisor, Quality
R. Fuller, Operations Manager, Unit 1
M. Harris, Technical Assistant
B. James, Outage Manager, Unit 2
R. Lane, Director, Design Engineering
J. McWilliams, Modifications Manager
D. Mims, Director, Licensing
T. Mitchell, Manager, Unit 2 System Engineering
T. Russell, Operations Manager, Unit 2
A. South, Licensing
H. Williams, Jr., Superintendent, Plant Security
C. Zimmerman, Plant Manager, Unit 1

INSPECTION PROCEDURES USED

IP 37551: Onsite Engineering
IP 61726: Surveillance Observations
IP 62707: Maintenance Observations
IP 71707: Plant Operations
IP 71750: Plant Support Activities
IP 92700: Onsite Followup of Written Reports of Nonroutine Events at Power Reactor Facilities
IP 92903: Followup - Engineering

ITEMS OPENED AND CLOSED

Opened

50-368/9703-01	VIO	Inoperability of One Train of EFW (Section 08.1)
50-368/9703-02	URI	Failure of MSSV Lift Tests (Section M1).
50-368/9703-03	IFI	EDG Oil Pump Failure (Section M1.5)
50-368/9703-04	VIO	Placement of a Fuel Assembly in a SFP Location Prohibited by TS (Section E1.3).

Closed

50-368/97-002	LER	Inadequate Configuration Control Resulted in Closed Pressure Switch Isolation Valves that Could Have Prevented One Train of EFW from Automatically Switching the Pump Suction to SW and Caused Operation Prohibited by TSs (Section 08.1)

LIST OF ACRONYMS USED

ACI	automatic closure interlock
CST	condensate storage tank
ECP	emergency cooling pond
EDG	emergency diesel generator
EFW	emergency feedwater
ESF	engineered safety feature
HPI	high pressure injection
JO	job order
LER	licensee event report
MSSV	main steam safety valve
RAS	recirculation actuation signal
RCP	reactor coolant pump
RCS	reactor coolant system
RWT	refueling water tank
SFP	spent fuel pump
SW	service water
TS	Technical Specification
UGS	upper guide structure