ENCLOSURE

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Inspection Report: 50-313/96-12
50-368/96-12

Licenses: DPR-51
NPF-6

Licensee: Entergy Operations, Inc.
1448 S.R. 333
Russellville, Arkansas

Facility Name: Arkansas Nuclear One, Units 1 and 2

Inspection At: Russellville, Arkansas

Inspection Conducted: February 20-23, 1996

Inspectors: J. Blair Nicholas, Ph.D., Senior Radiation Specialist
Plant Support Branch, Division of Reactor Safety

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Approved: Blaine Murray 3/13/96
Blaine Murray, Chief, Plant Support Branch
Division of Reactor Safety
Date

Inspection Summary

Areas Inspected (Units 1 and 2): Routine, announced inspection of the water chemistry, radiochemistry, and radiological environmental monitoring programs including: organization and management controls, training and qualifications, quality assurance program, reactor chemistry control, meteorological monitoring program, radiological environmental monitoring program, reports of environmental monitoring operations and a review of the Updated Final Safety Analysis Report.

Results (Units 1 and 2):

Plant Support

- The chemistry department organizational structure met staffing requirements. The chemistry department staffing was stable and experienced very low turnover of technical personnel. The stability of the chemistry organization was considered a strength. The water

chemistry, radiochemistry, and radiological environmental monitoring programs were properly implemented (Section 1).

- An excellent continuing training program was implemented for chemistry department personnel. The licensee maintained a well trained and qualified staff to effectively implement the water chemistry, radiochemistry, and radiological environmental monitoring programs. The practice of rotating and sharing personnel between the training department and the plant chemistry department was considered a training program strength (Section 2).

- Excellent oversight of the water chemistry, radiochemistry, and radiological environmental monitoring programs was achieved. Excellent, comprehensive audits and surveillances were performed by the quality assurance organization. An excellent self-assessment was also conducted to review the performance of the chemistry department. The quality assurance program was considered a strength (Section 3).

- The licensee's performance was excellent in implementing the water chemistry and radiochemistry programs. Chemistry laboratory instruments and in-line process instrumentation were properly calibrated and maintained. An excellent chemistry data management system was maintained. The licensee had implemented an aggressive chemistry control program to reduce the radiation source term and subsequent radiation exposure to personnel during plant operation and especially during plant outages (Section 4).

- A good meteorological tower was maintained to obtain a greater than 90 percent data recovery (Section 6).

- The radiological environmental monitoring program was well implemented. Excellent Annual Radiological Environmental Operating Reports were submitted in a timely manner and contained all of the required information in the proper format. Proper annual land use censuses were performed (Section 7).

- No deviations were noted regarding commitments made in the Updated Final Safety Analysis Report (Section 8).

Attachment:

- Attachment - Persons Contacted and Exit Meeting

DETAILS

1 ORGANIZATION AND MANAGEMENT CONTROLS (84750)

The organization, staffing, management controls, and assignment of the chemistry program and the radiological environmental monitoring program responsibilities were reviewed to determine agreement with the commitments in Chapters 12 and 13 of the Units 1 and 2 Updated Safety Analysis Reports, respectively, and compliance with the requirements in the Units 1 and 2 Technical Specification 6.2.

Technical Specification 6.2 identified the licensee's facility organizations. The inspectors reviewed the licensee's organization, staffing, and lines of authority as they related to the chemistry department, which was responsible for the implementation of the water chemistry, radiochemistry, and radiological environmental monitoring programs, to verify compliance with the Technical Specifications. There had been no major structural changes to the chemistry organization since the previous NRC inspection of the chemistry program. Also, there were no major changes in the chemistry and radiological environmental monitoring programs or the way in which the chemistry organization functioned. The inspectors concluded that the chemistry department's organizational structure was in accordance with Technical Specifications.

Procedures were reviewed for the assignment of responsibilities for the management and implementation of the chemistry and radiological environmental monitoring programs. Specifically, Chemistry Administrative Procedure 1052.023, "Conduct of Chemistry," Revision 5, and Chemistry Administrative Procedure 1052.022, "Radiological Effluents and Environmental Monitoring," Revision 1, were reviewed. These procedures identified the responsibilities, duties, and authority of the chemistry staff. The inspectors determined that the duties and responsibilities of the chemistry department were being implemented in an excellent manner. The inspectors determined, through discussions and observations, that the chemistry technicians were familiar with the requirements of the water chemistry, radiochemistry, and radiological environmental monitoring programs and maintained a high level of performance.

The inspectors reviewed the staffing of the chemistry department and noted that the chemistry staff was reduced by three personnel since the previous NRC inspection of the chemistry program. This reduction in staff did not appear to have a negative affect on the performance of the chemistry department. The inspectors concluded that the chemistry organization was very stable and adequate to meet shift staffing requirements and perform the required duties. The stability of the chemistry organization was considered a strength.

2 TRAINING AND QUALIFICATIONS (84750)

The inspectors reviewed the qualifications of selected chemistry department personnel to determine agreement with the commitments in Chapters 12 and 13 of the Updated Safety Analysis Reports for Units 1 and 2, respectively, and compliance with the requirements in the Units 1 and 2 Technical Specifications 6.3 and 6.4.

The inspectors interviewed the senior chemistry trainer. The inspectors reviewed selected training records for the chemistry staff and noted that all nuclear chemists had completed the initial training program. The inspectors noted that the licensee had developed an excellent training matrix for tracking the chemistry tack training completed by each of the nuclear chemists.

The inspectors reviewed the continuing training program for the chemistry staff as described in Training Administrative Procedure 1063.012, "Nuclear Chemist Training Sequence," Revision 10. The chemistry department's continuing training schedules for 1995 and 1996 were reviewed. The chemistry department's continuing training cycles generally included topics of current industry interest; plant evolutions; changes to plant and laboratory equipment and procedures affecting chemistry; and, preparation for special chemistry activities, such as outages. It was determined that the chemistry department's training program was being implemented in accordance with station procedures.

The inspectors noted that individuals from the chemistry training staff worked with the plant chemistry personnel during outages and took rotational assignments on the plant chemistry staff to keep current with plant chemistry activities. Likewise, individuals from the plant chemistry staff served rotational assignments with the chemistry training staff. This practice of rotating and sharing personnel between the training department and the plant chemistry department was considered a training program strength.

3 QUALITY ASSURANCE PROGRAM (84750)

The inspectors reviewed audits, surveillances, and a chemistry program assessment to verify agreement with the commitments in Chapters 12.4 and 13.4 of the Updated Safety Analysis Reports for Units 1 and 2, respectively, and Sections 1.3.8 and 18.3 of the Quality Assurance Manual Operations.

The inspectors reviewed the quality assurance audit schedules for 1994, 1995, and 1996; audit plans and checklists; and the qualifications of the quality assurance auditors and technical specialist who performed the audits of the water chemistry and radiochemistry programs and the radiological environmental monitoring program.

Reports of a quality assurance audit and an assessment performed during 1994 and 1995 of the areas related to the performance of the water chemistry and radiochemistry programs were reviewed for scope, thoroughness of program

evaluation, and timely followup of identified deficiencies. The audit and assessment were performed in accordance with quality assurance procedures by qualified auditors and technical specialists. The reviewed quality assurance audit and assessment of the water chemistry and radiochemistry programs were of excellent quality and provided excellent oversight and evaluation of the licensee's performance in implementing the water chemistry and radiochemistry programs and meeting the Units 1 and 2 Technical Specifications' requirements. The quality assurance program was considered a strength.

Quality Assurance Audit QAP-22, "Chemistry and Radiochemistry," conducted during the period September 27 through November 29, 1994, reviewed, in part, appropriate records to determine compliance with program requirements and data trends and observations of performance of chemistry activities to determine program effectiveness. The audit verified that the chemistry program was satisfactorily implemented and complied with applicable regulations. No audit findings or condition reports were issued as a result of the audit. Eight quality assurance recommendations for program improvement were identified and closed during the audit. The 1994 audit report indicated notable overall chemistry program improvement compared to the 1992 audit results.

An independent assessment of the chemistry program performance was conducted November 13-17, 1995. The assessment team was composed of nine members; most members were from other nuclear sites or the licensee's corporate office. The assessment team identified numerous strengths; but, it also identified four areas in which improvements could be made. The inspectors concluded that the observations were insightful and that the assessment was an excellent management oversight tool.

The inspectors reviewed the 1994 and 1995 annual quality assurance audits of the radiological environmental monitoring program. Three deficiencies were identified during the 1994 audit. These deficiencies were documented in condition reports. Corrective actions to the condition reports were initiated promptly, and the condition reports were closed during the audit. The 1995 audit identified no significant deficiencies and concluded that the radiological environmental monitoring program was satisfactorily implemented and complied with regulatory requirements. The inspectors determined that the audits were thcrough and noted that the audits included both performance and compliance based reviews.

The inspectors reviewed the qualifications of the quality assurance auditors. Audit team members had previous experience in the areas they reviewed and were qualified to evaluate the performance of program personnel. A technical specialist from another nuclear power facility knowledgeable in chemistry program requirements was used on the audit team for the chemistry program audit.

The licensee had also conducted excellent performance based quality assurance surveillances of chemistry program activities. The inspectors reviewed three quality assurance surveillances performed during 1994 and 1995. These quality assurance surveillances included direct observations and evaluations of

chemical usage in the plant which might cause potential problems related to plant equipment operation and/or ventilation systems, post-accident sampling system operability and monthly surveillance performance, and overall basic knowledge and performance of the nuclear chemists during the performance of routine chemistry program activities. The results of the surveillances were satisfactory.

4 LIGHT WATER REACTOR CHEMISTRY CONTROL (84750)

The inspectors reviewed the water chemistry and radiochemistry control and analyses programs to determine agreement with the commitments in Chapters 4 and 9 and Tables 4-11 and 9-3 of the Unit 1 Updated Safety Analysis Report and Chapters 5, 9, and 10 and Tables 9.3-4 and 10.3-2 of the Unit 2 Updated Safety Analysis Report and compliance with the requirements in the Unit 1 Technical Specifications 3.1.4, 3.1.5, and 3.10, and Table 4.1-3 and the Unit 2 Technical Specifications 3/4.4.7, 3/4.4.8, and 3/4.7.1.4 and Tables 3.4-1, 4.4-3, 4.4-4, and 4.7-2.

Water Chemistry/Radiochemistry

The inspectors' review of the water chemistry and radiochemistry programs verified that the licensee had revised and approved chemistry department administrative procedures, chemistry control procedures, sampling and analyses procedures, and calibration and quality control procedures for in-line process instrumentation and laboratory analytical instruments. The review of selected procedures revised since the previous NRC chemistry inspection conducted in January 1994 indicated that the chemistry department had written and implemented excellent procedures which met the commitments in the respective Updated Safety Analysis Reports and Technical Specifications for both units.

The inspectors inspected the secondary chemistry laboratory and the chemistry sample rooms and associated in-line process instrumentation for both units. The inspectors noted that the secondary laboratory was equipped with state-of-the-art analytical instrumentation to perform the required analyses. The inspectors noted that the licensee had installed an in-line ion chromatograph in each of the units for continuous online analyses of anions and cations and to monitor chemical parameters in the secondary water systems. The licensee had also recently upgraded the in-line process instrumentation in the secondary chemistry sample rooms of both units with state-of-the-art instrumentation. The inspectors verified that the in-line process instrumentation in the sample rooms of both units was calibrated, and an instrument quality control program was implemented. A review of in-line process instrumentation out-of-service data for 1994 showed that the established goal was being met a majority of the time but was better achieved in Unit 2 than in Unit 1. An excellent tracking program was established to monitor which in-line instruments were out-of- service the most and required the most maintenance.

The inspectors verified that the secondary chemistry laboratory analytical instruments were calibrated, and an instrument quality control program was implemented. It was noted that the licensee was implementing the use of instrument quality control charts to trend quality control data. The inspectors reviewed the quality control data charts for selected chemistry laboratory instruments for 1994 and 1995 and found them satisfactory.

The inspectors reviewed secondary water chemistry data and reactor coolant chemistry data for 1994 and 1995 to determine compliance with Technical Specification requirements. It was verified that required water chemistry and radiochemistry sampling and analyses were performed in both units. The inspectors reviewed the records of out-of- specification chemical parameters and the licensee's corrective actions taken when chemistry parameters did not meet established chemistry control limits. Very few out-of-specification chemistry conditions were noted during normal plant operation. Most of the out-of-specification chemistry conditions resulted during plant evolutions (e.g., startup) and were promptly corrected and brought to within the applicable chemistry control limits. The licensee's chemistry control limits were established according to the Electric Power Research Institute guidelines for pressurized water reactor secondary and primary water chemistry. The licensee had established action levels and corrective actions for out-of-specification chemistry conditions. The action levels and corrective actions to out-of-specification chemistry conditions were strictly enforced.

The inspectors reviewed the chemistry department's quality control program for the inter-laboratory cross-check program and chemical analyses of blind and spiked samples in secondary chemistry and radiochemistry. The results of the 1995 quality control program records indicated a high percentage of initial analysis results met the acceptance criteria for agreement with the known concentration. Very few analyses had to be repeated to meet acceptable analytical technique and results.

The inspectors inspected the radiochemistry counting facility instrumentation and selected detector calibration and quality control data. The licensee had sufficient state-of-the-art analytical instrumentation to perform the required radiochemistry analytical measurements. The inspectors' review verified that the radiochemistry counting facility's instruments were properly calibrated and that a good quality control program was implemented.

Source Term Reduction

The inspectors discussed with chemistry department personnel occupational dose as it relates to plant water chemistry control. Since 1992 the licensee had implemented an aggressive chemistry control program to reduce the radiation source term during plant operation and especially during plant outages. The first step in the chemistry control program was to control and maintain the pH of the reactor coolant during plant operation in a band from 6.9 to 7.4 throughout the operating cycle. This reactor coolant pH control was designed to minimize corrosion formation and buildup in the reactor primary system during normal operation. The second step in the chemistry

control program was to perform early boration of the reactor coolant system. Early boration of the reactor coolant system during cooldown placed the reactor coolant system chemistry in a hot, highly acidic reducing environment which caused corrosion products to remain soluble in the reactor coolant system so that they would be removed by filtration and demineralizers and minimize crud deposition and crud bursts during outage conditions. In conjunction with the early boration of the reactor coolant system, hydrogen peroxide was injected into the reactor coolant system to shock the system from a chemically reducing environment during cooldown to a chemically oxidizing environment which would remove corrosion product contamination from the primary system piping and make it soluble so that it would be removed from the reactor coolant system by filtration and demineralizers. The licensee had also installed in the reactor coolant letdown system sub-micron filters to maximize reactor coolant system purification. The third step in the chemistry control program was to control the reactor coolant system startup chemistry. The reactor coolant system demineralizers were kept in service at maximum flow during reactor startup to remove nickel. Removing nickel from the reactor coolant system removed precursor material that would become activated to cobalt-58 during the subsequent operating cycle. The licensee had employed this chemistry control program of early boration, hydrogen peroxide injection, and metallic precursor material removal during outages in both units over the past 4 years.

During Refueling Outage 11 for Unit 1 (1R11), the licensee initiated the chemistry control program described above in an attempt to reduce the radiation source term. As a result of the early boration of the reactor coolant system during reactor shutdown, approximately 1113 curies of radiocobalt were removed from the reactor coolant system. The cobalt-58 activity was reduced from a maximum concentration of 2.07 μCi/ml to 0.03 μCi/ml. Dose rates were reduced in the plant by 50 percent in some areas. An estimated 120 rems of radiation exposure were saved by performing the chemistry control program. During the reactor startup from Refueling Outage 1R11, the nickel concentration in the reactor coolant system was cleaned up to 0.1 ppm from a maximum concentration of 0.8 ppm. It is estimated that this process prevented the buildup of about 193 curies in the reactor coolant system.

During Refueling Outage 1R12, approximately 1145 curies of radiocobalt were removed from the reactor coolant system. The cobalt-58 maximum activity increased to 2.6 μCi/ml and was reduced to 0.3 μCi/ml. An estimated 70 rems of radiation exposure were saved by performing the outage chemistry control program. The total radiation dose for a refueling outage was reduced by over 70 percent from 650 rems during Refueling Outage 1R9 to 192 rems during Refueling Outage 1R12. This was accomplished with only a 30 percent reduction in RWP-hours. These radiation dose reductions were a direct result of implementing the outage chemistry control program.

During Refueling Outage 9 for Unit 2 (2R9), the licensee initiated the chemistry control program to reduce the radiation source term. As a result of the early boration of the reactor coolant system during reactor shutdown, approximately 545 curies of radiocobalt were removed from the reactor coolant system. The cobalt-58 activity was reduced from a maximum concentration of 2.46 μCi/ml to 0.07 μCi/ml. Dose rates were reduced in the plant by an average of 30 percent, and in some areas the dose rates were reduced as high as 50 percent. An estimated 111 rems of radiation exposure were saved by performing the chemistry control program.

During Refueling Outage 2R10, approximately 550 curies of radiocobalt were removed from the reactor coolant system. An estimated 80 rems of radiation exposure were saved by performing the outage chemistry control program. The effective dose rate was reduced by over 50 percent as a result of the implementation of the outage chemistry control program. Also, the total radiation dose for a refueling outage was reduced by over 50 percent from 282 rems during Refueling Outage 2R7 to 137 rems during Refueling Outage 2R10. These radiation dose reductions were a direct result of implementing the outage chemistry control program.

5 METEOROLOGICAL MONITORING PROGRAM (84750)

The inspectors reviewed the meteorological monitoring program to determine agreement with the recommendations of NRC Regulatory Guides 1.23 and 1.97, the American National Standards Institute-American Nuclear Society Standard 2.5-1984, and with the commitments in Chapter 2 of the Units 1 and 2 Updated Safety Analysis Reports; and compliance with Unit 2 Technical Specification 3.3.3.4 and Tables 3.3-8 and 4.3-5.

The inspectors reviewed selected meteorological instrumentation calibration procedures and associated records. The inspectors determined that the meteorological sensing and recording equipment was calibrated quarterly by the licensee's instrument and controls technicians and that the licensee had changed to semiannual calibrations in February 1995. The calibrations were conducted in accordance with approved procedures for wind speed, wind direction, and air temperature difference. The meteorological tower was equipped with instrumentation for wind speed, wind direction, and temperature sensing instrumentation at the 10 and 57 meter elevations. Backup power to the meteorological tower was provided by batteries and an electrical generator. Meteorological data was available in both units' control rooms and the emergency response facilities via the safety parameters display system. All records reviewed indicated that the meteorological monitoring instruments were being properly maintained, tested, and calibrated at required frequencies.

The licensee had obtained greater than 90 percent data recovery.

6 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (84750)

The inspectors performed a limited review of the radiological environmental monitoring program to determine compliance with Unit 1 Technical Specification 4.30.1 and Tables 4.30-1, 4.30-2, and 4.30-3; Unit 2 Technical Specification 3/4.12 and Tables 3.12-1, 3.12-2, and 3.12-3; and Offsite Dose Calculation Manual Table 4-1.

The inspectors visited selected environmental media sampling locations associated with the radiological environmental monitoring program. The following types of sampling locations were inspected: airborne, surface water, milk, and vegetation. Also, the inspectors accompanied and observed an environmental technician from the chemistry department collect air particulate and charcoal cartridge samples for shipment and analyses. All sample analyses for the radiological environmental monitoring program were performed by the offsite Entergy System Chemistry Laboratory. The chemistry department environmental technicians were also responsible for the calibration of the air samplers. All equipment used in the collection of environmental samples was operable and calibrated.

The inspectors observed that the location of the licensee's environmental air sampling stations were as required in the Technical Specifications. The inspectors inspected the environmental media sample storage and preparation area facilities. These facilities were stocked with the necessary equipment and supplies to perform the required sampling activities and sample shipment preparation.

It was determined that the collection, processing, and analyses of the radiological environmental media samples were conducted in accordance with the Units 1 and 2 Technical Specifications and the Offsite Dose Calculation Manual.

7 REPORTS OF ENVIRONMENTAL MONITORING OPERATIONS (84750)

The inspectors reviewed the Annual Radiological Environmental Operating Report for 1994 and the draft 1995 report to determine compliance with the reporting requirements in Unit 1 Technical Specification 6.12.2.5 and Unit 2 Technical Specification 6.9.4. The 1994 annual report was submitted in a timely manner and contained the required information. Any discrepancies or missed samples were reported. The inspectors determined that the Technical Specification sampling, analyses, and reporting requirements were met.

The results of the annual land use censuses preformed as required by Unit 1 Technical Specification 4.30.2 and Unit 2 Technical Specification 3/4.12.2 were documented as required in the appropriate Annual Radiological Environmental Operating Reports.

8 REVIEW OF UPDATED SAFETY ANALYSIS REPORT COMMITMENTS

A recent discovery of a licensee operating its facility in a manner contrary to the Updated Safety Analysis Report description highlighted the need for a special focused review that compares plant practices, procedures, and/or parameters to the Updated Safety Analysis Report descriptions. While performing the inspections discussed in this report, the inspectors reviewed the applicable chapters of the respective Updated Safety Analysis Reports for Units 1 and 2 that related to the areas inspected. The inspectors verified that the wording in the respective Updated Safety Analysis Reports was consistent with the observed plant practices, procedures, and/or parameters.

ATTACHMENT

1 PERSONS CONTACTED

1.1 Licensee Personnel

*P. Cox, Chemist
M. Frala, Supervisor, Chemistry
*C. Harris, Senior Technical Trainer - Chemistry
*W. McKelvy, Chemistry Superintendent
*T. Madeley, Senior Chemistry Specialist
*L. McCollum, Senior Chemistry Specialist
P. Miller, Maintenance Specialist, Instruments and Controls
*D. Mims, Director, Nuclear Safety
R. Partridge, Supervisor, Chemistry
*S. Pyle, Licensing Specialist
*M. Prock, Supervisor, Chemistry
P. Robbins, Supervisor, Chemistry
*M. Smith, Supervisor, Licensing
*G. Stephenson, Chemist
*L. Taylor, Events Analysis and Assessments
G. Thornton, Chemistry Specialist
*D. Wagner, Supervisor, Quality Assurance
*L. Waldinger, General Manager, Plant Operations

1.2 NRC Personnel

*S. Campbell, Resident Inspector
*K. Kennedy, Senior Resident Inspector

*Denotes personnel that attended the exit meeting on February 23, 1996.

In addition to the personnel listed, the inspectors contacted other personnel during this inspection period.

2 EXIT MEETING

An exit meeting was conducted on February 23, 1996. During this meeting, the inspectors reviewed the scope and findings of the report. The licensee did not express a position on the inspection findings documented in this report. The licensee did not identify as proprietary, any information provided to, or reviewed by the inspectors.