APPENDIX

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

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

Licenses: DPR-51
NPF-6

Dockets: 50-313
50-368

Licensee: Entergy Operations, Inc.
Route 3 Box 137G
Russellville, Arkansas 72801

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

Inspection At: ANO Site, Russellville, Arkansas

Inspection Conducted: December 8, 1990, through January 17, 1991

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

2-1-91
Date

Inspection Summary

Inspection Conducted December 8, 1990, through January 17, 1991
(Report 50-313/90-50; 50-368/90-50)

Areas Inspected: Onsite event followup, operational safety verification, modification installation, surveillance, maintenance, outage activities, review of previous inspection findings, and followup of licensee action on license event reports (LERs).

Results:

- Licensee response to an unisolable primary pressure boundary leak on the Unit 1 pressurizer (PZR) was appropriate and timely (Section 3.1).

- During surveillance testing, Unit 2 Emergency Diesel Generator (EDG) No. 8 air start check valve failed. Licensee response was appropriate and timely. Maintenance was completed in the timeframes required by Technical Specification (TS) 3.8.1.1 (Section 3.2).

- The licensee, on their own self-initiative, performed an additional Unit 1 emergency feedwater pump (EFWP) turbine test to ensure operability following the outage.

- The hold time was not correctly specified for the ASME Section XI hydrostatic test following the PZR repairs. However, hold time requirements were met (Section 4.1).

- The qualification test procedure for the Unit 2 EDG airstart header was given only as guidance in the qualification package. The test director modified the test method while conducting the test procedure in order to meet the acceptance criteria (Section 4.2).

- The EDG air distributor inspection package initially provided blank spaces for documenting 6 of the 12 air distributor check valve inspections. The vendor representative actually inspected all 12 check valves. The work package was corrected to reflect that all 12 valves were inspected (Section 4.3).

General Observation

In the three maintenance observations described above, the licensee performed technically acceptable repairs/testing. However, providing guides to control test activities, rather than quality documents, is not consistent with the intent of the procedure system. Further, technical reviews did not ensure all affected equipment was included on the work documents. In addition, ASME Code requirements were not clearly specified in work documents.

The inspectors discussed their observations with licensee management during the exit meeting. Licensee management is evaluating their current expectations in this area.

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
R. Edington, Unit 2 Operations Manager
R. Fenech, Unit 2 Plant Manager
J. Fisicaro, Licensing Manager
*M. Harris, Unit 2 Project Manager, Outages
*L. Humphrey, General Manager, Nuclear Quality
*R. King, Plant Licensing Supervisor
D. Mims, Unit 2 System Engineering Superintendent
D. Moss, Radiation Protection and Radwaste Manager
J. Mueller, Unit 1 Maintenance Manager
*R. Sessoms, Plant Manager, Central
J. Vandergrift, Unit 1 Plant Manager
*H. Williams, Security Manager
C. Zimmerman, Unit 1 Operations Manager

*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) (71707)

Unit 1 completed Refueling Outage 1R9 during this inspection period. Outage scope involved modifications to the high pressure injection system necessary for a license modification to return to 100 percent power. The unit had previously been limited by license to 80 percent power. Initial heatup was started December 17, 1990. Prior to criticality, group one shutdown rods were pulled to provide cocked rod protection.

On December 18, 1990, in order to conduct maintenance on one of the two running reactor coolant pumps (RCP), operations attempted to shift to a different operating pump. Prior to criticality, the pump shift was performed in the wrong order resulting in a reactor trip due to two RCPs being secured simultaneously in the same loop.

On December 22 the unit was at 1 percent power, with postrefueling, low-power physics testing complete, when workman discovered a small, unisolable, primary pressure boundary leak on the PZR. The licensee commenced a reactor shutdown as required by TS at 10:11 a.m. (CST), December 22, 1990.
After cooldown and depressurization, the necessary repairs were completed (Section 3.1 and 4.1).

Heatup commenced on January 4, 1991, with criticality attained on January 5, 1991. The main generator was placed on the grid at 12:04 p.m., January 6, 1991. The unit reached 100 percent power on January 10, 1991, and tripped 1 1/2 hours later at 11:25 p.m. due to the main generator exciter failing. The electrical fault within the exciter caused a turbine trip which resulted in an anticipatory reactor trip. All safety systems performed as designed.

The unit remained in hot shutdown during the exciter repairs. On January 17, 1991, at 9:52 p.m., Unit 1 went critical.

Unit 2 operated at 100 percent throughout the reporting period.

3. ONSITE EVENT FOLLOWUP (UNITS 1 and 2) (93702)

3.1 Unit 1 - Declaration of a Notice of Unusual Event (NOUE) - Plant Shutdown Due to Unisolable Leak In Pressurizer (PZR) Level Sensing Tap

On December 22, 1990, at 10:11 a.m., the licensee commenced a reactor shutdown due to an unisolable primary pressure boundary leak located at the penetration for PZR level Transmitter LT-1002. The licensee's emergency plan requires the declaration of a NOUE for any shutdown required by TS. A NOUE was declared simultaneous to the commencement of shutdown. The leak on LT-1002 was pinhole sized and was not visible, being identified audibly. See Section 4.1 for a description of the leak repair.

3.2 Unit 2 - Failure of B Emergency Diesel Generator (EDG) Air Start Check Valve No. 8

On January 3, 1991, during surveillance testing, the Unit 2, B EDG, No. 8 air start check valve failed open. This allowed exhaust gases to enter the 240 psi air start header. The header overheated causing paint to peel and burn on the copper tubing. The air jumper, which is brazed in place between the No. 8 cylinder and the air start header, gave way, depressurizing the air start header.

Operations tripped the EDG and entered TS 3.8.1.1 on January 3, 1991, at 9:35 a.m. The licensee and the diesel vendor (Fairbanks Morse) inspected all of the air start check valves, the air distributors, the air jumpers, and the air start header to determine the cause of the damage. It was determined that the locknut which sets the tension on the valve piston of No. 8 air start check valve worked loose allowing the piston to remain unseated during the piston's exhaust stroke. In addition, it was discovered that the No. 6 check valve had sustained damage. As a result, Nos. 6 and 8 air start check valves were replaced. The failed air jumper, the air start header, and the locknuts on all of the air start check valves were replaced. The licensee had previously reused the locknuts. The vendor indicated that reuse of the locknuts was the probable cause of the failure. No damage was found on the air distributors.

Repairs were completed on the B EDG and the licensee exited TS 3.8.1.1 on January 5, 1991, at 6 a.m. The licensee discussed requesting a waiver of compliance of TS with the NRC; however, no waiver of compliance was requested since the maintenance was completed within the required time.

Immediately following the failure, the licensee issued night orders instructing the operators to verify that hot air was not being vented through the air start vent and to monitor the air start check valves for abnormal temperature or discolorations during future EDG runs. A procedure improvement form was submitted to add these precautions to the appropriate operating instruction. The locknuts on the A EDG were also replaced to prevent a similar problem from occurring. See Sections 4.2 and 4.3 for a description of the air start header qualification testing and the air distributor inspections.

3.3 Summary of Findings

No violations or deviations were identified. The licensee's actions and response to the events described in this section of the report were appropriate and timely, which is reflective of a positive attitude toward identifying and solving quality problems.

4. MONTHLY MAINTENANCE/MODIFICATION INSTALLATION REVIEW (UNITS 1 and 2) (62703, 60705)

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 to ensure that proper priorities were assigned to safety-related equipment which could affect system performance.

4.1 Unit 1 - Repair of Unisolable Leak in Pressurizer (PZR) Level Sensing Tap (LCP 90 5059)

As a result of the unisolable leak in the PZR, as discussed in paragraph 3.1, the licensee cooled down and depressurized Unit 1 to repair the leaking, level-sensing tap. The leak was located using liquid penetrant (PT) examination and was further defined using ultrasonic examination (UT) techniques. A crack in the level sensing nozzle between the inner PZR cladding and the outer shell surface was discovered. No indication of base metal cracking was identified during subsequent nondestructive testing.

The existing nozzle was initially cut flush with the outer shell surface and a tapered hollow plug installed as a nozzle/debris dam into the end of the cut

pipe. The hollow plug had a pilot hole in the end to allow the centerline to be reestablished, once installed. The first layer of a 4-inch diameter weld pad was deposited around the penetration in the 6 3/4-inch PZR shell using 3/32-inch SFA-5.11 ENiCrFe-3 Inconel electrodes. After grinding this layer to approximately half of the deposited thickness, the weld pad buildup was continued using 1/8-inch SFA-5.11 EniCrFe-3 Inconel electrodes until the weld pad was approximately 5/16-inch in thickness. The weld pad plus a 10-inch band around the pad, was heated to 500°F ± 50°F and then held for 2 hours prior to cooling within 50°F of the component ambient temperature. The inspector noted from review of the process traveler that the preheat temperature, interpass temperature, and postweld heat treatment practice used were consistent with the requirements for half-bead weld repair contained in Subsection IWB of Section XI of the ASME Code. After verification of the integrity of the deposit by PT and UT examination, additional weld metal was deposited in four, 1/4-inch increments using 1/8-inch SFA-5.11 ENiCrFe-3 Inconel electrodes. Each increment was examined by PT to assure soundness of the deposit. The weld pad was then held for 48 hours within 50°F of ambient temperature and final nondestructive examination (i.e., PT examination of weld pad and 1/2 inch of base metal beyond the weld fusion line, UT examination of weld pad and a 10-inch band around the pad, and magnetic particle examination of a 10-inch band around the weld pad) performed.

The penetration was drilled to a depth which removed approximately 1 inch of the existing nozzle. After grinding a J-groove structural weld preparation in the weld pad, a new 1-inch nozzle was fitted using a gap of 1/10- to 1/8-inch between the old and new nozzles to accommodate thermal expansion. The structural weld connecting the weld pad to the new nozzle was then performed, with PT examinations at half and final weld thickness. This configuration has currently been qualified for one fuel cycle. The licensee plans to return to the original configuration during the next refueling outage.

The licensee is committed to the American Society of Mechanical Engineers (ASME) Section XI, 1980 edition, winter of 1981 addenda, for the inservice inspection program. They conducted repairs and replacements in accordance with the 1986 edition of Section XI, as allowed under the ASME Boiler and Pressure Vessel Code. The level sensing tap pressure boundary was moved from the inside of the PZR to the outside of the PZR and a half-bead weld technique was used for the repair. Therefore, a hydrostatic test was required by the 1986 edition of Section XI. The licensee uses Pressure Test Report Form No. 1092.190A to specify the test pressure, temperature, and hold time. The licensee indicated on the form, "No hold time required after test conditions achieved." This conflicts with Article IWA-5213 which specifies a 10-minute hold time for noninsulated systems. The final data package documentation indicates that the system had been at operating temperature and pressure 4 hours prior to the exam and that the elevated pressure was held for 45 minutes with no leakage. Therefore, no technical problem existed; however, the initial specification did not appear consistent with the licensee's commitments.

4.2 Unit 2 - B EDG Air Start Header Qualification Testing (CGI-91-00004 R00)

As a result of the Unit 2 EDG air start header failure as discussed in paragraph 3.2, the licensee purchased an identical replacement air start header; however, it was nonsafety grade. In order to upgrade the part, the licensee identified the critical characteristic of the header to be it's ability to hold pressure. The vendor indicated that, initially, the part was subjected to a pressure test at 1.5 times rated pressure. The licensee chose to perform a similar pressure test to demonstrate the ability of the nonsafety grade part to perform the safety function. The qualification package specified as acceptance criteria that no leaks be detected at 375 psig. Instructions for performing the test were included in the qualification package. However, the test instructions were included as guidance only. At the test director's discretion, they could be modified as long as the acceptance criteria was met. The inspector observed the performance of the test. The acceptance criteria was met, but it was necessary for the test director to redefine the test method.

The licensee pursued other repair strategies in parallel with the one described above. They ordered a new air start header to be manufactured by the vendor; however, the vendor was unable to provide the header due to the shortage of parts. The licensee also initially attempted to disassemble the damaged header for possible onsite repair. Accurate vendor information was not available. As a result, the licensee repair efforts further damaged the original air start header.

4.3 Unit 2 - B EDG Air Distributor Inspection (JO 832746)

The inspector observed portions of the air distributor inspection performed by the vendor. The job order for performing the work initially included signoff blanks for six air distributor check valves. The B EDG has two air distributors which each have six air distributor check valves. The licensee corrected the job order to provide for documentation of all 12 check valve inspections.

4.4 Summary of Findings

In the three maintenance observations described above, the licensee performed technically acceptable repairs/testing. However, providing guides to control test activities, rather than quality documents which require and allow compliance, is not consistent with the intent of the procedure system. Further, adequate technical reviews did not occur such that all affected equipment was included on the work documents. Code requirements were not clearly specified in work documents.

The inspector will continue to follow this item to determine the licensee's action to ensure that procedural steps, as opposed to procedural guides, are utilized in the preparation of procedures, and that adequate technical reviews are being performed on work documents. This item will be followed as Inspector Followup Item 313/9050-01; 368/9050-01.

The inspectors discussed their observations with licensee management during the exit meeting. Licensee management is evaluating their current expectations in this area.

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.

5.1 Unit 1 - Decay Heat Suction Isolation Valves CV-1050 & CV-1410 Leak Test - 1102.001 Supplement 2 (TS 3.1.6)

This test demonstrates proper seating of CV-1050 and CV-1410 when the decay heat system is isolated during plant startup. This test provides early indication of possible leakage paths. The inspector observed the performance of portions of this test on January 4, 1991. Prerequisite plant conditions were achieved, initial alignments were correct, and the necessary pressure indicators were operable. CV-1410 was tested first and the associated acceptance criteria was met. The operator was initially unable to depressurize downstream of CV-1050 to establish the prerequisites necessary for leak testing CV-1050. The procedure provides for a vent path through the decay heat cooler outlet sample isolation valve (SS-882) and sample sink inlet (SS-116). This vent path was not large enough to depressurize the line. The operator consulted the operations manager as required by the procedure. He correctly diagnosed the problem to be backleakage from the decay heat removal injection check valve. The differential pressure across the check valve was not enough to cause it to seat firmly. The prerequisite conditions were established by venting the decay heat side of the injection check valves. CV-1050 met the leakage acceptance criteria.

5.2 Unit 1 - Emergency Feedwater Pump (EFW) Operation 1106.006 Supplement 8 (TS 3.4.1.4)

The EFW Pump P-7A functional test demonstrates operability of P-7A, to the extent possible, with RCS temperature less than 280°F, by running the pump at low steam generator pressure, in minimum recirculation flow conditions. The test had been performed during the previous heatup and was not required. However, the operations manager conservatively directed that it be performed. The test is not a required TS surveillance, but it is used by operations to provide added assurance that TS 3.4.1.4 is satisfied, (i.e., that the steam-driven EFW pump and its flow path are operable). The inspector observed the performance of the test on January 4, 1991. The operator correctly performed the test. No equipment problems were identified.

5.3 Summary of Findings

The licensee's performance of surveillance test activities was good. The licensee conservatively performed additional tests to assure operability of critical equipment. This is considered a sound practice.

6. 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 and 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 control room annunciators. Various control room logs and other available licensee documentation were reviewed.

All activities observed were performed professionally and within license requirements.

7. UNIT 1 - ENGINEERED SAFETY FEATURE (ESF) SYSTEM WALKDOWN (71710)

The inspector independently verified the status of an ESF system. The licensee's system lineup procedure was compared to plant as-built drawings. The inspector checked for hardware problems, adequate labeling, housekeeping, transient fire load, correct valve switch and breaker alignments, and availability of support systems.

7.1 Unit 1 - EDG Walkdown

The inspector conducted an ESF system walkdown of Unit 1 EDGs to verify operability. Minor discrepancies were noted during the walkdown. One valve identification label was discovered missing from a valve, and several valves were not labeled in accordance with the valve lineup (OP 1104.36, Attachments A and B) and the system print (M217).

The isolation valve to Diesel Generator No. 2 Starting Air Compressor C4B1 discharge pressure gage (PI-5263) was closed, which is contrary to the required position on the valve lineup. The operator accompanying the inspector properly positioned the valve and informed the control room. The pressure gage provides local pressure indication only.

The inspector also identified a discrepancy between the air receiver drain valve lineup and the system print. The valve lineup requires both series air receiver drain valves to be shut, while the print specifies that the upstream valve is shut and the downstream valve is open. The valves were aligned as specified by the print. This discrepancy involves a total of eight valves, one per air receiver. It did not affect the diesel's start capability.

The inspector will continue to follow this item to determine the licensee's action to resolve the discrepancy between the valve lineup and the system print as Inspector Followup Item 313/9050-02.

7.2 Summary of Findings

One valve was discovered to be out of position and eight were positioned in accordance with the system print but not in accordance with the system valve lineup. Valve labeling discrepancies were noted, and one valve label was missing. The inspector observed that housekeeping in both EDG rooms was good, indicating that postoutage cleaning in those areas had received adequate effort.

8. UNIT 1 - OUTAGE ACTIVITIES (62703, 607[illegible])

8.1 Postweld Heat Treatment (PWHT) Practices During 1R9 (NO-90-02047)

The inspector reviewed the licensee's audit of the program for performing PWHT. For the period reviewed, prior to December 14, 1990, no safety-related systems were involved. However, the licensee had controlling specifications and instructions in place which defined the specific requirements for PWHT.

8.2 Summary of Findings

The ANO PWHT program appeared to provide adequate controls to assure that quality objectives were met.

9. REVIEW OF PREVIOUS INSPECTION FINDINGS AND LER FOLLOWUP (92701, 92700)

9.1 (Closed) Unresolved Item 368/9024-01 and LER 368/90-024: Emergency Feedwater Pump Turbine (EFWPT) Overspeed Trips

This item involved the unexpected overspeed trips of the EFWPT which occurred on November 13, November 29, and December 6, 1990. The licensee initially misdiagnosed the cause of the trips. The actual cause for the turbine trips was found to be sluggish response of the turbine governor valve due to a contaminated control oil system. The root cause was determined to be inadequacies in the preventive maintenance system.

By design, filtered oil from the turbine lube oil system is used as the hydraulic medium for the Model EG-R actuator. The Model EG-R actuator controls the governor valve position. Once the oil becomes part of the Model EG-R actuator hydraulic system it is not filtered. The available vendor technical

information discourages the licensee from opening the Model EG-R actuator. Nonnuclear facilities with continuous duty applications, however, historically returned the Model EG-R actuator to the vendor on a routine basis for disassembly and refurbishment. The EFWPT has passed many tests subsequent to the replacement of the Model EG-R actuator. This would tend to confirm that the root cause of the EFWPT trips has been found. The licensee plans to upgrade their preventive maintenance program to include periodic cleaning and/or replacement of the Model EG-R actuator and its associated remote servo. The licensee also plans to clean the turbine lube oil system during the next refueling outage.

During the period between the initial and the third overspeed trip, the reliability of the turbine-driven EFW pump was questionable. Even though the normal surveillance test required to prove pump operability had been successfully completed, the probability of an overspeed trip was possible due to the condition of the control oil and governor system components. Also, during the period between the first and third overspeed trips, motor-driven EFW Pump 2P7B was taken out of service for brief periods to perform valve stroke testing. The safety significance of this event is considered to be minimal since the motor-driven EFW pump was operable for most of the period during which the turbine-driven pump was more susceptible to an overspeed trip. The periods of time when the motor-driven EFW pump was not available were short, and the motor driven pump could have been started manually by operators, if needed.

Additionally, the turbine-driven pump could have been manually reset and started under manual control if needed to supply feedwater to the steam generators.

Based on the review of the status of the motor-driven feedwater pump during the period in question, the licensee's corrective actions, and the associated LER, the licensee's actions were determined to be effective. Unresolved Item 368/9024-01 and LER 368/90-24 are considered closed.

10. EXIT INTERVIEW

The inspectors met with members of the Entergy Operations staff, on January 17, 1991. 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.