



UNITED STATES  
NUCLEAR REGULATORY COMMISSION

REGION II  
101 MARIETTA STREET, N.W.  
ATLANTA, GEORGIA 30303

JUN 13 1984

Report Nos.: 50-325/84-14 and 50-324/84-14

Licensee: Carolina Power and Light Company  
411 Fayetteville Street  
Raleigh, NC 27602

Docket Nos.: 50-325 and 50-324

License Nos.: DPR-71 and DPR-62

Facility Name: Brunswick

Inspection Date: May 21 - 25, 1984

Inspection at Brunswick site near Southport, North Carolina

Inspector: George B. Kuzo  
G. B. Kuzo

8 June 1984  
Date Signed

Accompanying Personnel: P. C. McPhail

Approved by: D. M. Montgomery  
D. M. Montgomery, Section Chief  
Division of Reactor Safety

6-11-84  
Date Signed

SUMMARY

Areas Inspected

This routine unannounced inspection involved 75 inspector-hours on site in the areas of quality control and confirmatory measurements including: review of the laboratory quality control program; review of chemistry and radiochemistry procedures; review of quality control records and logs; and comparison of the results of split samples analyzed by the licensee and NRC RII Mobile Laboratory.

Results: Violation - Failure to follow procedures for calibration of a Ge(Li) detector system.

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## REPORT DETAILS

### 1. Persons Contacted

- \*C. R. Dietz, Plant General
- \*A. G. Cheatham, Manager, Environmental & Radiation Control
- \*C. E. Robertson, Environmental & Chemistry Supervisor
- \*M. Millinor, Foreman, Environmental & Radiation Control
- B. Nurnberger, Foreman, Environmental & Radiation Control
- \*K. E. Enzor, Director, Regulatory Compliance
- \*L. E. Jones, Director, Quality Assurance/Quality Control

Other licensee employees contacted included two technicians.

NRC Resident Inspector

- \*L. W. Garner

\*Attended exit interview

### 2. Exit Interview (30703)

The inspection scope and findings were summarized on May 25, 1984, with those persons indicated in Paragraph 1 above. One violation (Paragraph 7) concerning failure to follow procedures for calibration of effluent measurement instrumentation was discussed in detail. One IFI concerning proportional counter efficiency determination (Paragraph 6) remains open until further plant evaluation. The licensee acknowledged the findings and took no exceptions.

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

- a. The inspector discussed with cognizant licensee representatives the Quality Control Program for chemical and radiochemical measurements as follows:

- (1) Assignment of Responsibility and Authority to Manage and Conduct the QC Program.

The Environmental and Radiation Control (E&RC) Foremen are responsible for quality control associated with chemistry, radiochemistry, and counting room procedures. Specific Quality control procedures are carried out by technicians under the E&RC foremen.

- (2) Provisions for Audits/Inspections.

The E&RC foremen review results of quality control documentation associated with procedures and instrumentation to ensure that the QC program is being implemented. A semiannual plant surveillance program is conducted according to approved procedures.

- (3) Methods for Assuring Deficiencies and Deviations in the Program are Recognized, Identified and Corrected.

Quality Control checks with acceptance criteria are outlined in the operating procedures for chemistry and counting room instrumentation. Unacceptable results are brought to the attention of the E&RC foremen. Significant quality control items are identified to the attention of the Plant Nuclear Safety Committee. Action items are established to ensure corrective action is accomplished according to appropriate plant procedures. Followup on outstanding action items are conducted to assure implementation of corrective actions.

- (4) Quality Control of Purchased and Contracted Analyses.

No chemical or radiochemical analyses are contracted to outside vendors. Radiostrontium analyses of liquid effluent samples are conducted by CP&L's Harris Energy and Environmental Center. Vendors supplying chemicals and standards are required to be assigned to an "Approved Suppliers List," which is established according to Corporate Quality Assurance Program Audit requirements.

#### 4. Audits and Evaluations (84725)

The inspector reviewed the following selected audits, assessments, and followup responses:

1. Audit Report No. QAA/21-29, dated September 16, 1983.
2. INPO Evaluation of Brunswick Steam Electric Plant dated June 1983.
3. INPO Brunswick Steam Electric Plant Followup Assessment Visit, dated January 31, 1984.
4. Corporate Health Physics Assessment of the Brunswick Plant Environmental Radiological Surveillance Program, dated February 22, 1984.

The inspector noted that no significant items regarding the effluent measurements and reactor chemistry programs were identified.

#### 5. Review of Chemistry and Radiochemistry Procedures (84725)

- a. The inspector reviewed selected portions of the following procedures:
- (1) E&RC-1210 Determination of Radioiodine. Rev. 8. 11/9/83.
  - (2) E&RC-1211 Analysis for Radioiodine in Iodine Collection Cartridges, Rev 4. 4/22/83.

- (3) E&RC-1212 Gaseous Marinelli Beaker & Serum Vial Standard Preparation for GeLi Detector Calibration Rev 3. 4/6/83.
- (4) E&RC-1214 Source Check of Process Radiation Monitors. Rev 0. 6/8/83.
- (5) E&RC-1221 Collection, Preparation, and Analysis Procedure for Routine SJAЕ Off-Gas Analysis. Rev 3. 12/9/83.
- (6) E&RC-1230 Tritium Analyses of Liquids & Liquid Effluents. Rev 2. 7/6/83.
- (7) E&RC Tritium Analysis of Airborne Effluents Rev 8. 7/6/83.
- (8) E&RC-1270 Minimum Detectable Activity. Rev 2. 11/9/83.
- (9) E&RC-1700 Verification of Analytical Performance. Rev 0. 11/17/83.
- (10) E&RC-2150 Calibration of Plant In-line Conductivity Cells. Rev 1. 8/27/82.
- (11) E&RC-2201 Calibration/Operation of ND 6600 Multi-Channel Analyzer. Rev 7. 7/20/83.
- (12) E&RC-2202 Operation and Calibration on Packard Liquid Scintillation Counter, Rev 3. 12/29/83.
- (13) E&RC Calibration and Operation of Particulate Counters Rev 4. 1/4/84.
- (14) E&RC-2206 Radioactive Standards Preparation for Calibration of the ND 6600 Multichannel Analyzer. Rev 2. 4/22/83.

The results of the procedure review were discussed with cognizant licensee representatives as noted in Paragraphs 5b-c.

- b. The inspector reviewed and discussed procedures E&RC-2201 "Calibration/Operation of ND6600 Multichannel Analyzer" and E&RC 2206 "Radioactive Standards Preparation for Calibration of the ND6600 Multichannel Analyzer" with cognizant licensee representatives. The inspector noted that both procedures outlined recommended precautions and limits of five percent dead time during instrument calibration and routine sample analyses. Inspection of the inaccurate charcoal cartridge measurement results reported in Paragraph 7a disclosed that during a recalibration of the charcoal cartridge geometry for GeLi System No. 835 in March 1984, the recommended procedural dead time limits were exceeded. The inspector noted that failure to note and properly evaluate the elevated dead time resulted in the observed inaccurate efficiency calibrations for the specified geometry. The inspector informed licensee representatives that failure to follow

procedures was a violation of Technical Specification 6.8.1.a which requires written procedures be established, implemented, and maintained covering applicable procedures in Appendix "A" of Regulatory Guide 1.33, November 1972 (50-325/84-14-01, 50-324/84-14-01).

- c. The inspector determined following the procedure review and discussions with cognizant licensee representatives that procedure E&RC-1215 "Analysis for Strontium-Yttrium" had been removed from plant operating procedures and all current strontium analyses are conducted by the Harris Energy and Environmental Center. This closes a previously identified inspector followup item (50-325/83-21-01, 50-324/83-21-01).

6. Review of Records and Logs (84725)

- a. The inspector reviewed selected portions of the following records and logs:

- (1) GeLi Detector System Nos. 835 and 1414 QC Records for January - May 1984, including:

- i Reliability Records and Associated Charts
- ii Daily Resolution Check Results
- iii FWHM Determinations
- iv Background Checks
- v LLD Determination Data Sheets

- (2) Annual (1983) GeLi Detector Systems Nos 835 and 1414 Energy Calibrations for the following geometries: Gas vial, Silver zeolite cartridge, 100 cc gas beaker, Gas marinelli, 40 mm filter paper, Face-loaded charcoal cartridge, Liquid vial.

- (3) Liquid Scintillation System - TriCarb 2002 QC Records for January - May 1984 including:

- i Daily Quality Control Sheets
- ii Background Determinations
- iii Reliability Records and Trend Charts
- iv Chi-Square Determinations
- v Efficiency Determination

- (4) LB-5100 and Baird Atomic Nos. 142 & 146 Proportional Counter QC Records for January - May 1984 including:
  - i Daily Reliability Results and Trend Charts
  - ii Chi-Square Determination
  - iii Background Results
  - iv Efficiency Determinations
- (5) Spectrophotometer 21 - 1984 Chemistry Standard Curves for the following analyses:
  - i Silica
  - ii Boron
  - iii Chloride
  - iv Phosphate
- (6) Ion Chromatograph Log Book 1983 - 1984 including
  - i Chloride QC Results
  - ii Maintenance Checks
- (7) pH Meter Nos. 620-11, 12, 16, 17, 18, 25, 750-13 Calibration Sheets for January - May 1984.
- (8) Chemistry Intralaboratory Spiked Sample Results - January 1984.
- (9) Chemistry Round-Robin Water Chemistry Analyses (1982 and first and second quarter 1983) and Chemistry Cross Check Program Results (October 1983).
- (10) Radiochemistry Cross Check Program Results (1983).

The results of the record review were discussed with cognizant licensee representatives as noted in Paragraph 6b-c.

- b. The inspector determined from discussions with licensee representatives that a Sr-90 source was utilized to determine selected efficiencies for plant proportional counters. Cognizant licensee representatives informed the inspector that an evaluation concerning plant specific beta-emitting contaminants at the Brunswick Steam Electric Plant was in progress. The inspector informed licensee representatives that the inspector followup item regarding beta-emitter efficiency calibrations (50-325/83-21-02, 50-324/83-21-02) would remain open until completion of the evaluation and the appropriate sources for instrument calibration selected.

- c. The inspector discussed reported disagreements for Gross Alpha analyses Cross Check Results for 1983. The inspector noted that licensee representatives have identified problems in preparation of the highly acidic sample for normal plant analysis methodology and corrective action was being implemented. The inspector noted that results for all other analyses were adequate.

#### 7. 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 Mobile Laboratory gamma ray spectroscopy systems. The purpose of these comparative measurements was to verify the licensee's capability to adequately measure radionuclides in various plant systems. Analyses were conducted utilizing as many of the licensee's gamma spectroscopy systems as practicable. Samples included the following: a reactor coolant sample, simulated liquid waste sample and a gas sample collected at the augmented off-gas system. Spiked particulate and charcoal cartridge filter samples were provided for analyses in lieu of those licensee sample types not having sufficient levels of activity for analyses. Comparison of licensee and NRC results are presented in Table 1 with the acceptance criteria listed in Attachment 1. Excluding the charcoal cartridge sample analyzed using GeLi Detector No. 835, all sample types were in agreement for each nuclide. For the spiked charcoal cartridge analyzed using licensee detector No. 835 all nuclide values were in disagreement. The licensee results were approximately 50 percent higher than NRC values. Further inspection disclosed inaccurate efficiency values for the charcoal cartridge geometry were utilized from March to May 1984. The inspector noted that elevated dead-time during calibration resulted in the observed inaccurate efficiency values (Paragraph 5b). The inspector noted that this inaccurately calibrated detector was utilized to evaluate eleven samples between March - May 1984. It was noted that these errors would have resulted in over-estimating radioiodine discharges and that no regulatory limits would have been exceeded as a result. Comparisons of licensee results using corrected efficiency data for GeLi Detector System No. 835 are listed in Table 2. The corrected data were in agreement for all nuclides.
- b. The inspector verified that cognizant licensee representatives had received a spiked sample from the NRC Contract Laboratory. Cognizant licensee individuals informed the inspector that all required analyses had not been completed but results would be forwarded to the Regional Office in a timely manner. These results will be reviewed in a subsequent inspection.

TABLE I

## RESULTS OF CONFIRMATORY MEASUREMENTS AT BRUNSWICK STEAM ELECTRIC PLANT

MAY 21 - 25, 1984

SAMPLE	ISOTOPE	CONCENTRATION ( $\mu\text{Ci/cc}$ )			RESOLUTION	RATIO LICENSEE/NRC	COMPARISON
		LICENSEE	NRC				
(1) Reactor Coolant Liquid	Cr-51	1.33E-2	1.33 $\pm$ 0.07E-2	19	1.00	Agreement	
	Tc-99m	1.33E-2	1.18 $\pm$ 0.01E-2	118	1.13	Agreement	
(1) Liquid Waste - Simulated	Cr-51	5.2E-5	5.23 $\pm$ 0.59E-5	9	1.00	Agreement	
	Mn-56	2.44E-5	2.78 $\pm$ 0.12E-5	23	0.88	Agreement	
	Tc-99m	1.19E-4	1.15 $\pm$ 0.01E-4	115	1.03	Agreement	
(2) Liquid Waste - Simulated	Cr-51	4.98E-5	5.23 $\pm$ 0.59E-5	9	0.95	Agreement	
	Mn-56	2.36E-5	2.78 $\pm$ 0.12E-5	23	0.85	Agreement	
	Tc-99m	1.30E-4	1.15 $\pm$ 0.01E-4	115	1.13	Agreement	
(1) Particulate Filter Spike	Mn-54	1.09E-2	1.13 $\pm$ 0.03E-2	38	0.96	Agreement	
	Co-60	2.26E-2	2.40 $\pm$ 0.04E-2	600	0.94	Agreement	
	Cs-137	1.22E-2	1.36 $\pm$ 0.03E-2	45	0.90	Agreement	
	Cs-144	2.56E-2	2.40 $\pm$ 0.06E-2	40	1.07	Agreement	
(2) Particulate Filter Spike	Mn-54	1.14E-2	1.13 $\pm$ 0.03E-2	38	1.01	Agreement	
	Co-60	2.39E-2	2.40 $\pm$ 0.04E-2	600	0.99	Agreement	
	Cs-137	1.30E-2	1.36 $\pm$ 0.03E-2	45	0.96	Agreement	
	Cm-144	2.56E-2	2.40 $\pm$ 0.06E-2	40	1.07	Agreement	
(1) Charcoal Cartridge Spike	Co-57	1.65E-4	1.23 $\pm$ 0.32E-4	4	1.34	Agreement	
	Co-60	3.12E-2	3.09 $\pm$ 0.04E-2	77	1.01	Agreement	
	Cs-137	3.50E-2	3.39 $\pm$ 0.04E-2	85	1.03	Agreement	
(2) Charcoal Cartridge Spike	Co-57	2.54E-4	1.23 $\pm$ 0.32E-4	4	2.06	Disagreement	
	Co-60	4.66E-2	3.09 $\pm$ 0.04E-2	77	1.51	Disagreement	
	Cs-137	5.24E-2	3.39 $\pm$ 0.04E-2	85	1.54	Disagreement	
(1) Off-Gas	Kr-87	8.58E-4	9.90 $\pm$ 1.00E-4	10	0.87	Agreement	
	Xe-135	3.44E-4	4.70 $\pm$ 0.50E-4	9	0.73	Agreement	
	Xe-135m	3.14E-3	3.27 $\pm$ 0.10E-3	33	0.96	Agreement	
	Xe-138	1.32E-2	1.35 $\pm$ 0.05E-2	27	0.98	Agreement	
(2) Off-Gas	Kr-87	1.17E-3	9.90 $\pm$ 1.00E-4	10	1.18	Agreement	
	Xe-135	2.87E-4	4.70 $\pm$ 0.50E-4	9	0.61	Agreement	
	Xe-135m	3.38E-3	3.27 $\pm$ 0.10E-3	33	1.03	Agreement	
	Xe-138	1.28E-2	1.35 $\pm$ 0.05E-2	27	0.95	Agreement	

(1) Analyzed using licensee detector system No. 1414

(2) Analyzed using licensee detector system No. 835



TABLE II

RESULTS OF CORRECTED CHARCOAL CARTRIDGE ANALYSIS DATA FOR CONFIRMATORY MEASUREMENTS AT  
BRUNSWICK STEAM ELECTRIC PLANT - MAY 21 - 25, 1984

SAMPLE	ISOTOPE	CONCENTRATION (uCi/cc)		RESOLUTION	RATIO LICENSEE/NRC	COMPARISON
		LICENSEE	NRC			
(1) Charcoal Cartridge Spike	Co-57	4.14E-3	4.06±0.09E-3	45	1.02	Agreement
	Co-60	3.46E-2	3.61±0.05E-2	72	0.96	Agreement
(2) Charcoal Cartridge Spike	Co-57	5.07E-2	4.06±0.09E-3	45	1.25	Agreement
	Co-60	3.82E-2	3.61±0.05E-2	72	1.06	Agreement
	Co-137	3.52E-2	3.21±0.04E-2	80	1.10	Agreement
(1)	Analyzed using licensee detector system No. 1414					
(2)	Analyzed using licensee detector system No. 835					

Attachment 1

CRITERIA FOR COMPARING ANALYTICAL MEASUREMENTS

This attachment provides criteria for comparing results of capability tests and verification measurements. The criteria are based on an empirical relationship which combines prior experience and the accuracy needs of this program.

In these criteria, the judgement limits are variable in relation to the comparison of the NRC's value to its associated uncertainty. As that ratio, referred to in this program as "Resolution", increases, the acceptability of a licensee's measurement should be more selective. Conversely, poorer agreement must be considered acceptable as the resolution decreases.

$$\text{RATIO} = \frac{\text{LICENSEE VALUE}}{\text{NRC REFERENCE VALUE}}$$

<u>Resolution</u>	<u>Agreement</u>
<4	0.4 - 2.5
4 - 7	0.5 - 2.0
8 - 15	0.6 - 1.66
16 - 50	0.75 - 1.33
51 - 200	0.80 - 1.25
>200	0.85 - 1.18