



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA ST., N.W., SUITE 3100
ATLANTA, GEORGIA 30303

Report Nos. 50-324/80-38 and 50-325/80-41

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

Facility Name: Brunswick 1 and 2

License Nos. DPR-71 and DPR-62

Inspection at Brunswick Site, Southport, NC

Inspector: D. M. Montgomery 11/20/80
D. M. Montgomery Date Signed

Accompany Personnel: P. C. McPhail

Approved by: A. F. Gibson 12/5/80
A. F. Gibson, Section Chief, FFMS Branch Date Signed

SUMMARY

Inspection on October 20-24, 1980

Areas Inspected

This routine unannounced inspection involved 56 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; and comparison of the results of split samples analyzed by the licensee and the NRC RII Mobile Laboratory.

Results

Of the three areas inspected, no apparent items of noncompliance or deviations were identified in one area; two apparent items of noncompliance was found in two areas (Infraction - failure to follow procedures, Paragraphs 5b and 7b; Infraction - failure to adequately measure airborne particulate radioactivity releases, Paragraph 7c).

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DETAILS

1. Persons Contacted

Licensee Employees

- *A. C. Tollison, Jr., Plant General Manager
- *J. A. Padgett, Director - Nuclear Safety and QA
- *G. J. Oliver, Manager, Environmental and Radiation Control
- *D. Allen, QA Supervisor
- *R. Pasteur, E&C Supervisor
- *J. A. Kaham, Radiation Control and Test Foreman
- J. Davis, Plant Chemist

Other licensee employees contacted included four technicians.

NRC Resident Inspector

- *J. E. Ouzts

*Attended exit interview

2. Exit Interview

The inspection scope and findings were summarized on October 24, 1980 with those persons indicated in Paragraph 1 above. The licensee representative agreed to perform the analyses referred to in Paragraph 7b and submit the results to the NRC:RII office. The inspector informed the Plant Manager by telephone on November 10, 1980 that the failure to identify and measure all the particulate radioactivity at environmental release points would be carried as an item of noncompliance rather than an open item.

3. Licensee Action on Previous Inspection Findings

(Closed) Infraction (324-78-22-01 and 325-78-22-01) Failure to have procedures for the ND 6600 System. The inspector reviewed the approved procedure for the ND 6600 System, RCT 2201. Details of this review are given in Paragraph 5b.

4. Unresolved Items

Unresolved items were not identified during this inspection.

5. Laboratory Quality Control Program

- a. The inspector reviewed the licensee's Quality Control Program for chemical and radiochemical measurements in the following areas:

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

The Radiation Control and Test Foreman is responsible for quality control associated with chemistry, radiochemistry, and the counting room. Specific quality control procedures are carried out by technicians under the supervision of the RC&T foreman.

(2) Provisions for Audits/Inspections

The RC&T Foreman reviews the results of quality control documentation associated with instrumentation to ensure that the QC program is being carried out. In addition, a plant surveillance program is conducted according to Procedure OQA-2, "Conduct of Plant Surveillance Program." Routine surveillances are performed monthly and include the environmental and effluent monitoring program.

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

Specific quality control checks with acceptance criteria are provided in the operating procedures for the chemistry and counting room instrumentation. Items that are discovered during plant surveillances and need corrective action are brought to the attention of the Director - Nuclear Safety and QA. Action items are established to ensure corrective action is accomplished according to plant procedures. Follow-up on outstanding action items are performed to assure that corrective action has been taken.

(4) Quality Control of Purchased and Contracted Analyses

No chemical or radiochemical analyses are contracted to outside vendors. Analyses of liquid effluent samples for radiostrontium are performed by CP&L's Harris Energy and Environmental Center. Vendors supplying radioactive standards are required to be on an approved vendor list as determined by a Corporate Quality Assurance audit.

- b. The inspector noted that the analytical balances in the chemistry laboratory had not been calibrated for approximately 18 months. Licensee representatives stated that the balances had not been included in a routine calibration program. Chapter 6, Calibration Control, of the Corporate Quality Assurance Manual requires that portable MT&E shall be included in the calibration program, and specifies that equipment used both for calibration of installed instruments and to calibrate other standards shall be considered as portable MT&E. Since analytical balances meet this definition, the failure to include balances in a calibration program constitutes an item of noncompliance with Technical Specification 6.8.1. Licensee representative acknowledged the item of noncompliance and agreed to include the analytical balances in a calibration program (324/80-30-01, 325/80-41-01). This item was previously carried as an open item which is considered closed (324/78-22-02, 325/78-22-02).
- c. The inspector discussed the licensee's quality control program with licensee representatives and noted that they did not have an inter-laboratory cross check program for radioactive effluent measurements. Licensee representatives indicated that a corporate program was being developed and it should be initiated near the end of 1980.

6. Review of Chemistry and Radiochemistry Procedures

a. The inspector reviewed the following procedures:

- (1) RC&T 2201, Calibration/Operation of ND 6600 Multichannel Analyzer, Rev. 0, 3-27-80.
- (2) RC&T 2202, Operation and Calibration of Packard Liquid Scintillation Counter, Rev. 2, 3-19-80.
- (3) RC&T 1200, Radioactive Liquid Waste Analysis, Rev. 1, 5-2-80.
- (4) RC&T 1000, Sampling and Analysis Schedule for Radioactive and Nonradioactive Chemistry, Rev. 2, 6-20-80.
- (5) RC&T 1210, Determination of Radioiodine, Rev. 1, 2-6-80.
- (6) RC&T 1211, Analysis for Radioiodine in Charcoal Cartridges and Filters, Rev. 2, 12-31-79.
- (7) RC&T 1215, Analysis for Strontium-Yttrium, Rev. 0, 12-31-79.
- (8) RC&T 1230, Tritium Analysis of Liquid Effluents, Rev. 0, 12-4-79.
- (9) RC&T 1270, Minimum Detectable Activity, Rev. 0.
- (10) RC&T 2203, Calibration and Operation of Particulate Counters, Rev. 0, 11-2-79.
- (11) RC&T 2000, Radioactive Airborne Effluent Releases and Reports Rev. 2, 3-27-80.
- (12) RC&T 2010, Radioactive Liquid Effluent Releases and Reports, Rev. 1, 12-31-79.
- (13) RC&T 1110, Chloride by Color, Rev. 1, 5-2-80.
- (14) RC&T 1111, Chloride by Mercuric Nitrate Titration, Rev. 1, 5-2-80.
- (15) RC&T 1120, Conductivity Measurements, Rev. 0, 7-6-79.
- (16) RC&T 1130, Determination of Sodium Pentaborate Solution in Standby Liquid Control Tank, Rev. 0.

The results of the procedure review were discussed with licensee representatives as noted in Paragraph 5b - 5g.

b. The inspector noted the following deficiencies in RC&T 2201, Calibration/Operation of the ND 6600 Multichannel Analyzer:

- (1) The energy calibration source does not have gamma-ray photo peaks at intermediate energies and is not a good source for energy calibration.

- (2) A limit on analyzer deadline is not specified.
- (3) No provision is made for periodic background checks.
- (4) Minimum counting times are not specified to ensure LLD's are met for effluent samples.
- (5) Additional details on performing efficiency calibrations appear to be necessary.

Licensee representatives agreed to revise the procedure and address the items identified above (324/80-38-02, 325/80-41-02).

- c. The inspector noted that RC&T 1000, Sampling Analysis for Nonradioactive Chemistry does not specifically address sample preservation to assure that "plate out" of radionuclides does not invalidate the analytical results. The inspector noted that some controls and/or tests should be implemented to demonstrate or ensure sample integrity. This is particularly important for composite samples that are stored for a month prior to analysis. A licensee technician was observed during the liquid waste sampling process, and the sampling method could lead to cross contamination since many of the sample lines in the sample sink were leaking. The sampling procedure did not specifically address how to collect the sample. The method that was used would normally result in contamination of the outside of the sample bottle and possibly the technician since the bottle was inserted into the sample stream at a relatively high flow rate. Licensee representatives agreed to address the problem of sample preservation and modify the sampling procedure to prevent cross contamination of liquid effluent samples (324/80-38-03, 325/80-41-03).
- d. The inspector noted that RC&T 1210, Determination of Radioiodine did not specify the counting method and computational method. In addition, RC&T 1211, Analysis for Radioiodine in Iodine Collection Cartridges and Filters, did not specify the specific model of cartridge or filter to be used and did not specify how to prepare the cartridges for calibration of the gamma-ray spectroscopy systems. Licensee representatives agreed to address these items and revise the procedures (324/80-38-04, 325/80-41-04).
- e. The inspector noted that RC&T 1215, Analysis for Strontium-Yttrium did not include the procedure for calibration of the beta counters. Licensee representatives noted that this is a Harris Energy and Environmental Center Procedure. The inspector stated that this does not relieve the plant manager of the responsibility to review and approve the calibration procedure. This item will be considered open and the calibration procedure will be reviewed during a subsequent inspection (324/80-38-05, 325/80-41-05).
- f. The inspector noted that the method used for calculation of MDA, RC&T 1270, Minimum Detectable Activity, was not valid since the background should be summed over the same relative area as the photopeaks rather than 2 X FWHM. The preferable formula for calculation of minimum

detectable count rate is $4.66 (S_b)^{\frac{1}{2}}$ rather than $3(S_b)^{\frac{1}{2}}$. Licensee representatives agreed to revise the methodology (324/80-38-06, 325/80-41-06).

- g. The inspector noted the following items in regard to RC&T, 2203 Calibration and Operation of Particulate Counters:
- (1) The radionuclide used for efficiency calibration is not specified.
 - (2) Procedure refers to a nonexistent procedure, RC&T 1261.
 - (3) Use of Sr-90 for calibration is not justified since typical beta energies of actual samples would be lower.

Licensee representatives agreed to review the procedure and address the items listed above (324/80-38-07, 325/80-41-07).

7. Review of Instrument Records and Logs

- a. The inspector reviewed selected portions the following records and logs:
- (1) Reliability Checks GeLi 1 and GeLi 2, August - September 1980.
 - (2) Resolution Checks GeLi 1 and GeLi 2, February - October 1980.
 - (3) Efficiency Curves for GeLi 1 and GeLi 2, January 1978.
 - (4) Liquid Scintillation Reliability Checks, July - October 1980.
 - (5) Liquid Scintillation Efficiency Calibrations, July - October 1980.
 - (6) Liquid Scintillation Chi-Squared Test, July - October 1980.
 - (7) NMC Gas Flow Proportional Counters, Daily Reliability Checks, Plateaus, Chi-Squared Tests, Efficiency Calibrations, July - October 1980.
 - (8) Standard Curves for pH Meters, July - September 1980.
 - (9) Calibration Curves for Spectronic 21 Spectrophotometers. February - October 1980.
 - (10) Calibration Curves for Coleman Spectrophotometer, May 1970 - February 1980.
 - (11) Calibration Records for Spectronic 21, August - October 1980.
 - (12) Calibration of Portable Conductivity Bridges, February - October 1980.
 - (13) Liquid Waste Release Permits July - September 1980.

(14) Airborne Effluent Release Records June - September 1980.

The inspector discussed the record review as noted in Paragraphs 7b and 7c.

- b. The inspector noted that efficiency curves for the GeLi counting systems were not determined during the period of January 1978 to September 1980. RC&T Procedure 0201 dated March 17, 1979 requires annual efficiency determinations. The inspector informed licensee representatives that this was another example of noncompliance with Technical Specification 6.8.1 for failure to follow procedures. The inspector noted that the latest revision, RC&T 2201, dated March 27, 1980, does not specify an efficiency calibration frequency. The inspector stated that the operating procedure should specify efficiency calibration frequency and that efficiencies should be determined more than once.
- c. The inspector noted that analyses of air particulate filters and charcoal cartridges, CR-80-5386 (7-21-80) and CR-80-5479 (7-28-80) from Reactor Building Roof Vents showed significant "break through" of particulate activity to the charcoal cartridge. The computer analysis of the charcoal cartridge ignores the particulate contribution and therefore underestimates the release of particulate radioactivity. Radionuclides observed on both the particulate filter and charcoal cartridge included Mn-54, Co-60, and Cs-137. Review of gamma-ray spectra showed that approximately 40 percent of the total particulate activity associated with the samples of 7-21-80 was on the charcoal cartridge and not identified. Samples from 7-28-80 showed that approximately 20 percent of the total activity was on the charcoal cartridge and was not identified. A licensee representative informed the inspector that glass fiber filters were being used and the efficiency was assumed to be 99 percent. The reason for breakthrough may be related to bypass of the air flow around the filter which would probably be related to improper installation of the filter - cartridge combination. The inspector informed the Plant Manager on November 10, 1980 by telephone that failure to identify and measure particulate radioactivity on the charcoal cartridge was an item of noncompliance with Technical Specification 3.5.2.e, Appendix B that requires sampling and analysis of radioactive material at all environmental release points. The inspector stated that corrective action should include: an investigation of why activity is breaking through to the cartridge, the effect on reporting the quantity of radioactivity discharged as required by USNRC Regulatory Guide 1.21, the time period over which this has been occurring, and action to prevent reoccurrence. The Plant Manager stated that he understood the problem and would discuss corrective action with his staff (324/80-38-08, 325/80-41-08).

8. Confirmatory Measurements

- a. The results of samples collected on September 26, 1978 were discussed with the licensee (324-78-22-03 and 325/78-22-03). Agreement was obtained for all samples except particulate filters. Licensee results were systematically higher for all radionuclides by 30 to 90 percent. A licensee representative stated that this geometry had been recalibrated

and the new calibration should result in better agreement. Additional sample splits, discussed in Paragraph 8b, were performed and this item is considered closed.

- b. Liquid and gaseous samples were collected during this inspection and counted by the licensee and the NRC RII Mobile Laboratory to verify the licensee's capability to measure radionuclides in effluent and reactor coolant samples. Samples were analyzed by gamma-ray spectroscopy and included: a liquid waste monitor tank sample, a reactor coolant sample, a steam jet air ejector gas sample, a particulate filter and two charcoal cartridge samples from a reactor building roof vent. An aliquot of the liquid waste tank sample was sent to the NRC contract laboratory for tritium and radiostrontium analyses. The results will be compared to licensee results in a subsequent inspection report (324/80-38-09, 325/80-41-09).

The comparisons of the licensee and NRC results are presented in Table 1 with acceptance criteria in Attachment 1. The results showed agreement for all radionuclides associated with the particulate filter sample, liquid waste sample, and reactor coolant sample. Licensee values for charcoal cartridge #1 were systematically higher for both I-131 and I-133 and were outside the acceptance criteria. A second cartridge with high radioiodine concentrations was counted with similar results. The second cartridge was sent to the NRC contractor laboratory for analysis and the results for I-131 are given in parentheses below the NRC value. The results from the contractor laboratory agreed with the NRC value. The reason for higher values by the licensee appears to be due to the calibration technique which simulates a cartridge with the activity homogeneously distributed throughout. The cartridges are counted with the inlet side down which would overestimate the activity if the activity is preferentially absorbed on the inlet side. On November 11, 1980 the inspector informed licensee representatives of the results from the contractor laboratory and stated that the counting and/or calibration procedure for charcoal cartridges would have to be modified to obtain accurate results (324/80-38-10, 325/80-41-10).

Analysis of the off gas sample showed disagreement for Kr-88 and possible agreement for Kr-85m and Kr-87. The disagreement for Kr-88 appears to be due in part to the difference in branching ratio used by the licensee and NRC. The inspector noted that the licensee's nuclide library had not been updated recently and more current decay data are available. The reason for poor agreement for other gaseous radionuclides appeared to be due to the calibration technique. Liquid standards were used with no correction factor for attenuation in water. A licensee representative stated that gas standards were being obtained to permit more accurate calibration. The updating of the nuclide library and calibration with gas standards will be reviewed during a subsequent inspection (324/80-38-11, 325/80-41-11).

TABLE 1

RESULTS OF CONFIRMATORY MEASUREMENTS AT BRUNSWICK NUCLEAR PLANT

OCTOBER 20-24, 1980

<u>SAMPLE</u>	<u>ISOTOPE</u>	<u>BNEP</u>	<u>NRC</u>	<u>BNEP/NRC</u>	<u>COMPARISON</u>
Charcoal	I-131	2.33 ± 0.07E-12	1.25 ± 0.05E-12	1.86	Disagreement
Cartridge #1	I-133	6.7 ± 0.2E-12	4.0 ± 0.2E-12	1.67	Disagreement
10-20-80	Cs-137	ND	1.2 ± 0.3 E-13	-	NC
@ 8:59	Cr-51	ND	4.3 ± 0.3E-12	-	NC
	Mn-54	ND	1.6 ± 0.3E-13	-	NC
	Co-60	ND	5.1 ± 0.6E-13	-	NC
Particulate	Na-24	8.46 ± 0.08E-11	9.8 ± 0.1E-11	.86	Agreement
Filter	Cr-51	2.02 ± 0.03E-11	2.34 ± 0.04E-11	.86	Agreement
10-20-80	Mn-54	8.9 ± 0.5E-13	9.9 ± 0.6E-13	.90	Agreement
@ 8:59	Co-58	1.4 ± 0.3E-13	2.1 ± 0.5E-13	.67	Agreement
	Co-60	1.39 ± 0.06E-12	1.61 ± 0.08E-12	.87	Agreement
	As-76	1.05 ± 0.1E-12	1.1 ± 0.2E-2	.94	Agreement
	I-131	2.1 ± 0.3E-13	1.9 ± 0.3E-13	1.10	Agreement
	I-133	1.13 ± 0.08E-12	1.4 ± 0.1 E-12	.81	Agreement
	Mo-99	9.9 ± 2.7E-13	1.6 ± 0.3E-12	1.6	Agreement
	Cs-134	3.2 ± 0.4E-13	4.1 ± 0.4E-13	.78	Agreement
	Cs-137	5.6 ± 0.4E-13	7.2 ± 0.5E-13	.78	Agreement
Charcoal	I-131	2.43 ± 0.02E-10	1.56 ± 0.01 E-10	1.56	Disagreement
Cartridge #2			(1.84 ± .051 E-10)		
10-22-80 @	I-132	5.1 ± 0.2E-11	ND		NC
1514:00	I-133	9.22 ± 0.03E-12	7.22 ± 0.04E-12	1.28	Disagreement
	I-135	3.25 ± 0.05E-10	5.6 ± 0.2E-10	.58	Disagreement
Reactor	NA-24	1.40 ± 0.01E-1	1.40 ± 0.01E-1	1.02	Agreement
Coolant	Cr-51	1.58 ± 0.03E-2	1.47 ± 0.06E-2	1.07	Agreement
10-22-80	Mn-54	2.2 ± 0.4E-4	2.2 ± 0.8E-4	1.0	Agreement
@ 1109:00	AS-76	1.77 ± 0.09E-3	1.6 ± 0.2E-3	1.11	Agreement
	Tc-99M	1.78 ± 0.01E-2	1.66 ± 0.01E-2	1.07	Agreement
OFF GAS	Ar-41	4.4 ± 0.2 E-4	3.4 ± 0.3E-4	1.29	Agreement
Unit 2	Kr-85m	1.78 ± 0.02E-3	1.36 ± 0.01E-3	1.31	Possible Agreement
10-22-80	Kr-87	4.82 ± 0.05E-3	3.93 ± 0.05E-3	1.27	Possible Agreement
@ 1610:00	Kr-88	2.58 ± 0.03E-3	3.53 ± 0.06E-3	.73	Disagreement
	Xe-133	7.11 ± 0.03E-3	5.68 ± 0.04E-3	1.25	Agreement
	Xe-133m	3.4 ± 0.5E-4	ND	NC	NC
	Xe-135	1.09 ± 0.01E-2	9.69 ± 0.04E-3	1.12	Agreement
	Xe-135m	3.13 ± 0.03E-2	2.62 ± 0.05E-2	1.19	Agreement
Liquid Waste	Mn-54	4.8 ± 0.3E-7	5.8 ± 0.7E-7	.83	Agreement
Tank A	Co-60	6.2 ± 0.4E-7	7.2 ± 1.3E-7	.86	Agreement
10-21-80					
@ 1600:00					

Notes: NC - No Comparison; ND - Not Detected

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 judgment limits are variable in relation to the comparison of the NRC Reference Laboratory'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>	<u>Possible Agreement A</u>	<u>Possible Agreement B</u>
<3	0.4 - 2.5	0.3 - 3.0	No Comparison
4 - 7	0.5 - 2.0	0.4 - 2.5	0.3 - 3.0
8 - 15	0.6 - 1.66	0.5 - 2.0	0.4 - 2.5
16 - 50	0.75 - 1.33	0.6 - 1.66	0.5 - 2.0
51 - 200	0.80 - 1.25	0.75 - 1.33	0.6 - 1.66
>200	0.85 - 1.18	0.80 - 1.25	0.75 - 1.33

"A" criteria are applied to the following analyses:

Gamma Spectrometry where principal gamma energy used for identification is greater than 250 Kev.

Tritium analyses of liquid samples.

"B" criteria are applied to the following analyses:

Gamma Spectrometry where principal gamma energy used for identification is less than 250 Kev.

⁸⁹Sr and ⁹⁰Sr Determinations.

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