APPENDIX

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Inspection Report: 50-313/90-25
50-368/90-25

Licenses: DPR-51
NPF-6

Dockets: 50-313
50-368

Licensee: Entergy Operations, Inc.
P.O. Box 551
Little Rock, Arkansas 72203

Facility Name: Arkansas Nuclear One (ANO), Units 1 and 2

Inspection At: ANO Site, Russellville, Arkansas

Inspection Conducted: July 16 through September 4, 1990

Inspectors: C. C. Warren, Senior Resident Inspector
Project Section A, Division of Reactor Projects

L. J. Smith, Resident Inspector
Project Section A, Division of Reactor Projects

P. H. Harrell, Project Engineer
Project Section A, Division of Reactor Projects

Approved: for Thomas F. Westerman 9/22/90
T. F. Westerman, Chief, Project Section A Date
Division of Reactor Projects

Inspection Summary

Inspection Conducted July 16 through September 4, 1990 (Report 50-313/90-25; 50-368/90-25)

Areas Inspected: Followup of events, operational safety verification, surveillance, maintenance, design changes, licensee event reports, open items, and inspection findings.

Results:

- Performance observed during the inspection period was acceptable with no deviations or violations.
- Initially, the licensee's end use group incorrectly identified a replacement solenoid coil which was not physically similar to the failed coil. The licensee was eventually able to locate a qualified solenoid valve in the warehouse which contained an identical coil.

The issuance of incorrect material to the field for installation has previously been identified as a problem at ANO. The licensee's program to upgrade the materials program should be a long-term solution to this issue.

- The Technical Specification (TS) governing control element assembly failures does not appear to adequately address multiple control element assembly failures for reasons other than excessive friction, mechanical interference, or being untrippable (e.g., electrical failures). (See Section 3.2)

- Performance by Unit 2 personnel during repair of the pressurizer code safeties was very good. Despite having to maneuver the facility through two cooldown/heatup cycles, and remove and replace the safeties twice, no personnel or equipment performance issues occurred.

DETAILS

1. PERSONS CONTACTED

N. Carns, Vice President, Nuclear Operations
J. Yelverton, Director, Nuclear Operations
D. Boyd, Nuclear Safety and Licensing Specialist
M. Chisum, Unit 2 Assistant Operations Manager
K. Coates, Unit 2 Maintenance Manager
A. Cox, Unit 1 System Engineering Superintendent
M. Durst, Modification Engineering Superintendent
R. Eddington, Unit 2 Operations Manager
E. Ewing, General Manager, Technical Support and Assessment
*R. Fenech, Unit 2 Plant Manager
J. Fisicaro, Licensing Manager
*L. Humphrey, General Manager, Nuclear Quality
*J. Jacks, Nuclear Safety and Licensing Specialist
*R. King, Plant Licensing Supervisor
J. Kowalewski, Mechanical Engineer
G. Jones, General Manager, Engineering
D. Mims, Unit 2 System Engineering Superintendent
J. Mueller, Unit 1 Maintenance Manager
J. Vandergrift, Unit 1 Plant Manager
C. Zimmerman, Unit 1 Operations Manager
D. Irving, Unit 1 Assistant Operations Manager
B. Michulk, Mechanical Engineer
E. Bickel, Manager, Radiation Protection and Radioactive Waste
A. Jacobs, Supervisor, Surveillance Testing
R. Sessoms, Plant Manager, Central

*Present at exit interview.

The inspectors also contacted other plant personnel, including operators, engineers, technicians, and administrative personnel.

2. PLANT STATUS (UNITS 1 and 2)

Unit 1 operated at 80 percent power throughout this inspection period, with the exception of two short power reductions to perform turbine throttle valve and governor valve testing.

Unit 2 was shut down and placed in cold shutdown condition on July 13, 1990, for repair of leakage from the pressurizer code safety relief valves. Unit 2 returned to full power on July 25, 1990, and completed a 28-day run at 100 percent power. On August 21, 1990, the unit tripped because the B Main Steam Isolation Valve closed due to a failed ASCO solenoid valve. The unit restarted August 22, 1990.

3. FOLLOWUP OF EVENTS (UNITS 1 and 2) (93702, 62703, 71707)

3.1 Unit 2 ASCO Solenoid Valve Failure/Main Steam Isolation Valve (MSIV) Closure/Unit Trip

Unit 2 tripped from 100 percent power when the B MSIV shut following a solenoid failure. The control room operator noted the B MSIV going closed and attempted to manually trip the unit; however, the unit tripped automatically on an anticipatory high Tcold signal prior to the receipt of the manual trip. The plant responded to the trip as designed.

The licensee noted an increase in steam generator activity following the transient. The licensee aggressively implemented contamination controls, roping off the turbine building sump and initiating expanded sampling requirements. Leak rate calculations were performed based on measured activity levels and the actual primary-to-secondary leakage was determined to be very small (approximately 0.01 gpm).

Initially, the licensee's end use group incorrectly identified a replacement solenoid coil which was not physically similar to the failed coil. The error was detected prior to installation. Because of the long lead time for procuring this coil, the licensee asked ASCO to provide for them a list of previously supplied valves that contained the identical coil. The licensee was able to locate a qualified solenoid valve in the warehouse which contained an identical coil. The licensee repaired the solenoid valve and the unit was returned to service on August 22, 1990. The licensee has written a condition report (CR) to document the issuance of the wrong parts to the field.

3.2 Unit 2 Control Element Drive Mechanism Control System (CEDMCS) Electrical Failure

On August 22, 1990, Unit 2 went critical. During rod withdrawal, an electrical failure of the CEDMCS occurred which made Control Element Assembly (CEA) 1 and CEA 46 immovable in the "Manual Individual" position. Both assemblies are in Group 6. CEAs 1 and 46 also did not respond to "Manual Group" signals to Group 6. During troubleshooting, operations regained control of the CEAs. The group deviation (5 inches) was corrected, power ascension was resumed, and the generator tied on at 10:31 a.m. (CDT) on August 22, 1990. The cause of the failure was not determined at that time.

The inspectors observed control room manipulations associated with the CEDMCS failure. Two weaknesses were identified. One has been corrected.

- The TS governing electrical CEA failures needs to be clarified to address multiple CEA failures for reasons other than excessive friction, mechanical interference, or being untrippable.

- The licensee's Abnormal Operating Procedure 2203.03, Step 3.5 was revised to consistently implement the licensee's view of CEA operability.

The licensee did not consistently interpret TS 3.1.3.1.c. If CEA motion is considered to be a safety function of the CEAs, entry into TS 3.0.3 was required when two CEAs became electrically immovable. The licensee's Abnormal Operating Procedure 2203.03, Step 3.5, was consistent with this interpretation.

The CEAs had been tested within the required surveillance frequency. Based on the view that the only safety function for a CEA is its ability to trip, the licensee concluded that the CEAs were operable. They did not enter TS Actions 3.1.3.1.c or 3.0.3.

The licensee was able to correct the equipment failure before the period of TS 3.0.3 elapsed. The licensee has also clarified their abnormal operating instruction consistent with their interpretation that the trippable CEAs are operable if they have been tested within the required surveillance frequency. Region IV has requested a technical specification clarification from the Office of Nuclear Reactor Regulation. Further actions by Region IV and/or the licensee will be pending the NRR clarification position. This is an open item (368/9025-01).

The inspectors observed maintenance troubleshooting activities associated with the CEDMCS failure. One weakness was identified. The licensee did not log troubleshooting activities as they were being conducted. A log of this type would be useful in making the final determination of the cause of failures. Failures on this equipment are repetitive and the cause is not always determined.

3.3 Unit 2 Shutdown to Repair the Pressurizer Code Safety Valve Seat Leakage

On July 13, 1990, the licensee shut down the unit to repair Pressurizer Code Safety Valves 2PSV-4633 and -4634. Seat leakage through the valves had slowly increased to 1 gpm since startup from Refueling Outage 2R7. Although the leak rate was well within TS limits, the leakage into the quench tank and the resultant need to drain and fill the quench tank had become an unacceptable burden on the unit operators.

Unit 2 has had a history of pressurizer code safety seat leakage and the licensee had installed a vendor-recommended, modified seat design during Refueling Outage 2R7. Previous vendor experience with the new seat design had been positive; however, the leakage began to appear soon after the unit was restarted and slowly increased until the decision to shut down was reached.

The outage to replace both safeties was originally scheduled for 5 days and was well planned and coordinated between all effected groups. The original schedule would have been met; however, the licensee identified that the parts that had been supplied to modify the seats, called nozzle assemblies, were not compatible with the Combustion Engineering pressurizer flange. The vendor reviewed their records for the manufacture and delivery of the nozzles and found that they had been manufactured to fit a Westinghouse pressurizer, which has two land rings on the nozzle flange face instead of one. This manufacturing error was not due to improper purchase specifications but occurred during the vendor's engineering and manufacturing processes.

The nozzles had been supplied to the licensee prior to Refueling Outage 2R7 and had been installed in the safeties during the rebuilding process. Although the nozzles were dimensionally the same as the correct nozzles, the additional land caused a metal-to-metal joint between the safety and pressurizer flanges. The metal-to-metal joint prevented the outer land ring from properly compressing the flexitalic gasket material and caused added tensile stresses on the valve and pressurizer nozzle flanges. Despite the lack of gasket compression and metal-to-metal joint, the facility operated with the valves in this configuration for 7 months with no joint leakage.

Recognition that the wrong nozzles were installed in the safeties did not occur until after repairs had been completed and the plant returned to normal operating temperature and pressure. At that point, licensee management decided to cool down the unit and modify the nozzles. The valve vendor and pressurizer vendor performed stress analysis on the flanges to evaluate the effect of the additional loading caused by the nonstandard nozzles and determined that code allowable values had not been exceeded. The valve nozzles were machined to match the Combustion Engineering configurations, reinstalled, and satisfactorily tested.

The licensee conducted an indepth evaluation of the sequence of events which resulted in the installation of the wrong parts on the pressurizer. The licensee's root cause evaluation determined that the primary contributor to the problem was the failure of the valve manufacturer's quality assurance program to identify the deficiency prior to shipment of the parts. Although the licensee's evaluation did not identify any failings in its own procurement or inspection processes that could have contributed to this event, the evaluation did reveal that opportunities to identify the discrepancy did exist prior to the installation of the valves during Refueling Outage 2R7 and during the repair of the valves. The licensee is currently reviewing ways to enhance the procurement process to attempt to prevent any future occurrences of this type.

The inspector closely followed the licensee's actions in all facets of the repair activities. The licensee's initial schedule to remove, repair, and replace the valves was aggressive and would have been successfully implemented had it not been for the improper parts. Review of the licensee's root cause analysis found it to be comprehensive and thorough.

The inspector had no further questions regarding this issue.

3.4 Control Room Block Wall Not Seismically Qualified

On July 26, 1990, licensee personnel conducting fire barrier penetration surveillances identified a section of block wall (6 feet 8 inches wide by 7 feet 6 inches high) within the south control room wall of Unit 1 that did not have grout surrounding the electrical conduit passing through it. Review of the licensee's seismic calculations for the wall and the design drawing indicated that the wall was seismically qualified if the blocks were filled with grout. Because some grout was missing from the top of the wall, the licensee decided to drill test holes in the wall to determine the status of the

wall interior. The test drilling identified that the top four blocks had not been grouted and that no horizontal or vertical reinforcing steel had been installed.

The licensee declared the wall inoperable and, because vital 120-Vac Panel RS-1 is partially mounted on the block section of the wall, the licensee declared the Train A engineered safeguards (ES) and emergency feedwater (EFW) system inoperable. Train A ES and EFW actuation systems receive their vital power from Panel RS-1 and, therefore, could not have been considered operable after a seismic event. Because of ES equipment inoperability, the licensee entered TS Action Statement 3.3.5 which required the plant to be in hot shutdown within 24 hours. The licensee requested and received a waiver of compliance from TS 3.3.6 to allow time to grout and add structural steel to the section of the inoperable wall. The licensee satisfactorily completed modifications to the wall and returned all equipment to service within the time allowed by the waiver of compliance.

The inspector closely followed all licensee activities related to this event. The seismic calculations that support the operability of the wall after the completion of the modifications are currently being reviewed. The inspector found that the licensee's actions in rapidly following up the original finding were thorough and that the correction of the deficiency was timely and comprehensive.

4. OPERATIONAL SAFETY VERIFICATION (UNITS 1 and 2) (71707)

The inspectors routinely toured the facility during normal and backshift hours to assess general plant and equipment conditions, housekeeping, and adherence to fire protection, security, and radiological control measures. Ongoing work activities were monitored to verify that they were being conducted in accordance with approved administrative technical procedures and that proper communications with the control room staff had been established. The inspector observed valve, instrument, and electrical equipment lineups in the field to ensure that they were consistent with system operability requirements and operating procedures.

During tours of the control room, the inspectors verified proper staffing, access control, and operator attentiveness. Adherence to procedures and limiting conditions for operation were evaluated. The inspectors examined equipment lineup and operability, instrument traces, and status of the control room annunciator. Various control room logs and other available licensee documentation were reviewed.

No violations or deviations were identified.

5. MONTHLY SURVEILLANCE OBSERVATION (UNITS 1 and 2) (61726)

The inspectors observed the TS-required surveillance testing on the various components listed below and verified that testing was performed in accordance with adequate procedures, test instrumentation was calibrated, limiting conditions for operation were met, removal and restoration of the affected

components were accomplished, test results conformed with TS and procedure requirements, test results were reviewed by personnel other than the individual directing the test, and any deficiencies identified during the testing were properly reviewed and resolved by appropriate management personnel.

The inspectors witnessed portions of the following test activities:

- "Unit 1 Nuclear Instrumentation Calibration," Procedure 1304.32, JO 818565
- "Unit 1 Monthly Reactor Protection System "C" Surveillance Test," Procedure 1304.39, JO 818569
- "Unit 1 EFIC Channel "C" Monthly Surveillance Test," Procedure 1304.147, JO 818571
- "Unit 2 Emergency Feedwater Pump 2P-7B Monthly Test," Procedure 2106.06, JO 819484
- "Unit 2 Quarterly Containment Isolation Valve Stroke Test," Procedure 2305.05, Supplement 1, JO 819485

No violations or deviations were identified.

6. MONTHLY MAINTENANCE OBSERVATION (UNITS 1 and 2) (62703)

Station maintenance activities for the safety-related systems and components listed below were observed to ascertain that they were conducted in accordance with approved procedures, regulatory guides, and industry codes or standards, and in conformance with the TS.

The following items were considered during this review: the limiting conditions for operation were met while components or systems were removed from service, approvals were obtained prior to initiating the work, activities were accomplished using approved procedures and were inspected as applicable, functional testing and/or calibrations were performed prior to returning components or systems to service, quality control records were maintained, activities were accomplished by qualified personnel, parts and materials used were properly certified, and radiological and fire prevention controls were implemented.

Work requests were reviewed to determine the status of outstanding jobs and to ensure that priority was assigned to safety-related equipment maintenance which may affect system performance.

The following maintenance activities were observed:

- Unit 1 Containment Spray Pump (P-35A), Cooler cleaning and inspection, JO 817697
- Unit 1 Containment Spray Pump (P-35A), Flushing of inner and outer bearing housings and oil replacement, JO 818562

- Unit 1 Service Water Pump Rebuild, JO 817969
- Unit 1 Repair of Control Room Block Wall, LCP-90-5040
- Unit 2 Repair and Replacement of Pressurizer Code Safety Valves, 2PSV-4633 and 2PSV-4634
- Unit 2 Replacement of ASCO solenoid on the B MSIV

No violations or deviations were identified.

7. FOLLOWUP OF LICENSEE ACTION ON LICENSEE EVENT REPORTS (LERs) (UNITS 1 and 2) (92700)

The inspectors reviewed LERs to verify that reporting requirements had been met, causes had been identified, and corrective actions were completed.

7.1 (Closed) LER 50-313/89-008: Inoperable Reactor Coolant System Leak Detection Radiation Monitors

Manual Valve GCH-29, located in the bypass line around gaseous Radiation Monitor RE-2400 and air particulate Radiation Monitor RE-7455, was incorrectly designated by the radiochemistry system sampling procedure and the auxiliary system operating procedure to be normally open. The licensee determined that the ability of the monitors to perform their required function could not be ensured with the bypass valve open.

The procedures were consistent with the plant design drawing which was incorrect. The valve was installed in 1975. During a valve lineup performed on December 16, 1986, the licensee's operations personnel determined that the valve should be placed in a closed position. They left the valve in the closed position and documented it on an exception form, but no procedure revision was initiated. During the next sample, the valve was probably returned to the open position.

Licensee analysis concluded that one of the three methods for reactor coolant leakage detection (radiation monitoring of the reactor building atmosphere) was unknowingly inoperable for a significant length of time and, therefore, the condition was a safety concern. However, since an actual condition did not exist which required reliance on the radiation monitors, the licensee concluded that the actual safety significance of this event was minimal.

The licensee revised the applicable procedures and the applicable design drawing. The licensee has also revised its program for evaluating design changes, ensuring procedure revisions, and identifying testing requirements since the initial installation in 1975. This LER is closed.

7.2 (Closed) LER 50-368/89-017: Inoperable Logarithmic Power Level Nuclear Instrumentation Channels

Less than the required number of logarithmic power level channels were operable October 3-5, 1989, without performing the required shutdown margin calculations

within 1 hour of removing the third channel from service. The shift supervisor and the control room senior reactor operator permitted maintenance personnel to remove the channels from service. Operations personnel logged that the required channel checks could not be performed but did not apply the appropriate TS. The maintenance personnel did not follow their approved work instructions, which required bypassing each channel prior to removing it from service for cable connector replacement. The system is physically designed to prevent bypassing more than one channel at a time.

Shutdown margin calculations were performed once per 12 hours during this period with no noted changes. Two alternate methods of monitoring reactivity (boron dilution monitors and startup nuclear instrumentation) were in service.

The licensee has provided training to operations personnel and maintenance personnel on this LER. This LER is closed.

7.3 (Closed) LER 50-313/89-021: Inadvertent Main Steam Isolation Valve (MSIV) Closure During Troubleshooting

This LER reported an event where the A MSIV was inadvertently closed during troubleshooting activities by instrumentation and control (I&C) technicians. Troubleshooting was being performed to determine the cause of spurious actuations in the EFW initiation and control (EFIC) system.

At the time of the event, the plant was in cold shutdown; therefore, the event did not impact plant safety.

In review of this event, the licensee determined that the inadvertent actuation of the MSIV was due to two defective receiver/transmitter modules in the EFIC system. The modules were replaced and satisfactorily tested. The unit returned to power operations without further problems with the replaced modules. This LER is closed.

7.4 (Closed) LER 50-313/89-027: Failure to Test Redundant Injection Valve (CV-1401)

Train B Injection Valve CV-1400 was removed from service for maintenance and the redundant Train A injection valve (CV-1401) was not tested to verify operability in accordance with the requirements of TS 3.3.5. The failure to test redundant Valve CV-1401 was attributed by the licensee to be an oversight by the shift operations supervisor.

To address this issue, the licensee issued a memorandum, dated September 19, 1989, to all Unit 1 licensed operators to stress the requirement for testing redundant equipment and components when safety-related equipment is removed from service.

It appears that this action has satisfactorily resolved this issue since additional problems in this area have not recurred. This LER is closed.

8. FOLLOW UP OF LICENSEE ACTION ON PREVIOUSLY IDENTIFIED OPEN ITEMS (92701)

8.1 (Closed) Unresolved Item 313/8720-03; 368/8720-03: Review of Licensee's Corrective Action Program

This item involved licensee audit reports that identified weaknesses in the licensee's corrective action program. This item was left unresolved pending a review of the licensee's corrective action program. A comprehensive and indepth review of the licensee's corrective action program was performed in July 1990. The results, documented in NRC Inspection Report 50-313/90-21; 50-368/90-21, indicated that the licensee was implementing a satisfactory program.

Based on the performance of this inspection, this item is considered closed.

8.2 (Closed) Inspector Followup Item 313/8836-02; 368/8836-02: Review of Licensee's Implementation of the Root Cause Analysis Program

This item involved past problems with the licensee's ability to determine and correct the causes of system/equipment problems and failures. This item was designated as an inspector followup item to allow licensee time to fully implement its condition reporting system.

A comprehensive and indepth review of the licensee's corrective action program was performed in July 1990. The results, documented in NRC Inspection Report 50-313/90-21; 50-368/90-21, indicated that the licensee was implementing a satisfactory program.

Based on the performance of this inspection, this item is considered closed.

8.3 (Closed) Unresolved Item 368/8727-01: Missing Screws in the Plant Protection System (PPS) Cabinet Doors

This item involved the failure of maintenance technicians to replace 12 of 14 screws in a cabinet door for the PPS. Due to the missing screws, the seismic qualification of the cabinet was questionable.

To document the details of this issue, the licensee issued LER 368/87-010 on June 1, 1989. In this LER, the licensee provided the root cause of the problem and the corrective actions taken to prevent recurrence of the problem.

As documented in NRC Inspection Report 50-313/90-02; 50-368/90-02, a review of the licensee's actions was performed to verify appropriate implementation. During the review, no problems were noted.

Based on the reviews performed on this issue, this item is considered closed.

8.4 (Closed) Inspector Followup Item 313/8935-01; 368/8935-01: Control of Lifted Leads

This item involved a lack of independent verification when lifted leads were replaced during performance of maintenance activities. In addition, the

licensee stated that verification of the lead(s) to be lifted would be made using the applicable wiring diagram.

To address this issue, the licensee revised Procedure 1025.003, "Conduct of Maintenance," to require that an independent verification be performed after a lifted lead has been reinstalled. In addition, requirements also state that a drawing be used to verify that the lead intended to be lifted is the proper one.

A side issue related to this item was a commitment made by the licensee to change the "shoulds" in Procedure 1025.003 to "shalls" to provide the appropriate emphasis on the need to properly complete the instructions. The licensee completed this effort.

Based on the actions taken by the licensee, this item is considered closed.

9. EXIT INTERVIEW

The inspectors met with members of the Entergy Operations staff, on September 4, 1990, at the end of the inspection. The list of attendees is provided in paragraph 1 of this inspection report. At this meeting, the inspectors summarized the scope of the inspection and the findings. The licensee did not identify as proprietary any of the material provided to, or reviewed by, the inspectors during this inspection.