U. S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-354/87-28

Docket No. 50-354

License No. NPF-50 Priority -- Category B

Licensee: Public Service Electric and Gas Company
80 Park Plaza-17c
Newark, New Jersey 07101

Facility Name: Hope Creek Generating Station

Inspection At: Hancock's Bridge, New Jersey

Inspection Conducted: November 16-20, 1987

Inspectors: for J. J. Kottan 12-21-87
A. Kirkwood, Radiation Specialist date

J. J. Kottan 12-21-87
J. Kottan, Radiation Laboratory Specialist date

Approved by: W. J. Pasciak 12/21/87
W. J. Pasciak, Chief, Effluents date
Radiation Protection Section

Inspection Summary: Inspection on November 16-20, 1987 (Inspection Report No. 50-354/87-28)

Areas Inspected: Routine, unannounced inspection of the licensee's radiochemical measurements program using the NRC:I Mobile Radiological Measurements Laboratory and laboratory assistance provided by DOE's Radiological and Environmental Sciences Laboratory. Areas reviewed included: previously identified items, confirmatory measurements, audits and boron analysis.

Results: Within the areas inspected, no violations were identified.

Details

1.0 Individuals Contacted

1.1 Principal Licensee Employees

*J. Lovell, Radiation Protection/Chemistry Manager
*J. Molner, Radiation Protection Senior Supervisor
*R. Beckwith, Station Licensing Engineer
*J. Clancy, Principal Health Physicist
*J. Wray, Radiation Protection Senior Supervisor
*K. Heath, Chemistry Counting Room Supervisor
*E. Karpe, Senior Radiological Engineer
*E. Galbraith, Chemistry Engineer
*W. Schell, Technical Engineer
*T. Cellmer, Radiation Protection Engineer
*S. LaBruna, General Manager
*S. Hilditch, Station QA Senior Staff Engineer
*A. Schettino, Station QA Senior Staff Engineer
*M. Shedlock, Maintenance Engineer
*J. Hagan, Maintenance Manager
*R. Griffith, Principal Engineer-QA
S. Spiese, Radiation Protection Technician
R. Gary, Radiation Protection, Technical Supervisor

The inspector also talked with and interviewed other licensee employees, including members of the chemistry and health physics staff.

2.0 Previously Identified Items

(Closed) Inspector Follow-up Item (50-354/85-59-03): software documentation for fitting IC recalibration data. The inspector reviewed procedure CH-TI.22-017(Q), Chemistry Computer Code Software Documentation Procedure, and noted that the program used for calibration data curve fitting was documented and verified as required.

3.0 Confirmatory Measurements

3.1 Split Sample Results

During this part of the inspection, liquid, particulate filter, and gas samples were split between the licensee and NRC for the purpose of intercomparison. Where possible, the split samples are actual effluent samples or inplant samples which duplicate counting geometries used by the licensee for effluent sample analyses. In addition, spiked charcoal cartridge standards were submitted to the licensee for analysis because radioiodine was not present on any effluent charcoal cartridge samples. The samples and standards were analyzed by the licensee using normal methods and equipment, and by the NRC: I Mobile Radiological Measurements Laboratory. Joint

analyses of actual effluent samples are used to verify the licensee's capability to measure radioactivity in effluent samples with respect to Technical Specifications and other regulatory requirements.

In addition, a liquid effluent sample was sent to the NRC reference laboratory, Department of Energy, Radiological and Environmental Sciences Laboratory (RESL), for analyses requiring wet chemistry. The analyses to be performed on the sample are Sr-89, Sr-90, Fe-55, gross alpha, and tritium. The results will be compared with the licensee's results when received at a later date and will be documented in a subsequent inspection report.

The results of the sample measurements comparison indicated that all of the measurements were in agreement under the criteria used for comparing results. (See Attachment 1.)

The results of the comparisons are listed in Table 1. Arsenic-76 was not identified by the licensee in several samples although this isotope was present. As-76 was not identified and quantified because it was not in the licensee's nuclide identification library. The licensee stated that the isotope library would be reviewed and made complete. The radiation protection gamma spectrometers are used for counting airborne effluent samples: charcoal cartridges, particulate filters, and gas samples; and chemistry gamma spectrometers are used for analyzing liquid radioactive effluents and inplant process and reactor water samples.

3.2 Laboratory QA/QC

The licensee's laboratory QA/QC program is described in procedure CH-AP.22-017(Q), Chemistry Quality Control Program. The inspector reviewed this procedure with respect to radiochemical measurements. Chemistry is responsible for the overall calibration and QC of both the radiation protection and chemistry gamma spectrometry systems, although radiation protection personnel perform the actual QC checks and source placement for calibration. The QC checks for the gamma spectrometry and liquid scintillation counter (LSC) systems include efficiency and background, and where applicable, gain on a daily basis. LSC calibrations are performed annually and gamma spectrometry calibrations are performed semi-annually. In addition, the licensee participates in a semi-annual interlaboratory comparison for tritium, gross beta, and gamma isotope measurements. The primary source of the interlaboratory samples is the Environmental Protection Agency (EPA). However, most of the EPA crosscheck samples contain too little radioactivity for obtaining meaningful comparison results for nuclear power plant effluent radioactivity measurement systems. The licensee stated that beginning in 1988 an interlaboratory cross check program with a commercial laboratory will be implemented. This program will include all routine effluent counting geometries at appropriate

activity levels. The licensee further stated that procedure CH-AP.22-017(Q) would be modified to include the new interlaboratory crosscheck program. The licensee's laboratory QA/QC program also includes provisions for repeat sampling and analysis in order to verify sampling results. No violations were identified in this area.

3.3 Procedures

The inspector reviewed the following selected licensee effluent and inplant analysis procedures:

- CH-RC.22-002(Q), Gross Beta by Liquid Scintillation
- CH-EU.22-013(Q), Liquid Scintillation System
- CH-RC.22-007(Q), Gamma Spectroscopy Sample Counting
- CH-RC.22-004(Q), Tritium (H^3) Analysis by Liquid Scintillation
- CH-RC.22-031(Q), Gamma Spectroscopy Sample Counting.

In addition the inspector also reviewed selected calibration and laboratory QA/QC data.

In reviewing the above procedures and data the inspector noted that, in many cases, the gamma spectrometry calibration data had counting uncertainties of 7%-10% or greater. The licensee's procedures did not require a minimum number of counts in each photo peak of the calibration spectrum. The inspector discussed this matter with the licensee and stated that a minimum number of counts should be required in order to minimize the counting uncertainty relative to the uncertainty of the standard. The licensee stated that action would be taken on this matter. Also the inspector noted that the printout of the radiation protection gamma spectrometric systems contained only peak search data and final results. This type of data format, when used with an abbreviated nuclide identification library, can result in isotopes not being identified and quantified because they are not in the nuclide identification library and no other indication of their presence is given. The inspector discussed this matter with the licensee since the licensee does, in fact, use an abbreviated nuclide identification library for some of the radiation protection gamma spectrometry systems printouts. The licensee stated that this area would be reviewed, and an expanded printout including unknown photopeaks, as a minimum, would be used in the future. This would permit hand calculation of the isotopes not in the library. An example of this is the charcoal cartridge data presented in Table I. The Co-57 and Cd-109 lines are not in the licensee's library, but the printout used by chemistry allowed for hand calculation of these results, whereas the radiation protection printout did not. Additionally, the chemistry results from the charcoal cartridge analyses were in better agreement with the NRC than the radiation protection results, although the same standards had been used for both calibrations. The licensee stated that chemistry would be more involved in the calibrations of the

radiation protection gamma spectrometry systems in order to ensure proper source placement during calibration. The inspector stated that the above areas, including modifications to the isotope library identified in 3.1 and modification to the laboratory QC procedure discussed in 3.2, would be reviewed during a subsequent inspection. (50-354/87-28-01)

No violations were identified.

4.0 Audits

The inspector reviewed Nuclear Quality Assurance Department Audit No. NM-87-02, Radiation Protection/Chemistry which was conducted on January 19-March 3, 1987. Areas audited included organization, training and qualifications, procedures, sampling, laboratory analyses, QC program, and instrument calibration. The audit appeared to cover the stated objectives and resulted in three quality action requests in the chemistry area. The corrective actions in response to the quality action requests were timely and technically sound.

The inspector also reviewed an assessment of the licensee's counting program conducted in October, 1987, by a contractor. This assessment was conducted by experts in the field and was initiated by the Radiation Protection Services organization. This assessment evaluated the quality of the licensee's radioactivity measurements program and did not identify any programmatic weaknesses.

No violations were identified.

5.0 Boron Analysis

During a previous inspection, Inspection Report No. 50-354/87-40, conducted on January 27-30, 1987, the licensee's method of post accident sampling system (PASS) boron analysis was discussed. At that time the inspector questioned the ability of the licensee to use the ion specific electrode for boron determinations without a 24 hour conditioning period. The licensee's current PASS boron procedure, CH-CA.22-025(Q), Boron by Specific Ion Electrode, requires a ten minute soaking period prior to use. In order to verify the licensee's capability to measure PASS boron using the procedure, three boron standards of approximately 1000, 3000, and 5000 ppm were submitted to the licensee for analysis. The standards were diluted 1:100 in order to duplicate the concentrations normally encountered in PASS samples. The results are presented in Table II. The 1000 ppm result met the licensee's FSAR commitment.

6.0 Exit Interview

The inspectors met with the licensee's representatives (denoted in Section 1) at the conclusion of the inspection on November 20, 1987, and summarized the scope and findings of the inspection.

TABLE 1

HOPE CREEK VERIFICATION TEST RESULTS

SAMPLE	ISOTOPE			COMPARISON
Crud Filter	Na-24	(2.5±0.5)E-4	(2.2±0.2)E-4	Agreement
0915 hrs.	Cr-51	(5.6±0.3)E-3	(5.48±0.14)E-3	Agreement
11/17/87	Mn-54	(1.24±0.05)E-3	(1.25±0.03)E-3	Agreement
Chemistry analysis	Mn-56	(1.78±0.04)E-2	(1.76±0.03)E-2	Agreement
Detector 3, Shelf 1	Co-58	(7.1±0.4)E-4	(7.7±03)E-4	Agreement
	Fe-59	(1.62±0.10)E-3	(1.72±0.05)E-3	Agreement
	Co-60	(6.1±0.4)E-4	(5.9±0.2)E-4	Agreement
	Zn-65	(2.63±0.12)E-3	(2.78±0.07)E-3	Agreement
	Zn-69m	(2.6±0.3)E-4	(2.6±0.2)E-4	Agreement
	As-76	(5.7±1.1)E-4		
	W-187	(1.15±0.14)E-3	(9.6±0.7)E-4	Agreement
	Tc-99m	(4.3±0.3)E-4	(4.25±0.14)E-4	Agreement
	Ce-144	(9.9±1.3)E-4	(6.9±0.5)E-4	Agreement
	As-76	(5.7±1.1)E-4	*(7.0±0.5)E-4	Agreement

* Hand calculated value.

TABLE 1

HOPE CREEK VERIFICATION TEST RESULTS

SAMPLE	ISOTOPE			COMPARISON
Reactor Coolant	Cr-51	(7.5±0.3)E-3	(7.24±0.12)E-3	Agreement
0950 hrs.	Mn-56	(1.22±0.09)E-3	(1.13±0.03)E-3	Agreement
11/18/37,	Zn-65	(5.6±1.2)E-4	(5.5±0.4)E-4	Agreement
Chemistry Analysis	Zn-69m	(1.6±0.3)E-4	(1.38±0.10)E-4	Agreement
Det. 3, Shelf 1	Tc-99m	(7.94±0.06)E-3	(7.92±0.02)E-3	Agreement
	I-132	(2.1±0.4)E-4	(1.7±0.2)E-4	Agreement
	Na-24	(4.17±0.12)E-3	(4.11±0.14)E-3	Agreement

TABLE 1

HOPE CREEK VERIFICATION TEST RESULTS

SAMPLE	ISOTOPE	NRC VALUE	LICENSEE VALUE	COMPARISON
		Results in Microcuries/ml		
Floor Drain	CR-51	(8.6±1.1)E-6	(9.1±0.7)E-6	Agreement
Sample Tank	Zn-65	(4.8±0.6)E-6	(4.9±0.5)E-6	Agreement
11/18/87	Na-24	(6.83±0.08)E-5	(6.38±0.06)E-5	Agreement
1430 hrs.				
Chemistry analysis				
Det.2				

TABLE 1

HOPE CREEK VERIFICATION TEST RESULTS

SAMPLE	ISOTOPE	NRC VALUE	LICENSEE VALUE	COMPARISON
		Results in Microcuries/ml		
Crud Filter	Mn-54	(1.24±0.05)E-3	(1.18±0.03)E-3	Agreement
0915 hrs	Co-58	(7.1±0.4)E-4	(6.9±0.2)E-4	Agreement
11/17/87	Fe-59	(1.62±0.10)E-3	(1.69±0.05)E-3	Agreement
Radiation	Co-60	(6.1±0.4)E-4	(5.4±0.2)E-4	Agreement
Protection	Zn-65	(2.63±0.12)E-3	(2.53±0.06)E-3	Agreement
Det.4, Shelf 1	Na-24	(2.5±0.5)E-4	(1.8±0.2)E-4	Agreement
	Cr-51	(5.6±0.3)E-3	(4.69±0.14)E-3	Agreement
	W-187	(1.15±0.14)E-3	(9.6±0.6)E-4	Agreement
	Mn-56	(1.78±0.04)E-2	(1.56±0.03)E-2	Agreement
	Zn-69m	(2.6±0.3)E-4	(2.3±0.2)E-4	Agreement
	As-76	(5.7±1.1)E-4	Not identified	No comparison
	Tc-99m	(4.3±0.3)E-4	(3.68±0.13)E-4	Agreement
	Ce-144	(9.9±1.3)E-4	(6.9±0.5)E-4	Agreement

TABLE 1

HOPE CREEK VERIFICATION TEST RESULTS

SAMPLE	ISOTOPE	NRC VALUE	LICENSEE VALUE	COMPARISON
		Result in Microcuries/ml		
Crud Filter	Mn-54	(1.24±0.05)E-3	(1.28±0.12)E-3	Agreement
0915 hrs	Co-58	(7.1±0.4)E-4	(6.5±0.9)E-4	Agreement
11/17/87	Fe-59	(1.62±0.10)E-3	(1.6±0.2)E-3	Agreement
Radiation	Co-60	(6.1±0.4)E-4	(4.5±0.7)E-4	Agreement
Protection	Zn-65	(2.63±0.12)E-3	(2.3±0.2)E-3	Agreement
Det.4, Shelf 3	Cr-51	(5.6±0.3)E-3	(6.6±0.8)E-3	Agreement
	W-187	(1.15±0.14)E-3	(1.3±0.3)E-3	Agreement
	Zn-69m	(2.6±0.3)E-4	(3.5±1.1)E-4	Agreement
	As-76	(5.7±1.1)E-4	Not identified	No comparison
	Tc-99m	(4.3±0.3)E-4	(3.8±0.9)E-4	Agreement
	Ce-144	(9.9±1.3)E-4	(1.1±0.4)E-3	Agreement

TABLE 1

HOPE CREEK VERIFICATION TEST RESULTS

SAMPLE	ISOTOPE	NRC VALUE	LICENSEE VALUE	COMPARISON
		Results in Microcuries/ml		
Offgas	Kr-85m	(3.6±0.2)E-4	(3.37±0.11)E-4	Agreement
1120hrs	Kr-87	(1.46±0.09)E-3	(1.46±0.05)E-3	Agreement
11-17-87	Kr-88	(1.13±0.07)E-3	(1.02±0.07)E-3	Agreement
Chemistry analysis	Xe-135	(1.10±0.03)E-3	(8.7±0.2)E-4	Agreement
Det. 3, Shelf-2				

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Crud Filter	Na-24	(2.5±0.5)E-4	(2.2±0.2)E-4	Agreement
0915 hrs.	Cr-51	(5.6±0.3)E-3	(5.48±0.14)E-3	Agreement
11/17/87	Mn-54	(1.24±0.05)E-3	(1.25±0.03)E-3	Agreement
Chemistry analysis	Mn-56	(1.78±0.04)E-2	(1.76±0.03)E-2	Agreement
Detector 3, Shelf 1	Co-58	(7.1±0.4)E-4	(7.7±03)E-4	Agreement
	Fe-59	(1.62±0.10)E-3	(1.72±0.05)E-3	Agreement
	Co-60	(6.1±0.4)E-4	(5.9±0.2)E-4	Agreement
	Zn-65	(2.63±0.12)E-3	(2.78±0.07)E-3	Agreement
	Zn-69m	(2.6±0.3)E-4	(2.6±0.2)E-4	Agreement
	As-76	(5.7±1.1)E-4		
	W-187	(1.15±0.14)E-3	(9.6±0.7)E-4	Agreement
	Tc-99m	(4.3±0.3)E-4	(4.25±0.14)E-4	Agreement
	Ce-144	(9.9±1.3)E-4	(6.9±0.5)E-4	Agreement
	As-76	(5.7±1.1)E-4	*(7.0±0.5)E-4	Agreement

* Hand calculated value.

TABLE 1

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SAMPLE	ISOTOPE			COMPARISON
Reactor Coolant	Cr-51	(7.5±0.3)E-3	(7.24±0.12)E-3	Agreement
0950 hrs.	Mn-56	(1.22±0.09)E-3	(1.13±0.03)E-3	Agreement
11/18/87,	Zn-65	(5.6±1.2)E-4	(5.5±0.4)E-4	Agreement
Chemistry Analysis	Zn-69m	(1.6±0.3)E-4	(1.38±0.10)E-4	Agreement
Det. 3, Shelf 1	Tc-99m	(7.94±0.06)E-3	(7.92±0.02)E-3	Agreement
	I-132	(2.1±0.4)E-4	(1.7±0.2)E-4	Agreement
	Na-24	(4.17±0.12)E-3	(4.11±0.14)E-3	Agreement

TABLE 1

HOPE CREEK VERIFICATION TEST RESULTS

SAMPLE	ISOTOPE	NRC VALUE	LICENSEE VALUE	COMPARISON
		Results in Total Microcuries		
Charcoal Cart.	Cs-137	(9.8±0.4)E-2	(7.99±0.08)E-2	Agreement
Radiation	Co-60	(1.02±0.05)E-1	(8.88±0.12)E-2	Agreement
Protection				
Detector 5				
Shelf 1				
Charcoal Cart.	Cs-137	(1.02±0.05)E-1	(8.45±0.08)E-2	Agreement
Radiation	Co-60	(1.06±0.05)E-1	(9.06±0.12)E-2	Agreement
Protection				
Detector 5				
Shelf 1				
Charcoal Cart.	Cs-137	(9.8±0.4)E-2	(8.41±0.11)E-2	Agreement
Radiation	Co-60	(1.02±0.05)E-1	(9.6±0.2)E-2	Agreement
Protection				
Detector 4				
Shelf 1				
Charcoal Cart.	Cs-137	(1.02±0.05)E-1	(8.60±0.11)E-2	Agreement
Radiation	Co-60	(1.06±0.05)E-1	(9.4±0.2)E-2	Agreement
Protection				
Detector 4				
Shelf 1				

TABLE 1

HOPE CREEK VERIFICATION TEST RESULTS

SAMPLE	ISOTOPE	NRC VALUE	LICENSEE VALUE	COMPARISON
		Results in Total Microcuries		
Charcoal Cart.	Cs-137	(9.8±0.4)E-2	(9.03±0.10)E-2	Agreement
Chemistry	Co-60	(1.02±0.05)E-1	(1.000±0.014)E-1	Agreement
analysis	Cd-109	(2.29±0.11)	*(2.42±0.04)	Agreement
Detector 1	Co-57	(3.9±0.2)E-2	*(4.0±0.2)E-2	Agreement
Shelf 1				
Charcoal Cart.	Cs-137	(1.02±0.05)E-1	(8.90±0.08)E-2	Agreement
Chemistry	Co-60	(1.06±0.05)E-1	(9.84±0.11)E-2	Agreement
Analysis	Cd-109	(2.37±0.11)	*(2.46±0.03)	Agreement
Detector 3	Co-57	(4.0±0.2)E-2	*(4.2±0.2)E-2	Agreement
Shelf 1				

* Hand calculated values

TABLE 1

HOPE CREEK VERIFICATION TEST RESULTS

SAMPLE	ISOTOPE	NRC VALUE	LICENSEE VALUE	COMPARISON
		Results in Total Microcuries		
Charcoal Cart.	Cs-137	(9.8±0.4)E-2	(8.9±0.2)E-2	Agreement
Chemistry	Co-60	(1.02±0.05)E-1	(1.00±0.03)E-1	Agreement
Analysis	Cd-109	(2.29±0.11)	*(2.40±0.07)	Agreement
Detector 1	Co-57	(3.9±0.2)E-2	*(4.5±0.4)E-2	Agreement
Shelf 2				
Charcoal Cart	Cs-137	(1.02±0.05)E-1	(9.47±0.15)E-2	Agreement
Chemistry	Co-60	(1.06±0.05)E-1	(1.01±0.02)E-2	Agreement
Analysis	Cd-109	(2.37±0.11)	*(2.67±0.05)	Agreement
Detector 3	Co-57	(4.0±0.2)E-2	*(3.9±0.3)E-2	Agreement
Shelf 2				

* Hand calculated values

Table 2

Boron Analysis Results

Standard

Parameter	Known Concentration	Meas. Conc.	Difference	Licensee Commitment in FSAR Table 9.3-7
Boron	1000±10ppm	1030±?ppm	+30ppm	±50ppm over range 50-1000ppm
	3024±46ppm	3250±?ppm	+226ppm	
	4947±61ppm	5300±?ppm	+353ppm	

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 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.

Resolution[1]	Ratio For Agreement[2]
<3	No comparison
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

[1]Resolution = (NRC Reference Value/Reference Value Uncertainty)

[2]Ratio = (License Value/NRC Reference Value)