

APPENDIX

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

NRC Inspection Report: 50-313/90-49 Operating Licenses: DPR-51
50-368/90-49 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)

Inspection At: ANO Site, Russellville, Arkansas

Inspection Conducted: December 3-5, 1990

Inspector: J. Blair Nicholas 12/18/90
J. B. Nicholas, Senior Radiation Specialist Date
Radiological Protection and Emergency
Preparedness Section

Approved: Blaine Murray 12/19/90
Blaine Murray, Chief, Radiological Protection Date
and Emergency Preparedness Section

Inspection Summary

Inspection Conducted December 3-5, 1990 (Report 50-313/90-49; 50-368/90-49)

Areas Inspected: Routine, announced inspection of the licensee's radiological effluent dose calculations of offsite doses resulting from radioactive effluents released to the environment.

Results: The inspector determined that the licensee was calculating offsite doses using methods described in the Offsite Dose Calculation Manual (ODCM). Initial confirmatory dose calculations were performed during the inspection using the NRC PC-DOSE computer code for offsite dose calculations. The licensee's and the NRC's calculated doses were in agreement for the radioactive liquid effluents and the noble gas effluents. Comparisons between the licensee's and the NRC's calculated dose results indicated differences for the total body and critical organ doses resulting from radioactive airborne tritium, iodines, and particulates effluents. These differences in the

calculated offsite doses are the subject of an open item discussed in paragraph 4 of this report.

Within the areas inspected, no violations or deviations were identified. One previously identified violation and one previously identified open item were closed.

DETAILS

1. Persons Contacted

AP&L

- *J. W. Yelverton, Director, Nuclear Operations
- *D. W. Boyd, Licensing Specialist
- *J. J. Fisicaro, Manager, Licensing
- *W. C. McKelvy, Superintendent, Chemistry
- *W. R. Pool, Supervisor, Nuclear Chemistry
- *R. A. Sessoms, Plant Manager, Central

NRC

- C. C. Warren, Senior Resident Inspector, ANO
- L. J. Smith, Resident Inspector, ANO

*Indicates those present at the exit meeting on December 5, 1990.

2. Followup on Previously Identified Inspection Findings (92701)

(Closed) Violation (368/8914-01): Failure to Maintain Proper Radiation Monitor Alarm Setpoint - This violation was identified in NRC Inspection Report 50-368/89-14 as a result of Licensee Event Report (LER) 368/88-014, which was discussed and closed in NRC Inspection Report 50-368/89-14. The LER and resulting violation involved the licensee operating ANO Unit 2 control room ventilation radiation monitor for the time period between August 11-22, 1988, with an alarm/trip setpoint above the required Technical Specification (TS) limit. The licensee had implemented adequate corrective actions prior to the inspection to resolve the violation.

(Closed) Open Item (313/8914-03; 368/8914-03): Semiannual Effluent Release Report Dose Data Format - This item was identified in NRC Inspection Report 50-313/89-14; 50-368/89-14 and involved the presentation of the annual summary of radiation doses resulting from radiological effluents in a format in the semiannual effluent release reports which would not readily indicate to the reader compliance with TS requirements. The inspector reviewed the radiation dose data summary for 1989 as reported in the third and fourth quarter 1989 semiannual effluent release report. The licensee's dose data reporting format was found to be satisfactory to resolve the NRC's concerns in this matter.

3. Open Items Identified During This Inspection

An open item is a matter that requires further review and evaluation by the licensee and the inspector. Open items are used to document, track, and ensure adequate followup on matters of concern to the inspector. The following open item was identified:

<u>Open Item</u>	<u>Title</u>	<u>Paragraph</u>
313/9049-01	Radioactive Effluent	4
368/9049-01	Dose Calculations	

4. Radioactive Liquid and Gaseous Effluent Dose Calculations (84750)

The inspector reviewed the licensee's radioactive effluent dose calculations to determine compliance with the requirements in the ODCM and Sections 3.25.1, 3.25.2, 4.29.2, and 4.29.3 of the Unit 1 TS and Sections 3/4.11.1 and 3/4.11.2 of the Unit 2 TS.

The inspector conducted initial confirmatory calculations of the offsite doses from the plant's liquid and gaseous radioactive effluents released to the environment. Radioactive effluent dose calculations were performed by the inspector for liquids; noble gases; and airborne tritium, iodines, and particulates using the NRC computer code, PC-DOSE, which was developed to verify the dose calculations described in the licensee's ODCM.

The licensee's chemistry staff performed effluent dose calculations using methodologies, assumptions, and equations described in the ODCM and implemented by a computer code supplied by a vendor. The inspector, in cooperation with the chemistry staff, developed realistic test cases based on typical effluent radionuclide concentrations and release rates for radioactive liquid and gaseous effluents. The inspector and one of the licensee's nuclear chemistry supervisors performed dose calculations using the same radionuclide concentrations for the liquid effluent test case. The calculated dose results from the original test for the radwaste liquid effluents were in agreement between the licensee's and the NRC's dose results for the adult total body and adult critical organs for all radionuclides tested except for manganese-54. The licensee's manganese-54 dose results for adult total body and adult critical organs were less than the NRC's dose results for manganese-54. After evaluation of the licensee's computer code and bioaccumulation data tables, it was discovered that the bioaccumulation factor for manganese-54 was 6.0 in the licensee's computer code data table instead of 400 as per Regulatory Guide 1.109 and PC-DOSE. This error caused the dose resulting from manganese-54 to be calculated by a less conservative factor of 66.67. The licensee corrected the bioaccumulation factor for manganese-54 and reran the test case. The calculated dose results from this test for the radioactive liquid test case were all in agreement for the adult total body and adult critical organs for all radionuclides tested. The inspector reviewed selected radioactive liquid effluent releases performed during 1990 from both Unit 1 and Unit 2 and noted that the concentration of manganese-54 was in the order of $1.0E-5$ microcuries per milliliter ($\mu\text{Ci/ml}$) in the T16 liquid radwaste tanks in Unit 1 and in the order of $1.0E-7$ $\mu\text{Ci/ml}$ in the T21 liquid radwaste tanks in Unit 2 which were discharged as radioactive effluents from the respective plants. The less conservative doses calculated from these radionuclide concentrations of manganese-54, if recalculated using the correct bioaccumulation factor and, therefore, increasing the dose from manganese-54 by a factor of

66.67, would not cause the overall dose from the release of the respective liquid radwaste tanks to exceed TS dose limits.

In addition to the radioactive liquid effluent test case, a test case for noble gas dose and a test case for airborne tritium, iodines, and particulates dose was run. The licensee's dose results for the total body gamma-air dose and the total body beta-air dose from exposure to radioactive noble gases were in agreement with the NRC's calculated doses. The licensee's dose data from the radioactive airborne tritium, iodines, and particulates was greater and conservative when compared to the NRC's dose results. For example, the dose data comparisons between the licensee's and NRC's calculated doses for the child age group indicated that the licensee's calculated doses were greater than the NRC's calculated doses in the range from a factor of 3.28 for the gastro-intestine organ to a factor of 1.15 for bone. The licensee's calculated dose for the child thyroid was identical to the NRC's calculated dose. The differences in the dose results between the licensee's results and the NRC's results were discussed with the licensee during the inspection and at the exit meeting on December 5, 1990. The differences appeared to be caused by possible errors in the licensee's computer code dose factor tables. The licensee acknowledged that there appeared to be errors in their computer software and stated that they would review and evaluate their computer code dose factor tables in an attempt to resolve the calculated dose differences. This matter is considered an open item pending further review by the inspector (313/9049-01; 368/9049-01).

No violations or deviations were identified in this program area.

5. Exit Meeting (30703)

The inspector met with the licensee representatives identified in paragraph 1 of this report at the conclusion of the inspection on December 5, 1990. The inspector summarized the scope and findings of the inspection and discussed the differences between the licensee and NRC's offsite dose results calculated during the inspection. The licensee agreed to investigate and evaluate their computer methodologies in an attempt to resolve the calculated dose differences. The licensee did not identify as proprietary any of the materials provided to, or reviewed by, the inspector during the inspection.