U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-354/92-10

Docket No. 50-354

License No. NPF-50

Licensee: Public Service Electric & Gas Company
P. O. Box 236
Hancock's Bridge, New Jersey 08038

Facility Name: Hope Creek Generating Station

Inspection At: Hancock's Bridge, New Jersey

Inspection Conducted: July 6-10, 1992

Inspectors: J. J. Kottan 7-27-92
N. McNamara, Physical Science Technician Date
Effluents Radiation Protection Section (ERPS)

J. J. Kottan 7-27-92
J. Kottan, Laboratory Specialist, ERPS Date
Facilities Radiological Safety and Safeguards
Branch (FRSSB)

Approved By: John J. Hayes Jr. 7/27/92
R. Bores, Chief, ERPS, FRSSB Date
Division of Radiation Safety and Safeguards

Areas Inspected: Unannounced inspection of the radiological and non-radiological chemistry programs. Areas reviewed included: Confirmatory Measurements - Radiological, Standards Analyses - Chemistry, Laboratory QA/QC, and Audits.

Results: The licensee had in place effective programs for measuring radioactivity in process and effluent samples and for measuring chemical parameters in plant systems. No safety concerns, violations or deviations were observed.

DETAILS

1.0 Individuals Contacted

Principal Licensee Employees

J. Clancy, Rad Pro/Chemistry Manager
A. Giardino, QA Audits and Programs Manager
*R. Griffith, Station QA Manager
*A. Hoornik, Chemistry Supervisor
*R. Hovey, Operations Manager
*T. Lake, Chemistry Supervisor
H. Lowe, Senior QA Engineer
*C. Manges, Lead Engineer-Licensing
K. Maza, Chemistry Engineer
*D. Miller, Rad Pro/Chemistry Services Engineer
J. O'Neill, QA Engineer
*M. Prystupa, Radiation Protection
*G. Slaby, Senior Chemistry Supervisor

NRC Employees

*T. Johnson, Senior Resident Inspector
K. Lathrop, Resident Inspector

* Denotes those present at the exit meeting on July 10, 1992. The inspectors also interviewed other licensee personnel, including members of the chemistry and radiation protection staffs.

2.0 Purpose

The purpose of this inspection was to review the following areas:

- The licensee's ability to measure radioactivity in plant systems samples and effluent samples, and the ability to measure chemical parameters in various plant systems samples.

- The licensee's ability to demonstrate the acceptability of analytical results through implementation of a laboratory QA/QC program.

3.0 Radiological and Chemical Measurements

3.1 Confirmatory Measurements - Radiological

Du[illegible]his part of the inspection, liquid, airborne particulate (filter) and io[illegible]e (charcoal cartridge), and gas samples were analyzed by the licensee's C[illegible]emistry Department and the NRC for the purpose of intercomparison. The samples were act[illegible] split samples with the exception of the particulate filters and gas sample[illegible] In those cases the samples could not be split and the same samples were analyzed by the licensee and the NRC. Where possible, the samples were actual effluent samples or in-plant samples which duplicated the counting geometries used by the licensee for effluent sample analyses. The charcoal cartridge was a spiked sample supplied to the licensee by the NRC [illegible] no effluent or in-plant charcoal cartridge sample, which contained [illegible]tive iodine, was available. The samples were analyzed by the licensee [illegible]routine methods and equipment and by the NRC I Mobile Radiological [illegible]rements Laboratory. Joint analyses of actual effluent samples were used [illegible]crify the licensee's capability to measure radioactivity in effluent and other [illegible]les with respect to Technical Specifications and other regulatory [illegible]ements.

In addition, a liquid effluent sample was sent to the NRC reference laboratory, Depa[illegible]nt of Energy, Radiological and Environmental Sciences Laboratory [illegible] analyses requiring wet chemistry. The analyses to be performed [illegible]ple are Sr-89, Sr-90, Fe-55, H-3, and gross alpha. The results of [illegible]lyses 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 from a liquid sample split between the licensee and the NRC during a previous inspection on March 5-9, 1990 (Inspection No. 50-354/90-05) could not be compared because of a poor sample split due to "plate out" of the radionuclides on the walls of the sample container even though the sample had been acidified.

The licensee's Radiation Protection Department also possessed a gamma spectrometry system. This system was a part of the chemistry gamma spectrometry system in that the multichannel analyzer (MCA) terminals were interfaced to the Chemistry Department gamma spectrometry computer. The Chemistry Department was responsible for calibration and quality control of this system. However, the system was operated by Radiation Protection Department personnel, and was routinely used to analyze airborne radioactive effluents from the facility. Therefore, the particulate filter, gas Marinelli beaker, and spiked charcoal cartridge were analyzed using this counting system and compared with the NRC results.

The results of all of the above comparisons, which are presented in Table I, indicated that all of the results were in agreement under the criteria used for comparing results (see Attachment 1 to Table I). No violations or safety concerns were identified in this area.

3.2 Standards Analyses - Chemical

During this part of the inspection, standard chemical solutions were submitted to the licensee for analysis. The standards were prepared by Oak Ridge National Laboratory (ORNL) for the NRC, and were analyzed by the licensee using routine methods and equipment. The analysis of standards is used to verify the licensee's capability to monitor chemical parameters in various plant systems with respect to Technical Specifications and other regulatory requirements. In addition, the analysis of standards is used to evaluate the licensee's procedures with respect to accuracy and precision. The standards were submitted to the licensee for analysis in triplicate at three concentrations spread over the licensee's normal calibration and analysis range. However, the boron analyses were performed in duplicate at only two concentrations due to the lack of sufficient volume of the NRC standard. Also, the sulfate analysis at approximately eight parts per billion (8 ppb) was performed in duplicate due to sulfate contamination of one of the diluted NRC standards. The sulfate standards were analyzed at four concentrations in order to cover the licensee's sulfate calibration range.

A feedwater sample was spiked with a standard anion solution and sent to ORNL for analysis. The analyses to be performed on the sample are chloride and sulfate. The licensee will perform the same analyses on an aliquot of this spiked sample. The results of these analyses will be compared when received at a later date and will be documented in a subsequent inspection report. The analysis of spiked samples permits results comparisons from an actual sample matrix.

The results of the standards measurements comparisons indicated that all of the measurements were in agreement or qualified agreement under the criteria used for comparing results (see Attachment 2 to Table II). The data are presented in Table II. Note that two sets of data for the metals results were presented in Table II. One set of data was generated with a single point calibration of the plasma emission spectrometer (ICP), and the second set of data was generated with a multipoint calibration curve. The licensee's normal protocol for operation of the ICP required a single point calibration, but after discussion with the inspector, the licensee also performed the analyses with the

multipoint calibration. The results with the multipoint calibration were in better agreement with the NRC known values than were the results with the single point calibration. The licensee modified the ICP calibration protocol so that multipoint calibrations would be performed routinely.

4.0 Laboratory QA/QC

The inspector reviewed the licensee's chemistry and radiochemistry laboratory QA/QC program. This program is described in Procedure No. HC.CH-TI.ZZ-0900(Q), "Chemistry Quality Control". The procedure provides for both an intralaboratory QC program and an interlaboratory QC program. The intralaboratory program consisted of instrument and procedure control charts and the periodic analysis of spiked samples for certain chemical analyses. The interlaboratory program consisted of the analysis of spiked samples received from outside laboratories for both chemical and radioactivity analyses. Also included in the interlaboratory program was the vendor laboratory utilized by the licensee for the analysis of radioactive effluent samples that require wet chemistry. Additionally, the inspector reviewed Radiation Protection/Chemistry Services Procedure No. M12-COP-001, "Interlaboratory Quality Control Comparison Program". This procedure provided for the evaluation of interlaboratory QC results by the Radiation Protection/Chemistry Services Department, which is an independent licensee support group located at the Salem/Hope Creek site. This procedure contained the criteria for detailed independent reviews of the interlaboratory QC crosscheck results.

The inspector reviewed selected data generated by the above procedures for 1991 and 1992 to date and noted that the licensee appeared to be implementing the laboratory QA/QC program as required. In particular, the inspector noted the Radiation Protection/Chemistry Services QC data reviews of the analytical chemistry interlaboratory results and the Chemistry Department's annual summary of the crosscheck program as strengths of the laboratory QA/QC program. In reviewing the above data, however, the inspector noted that the interlaboratory crosscheck data for radioactivity analyses were not being reviewed by the Chemistry Services group. The inspector discussed this matter with the licensee and stated that the Chemistry Services group performed detailed reviews of the non-radiological chemistry crosscheck data and also provided long term trending of this data. These same detailed reviews and long term trend reviews would be useful for radioactivity QC data as well. In fact, the inspector, in reviewing the radioactivity QC crosscheck data, demonstrated to the licensee an instance where a more detailed review would have indicated a potential problem for a particular counting geometry. The licensee stated that this area would be evaluated and appropriate action taken. The inspector stated that this area would be reviewed during a subsequent inspection.

5.0 Surveillance and Audit Activities

The inspector reviewed selected surveillance activities of the chemistry area for 1991 and 1992 to date. The licensee performs both scheduled and unscheduled surveillances of the chemistry area. The surveillances were performed by a technical specialist, a checkoff sheet was utilized, and findings were described in detail. Additionally, periodic assessments of the chemistry area were performed using the results of previous surveillance activities. The inspector stated that the periodic assessments were a noted strength in this area.

The inspector also reviewed QA Audit Report No. 91-155, "Chemistry", which was performed on November 4-December 3, 1991. This audit, which appeared to be performance based, was conducted using detailed checklists, had comprehensive comments on each reviewed area, and the audit team included a technical specialist. The QA audits of chemistry were performed on a biannual basis. The inspector noted that the above audits and surveillances appeared to provide adequate independent oversight and assessment of chemistry performance. No safety concerns or violations were identified in this area.

6.0 Exit Meeting

The inspector met with the licensee representatives denoted in Section 1.0 at the conclusion of the inspection on July 10, 1992. The inspector summarized the purpose, scope, and findings of the inspection.

TABLE I

Hope Creek Verification Test Results

SAMPLE	ISOTOPE	NRC VALUE	LICENSEE VALUE	COMPARISON
		Results in Microcuries per Milliliter		
Reactor Water	Tc-99m	(1.971 ± 0.006) E-2	(1.808 ± 0.004) E-2	Agreement
1010 hours	Na-24	(1.130 ± 0.011) E-2	(9.57 ± 0.06) E-3	Agreement
7-9-92				
(Detector #2)				
Reactor Water	Na-24	(1.005 ± 0.011) E-3	(1.056 ± 0.008) E-3	Agreement
Particulate Filter	Cr-51	(4.04 ± 0.12) E-4	(4.06 ± 0.05) E-4	Agreement
0800 hours	Mn-54	(1.291 ± 0.006) E-3	(1.369 ± 0.003) E-3	Agreement
7-7-92	Co-58	(7.2 ± 0.2) E-5	(7.52 ± 0.12) E-5	Agreement
(Detector #3)	Fe-59	(7.37 ± 0.08) E-4	(7.77 ± 0.04) E-4	Agreement
	Co-60	(1.85 ± 0.03) E-4	(2.00 ± 0.02) E-4	Agreement
	Zn-65	(3.17 ± 0.07) E-4	(3.442 ± 0.004) E-4	Agreement

TABLE I - (continued)

Hope Creek Verification Test Results

SAMPLE	ISOTOPE	NRC VALUE	LICENSEE VALUE	COMPARISON
		Results in Microcuries per Milliliter		
Waste Sample	Cr-51	(8.3 ± 0.2) E-5	(8.9 ± 0.3) E-5	Agreement
Tank B	Mn-54	(1.704 ± 0.008) E-4	(1.735 ± 0.011) E-4	Agreement
1335 hours	Co-58	(6.3 ± 0.3) E-6	(6.2 ± 0.4) E-6	Agreement
7-8-92	Fe-59	(4.42 ± 0.07) E-5	(4.77 ± 0.11) E-5	Agreement
(Detector #3)	Co-60	(2.11 ± 0.03) E-5	(2.18 ± 0.04) E-5	Agreement
	Zn-65	(9.66 ± 0.11) E-5	(1.002 ± 0.014) E-4	Agreement
Condenser Air	Kr-85m	(1.51 ± 0.11) E-4	(1.6 ± 0.2) E-4	Agreement
Ejector Offgas	Kr-87	(8.0 ± 0.4) E-4	(9.7 ± 0.7) E-4	Agreement
1439 hours	Kr-88	(5.7 ± 0.6) E-4	(7.1 ± 0.9) E-4	Agreement
(Detector #3)	Xe-135	(5.9 ± 0.2) E-4	(6.0 ± 0.3) E-4	Agreement

TABLE I - (continued)

Hope Creek Verification Test Results

SAMPLE	ISOTOPE	NRC VALUE	LICENSEE VALUE	COMPARISON
		Results in Total Microcuries		
NRC Spiked Charcoal Cartridge (Detector #2)	Ba-133	(2.53 ± 0.03) E-2	(2.92 ± 0.04) E-2	Agreement
		Results in Microcuries Per Milliliter		
Reactor Water	Na-24	(1.005 ± 0.011) E-3	(9.00 ± 0.12) E-4	Agreement
Particulate Filter	Cr-51	(4.04 ± 0.12) E-4	(3.18 ± 0.06) E-4	Agreement
0800 hours	Mn-54	(1.291 ± 0.006) E-3	(1.168 ± 0.003) E-3	Agreement
7-7-92	Co-58	(7.2 ± 0.2) E-5	(6.50 ± 0.14) E-5	Agreement
(Detector #4)	Fe-59	(7.37 ± 0.08) E-4	(6.65 ± 0.04) E-4	Agreement
(Rad. Protection	Co-60	(1.85 ± 0.03) E-4	(1.699 ± 0.015) E-4	Agreement
Analysis)	Zn-65	(3.17 ± 0.07) E-4	(2.97 ± 0.03) E-4	Agreement

TABLE I - (continued)

Hope Creek Verification Test Results

SAMPLE	ISOTOPE	NRC VALUE	LICENSEE VALUE	COMPARISON
		Results in Total Microcuries		
Gas Marinelli	Kr-85m	(9.6 ± 0.4) E-4	(1.04 ± 0.08) E-3	Agreement
Beaker with Offgas	Kr-87	(4.9 ± 0.2) E-3	(5.8 ± 0.3) E-3	Agreement
1405 hours	Kr-88	(3.29 ± 0.16) E-3	(3.5 ± 0.4) E-3	Agreement
7-9-92	Xe-135	(3.69 ± 0.06) E-3	(4.14 ± 0.16) E-3	Agreement
(Detector #5)	Xe-138	(2.2 ± 0.2) E-2	(2.92 ± 0.15) E-2	Agreement
(Rad. Protection Analysis)				
NRC Spiked Charcoal Cartridge (Detector #5) (Rad. Protection Analysis)	Ba-133	(2.53 ± 0.03) E-2	(2.47 ± 0.02) E-2	Agreement

Note: Reported uncertainties are ± 1S counting uncertainties for both NRC and licensee results.

ATTACHMENT 1 TO TABLE I

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]
< 4	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 Unvertainty)
[2] Ratio = (Licensee Value/NRC Reference Value)

TABLE II

Hope Creek Chemistry Test Results

Chemical Analysis	Method of Analysis	NRC Known Value	Licensee Value	Percent Difference	Comparison
		Results in Parts Per Billion (ppb)			
Chloride	IC	1.90 ± 0.03	1.99 ± 0.09	+ 5%	Agreement
		3.80 ± 0.06	4.07 ± 0.16	+ 7%	Agreement
		7.5 ± 0.3	8.3 ± 0.4	+ 11%	Qualified Agreement
Sulfate	IC	1.94 ± 0.03	2.06 ± 0.09	+ 6%	Agreement
		3.88 ± 0.06	3.90 ± 0.05	0%	Agreement
		7.9 ± 0.2	7.7 ± 0.5	- 3%	Agreement
		15.9 ± 0.4	16.5 ± 1.1	+ 4%	Agreement
Silica	SP	15 ± 2	13 ± 0	-13%	Qualified Agreement
		28.4 ± 0.4	26.7 ± 0.6	- 6%	Agreement
		60.1 ± 1.0	58.7 ± 0.6	- 2%	Agreement

TABLE II - (continued)

Hope Creek Chemistry Test Results

Chemical Analysis	Method of Analysis	NRC Known Value	Licensee Value	Percent Difference	Comparison
		Results in Parts Per Billion (ppb)			
[2]Nickel	ICP	199 ± 2	213 ± 3	+ 7%	Qualified Agreement
		400 ± 4	433 ± 2	+ 8%	Qualified Agreement
		800 ± 8	859.3 ± 1.5	+ 7%	Qualified Agreement
[2]Iron	ICP	199 ± 2	221.3 ± 1.2	+11%	Qualified Agreement
		398 ± 4	451 ± 9	+13%	Qualified Agreement
		795 ± 7	877 ± 5	+10%	Qualified Agreement
[2]Copper	ICP	202 ± 2	216 ± 4	+ 7%	Agreement
		403 ± 4	437.0 ± 1.0	+ 8%	Agreement
		810 ± 10	868 ± 4	+ 7%	Agreement
[2]Chromium	ICP	200 ± 2	225 ± 6	+12%	Qualified Agreement
		402 ± 4	456.0 ± 1.0	+13%	Qualified Agreement
		804 ± 7	901.7 ± 1.5	+12%	Qualified Agreement

TABLE II - (continued)

Hope Creek Chemistry Test Results

Chemical Analysis	Method of Analysis	NRC Known Value	Licensee Value	Percent Difference	Comparison
		Results in Parts Per Billion (ppb)			
[2]Zinc	ICP	52.2 ± 0.7	58 ± 2	+11%	Qualified Agreement
		261 ± 4	290 ± 11	+11%	Qualified Agreement
		515 ± 5	538 ± 4	+ 5%	Agreement
[3]Nickel	ICP	199 ± 2	191 ± 3	- 4%	Agreement
		400 ± 4	396 ± 2	- 1%	Agreement
		800 ± 8	778 ± 4	- 3%	Agreement
[3]Iron	ICP	199 ± 2	203 ± 6	+ 2%	Agreement
		398 ± 4	409 ± 12	+ 3%	Agreement
		795 ± 7	784 ± 8	- 1%	Agreement
[3]Copper	ICP	202 ± 2	199 ± 4	- 2%	Agreement
		403 ± 4	404 ± 4	0%	Agreement
		810 ± 10	801 ± 10	- 1%	Agreement

TABLE II - (continued)

Hope Creek Chemistry Test Results

Chemical Analysis	Method of Analysis	NRC Known Value	Licensee Value	Percent Difference	Comparison
		Results in Parts Per Billion (ppb)			
[3]Chromium	ICP	200 ± 2	199 ± 7	0%	Agreement
		402 ± 4	408 ± 3	+ 2%	Agreement
		804 ± 7	813 ± 8	+ 1%	Agreement
[3]Zinc	ICP	52.2 ± 0.7	51 ± 7	- 2%	Agreement
		261 ± 4	260 ± 12	0%	Agreement
		515 ± 5	485.3 ± 1.2	- 6%	Agreement
		Results in Parts Per Million (ppm)			
Boron	T	911 ± 11	903 ± 3	- 1%	Agreement
		1520 ± 20	1498 ± 5	- 1%	Agreement

Notes: IC = Ion Chromatography
SP = UV-Vis Spectrophotometry
ICP = Inductively Coupled Plasma Emission Spectrometry
T = Titration with PHT endpoint

[1] Duplicate analysis only
[2] Licensee results obtained with single point calibration
[3] Licensee results obtained with multipoint calibration

ATTACHMENT 2 TO TABLE II

Criteria for Comparing Analytical Measurements from Table II

This attachment provides criteria for comparing results of capability tests. In these criteria the judgement limits are based on data from Table 2.1 of NUREG/CR-5244, "Evaluation of Non Radiological Water Chemistry at Power Reactors". Licensee values within the plus or minus two standard deviation range (±2Sd) of the ORNL known values are considered to be in agreement. Licensee values outside the plus or minus two standard deviation range but within the plus or minus three standard deviation range (±3Sd) of the ORNL known values are considered to be in qualified agreement. Repeated results which are in qualified agreement will receive additional attention. Licensee values greater than the plus or minus three standard deviations range of the ORNL known value are in disagreement. The standard deviations were computed using the average percent standard deviation values of each analyte in Table 2.1 of the NUREG.

The ranges for the data in Table II are as follows:

Analyte	Agreement Range	Qualified Agreement Range
Chloride	± 8%	± 12%
Sulfate	± 10%	± 15%
Silica	± 10%	± 15%
Chromium	± 10%	± 15%
Copper	± 10%	± 15%
Iron	± 10%	± 15%
Nickel	± 6%	± 9%
Boron	± 2%	± 3%
Zinc	± 10%	± 15%