



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION II  
101 MARIETTA STREET, N.W.  
ATLANTA, GEORGIA 30323

JUN 27 1985

Report Nos.: 50-369/85-17 and 50-370/85-18

Licensee: Duke Power Company  
422 South Church Street  
Charlotte, NC 28242

Docket Nos.: 50-369 and 50-370

License Nos.: NPF-9 and NPF-17

Facility Name: McGuire 1 and 2

Inspection Conducted: May 28-31, 1985

Inspectors: G. B. Kuzo

13 June 1985  
Date Signed

Accompanying Personnel: J. D. Harris

Approved by: D. M. Montgomery  
D. M. Montgomery, Section Chief  
Emergency Preparedness and Radiological  
Protection Branch  
Division of Radiation Safety and Safeguards

6/13/85  
Date Signed

SUMMARY

Scope: This routine, unannounced inspection entailed 55 inspector-hours on site in the areas of quality control and confirmatory measurements including review of the laboratory quality control program; review of procedures and instructions; review of quality control records and logs; review of the counting room and chemistry laboratory facilities; results of split samples analyzed by the licensee and the NRC Region II Mobile Laboratory; and whole-body counter measurements using a fission product phantom.

Results: No violations or deviations were identified.

## REPORT DETAILS

### 1. Persons Contacted

#### Licensee Employees

- \*T. L. McConnell, Station Manager
- J. W. Foster, Station Health Physicist
- \*W. F. Byrum, Health Physics Coordinator
- \*K. L. Murray, Assistant Health Physicist
- \*L. K. Criminger, Health Physics Specialist
- \*C. D. Martinec, Junior Health Physicist
- \*G. T. Powell, Corporate Health Physicist
- \*N. McCraw, Compliance Engineer
- J. M. Curtis, QA Manager, Vendors
- M. J. Geer, Corporate Health Physicist

Other licensee employees contacted included office personnel.

#### NRC Resident Inspectors

- \*W. T. Orders
- \*R. Pierson

\*Attended exit interview

### 2. Exit Interview

The inspection scope and findings were summarized on May 31, 1985, with those persons indicated in Paragraph 1 above. Two inspector followup items concerning gaseous effluent measurements (Paragraph 8.a) and Fe-55 analysis verification (Paragraph 8.b) were discussed. Licensee management representatives acknowledged the inspectors' comments and expressed no contrary opinions. The licensee did not identify as proprietary any of the materials provided to or reviewed by the inspectors during this inspection.

### 3. Licensee Action on Previous Enforcement Matters

(Closed) 50-369/83-52-03, 50-370/83-45-03: Failure to properly calibrate Ge(Li) detectors for charcoal cartridge ~~count~~ rates. From a review of procedures and records (Paragraphs 6.a and 7.a), and comparison of licensee and NRC split sample confirmatory analyses (Paragraph 8.a) the inspectors verified that corrective actions have been implemented and charcoal cartridge calibrations are adequate.

### 4. Laboratory Quality Control Program (84725)

The inspectors reviewed selected portions of the Quality Assurance program with cognizant licensee representatives and determined that organizational structure and program management had not changed since the previous

inspection (IE 50-369/83-45, 50-370/83-52). The inspectors noted that program implementation met the general guidance of Regulatory Guide 4.15 "Quality Assurance for Radiological Monitoring Programs," with respect to the radioactive effluent monitoring program.

No violations or deviations were identified.

5. Audits (84725)

Technical Specification (TS) 6.5.2.9 states audits of unit activities shall be performed under the cognizance of the Nuclear Safety Review Board (NSRB) encompassing conformance of unit operation to provisions contained within the TS's and applicable license conditions at least once per 12 months; the Radiological Environmental Monitoring Program and the results thereof at least once per 12 months; the Offsite Dose Calculation Manual and implementing procedure at least once per 24 months; and the performance of activities required by the Quality Assurance Program for effluent and environmental monitoring at least once per 12 months. The inspectors reviewed the following audit reports:

- a. Departmental Audit NP-85-5(MS)
- b. Selected QA Department Vendor Audits, 1984 - 1985.

The inspectors noted that chemical and radiological measurements program areas were audited against applicable sections of the Technical Specifications, approved plant operating procedures and manuals, and Regulatory Guide 4.15. The inspectors noted that audits mainly addressed implementation of the chemical and radiochemical measurements program. No significant adverse findings were noted in the audit reports. The inspectors discussed with cognizant licensee representatives details of disagreement between licensee and known NRC values for selected radiochemical analyses (Paragraph 8.b) and noted that improved/additional audits should be conducted to ensure adequacy of all chemical/radiochemical measurements. Licensee representatives outlined their on-going program to evaluate this area by providing spiked samples to analytical laboratories.

No violations or deviations were identified.

6. Procedures (84725)

- a. Technical Specification 6.8.1 requires written procedures to be established, implemented and maintained covering the applicable procedures recommended in Appendix "A" of Regulatory Guide 1.33, Rev. 2, February 1978; and the Quality Assurance Program for effluent and environmental monitoring. The inspectors reviewed selected portions of the following procedures:
  - 1. McGuire Health Physics Manual Section 12.9, Operation of the ND680 Body Burden Analysis System, Rev. 2, 3/13/85.

2. McGuire Health Physics Manual Section 13.5, Preparation of Samples for Count Room Analysis, Rev. 4, 1/22/85.
3. HB-0-B-1001-10 Quality Assurance for ND6600 Gamma-Ray Spectroscopy System, Rev. 8, 5/9/85.
4. HB-0-B-1001-16 Calibration and Quality Assurance of ND-680 Body Burden Analysis System, Rev. 1, 2/27/85.
5. HB-0-B-1001-17 Calibration and Quality Assurance for Tennelec LB 5100 Automatic Alpha/Beta Counter, Rev. 1 4/16/85.
6. HB-0-B-1001-18 Calibration and Quality Assurance for Tennelec LB 1000 Manual Alpha Beta Counter, Rev. 1, 6/4/84.
7. HB-0-B-1001-19 Calibration and Quality Assurance for the ND 6600 Gamma-Ray Spectroscopy System, Rev. 11, 12/11/84.
8. HB-0-B-1001-20 Calibration, Quality Assurance and Parameter Set-up for Beckman LS-5800 Series Liquid Scintillation, Rev. 0, 6/25/84.
9. HB-0-B-1003-07 Preparation of Count Room Standards, Rev. 1. 4/4/84.

The inspectors noted that procedures were being reviewed and approved in accordance with established procedures. Results of the procedure review were discussed with cognizant licensee representatives as noted in Paragraph 6.b.

- b. The inspectors discussed with cognizant license representatives effluent sampling and analyses procedure limits required by TS 3/4. 11.1. The inspectors noted that TS Lower Limits of Detection (LLD) calculations were based on the time interval between sample collection and analyses. In contrast, McGuire Nuclear Station procedures detailing liquid and gaseous analyses did not establish a maximum time limit between sampling and analyses. The inspectors discussed with licensee representatives the need to establish a maximum time interval between sampling and analyses to ensure that TS effluent analyses LLD's are met. Licensee representatives agreed to evaluate this area.

No violations or deviations were identified.

#### 7. Records (84725)

- a. The inspectors reviewed selected portions of the following records:
  1. Beckman 1800 Liquid Scintillation Counter No. MCHHPS-26470 Quality Control Logs for April - May 1985 including:



- i. H-3, C-14 Daily Performance and Background Data Sheets
  - ii. Performance Graphs
  - iii. Check Source Data Sheet
  - iv. Efficiency and Monthly Performance Value Determination Worksheet.
  - v. Weekly Calibration Log Sheet
2. Tennelec LB-5100 Automatic Proportional Counter (Detector Nos. 26012 and 26280) and Tennelec 1000 Manual Alpha/Beta Counter (Detector No. 26403) Log Book Records for May 1985 including:
  - i. Daily Performance and Background Checks
  - ii. Performance Graph
  - iii. Check Source Data Sheet
  - iv. Efficiency and Monthly Performance Determination
  - v. Voltage Plateau Charts
  - vi. Quality Assurance Check Source Data Sheet
3. Ge(Li) Detector (System Nos. A, B, C and D) Quality Control Logs for May 1985 including:
  - i. Daily Check Report
  - ii. Performance Graph
  - iii. Monthly Energy Calibration
  - iv. Monthly Energy Resolution Check
4. 1984 Efficiency Calibration Data for Gamma Spectroscopy Detectors Nos. A, B, C and D including the following geometries: 12 cc Gas Vial, 100 cc Gas Bomb, 4400 cc Gas Marinelli, 50 ml Bottle, 47 mm Fiber Filter, Face-loaded Charcoal Cartridge.
5. Standard Radionuclide Source Certificates
6. Intralaboratory Cross Check Results for the Counting Room, January - May 1985.
7. Interstation Cross Check Program Results, October 1983 - May 1985 for the following analyses:
  - i. Gamma in Water, Particular Filter, Charcoal Cartridge
  - ii. Body Burden Analyses
  - iii. Alpha/Beta Swipes
8. Waste Gas Decay Tank Release Reports, 1984 - 1985
9. Gamma Spectroscopy System LLD Determinations for a 100 cc Gas Bomb.

Results of the record review were discussed with cognizant licensee representatives as noted in Paragraphs 7.b - .c.

- b. The inspectors reviewed gamma spectroscopy efficiency curves for gaseous effluent measurements. The inspectors noted deviations from the expected curves. The inspectors informed licensee representatives that the noted deviations from the expected curve could indicate detector gamma-ray summing problems resulting in lower efficiency values, and thus, possibly could explain the systematically high values relative to NRC results for gaseous analyses (Paragraph 8.a). Licensee representatives agreed to evaluate this area during the next calibration. This area will be reviewed as part of the inspector followup item detailed in Paragraph 8.a.

No violations or deviations were identified.

#### 8. Confirmatory Measurements (84725)

- a. During the inspection, reactor coolant and selected liquid and gaseous plant effluent process streams were sampled and the resultant sample matrices analyzed for radionuclide concentrations using licensee and NRC Region II Laboratory gamma-ray spectroscopy systems. The purpose of these comparative measurements was to verify the licensee's capability to measure radionuclides accurately in various plant systems. Analyses were conducted utilizing as many of the licensee's gamma spectroscopy systems as practicable. Sample types and counting geometries included the following: reactor coolant system (RCS) sample - 50 ml bottle; liquid waste - 3500 ml marinelli; and gaseous waste - 12 cc vial, 100 cc gas bomb and 4400 cc marinelli. Spiked particulate filter and charcoal cartridge sample types were provided for analyses in lieu of licensee samples which did not have sufficient levels of activity for analysis. Comparison of licensee and NRC results are listed in Table 1 with the acceptance criteria listed in Attachment 1. Results were in agreement for all liquid, particulate filter, and charcoal cartridge sample analyses. For gaseous sampling - 100 cc gas bomb geometry, Kr-85m was in disagreement for all detectors and for the 4400 cc gas marinelli, Xe-133 was in disagreement for detector No. 24-P-1160B. Further inspection disclosed that the difference between the licensee and NRC for Kr-85m measurements resulted from the licensee using the improper abundance value for the isotope. Licensee results using the correct abundance value were in agreement. The causes for disagreement of the Xe-133 value and systematically high values for licensee measurements using 100 cc bomb and 4400 cc marinelli geometries, were not determined prior to the end of the inspection. The inspectors noted that high gas values were observed during a previous confirmatory measurements inspection (IE 50-369/93-45, 50-370/83-52) and that calibration techniques should be reviewed. Licensee evaluation of this area will be considered a inspector followup item and will be reviewed during a subsequent inspection (50-369/85-17-01, 50-370/85-18-01).

- b. The inspectors noted that the licensee was provided with a simulated liquid waste sample by the NRC contract laboratory and was requested to complete radiochemical analyses for H-3, Fe-55, Sr-89, and Sr-90. Comparison of licensee and NRC results are listed in Table 2 with the acceptance criteria listed in Attachment 1. Results were in agreement for H-3, Sr-89 and Sr-90 analyses. For Fe-55, licensee results were in disagreement, approximately 60% higher than the known value. Licensee representatives detailed current efforts to verify their accuracy in Fe-55 analyses, including a program to provide the current vendor with spiked samples for verification analyses. The inspectors informed licensee representatives that following completion of their current verification analyses, an additional spiked sample would be provided by the NRC for Fe-55 analyses. The inspectors informed licensee representatives that this would be considered an inspector followup item and would be reviewed during a subsequent inspection (50-369/85-17-02, 50-370/85-18-02).

No violations or deviations were identified.

9. Tour of the Chemistry and Counting Room Facilities (84725)

The inspectors toured the counting room facilities. The inspectors noted adequate cleanliness and organization in the laboratory.

No violations or deviations were identified.

10. Use of Fission Product Phantom for Checking Whole-body Counter Measurements (92706)

During this inspection, the inspectors verified the licensee's capability to perform radiological bioassays using their whole-body counting system. A fission product phantom containing radioactive sources was provided to the licensee for analyses. The phantom duplicated nuclide and organ burdens that the licensee might encounter during normal operation. The phantom was analyzed using the licensee's normal methods and equipment.

The licensee had two whole-body counting systems, however, one of the counters was out of service at the time of this inspection. The licensee's whole-body counter was a standard chair geometry system consisting of Nuclear Data electronics and three NaI detectors for the thyroid, lungs, and lower torso. The inspectors reviewed the licensee operating calibration, and quality assurance procedures for the whole-body counting system. Calibrations were conducted using vendor supplied block phantoms for the thyroid, lung, and lower torso. The licensee used individual Ce-139, Sn-113, Cs-137, Y-88, and Zn-65 nuclide sources for calibration.

The results of the intercomparison are presented in Table 3. The results are based on an average of five measurements except as indicated by footnote in the Table. Licensee measurements were in general agreement with the known values. In general, all measurements were higher than the known values except for Co-57.

No violations or deviations were identified.

11. Inspector Followup Items (92701)

- a. (Closed) 50-369/83-45-01, 50-370/83-52-01: evaluation of high dead time on Ge(Li) detector efficiencies. From a review of procedures the inspectors noted that gamma spectroscopy dead time requirements are now limited to a maximum value of 10%. Review of selected data sheets verified that the established limit was not exceeded.
- b. (Closed) 50-369/83-45-02, 50-370/83-52-02: review of interlaboratory chemistry cross check program administrative control. From review of revised procedures the inspectors noted that administrative limits regarding the interlaboratory cross check program have been detailed. The criteria are based on NRC confirmatory measurements criteria.
- c. (Closed) 50-369/83-45-04, 50-370/83-52-04: results of H-3 spiked sample analysis. Results of the confirmatory measurements H-3 analysis (Paragraph 8.b) were in agreement.



TABLE 1  
RESULTS OF CONFIRMATORY GAMMA SPECTROSCOPY MEASUREMENTS AT MCGUIRE  
NUCLEAR STATION, MAY 28-31, 1985

SAMPLE TYPE (License Geometry)	ISOTOPE	CONCENTRATION (uCi/Unit)		RESOLUTION	RATIO LICENSEE/NRC	COMPARISON
		LICENSEE	NRC			
(1) Liquid-RCS (50 ml Bottle)	I-132	5.51 E-3	5.59±0.54 E-3	10	0.98	Agreement
	I-133	3.36 E-3	4.02±0.23 E-3	17	0.84	Agreement
	I-135	7.03 E-3	6.53±0.92 E-3	7	1.08	Agreement
(2) Liquid-RCS (50 ml Bottle)	I-132	5.96 E-3	5.59±0.54 E-3	10	1.07	Agreement
	I-133	3.75 E-3	4.02±0.23 E-3	17	0.93	Agreement
	I-135	7.13 E-3	6.53±0.92 E-3	7	1.09	Agreement
(3) Liquid-RCS (50 ml Bottle)	I-132	6.04 E-3	5.59±0.54 E-3	10	1.08	Agreement
	I-133	3.67 E-3	4.02±0.23 E-3	17	0.91	Agreement
	I-135	7.14 E-3	6.53±0.92 E-3	7	1.09	Agreement
(4) Liquid-RCS (50 ml Bottle)	I-132	5.98 E-3	5.59±0.54 E-3	10	1.07	Agreement
	I-133	3.62 E-3	4.02±0.23 E-3	17	0.90	Agreement
	I-135	7.26 E-3	6.53±0.92 E-3	7	1.11	Agreement
(1) Liquid-WMT (3500 ml Marinelli)	Co-58	1.55 E-5	1.40±0.06 E-5	23	1.11	Agreement
	Co-60	3.03 E-6	3.82±0.42 E-6	9	0.79	Agreement
(2) Liquid-WMT (3500 ml Marinelli)	Co-58	1.54 E-5	1.40±0.06 E-5	23	1.10	Agreement
	Co-60	3.23 E-6	3.82±0.42 E-6	9	0.84	Agreement
(3) Liquid-WMT (3500 ml Marinelli)	Co-58	1.53 E-5	1.40±0.06 E-5	23	1.09	Agreement
	Co-60	3.43 E-6	3.82±0.42 E-6	9	0.90	Agreement
(1) Particulate Filter (47 mm Filter)	Co-60	1.09 E-2	1.04±0.03 E-2	35	1.05	Agreement
	Cs-137	1.33 E-2	1.26±0.03 E-2	42	1.06	Agreement
(2) Particulate Filter (47 mm Filter)	Co-60	1.04 E-2	1.04±0.03 E-2	35	1.00	Agreement
	Cs-137	1.30 E-2	1.26±0.03 E-2	42	1.03	Agreement
(3) Particulate Filter (47 mm Filter)	Co-60	1.03 E-2	1.04±0.03 E-2	35	0.99	Agreement
	Cs-137	1.25 E-2	1.26±0.03 E-2	42	0.99	Agreement
(4) Particulate Filter (47 mm Filter)	Co-60	1.04 E-2	1.04±0.03 E-2	35	1.00	Agreement
	Cs-137	1.28 E-2	1.26±0.03 E-2	42	1.02	Agreement
(1) Charcoal Cartridge (Face Loaded)	Ba-133	4.50 E-2	4.50±0.04 E-2	112	1.00	Agreement
(2) Charcoal Cartridge (Face Loaded)	Ba-133	4.66 E-2	4.50±0.04 E-2	112	1.04	Agreement
(3) Charcoal Cartridge (Face Loaded)	Ba-133	4.24 E-2	4.50±0.04 E-2	112	0.94	Agreement

TABLE 1 (Con't)

SAMPLE TYPE (License Geometry)	ISOTOPE	CONCENTRATION (uCi/Unit)		RESOLUTION	RATIO LICENSEE/NRC	COMPARISON
		LICENSEE	NRC			
(4) Charcoal Cartridge (Face Loaded)	Ba-133	4.31 E-2	4.50±0.04 E-2	112	0.96	Agreement
(2) Gas-WGDT (12 cc Gas Vial)	Xe-133	1.82 E-3	1.74±0.06 E-3	29	1.04	Agreement
(3) Gas-WGDT (12 cc Gas Vial)	Xe-133	1.74 E-3	1.74±0.06 E-3	29	1.00	Agreement
(2) Gas-WGDT (100 cc Bomb)	Kr-85m	2.05 E-4	1.35±0.04 E-4	34	1.52	Disagreement
	Kr-88	1.53 E-4	1.57±0.09 E-4	17	0.97	Agreement
	Xe-133	2.26 E-3	2.02±0.02 E-3	101	1.12	Agreement
	Xe-135	2.12 E-4	2.03±0.05 E-4	41	1.04	Agreement
(3) Gas-WGDT (100 cc Bomb)	Kr-85m	2.43 E-4	1.35±0.04 E-4	34	1.80	Disagreement
	Kr-88	1.86 E-4	1.57±0.09 E-4	17	1.18	Agreement
	Xe-133	2.63 E-3	2.02±0.02 E-3	101	1.30	Disagreement
	Xe-135	2.44 E-4	2.03±0.05 E-4	41	1.20	Agreement
(4) Gas-WGDT (100 cc Bomb)	Kr-85m	2.00 E-4	1.35±0.04 E-4	34	1.48	Disagreement
	Kr-88	1.43 E-4	1.57±0.09 E-4	17	0.91	Agreement
	Xe-133	2.19 E-3	2.02±0.02 E-3	101	1.08	Agreement
	Xe-135	2.07 E-4	2.03±0.05 E-4	41	1.02	Agreement
(2) Gas-Vent (4400 cc Marinelli)	Xe-133	7.07 E-6	5.07±0.18 E-6	28	1.39	Disagreement
	Xe-135	2.37 E-6	2.05±0.07 E-6	29	1.16	Agreement
(3) Gas-Vent (4400 cc Marinelli)	Xe-133	6.25 E-6	5.07±0.18 E-6	28	1.23	Agreement
	Xe-135	2.30 E-6	2.05±0.07 E-6	29	1.12	Agreement
(4) Gas-Vent (4400 cc Marinelli)	Xe-133	5.80 E-6	5.07±0.18 E-6	28	1.14	Agreement
	Xe-135	2.22 E-6	2.05±0.07 E-6	29	1.07	Agreement

ND Not Detected

NC Not Compared

(1) Analyzed Using Gamma Spectroscopy System No. A 1792

(2) Analyzed Using Gamma Spectroscopy System No. B 24-P-1160B

(3) Analyzed Using Gamma Spectroscopy System No. C 24-P-1301

(4) Analyzed Using Gamma Spectroscopy System No. D 23-P-67WB

TABLE 2

RESULTS OF H-3, Fe-55, Sr-89 AND Sr-90 ANALYSIS FOR MCGUIRE  
NUCLEAR PLANT, MAY 28-31, 1985

<u>SAMPLE TYPE</u>	<u>ISOTOPE</u>	<u>CONCENTRATION (uCi/Unit)</u>		<u>RESOLUTION</u>	<u>RATIO LICENSEE/NRC</u>	<u>COMPARISON</u>
		<u>LICENSEE</u>	<u>NRC</u>			
*Liquid-Spiked (Sample)	H-3	4.50 E-5	4.60±0.13 E-5	35	0.98	Agreement
	Fe-55	2.60 E-5	1.62±0.08 E-5	20	1.60	Disagreement
	Sr-89	1.20 E-5	1.27±0.03 E-4	42	0.94	Agreement
	Sr-90	2.20 E-5	2.08±0.06 E-5	35	1.06	Agreement

\*Spiked Sample From NRC Contract Laboratory May 1984

TABLE 3

RESULTS OF WHOLE BODY COUNTER MEASUREMENTS  
USING A COMMERCIALLY AVAILABLE FISSION PRODUCT PHANTOM AT MCGUIRE  
NUCLEAR PLANT, MAY 28-31, 1985

Nuclide	Organ	Licensee <sup>(1)</sup> (nCi)	NRC (nCi)	Ratio (Licensee/NRC)
Mn-54 <sup>(2)</sup>	Lung	47 <sup>(3)</sup>	33	1.42
Co-57 <sup>(2)</sup>	Lung	36	56	0.64
Co-60	Lung	227	186	1.22
Cs-137	Lung	110	89	1.24

1. Licensee value represents the arithmetic mean of five measurements, each measurement was 180 seconds.
2. Licensee's whole-body counting system nuclide library only identified Co-60 and Cs-137.
3. Licensee value represents the arithmetic mean of only four measurements, the whole-body counting system did not identify the Mn-54 peak for one of the measurements.