APPENDIX

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Inspection Report: 50-285/93-10

Operating Licenses: DPR-40

Licensee: Omaha Public Power District
444 South 16th Street Mall
Mail Stop 8E/EP4
Omaha, Nebraska 68102-2247

Facility Name: Fort Calhoun Station

Inspection At: Blair, Nebraska

Inspection Conducted: June 21-25, 1993

Inspector: L. Wilborn, Radiation Specialist
Facilities Inspection Programs Section

Approved: Blaine Murray 7/9/93
B. Murray, Chief, Facilities Inspection Programs Section — Date

Inspection Summary

Areas Inspected: Routine, announced inspection of the radiochemistry radiological confirmatory measurements programs.

Results:

- The radiochemistry group's organizational structure and staffing level met the requirements of the Technical Specifications and commitments of the Updated Safety Analysis Report (Section 1.2).
- The radiochemistry program was well managed and implemented (Section 1.2).
- The radiochemistry group had experienced a personnel turnover of 100 percent, but no decrease in performance was noted (Section 1.2).
- Well trained and qualified radiochemistry staff was maintained (Section 2.2).

- Performance in the radiological confirmatory measurements area was outstanding (Section 3.2).

Attachments:

- Attachment 1 - Personnel Contacted and Exit Meeting
- Attachment 2 - Radiological Confirmatory Measurement Results
- Attachment 3 - 1991 Quality Assurance Liquid Capability Test Sample Results
- Attachment 4 - Criteria for Comparing Radiochemistry Analytical Measurements

DETAILS

1 ORGANIZATION AND MANAGEMENT CONTROLS (84750)

The inspector reviewed the licensee's organization, management controls, and staffing of the radiochemistry group (one of the four groups of the chemistry section) to determine compliance with the requirements in Section 5.2 of the Technical Specifications and agreement with the commitments in Chapter 12 of the Updated Safety Analysis Report.

1.1 Discussion

The inspector reviewed the organizational structure of the radiochemistry group and noted no structural changes or reporting chain differences since the previous NRC inspection of the radiochemistry program conducted in April 1991. The inspector verified that the radiochemistry organization consisted of a supervisor, an alternate supervisor/chemist, a chemist, and a technician in training. The inspector determined that the radiochemistry organization was as defined in the Technical Specifications and Updated Safety Analysis Report.

The management control procedures contained the assignment of principal responsibilities for the management and implementation of the radiochemistry group. The inspector determined that the radiochemistry group activities were managed and implemented in accordance with station procedures.

The radiochemistry group's staffing positions were all filled. Since the previous NRC inspection of the radiochemistry program conducted in April 1991, the radiochemistry group had experienced a personnel turnover of 100 percent. Even though a 100 percent turnover occurred, it did not result in any observed decrease in the effectiveness of the licensee's performance. The replacement personnel had been long standing staff members of the Fort Calhoun chemistry section.

1.2 Conclusion

The radiochemistry group's organizational structure and staffing level met the requirements of the Technical Specifications and commitments of the Updated Safety Analysis Report. The radiochemistry program was managed and implemented in accordance with station procedures. The radiochemistry group had experienced a personnel turnover of 100 percent, but no decrease in the effectiveness of the licensee's performance was noted.

2 TRAINING AND QUALIFICATION (84750)

The inspector reviewed the licensee's continuing training and qualification program for radiochemistry group personnel to determine compliance with the requirements in Sections 5.3 and 5.4 of the Technical Specifications and agreement with the commitments in Chapter 12 of the Updated Safety Analysis Report.

2.1 Discussion

The inspector reviewed the performance evaluation checklist for documentation of training and, the qualifications for radiochemistry staff. The inspector determined that, except for one new technician in training, the radiochemistry staff was properly trained and met the qualifications specified in the Technical Specifications and Updated Safety Analysis Report.

2.2 Conclusion

An adequately trained and qualified radiochemistry staff was maintained.

3 RADIOLOGICAL CONFIRMATORY MEASUREMENTS (84750)

The inspector reviewed the licensee's radiochemical analysis program by performing radiological confirmatory measurements to determine compliance with the requirements in Sections 2.1, 2.9.1, 2.20, 3.12, 5.8, and 5.15 of the Technical Specifications.

3.1 Discussion

During this inspection, radiological confirmatory measurements were performed on standards and split samples by the radiochemistry group in the radiochemistry counting room and the inspector in the Region IV Mobile Laboratory on site. The standards and samples were analyzed using routine methods and equipment.

Radiological confirmatory measurements were performed on the following standards and samples:

- NRC Air Particulate Filter Standard (44710-109)
- Fort Calhoun Air Particulate Filter Standard (46266A-22)
- NRC CESCO Charcoal Cartridge Standard (44712-109)
- Fort Calhoun Charcoal Cartridge Standard (957)
- Waste Liquid from C WHUT (1000 ml in a 1000 ml Marinelli Beaker)
- Reactor Coolant Gas Sample (NRC: 2 cc in a 15 cc serum vial - Licensee: 2 cc in a 6.5 cc vial)
- Reactor Coolant Liquid Sample (NRC: 2 ml in a 20 ml scintillation vial - Licensee: 2 ml in a 8 ml vial)
- Containment Atmosphere Sample (1250 cc in a 1000 cc gas Marinelli beaker)

The radiological confirmatory measurement tests consisted of comparing the analysis results from the licensee's radiochemistry counting room with the NRC

The radiological confirmatory measurement tests consisted of comparing the analysis results from the licensee's radiochemistry counting room with the NRC Region IV Mobile Laboratory analytical results. The NRC Mobile Laboratory's measurements were referenced to the National Institute of Standards and Technology by laboratory intercomparisons. The radiological confirmatory measurement comparisons were made only for those nuclides identified by the NRC as being present in concentrations greater than 10 percent of the respective isotopic values for liquid and gas concentrations as stated in 10 CFR Part 20, Appendix B, Table II.

At the time of the inspection, the licensee was utilizing two germanium-lithium detector systems in the radiochemistry counting room. These detector systems were used routinely for isotopic analysis of radioactive samples to demonstrate compliance with Technical Specification requirements. Individual sample analysis results and their comparison with the NRC analysis results are tabulated in Attachment 2. The tabulated results from the two detectors are listed in the following order:

- Radiochemistry Counting Room - Detector #2
- Radiochemistry Counting Room - Detector #3

The licensee's radiochemistry counting room gamma isotopic analysis results from the standards and samples listed in Attachment 2 showed 100 percent agreement with NRC gamma isotopic analysis results based on 118 analytical comparisons.

The licensee performed radiological confirmatory measurements on a quality assurance liquid capability test sample prepared by the NRC's reference laboratory, The Department of Energy's Radiological and Environmental Sciences Laboratory in Idaho Falls, Idaho. The licensee's analytical results were compared to the certified sample radionuclide activities and the results of the comparisons are presented in Attachment 3. The gamma isotopic analysis results, tritium result, strontium-89 result, strontium-90 result, and iron-55 result were in agreement.

The criteria used to compare the analytical results is listed in Attachment 4.

3.2 Conclusion

The licensee's performance in the area of radiological confirmatory measurements was outstanding.

ATTACHMENT 1

1 PERSONS CONTACTED

1.1 Licensee Personnel

*R. L. Andrews, Division Manager, Nuclear Services
T. R. Dukarski, Supervisor, Laboratory
*J. K. Gasper, Acting Division Manager, Nuclear Operations
*W. W. Orr, Manager, Quality Assurance/Quality Control
B. A. Schmidt, Supervisor, Radiochemistry
*J. L. Shipman, Chemist
*R. W. Short, Manager, Nuclear Licensing
*C. F. Simmons, Station Licensing Engineer
*F. K. Smith, Supervisor, Chemistry
K. Steele, Radiation Protection, ALARA Coordinator
*M. A. Tesar, Supervisor, Technician and Radiation Training

1.2 NRC Personnel

*R. V. Azua, Resident Inspector
R. P. Mullikin, Senior Resident Inspector

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

*Denotes personnel that attended the exit meeting.

2 EXIT MEETING

An exit meeting was conducted on June 25, 1993. During this meeting, the inspector reviewed the scope and findings of the report. The licensee did not identify as proprietary any information provided to, or reviewed by, the inspector during the inspection.

ATTACHMENT 2

RADIOLOGICAL CONFIRMATORY MEASUREMENT RESULTS

NRC INSPECTION REPORT: 50-285/93-10

1 NRC AIR PARTICULATE FILTER STANDARD (44710-109) (Standardized: 08:00, CDT, June 22, 1993) Radiochemistry Detectors # 2 and # 3				
Nuclide	FCS Results (μCi/Sample)	NRC Results (μCi/Sample)	FCS/NRC Ratio	Comparison Decision
Cd-109	8.08±0.058E-1	8.353±0.042E-1	0.97	Agreement
	8.98±0.065E-1		1.08	Agreement
Co-57	1.19±0.001E-2	1.320±0.011E-2	0.90	Agreement
	1.31±0.001E-2		0.99	Agreement
Ce-139	0.968±0.001E-2	1.048±0.011E-2	0.92	Agreement
	1.06±0.001E-2		1.01	Agreement
Hg-203	4.49±0.001E-4	4.499±0.807E-4	1.00	Agreement
	3.15±0.001E-4		0.70	Agreement
Sn-113	0.978±0.001E-2	1.105±0.018E-2	0.89	Agreement
	1.12±0.001E-2		1.01	Agreement
Cs-137	5.14±0.003E-2	5.687±0.033E-2	0.90	Agreement
	5.75±0.003E-2		1.01	Agreement
Y-88	1.66±0.001E-2	1.835±0.027E-2	0.90	Agreement
	1.81±0.001E-2		0.99	Agreement
Co-60	7.29±0.003E-2	7.961±0.042E-2	0.92	Agreement
	7.90±0.003E-2		0.99	Agreement

2 FCS AIR PARTICULATE FILTER STANDARD (46266A-22)
(Standardized: 11:00, CST, April 01, 1993)
Radiochemistry Detectors # 2 and # 3

Nuclide	FCS Results (μCi/Sample)	NRC Results (μCi/Sample)	FCS/NRC Ratio	Comparison Decision
Cd-109	2.02±0.146E0	1.721±0.006E0	1.17	Agreement
	1.93 E0		1.12	Agreement
Co-57	4.02±0.002E-2	4.018±0.023E-2	1.00	Agreement
	3.79 E-2		0.94	Agreement
Ce-139	7.41±0.007E-2	7.460±0.033E-2	0.99	Agreement
	7.20 E-2		0.97	Agreement
Hg-203	1.15±0.010E-1	1.110±0.007E-1	1.04	Agreement
	1.09 E-1		0.98	Agreement
Sn-113	1.28±0.009E-1	1.302±0.007E-1	0.98	Agreement
	3.052±0.022E-2		0.92	Agreement
Cs-137	6.87±0.004E-2	7.007±0.041E-2	0.98	Agreement
	6.53 E-2		0.93	Agreement
Y-88	2.31±0.010E-1	2.376±0.009E-1	0.97	Agreement
	2.18 E-1		0.92	Agreement
Co-60	1.07±0.001E-1	1.074±0.005E-1	1.00	Agreement
	1.01 E-1		0.94	Agreement

Attachment 2 (cont')

3 NRC CESCO CHARCOAL CARTRIDGE STANDARD (44711-109) (Standardized: 08:00, CDT, June 22, 1993) Radiochemistry Detectors # 2 and # 3					
Nuclide	FCS Results (μCi/Sample)		NRC Results (μCi/Sample)	FCS/NRC Ratio	Comparison Decision
Cd-109	10.1	E-1	8.591±0.045E-1	1.18	Agreement
	9.68			1.13	Agreement
Co-57	1.58	E-2	1.383±0.012E-2	1.14	Agreement
	1.48	E-2		1.07	Agreement
Ce-139	1.24	E-2	1.104±0.012E-2	1.12	Agreement
	1.18	E-2		1.07	Agreement
Hg-203	4.60	E-4	4.800±0.787E-4	0.96	Agreement
	5.16	E-4		1.08	Agreement
Sn-133	1.25	E-2	1.204±0.021E-2	1.04	Agreement
	1.22	E-2		1.01	Agreement
Cs-137	6.86	E-2	6.082±0.035E-2	1.13	Agreement
	6.56	E-2		1.09	Agreement
Y-88	2.09	E-2	1.953±0.032E-2	1.07	Agreement
	1.99	E-2		1.07	Agreement
Co-60	9.13	E-2	8.372±0.046E-2	1.09	Agreement
	8.87	E-2		1.06	Agreement

Attachment 2 (cont')

4 FCS TEDA 2 CHARCOAL CARTRIDGE STANDARD (957) (Standardized: 11:00, CST, April 01, 1993) Radiochemistry Detectors # 2 and # 3					
Nuclide	FCS Results (μCi/Sample)		NRC Results (μCi/Sample)	FCS/NRC Ratio	Comparison Decision
Cd-109	1.49	E0	1.341±0.007E0	1.11	Agreement
	1.41	E0		1.05	Agreement
Co-57	3.08	E-2	2.899±0.021E-2	1.06	Agreement
	2.83	E-2		0.98	Agreement
Ce-139	5.46	E-2	5.244±0.029E-2	1.04	Agreement
	5.27	E-2		1.00	Agreement
Hg-203	8.46	E-2	7.206±0.056E-2	1.17	Agreement
	8.06	E-2		1.12	Agreement
Sn-113	9.46	E-2	8.840±0.052E-2	1.07	Agreement
	8.75	E-2		0.99	Agreement
Cs-137	5.13	E-2	4.761±0.036E-2	1.08	Agreement
	4.80	E-2		1.01	Agreement
Y-88	1.68	E-2	1.609±0.008E-2	1.04	Agreement
	1.57	E-2		0.98	Agreement
Co-60	7.65	E-2	7.189±0.045E-2	1.06	Agreement
	7.31	E-2		1.02	Agreement

Attachment 2 (con't)

5 WASTE LIQUID C WHUT SAMPLE - 1000 MILLILITERS
(Sampled: 13:49, CDT, June 22, 1993)
Radiochemistry Detectors # 2 and # 3

Nuclide	FCS Results (μCi/ml		NRC Results (μCi/ml	FCS/NRC Ratio	Comparison Decision
Mn-54	5.85	E-6	6.141±0.186E-6	0.95	Agreement
	5.70	E-5		0.93	Agreement
Co-57	9.26	E-7	9.306±1.279E-7	1.00	Agreement
	9.85	E-7		1.06	Agreement
Co-58	1.09	E-5	1.778±0.021E-5	0.95	Agreement
	1.80	E-5		1.01	Agreement
Co-60	4.16	E-5	4.879±0.034E-5	0.85	Agreement
	4.33	E-5		0.89	Agreement
Ag-110M	3.11	E-6	2.599±0.210E-6	1.20	Agreement
	2.79	E-6		1.07	Agreement
Sb-125	5.20	E-5	5.743±0.072E-5	0.91	Agreement
	5.68	E-5		0.99	Agreement
I-131	2.04	E-5	1.983±0.024E-5	1.03	Agreement
	1.99	E-5		1.00	Agreement
I-133	3.45	E-6	3.171±0.200E-6	1.09	Agreement
	3.36	E-6		1.06	Agreement
Cs-134	3.93	E-5	3.955±0.032E-5	0.99	Agreement
	3.76	E-5		0.95	Agreement

Attachment 2 (cont')

Nuclide	FCS Results (μCi/ml		NRC Results (μCi/ml	FCS/NRC Ratio	Comparison Decision
Cs-136	1.29	E-6	1.606±0.171E-6	0.80	Agreement
	1.21	E-6		0.75	Agreement
Cs-137	2.31	E-4	2.256±0.006E-5	1.02	Agreement
	2.27	E-4		1.01	Agreement

Attachment 2 (cont')

6 REACTOR COOLANT GAS SAMPLE - 2cc
(Sampled: 11:01, CDT, June 23, 1993)
Radiochemistry Detectors # 2 and # 3

Nuclide	FCS Results (μCi/cc		NRC Results (μCi/cc	FCS/NRC Ratio	Comparison Decision
Ar-41	1.62	E-2	1.497±0.022E-2	1.08	Agreement
	1.72	E-5		1.15	Agreement
Kr-85M	8.23	E-3	7.514±0.101E-3	1.10	Agreement
	8.15	E-4		1.08	Agreement
Kr-87	1.83	E-2	1.688±0.027E-2	1.08	Agreement
	1.79	E-2		1.06	Agreement
Kr-88	2.03	E-2	1.878±0.029E-2	1.08	Agreement
	1.99	E-2		1.06	Agreement
Xe-133M	1.51	E-3	2.375±0.398E-3	0.64	Agreement
	2.12	E-3		0.89	Agreement
Xe-133	5.91	E-2	5.449±0.034E-2	1.10	Agreement
	5.98	E-2		1.10	Agreement
Xe-135	6.73	E-2	6.627±0.019E-2	1.02	Agreement
	6.67	E-2		1.01	Agreement

Attachment 2 (cont')

7 **REACTOR COOLANT LIQUID SAMPLE - 2ml** (Sampled: 11:01, CDT, June 23, 1993) Radiochemistry Detectors # 2 and # 3					
Nuclide	FCS Results (μCi/ml)		NRC Results (μCi/ml)	FCS/NRC Ratio	Comparison Decision
I-131	2.84	E-3	2.759±0.115E-3	1.03	Agreement
	2.72	E-3		0.99	Agreement
I-132	4.55	E-2	4.625±0.039E-2	0.98	Agreement
	4.15	E-2		0.90	Agreement
I-133	3.10	E-2	3.061±0.019E-2	1.01	Agreement
	2.98	E-2		0.97	Agreement
I-134	7.61	E-2	8.003±0.141E-2	0.95	Agreement
	7.04	E-2		0.88	Agreement
I-135	5.47	E-2	5.439±0.074E-2	1.01	Agreement
	5.13	E-2		0.94	Agreement
Cs 138	9.52	E-2	7.642±0.264E-2	1.25	Agreement
	8.66	E-2		1.13	Agreement

Attachment 2 (cont')

8 CONTAINMENT ATMOSPHERE SAMPLE - 1250cc (Sampled: 13:38, CDT, June 23, 1993 Radiochemistry Detectors # 2 and # 3					
Nuclide	FCS Results (μCi/cc)		NRC Results (μCi/cc)	FCS/NRC Ratio	Comparison Decision
Ar-41	4.94	E-6	4.472±0.134E-6	1.10	Agreement
	4.96	E-6		1.11	Agreement
Xe-133	1.74	E-5	1.543±0.016E-5	1.13	Agreement
	1.72	E-5		1.11	Agreement
Xe-135	6.42	E-7	5.531±0.236E-7	1.16	Agreement
	6.25	E-7		1.13	Agreement

ATTACHMENT 3

1993 QUALITY ASSURANCE LIQUID CAPABILITY TEST SAMPLE RESULTS

NRC INSPECTION REPORT: 50-285/93-10

1. Gamma Isotopic Analyses

Nuclide	FCS Results (μCi/ml)	NRC Results (μCi/ml)	FCS/NRC Ratio	Comparison Decision
Mn-54	9.917 E-6	8.96±0.24E-6	1.11	Agreement
Co-60	7.690 E-6	7.49±0.26E-6	1.03	Agreement
Cs-137	1.283 E-5	1.165±0.04E-5	1.10	Agreement

2. Beta Isotopic Analyses

Nuclide	FCS Results (μCi/ml)	NRC Results (μCi/ml)	FCS/NRC Ratio	Comparison Decision
H-3	1.186±0.03E-4	1.03±0.03E-4	1.15	Agreement
Sr-89	1.011±0.03E-4	1.11±0.03E-4	0.91	Agreement
Sr-90	1.792±0.09E-5	1.83±0.05E-5	0.98	Agreement
Fe-55	9.205±2.5E-6	9.78±0.29E-6	0.94	Agreement

ATTACHMENT 4

CRITERIA FOR COMPARING RADIOCHEMISTRY ANALYTICAL MEASUREMENTS

The following are the criteria used in comparing the results of capability tests and verification measurements. The criteria are based on an empirical relationship established through prior experience and this program's analytical requirements.

In these criteria, the judgement limits vary in relation to the comparison of the resolution.

$$\text{Resolution} = \frac{\text{NRC VALUE}}{\text{NRC UNCERTAINTY}}$$

$$\text{Ratio} = \frac{\text{LICENSEE VALUE}}{\text{NRC VALUE}}$$

Comparisons are made by first determining the resolution and then reading across the same line to the corresponding ratio. The following table shows the acceptance values.

RESOLUTION	AGREEMENT RATIO
< 4	0.40 - 2.50
4 - 7	0.50 - 2.00
8 - 15	0.60 - 1.66
16 - 50	0.75 - 1.33
51 - 200	0.80 - 1.25
> 200	0.85 - 1.18

The above criteria are applied to the following analyses:

(1) Gamma Spectrometry

(2) Tritium in liquid samples

(3) Iodine on adsorbers

(4) ^{89}Sr and ^{90}SR determinations

(5) Gross Beta where samples are counted on the same date using the same reference nuclide.