U. S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-219/91-36

Docket No. 50-219

License No. DPR-16

Licensee: GPU Nuclear Corporation
P.O. Box 388
Forked River, New Jersey

Facility Name: Oyster Creek Nuclear Generating Station

Inspection At: Forked River, New Jersey

Inspection Conducted: November 18-22, 1991

Inspectors: T. V. Kottan 12-6-91
N. McNamara, Physical Science Technician date
Effluents Radiation Protection Section (ERPS)
Facilities Radiological Safety & Safeguards Branch (FRSSB)
Division of Radiation Safety and Safeguards (DRSS)

T. V. Kottan 12-6-91
J. Kottan, Laboratory Specialist date
ERPS, FRSSB, DRSS

Approved by: Robert J. Bores 12-06-91
R. Bores, Chief, ERPS, FRSSB, DRSS date

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 an adequate program for measuring radioactivity in process and effluent samples. No violations or deviations were identified.

DETAILS

1.0 Individuals Contacted

Principal Licensee Employees

W. Barnshaw, General Chemistry Supervisor
*R. Barrett, Plant Operations Director
K. Brown, QA Lead Monitor
*P. Cooper, Acting Chemistry Manager
*M. Douches, QA Auditor
*M. Heller, Licensing Engineer
C. Jorden, General Chemistry Supervisor
*S. Levin, Director, Operations and Maintenance
J. Mockridge, Chemist
G. Mulleavy, Chemist
R. Robertson, Chemistry Technician
*D. Robillard, Acting Operations QA Manager
*M. Slobodien, Radiological Controls Director
R. Stoudnour, Senior Engineer

NRC Employees

*D. Vito, Senior Resident Inspector

*Denotes those present at the exit meeting on November 22, 1991. The inspectors also interviewed other licensee personnel, including members of the chemistry and radiological controls staffs.

2.0 Purpose

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

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

2. 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

During this part of the inspection, liquid, airborne particulate (filter) and iodine (charcoal cartridge), and gas samples were analyzed by the licensee and the NRC for the purpose of inter-comparison. The samples were actual split samples with the exception

of the particulate filters, charcoal cartridges, and Marinelli beaker offgas samples. In these cases the samples could not be split and the same samples were analyzed by the licensee and the NRC. Where possible, the samples are actual effluent samples or in-plant samples which duplicated the counting geometries used by the licensee for effluent sample analyses. The samples were analyzed by the licensee using routine 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 and other samples with respect to Technical Specifications and other regulatory requirements.

In addition, a liquid 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, gross alpha, tritium and Fe-55. The results of these analyses 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 a liquid sample split between the licensee and the NRC during a previous inspection on October 16-20, 1989 (Inspection Report No. 50-219/89-25) were also compared during this inspection.

The licensee's Radiological Controls Department also possessed a gamma spectrometry system which was used to quantify radioactivity on in-plant samples for radiation protection purposes. During this inspection, the charcoal cartridge and particulate filter samples were also analyzed by the licensee's Radiological Controls Department and compared with the NRC results. These types of samples are those normally analyzed by this department.

The results of the sample measurements comparisons, which are presented in Table I, indicated that all of the measurements were in agreement under the criteria used for comparing results (see Attachment 1 to Table I) with the exception of the Fe-55 and Sr-90 results from the liquid sample split during the previous inspection. The specific reasons for the disagreements could not be determined during this inspection. However, as stated above, a liquid sample was split for Fe-55 and Sr-90 analyses during this inspection, and these results will be compared as soon as received in order to resolve this discrepancy. Some possible reasons for the disagreements could be a poor sample split or a matrix effect present in the sample. Since the licensee does not routinely discharge liquid radioactive effluents, these disagreements would not result in the licensee exceeding Technical Specification effluent release limits. The inspector had no further questions in this area at this time.

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. The iron analyses, however, were performed at four concentrations rather than three due to the wide range over which the licensee normally measures iron.

The results of the standards measurement comparisons indicated that all of the licensee's measurements were in agreement with the NRC's known values under the criteria used for comparing results (see Attachment 2 to Table II). The licensee's nickel results at approximately 200 ppb (parts per billion) were in disagreement with the NRC's known values when first analyzed. This disagreement appeared to be due to the high blank emission values obtained for the emission line used for nickel analysis on the inductively coupled plasma spectrometer (ICP). Although the licensee originally stated that nickel could be quantified at the 100 ppb level, it appeared that because of the high blank, the nickel limit of quantification (LOQ) was really approximately 300 ppb. Therefore, since the results from the analyses at approximately 200 ppb were below the licensee's LOQ, these data were not included in Table II. The inspector discussed this matter with the licensee, and the licensee stated that the area would be reviewed and evaluated. Additionally, the inspector noted that the licensee performs a one-point calibration of the ICP at 1 ppm (parts per million) for all metals except for iron and at 10 ppm for iron, and then analyzes a check standard at 0.5 ppm for all metals. The licensee's acceptance criteria for the 0.5 ppb check standard is plus or minus ten percent (±10%). The inspector discussed this matter with the licensee and the use of multipoint vs. single-point calibrations. The licensee stated that this area would be reviewed and evaluated and consideration given to performing multipoint calibrations of the ICP. The inspector stated that the above areas would be reviewed during a subsequent inspection.

The inspector had no further questions in this area.

4.0 Laboratory QA/QC

The inspector reviewed the licensee's chemistry and radiochemistry laboratory QA/QC program. The program was described in the following procedures.

822.1	Chemistry Quality Control: Program Outline
822.2	Chemistry Quality Control: Instrumentation
822.3	Chemistry Quality Control: Chemicals and Reagents
822.4	Chemistry Quality Control: Analytical Methods
822.6	Chemistry Quality Control: Vendor Laboratories
822.7	Chemistry Quality Control: Laboratory Control and Safety

These procedures provided for both an intralaboratory QC program and an interlaboratory QC program. The intralaboratory QC program consisted of instrument and procedure control charts and the analysis of independent check standards. The interlaboratory program consisted of the analysis of spiked samples received from outside laboratories for both radioactivity and chemical measurements. Also included in the interlaboratory QC program was the offsite vendor laboratory used for the analyses of radioactive effluent samples which required separation chemistry procedures. The inspector reviewed selected data generated by the licensee's laboratory QC program for 1990 and 1991 to date. Based upon this data review and discussions with the licensee the inspector determined that the licensee was implementing the laboratory QC program as required.

In reviewing the above data the inspector noted that the interlaboratory radioactivity crosscheck spiked samples all consisted of liquid samples rather than a variety of spiked samples which could have included all of the counting geometries analyzed by the licensee, such as particulate filters, charcoal cartridges, and various gas counting containers. The inspector discussed this matter with the licensee, and the licensee stated that all of the counting geometries would be included in future crosscheck programs. Also, the inspector noted that the licensee maintained some control charts employing a fixed percentage for control limits rather than statistical limits at the two and three sigma values about the mean. The inspector further noted that the licensee's procedures address only the construction and use of statistical control charts, and do not address the use of a fixed percentage control limit. The inspector discussed this matter with the licensee, and the licensee stated that this area would be examined and evaluated. The inspector stated that the above areas would be reviewed during a subsequent inspection in this area. Finally, the inspector observed that the licensee prepared a semi-annual internal laboratory QA/QC report which included all the results and control charts generated from the laboratory QC program. The inspector noted that the licensee's extensive periodic review of the QC data for use in assessing and monitoring laboratory performance was noteworthy.

5.0 Audits and Surveillance Activities

The inspector reviewed recent quality assurance audits of the licensee's chemistry program performed by the licensee's QA Program Development and Audit group. The following audits were reviewed.

Audit Report No. S-QC-90-06, "Chemistry", performed July 26, 1990 - February 13, 1991

Audit Report No. S-QC-89-08, "Chemistry/Radiological Environmental Technical Specifications", performed July 27 -September 21, 1989

These audits included the licensee's programs and procedures for chemical and radiochemical measurements and the laboratory quality assurance program for these measurements. The audits appeared to be of excellent technical depth, sufficient to identify programmatic weaknesses. The inspector also reviewed the tracking system the licensee had in place to track audits and audit findings. Based on this review and through discussions with the licensee the inspector determined that the tracking program appeared to be adequate to resolve audit findings in a timely manner.

The inspector also reviewed the 1991-to-date surveillance activities reports (Operations QA Monitoring Reports) of the chemistry area. These surveillance activities were conducted by the licensee's QA Operations Quality Assurance group. This group maintained an annual surveillance plan for the following site chemistry areas: administrative controls, equipment control, control of procedures and records, training and qualifications, safety and radiological controls, control of nonconformances and deficiencies, commitment followup, [illegible]ty control, and radiological effluent technical specifications. While reviewing the surveillance reports the inspector noted that the reports appeared to be of good technical depth, the surveillance activities were conducted using a checklist, and the laboratory QC program was included.

The inspector had no further questions 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 November 22, 1991. The inspector summarized the purpose, scope and findings of the inspection.

Table I

Oyster Creek Verification Test Results

SAMPLE	ISOTOPE	NRC VALUE	LICENSEE VALUE	COMPARISON
		Results in microCuries per milliliter		
Reactor Water	Cr-51	(1.559±0.006)E-3	(1.75±0.06)E-3	Agreement
Anion Filter	Co-58	(1.9±0.2)E-6	(1.64±0.10)E-6	Agreement
0950 hrs	Co-60	(1.8±0.2)E-6	(1.85±0.11)E-6	Agreement
11-18-91	I-131	(6.07±0.05)E-5	(7.0±0.2)E-5	Agreement
	I-133	(9.95±0.07)E-4	(1.14±0.04)E-3	Agreement
Reactor Water	Na-24	(5.8±0.2)E-4	(6.3±0.2)E-4	Agreement
Cation Filter	Co-58	(1.077±0.009)E-4	(1.19±0.04)E-4	Agreement
0950 hrs	Co-60	(1.235±0.012)E-4	(1.34±0.04)E-4	Agreement
11-18-91	Ba-140	(2.9±0.2)E-5	(3.48±0.16)E-5	Agreement
Reactor Water	Cr-51	(6.10±0.15)E-5	(6.5±0.3)E-5	Agreement
Particulate Filter	Mn-54	(3.2±0.2)E-6	(3.30±0.14)E-6	Agreement
0950 hrs	Co-58	(3.4±0.2)E-6	(4.0±0.2)E-6	Agreement
11-18-91	Co-60	(6.2±0.2)E-6	(6.0±0.3)E-6	Agreement
Stack	I-131	(1.15±0.11)E-12	(1.30±0.12)E-12	Agreement
Charcoal Cartridge	I-133	(3.17±0.16)E-12	(4.0±0.3)E-12	Agreement
0831 hrs				
11-19-91				
Stack	I-131	(4.1±0.2)E-13	(3.4±0.3)E-13	Agreement
Particulate Filter	I-133	(1.98±0.09)E-12	(2.2±0.2)E-12	Agreement
0831 hrs				
11-19-91				
Drywell Sump	Mn-54	(5.4±0.2)E-6	(5.3±0.2)E-6	Agreement
1125 hrs	Co-60	(6.41±0.05)E-5	(6.4±0.2)E-5	Agreement
11-21-91	I-131	(3.17±0.15)E-6	(3.33±0.16)E-6	Agreement
(Licensee's	I-133	(1.30±0.02)E-5	(1.42±0.06)E-5	Agreement
Marinelli beaker	Cs-137	(5.1±0.2)E-6	(4.7±0.3)E-6	Agreement
counting				
geometry)				
Drywell Sump	Mn-54	(5.4±0.2)E-6	(6.69±0.06)E-6	Agreement
1125 hrs	Co-60	(6.41±0.05)E-5	(7.4±0.3)E-5	Agreement
11-21-91	I-131	(3.17±0.15)E-6	(3.3±0.4)E-6	Agreement
(Licensee's	I-133	(1.30±0.02)E-5	(1.41±0.08)E-5	Agreement
500 ml bottle	Cs-137	(5.1±0.2)E-6	(5.2±0.4)E-6	Agreement
counting				
geometry)				

Table 1 (Continued)

Oyster Creek Verification Test Results

SAMPLE	ISOTOPE	NRC VALUE	LICENSEE VALUE	COMPARISON
		Results in microCuries per milliliter		
Reactor Water 0830 hrs 11-19-91	I-132	(2.68±0.04)E-3	(3.04±0.12)E-3	Agreement
	I-133	(1.12±0.02)E-3	(1.10±0.04)E-3	Agreement
	I-134	(1.15±0.03)E-2	(1.34±0.04)E-2	Agreement
	I-135	(3.20±0.10)E-3	(3.15±0.11)E-3	Agreement
Offgas 1145 hrs 11-21-91 (1st count)	Kr-85m	(5.3±0.3)E-4	(5.8±0.3)E-4	Agreement
	Kr-88	(2.17±0.11)E-3	(2.21±0.15)E-3	Agreement
	Xe-135m	(1.61±0.04)E-2	(1.91±0.07)E-2	Agreement
	Xe-135	(3.56±0.06)E-3	(3.41±0.16)E-3	Agreement
	Xe-138	(7.57±0.12)E-2	(8.2±0.4)E-2	Agreement
Offgas 1023 hrs 11-20-91 (2nd count)	Kr-85m	(5.4±0.4)E-4	(5.7±0.3)E-4	Agreement
	Kr-87	(3.2±0.3)E-3	(3.5±0.2)E-3	Agreement
	Kr-88	(2.13±0.15)E-3	(2.10±0.11)E-3	Agreement
	Xe-135	(3.58±0.05)E-3	(3.62±0.16)E-3	Agreement
		Results in total microCuries		
Offgas 1016 hrs 11-20-91 (licensee's Marinelli beaker counting geometry)	Kr-85m	(5.8±0.6)E-4	(6.2±0.5)E-4	Agreement
	Kr-88	(1.7±0.2)E-3	(1.8±0.2)E-3	Agreement
	Xe-135	(3.49±0.06)E-3	(3.8±0.2)E-3	Agreement
		Results in microCuries per milliliter		
Drywell Sump 1404 hrs 10-17-89	gross alpha	(5±2)E-9	<7.20E-8	No Comparison
	Sr-89	(3.2±0.3)E-7	(4.19±0.65)E-7	Agreement
	Sr-90	(2.20±0.13)E-7	(3.0±0.2)E-7	Disagreement
	Fe-55	(1.52±0.01)E-5	(8.1±1.3)E-6	Disagreement
Stack Charcoal Cartridge 0831 hrs 11-19-91 (Radiological Controls Analysis)	I-131	(1.15±0.11)E-12	(1.31±0.10)E-12	Agreement
	I-133	(3.17±0.16)E-12	(3.3±0.3)E-12	Agreement

Table I (Continued)

Oyster Creek Verification Test Results

SAMPLE	ISOTOPE	NRC VALUE	LICENSEE VALUE	COMPARISON
		Results in microCuries per milliliter		
Reactor Water	Cr-51	(1.559±0.006)E-3	(1.33±0.02)E-3	Agreement
Anion Filter	Co-58	(1.9±0.2)E-6	(1.24±0.11)E-6	Agreement
0950 hrs	Co-60	(1.8±0.2)E-6	(1.49±0.13)E-6	Agreement
11-18-91	I-131	(6.07±0.05)E-5	(4.88±0.04)E-5	Agreement
(Radiological	I-133	(9.95±0.07)E-4	(8.57±0.04)E-4	Agreement
Controls Analysis)				
(Counting Geometry #1)				
Reactor Water	Cr-51	(1.559±0.006)E-3	(1.41±0.02)E-3	Agreement
Anion Filter	Co-58	(1.9±0.2)E-6	<9.87E-7	No Comparison
0950 hrs	Co-60	(1.8±0.2)E-6	(2.1±0.3)E-6	Agreement
11-18-91	I-131	(6.07±0.05)E-5	(5.74±0.11)E-5	Agreement
(Radiological	I-133	(9.95±0.07)E-4	(8.8±0.2)E-4	Agreement
Controls Analysis)				
(Counting Geometry #4)				

NOTE: Reported uncertainties are one standard deviation counting uncertainties for both licensee and NRC 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 Uncertainty)
[2]Ratio = (Licensee Value/NRC Reference Value)

TABLE II

Oyster Creek Chemistry Test Results

Chemical Parameter	Method of Analysis	NRC Known Value	Licensee Measured Value	Ratio (LIC/NRC)	Comparison
			Results in parts per million (ppm)		
Iron	ICP	0.200±0.010	0.1830±0.0010	0.92±0.05	Agreement
		0.41±0.02	0.380±0.004	0.93±0.05	Agreement
		0.83±0.06	0.768±0.008	0.92±0.07	Agreement
		6.6±0.4	6.379±0.003	0.97±0.06	Agreement
Copper	ICP	0.197±0.009	0.190±0.010	0.96±0.07	Agreement
		0.40±0.03	0.387±0.006	0.97±0.07	Agreement
		0.82±0.04	0.780±0.010	0.95±0.05	Agreement
Nickel	ICP	0.39±0.03	0.413±0.012	1.06±0.09	Agreement
		0.79±0.05	0.803±0.015	1.02±0.07	Agreement
Chromium	ICP	0.193±0.011	0.18±0	0.93±0.05	Agreement
		0.40±0.03	0.380±0.010	0.95±0.08	Agreement
		0.81±0.07	0.77±0.02	0.95±0.09	Agreement

NOTE: ICP = Inductively coupled plasma spectrometry

ATTACHMENT 2 TO TABLE II

Criteria for Comparing Analytical Measurements for 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
Iron	0.181-0.219	0.171-0.229
	0.37-0.45	0.35-0.47
	0.75-0.91	0.71-0.95
Copper	0.178-0.216	0.169-0.225
	0.36-0.44	0.34-0.46
	0.74-0.90	0.70-0.94
Nickel	0.37-0.42	0.36-0.43
	0.74-0.84	0.71-0.87
Chromium	0.174-0.212	0.165-0.221
	0.36-0.44	0.34-0.46
	0.73-0.89	0.69-0.93