U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-219/89-25

Docket No. 50-219

License No. DPR-16 Priority - Category C

Licensee: GPU Nuclear Corporation
P.O. Box 388
Forked River, New Jersey 08731

Facility Name: Oyster Creek Nuclear Generating Station

Inspection At: Forked River, New Jersey

Inspection Conducted: October 16-20, 1989

Inspectors: J. J. Kottan 11-13-89
J. J. Kottan, Laboratory Specialist, ERPS date

for J. J. Kottan 11-13-89
N. T. McNamara, Laboratory Assistant, ERPS date

Approved by: Robert J. Bores 11-14-89
R. J. Bores, Chief, Effluents Radiation Protection Section, FRSS Branch date

Inspection Summary: Inspection on October 16-20, 1989 (Inspection Report No. 50-219/89-25).

Areas Inspected: Routine, unannounced inspection of the radiological and non-radiological chemistry program. Areas reviewed included: confirmatory measurements - radiological, standards analyses - chemistry, and laboratory QA/QC.

Results: Of the areas reviewed, no violations were identified.

DETAILS

1.0 Individuals Contacted

J. Barton, Deputy Director, Oyster Creek
*R. Hillman, Manager, Plant Chemistry
*M. Heller, QC Licensing Engineering
*D. MacFarlane, Site Audit Manager
*D. Arbach, Manager, Radiological Health
*G. Busch, QC Licensing Manager
R. Stoudnour, Senior Engineer - Chemistry
W. Dunphy, Senior Chemist
G. Mulleavy, Staff Chemist
W. Barnshaw, Chemistry Supervisor
J. Mockridge, Chemistry Supervisor
F. Jordan, Chemistry Technician
J. Deuchler, Chemistry Technician
G. Beh, Chemistry Technician
C. Heale, Chemistry Technician
M. Slobodien, Radiological Controls Director

*Denotes those personnel who attended the exit meeting on October 20, 1989.

The inspector also interviewed other licensee personnel including other members of the chemistry staff.

2.0 Purpose

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

1. The licensee's ability to measure radioactivity in plant systems and effluent samples, and chemistry 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 intercomparison. The samples were actual split samples with the exception of the particulate filters, charcoal cartridge, and offgas samples. In these cases the samples could not be split, and the same samples were analyzed by both the licensee and the NRC. Where possible, the samples are actual effluent samples or inplant 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 the 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, H-3, and gross alpha. 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 an effluent sample split between the licensee and the NRC during a previous inspection on August 24-28, 1987 (Inspection Report No. 50-219/87-26) were also compared during this inspection.

The licensee's Radiological Controls Department also possesses a gamma spectrometry system. Therefore, the particulate filter and charcoal cartridge samples (samples routinely analyzed by this department) were also analyzed using this counting system and compared with the NRC results.

The results of the sample measurement intercomparisons indicated that all of the measurements were in agreement under the criteria for comparing results (see Attachment 1) with two exceptions. The two exceptions were the Fe-55 analysis on a liquid sample split during a previous inspection and the Radiological Controls' analysis of the charcoal cartridge. The licensee's Fe-55 result was low by approximately a factor of five compared to the NRC result. This analysis was performed by the licensee's vendor laboratory and the NRC reference laboratory. The difference between the two results may indicate a poor sample split due to particulate material present in the sample which may have "plated out" on the sample container wall. The results of the liquid sample split during this inspection will be compared as soon as available in order to resolve this disagreement. The licensee does not routinely discharge liquid radioactive effluents. Therefore, the Fe-55 value would not result in the licensee underestimating radioactivity in liquid effluent releases.

The disagreement on the analysis of the charcoal cartridge for radioiodine by the Radiological Controls Department was due to the fact that the licensee calibrates the gamma spectrometer with the inlet side of cartridge facing away from the detection and then analyzes the sample with the inlet facing toward the detector. The inspector discussed this practice with the licensee. The licensee stated that this counting practice was employed so that in the event a technician happened to place the charcoal cartridge on the detector

improperly, the result would not be in error and if the charcoal cartridge were properly placed on the detector the result would be conservative. The inspector discussed this matter with the licensee and stated that the measurements should be accurate, not just conservative. The licensee stated that the counting procedure would be modified so that the charcoal cartridge would be counted in the same geometry as the calibration standard.

Also noted during this inspection was the licensee's practice of counting offgas samples as soon as possible after obtaining the sample. In fact, the licensee's procedure requires that the first count of the offgas sample be made within 30 minutes of sampling so that short-lived radionuclides can be measured. This results in a complex multiplet photopeak at approximately 400 keV in the gamma ray spectrum, complicating the analysis of Kr-87. The first offgas sample analysis which was compared was performed approximately six minutes after sampling. The resulting measurement by the licensee of Kr-87 was in disagreement with the NRC result. A second count of the offgas sample after a five-hour decay resulted in the Kr-87 measurement being in agreement. After discussing this matter with the inspector the licensee modified the counting procedure so that the first count of the offgas sample would be made after a decay time of 25-30 minutes to permit some decay of short-lived, interfering isotopes. The Kr-87 result on a sample analyzed following this procedure was in agreement. The inspector noted the licensee's prompt response to this matter.

The results of the radioactivity measurements comparison are listed in Table I. The inspector had no further questions in this area. No violations were identified.

3.2 Standards Analyses (Chemical)

During this part of the inspection, standard chemical solutions were submitted to the licensee for analysis. The standard solutions were prepared by Brookhaven National Laboratory (BNL) 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 specification 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 results of the standards measurement comparisons indicated that all of the measurements were in agreement or qualified agreement under the criteria used for comparing results (See Attachment 2).

The results of the comparisons are listed in Table II. The standards were submitted to the licensee for analysis in triplicate at three concentrations spread over the licensee's normal calibration range. One of the three metals concentrations was analyzed in duplicate due to the lack of sufficient volume of the NRC-supplied standard to perform the analysis in triplicate. Also the iron analyses were performed at four concentrations rather then three due to the wide range over which the licensee calibrates the instrument for iron analyses.

The inspector had no further questions in this area. No violations were identified.

4.0 Laboratory QA/QC

The inspector reviewed the licensee's chemistry and radiochemistry laboratory QA/QC program. This program is described in a number of procedures:

822.1	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
822.5	Chemistry Quality Control: Analyst Performance
822.6	Chemistry Quality Control: Vendor Laboratories
822.7	Chemistry Quality Control: Laboratory Control and Safety

The procedures provide for both an intralaboratory QA/QC program and an interlaboratory QA/QC program. The intralaboratory QA/QC program consisted of instrument and procedure control charts and the analysis of spiked and duplicate samples. The spiked and duplicate samples results were plotted on accuracy and range control charts, respectively. These results were plotted so that the individual analysts could be identified. This provided a mechanism for tracking the performance of individual analysts, as well as monitoring a specific analytical method. The interlaboratory program consisted of the analysis of standards received from outside laboratories for both chemical and radiological parameter analyses. The licensee's procedures contain acceptance criteria for comparing these results. Also included in the licensee's interlaboratory program was the vendor laboratory that performed the radiochemical analyses of effluent samples. The inspector reviewed selected data generated by the licensee's laboratory QA/QC program for 1988 and 1989 to date and noted that the licensee appeared to be implementing the laboratory QA/QC program as required.

In reviewing other laboratory data the inspector noted that the licensee was running standards on the ion chromatograph (IC) and the inductively coupled plasma spectrometer (ICP), but was not plotting these standards on control charts. The IC standards, however, were being used to trend the performance of the IC separator column. The inspector discussed with the licensee the fact that these data could be plotted on control charts

and would lend additional credibility and validity to the licensee's results obtained from these instruments. The licensee responded that control charts would be implemented for these instruments. In addition the inspector observed that the control charts for the licensee's gamma spectrometry system appeared biased, in that, most of the data points were located on one side of the mean. Through discussions with the licensee, the inspector determined that the control charts' mean values and standard deviations were determined over a brief period of time and were not representative of actual long-term, day to day activities. The inspector stated that long-term reliable estimates of the mean and standard deviation are necessary to establish control limits. The licensee stated that actual data accumulated over a period of time sufficient to estimate long-term trends will be used to construct new control charts.

The inspector also 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 QA/QC program. The inspector noted that this periodic review of the laboratory QA/QC data, along with the interlaboratory program in both chemistry and radiochemistry, as well as, the control charts assessing technician performance for accuracy and precision were noted strengths of the licensee's laboratory QA/QC program. The inspector had no further questions in this area. No violations were identified.

5.0 Exit Interview

The inspector met with the licensee representatives denoted in Section 1 of this report at the conclusion of the inspection on October 20, 1989. 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		
Offgas	Kr-85m	(3.24±0.07)E-3	(3.04±0.13)E-3	Agreement
10-19-89	Kr-87	(1.34±0.03)E-2	(1.44±0.07)E-2	Agreement
1107 hrs	Kr-88	(1.09±0.03)E-2	(1.09±0.06)E-2	Agreement
(Detector #1)	Xe-133	(3.27±0.13)E-3	(3.1±0.3)E-3	Agreement
(~30 min. decay	Xe-135m	(5.4±0.2)E-2	(4.4±0.2)E-2	Agreement
prior to counting)	Xe-135	(1.484±0.015)E-2	(1.45±0.08)E-2	Agreement
	Xe-138	(2.15±0.06)E-1	(1.66±0.09)E-1	Agreement
Offgas	Kr-85m	(3.28±0.05)E-3	(3.13±0.13)E-3	Agreement
10-18-89	Kr-87	(1.34±0.03)E-2	(1.23±0.06)E-2	Agreement
1007 hrs	Kr-88	(1.02±0.02)E-2	(9.8±0.5)E-3	Agreement
(Detector #1)	Xe-133	(3.34±0.04)E-3	(3.2±0.3)E-3	Agreement
(~5 hr. decay	Xe-135	(1.520±0.006)E-2	(1.49±0.08)E-2	Agreement
to counting)				
Offgas in	Kr-85m	(1.20±0.02)E-2	(1.26±0.09)E-2	Agreement
Marinelli Beaker	Kr-87	(4.92±0.10)E-2	(5.1±0.2)E-2	Agreement
(to simulate	Kr-88	(3.88±0.08)E-2	(4.0±0.3)E-2	Agreement
stack gas)	Xe-133	(1.37±0.03)E-2	(1.41±0.12)E-2	Agreement
10-18-89	Xe-135	(6.01±0.04)E-2	(6.0±0.3)E-2	Agreement
1007 hrs				
(Detector #2)				
Reactor Water	I-131	(1.43±0.11)E-4	(1.44±0.13)E-4	Agreement
10-17-89	I-132	(5.26±0.05)E-3	(5.6±0.2)E-3	Agreement
0950 hrs	I-133	(2.17±0.02)E-3	(2.05±0.08)E-3	Agreement
(Detector #2)	I-134	(2.57±0.07)E-2	(2.44±0.07)E-2	Agreement
	I-135	(6.31±0.11)E-3	(5.4±0.2)E-3	Agreement
Water-Drywell	Co-60	(5.68±0.15)E-5	(4.9±0.3)E-5	Agreement
Sump	I-131	(1.55±0.08)E-5	(1.6±0.2)E-5	Agreement
10-17-89	I-132	(3.30±0.13)E-5	(3.4±0.2)E-5	Agreement
1404 hrs	I-133	(8.98±0.12)E-5	(8.8±0.5)E-5	Agreement
(Detector #1)	I-135	(1.25±0.04)E-4	(1.14±0.08)E-4	Agreement
	Cs-134	(1.94±0.09)E-5	(2.1±0.2)E-5	Agreement
	Cs-137	(3.37±0.12)E-5	(3.3±0.2)E-5	Agreement

Table I (Continued)

Oyster Creek Verification Test Results

SAMPLE	ISOTOPE	NRC VALUE	LICENSEE VALUE	COMPARISON
		Results in Microcuries Per Milliliter		
Drywell Sump	Cr-51	(5.0±0.3)E-6	(4.5±0.6)E-6	Agreement
Filter	Mn-54	(1.43±0.07)E-6	(1.45±0.13)E-6	Agreement
10-17-89	Co-60	(8.17±0.11)E-6	(6.9±0.3)E-6	Agreement
1404 hrs	I-131	(1.00±0.04)E-6	(1.11±0.09)E-6	Agreement
(Detector #2)	I-133	(4.25±0.08)E-6	(4.2±0.2)E-6	Agreement
Stack Charcoal	I-131	(3.9±0.3)E-12	(3.9±0.4)E-12	Agreement
Cartridge	I-133	(9.5±0.3)E-12	(8.6±0.6)E-12	Agreement
10-17-89				
0825 hrs				
(Detector #1)				
Water Drywell	Fe-55	(2.86±0.02)E-5	(5.2±1.1)E-6	Disagreement
Sump	H-3	(3.32±0.05)E-3	(3.39±0.01)E-3	Agreement
8-26-87	gross alpha	(1.0±0.3)E-8	<9E-8	No Comparison
1450 hrs	Sr-89	(2.7±0.5)E-7	(2.0±0.4)E-7	Agreement
	Sr-90	(4.4±0.2)E-7	(4.8±0.2)E-7	Agreement
(The following analyses were performed by the Radiological Controls Group)				
Stack Charcoal	I-131	(3.9±0.3)E-12	(7.8±0.3)E-12	Disagreement
Cartridge	I-133	(9.5±0.2)E-12	(1.88±0.06)E-11	Disagreement
10-17-89				
0825 hrs				
Drywell Sump	Cr-51	(5.0±0.3)E-6	(5.0±0.3)E-6	Agreement
Filter	Mn-54	(1.43±0.07)E-6	(1.54±0.08)E-6	Agreement
10-17-89	Co-60	(8.17±0.11)E-6	(7.4±0.2)E-6	Agreement
1404 hrs	I-131	(1.00±0.04)E-6	(1.20±0.05)E-6	Agreement
	I-133	(4.25±0.08)E-6	(5.2±0.2)E-6	Agreement

Table II

Oyster Creek Capability Test Results

Chemical Parameter	Method of Analysis*	NRC Known Value	Licensee Measured Value	Comparison
			Results in parts per billion (ppb)	
Chloride	IC	3.0±0.2	2.9±0	Agreement
		6.2±0.4	5.73±0.15	Agreement
		4.8±0.3	4.47±0.06	Agreement
Sulfate	IC	1.9±0.3	2.0±0.2	Agreement
		3.8±0.4	3.75±0	Agreement
		6.0±0.4	5.6±0	Agreement
Silica	SP	25±2	25±0	Agreement
		55.0±1.0	50.7±1.2	Agreement
		80.5±1.5	76.3±1.5	Agreement
			Results in parts per million (ppm)	
Boron	Tit.	20.6±0.4	20.6±0.4	Agreement
		59.8±0.8	60.5±0.6	Agreement
		102±2	100.7±0.9	Agreement
Iron	ICP	0.198±0.003	0.187±0.012	Agreement
		0.580±0.010	0.560±0.009	Agreement
		0.784±0.002	0.792±0.003[1]	Agreement
		5.80±0.10	6.3±0.2	Agreement
Copper	ICP	0.199±0.004	0.194±0.012	Agreement
		0.595±0.005	0.58±0.02	Agreement
		0.810±0.006	0.797±0[1]	Agreement
Nickel	ICP	0.203±0.005	0.190±0.006	Agreement
		0.610±0.010	0.589±0.013	Agreement
		0.806±0.012	0.84±0.03[1]	Agreement
Chromium	ICP	0.200±0.010	0.179±0.016	Qualified Agreement
		0.600±0.007	0.560±0.013	Agreement
		0.81±0.02	0.80±0.02[1]	Agreement

*Note: SP = UV-Vis Spectrophotometry
IC = Ion Chromatography
Tit. = Potentiometric Titration
ICP = Inductively Coupled Plasma Spectrometry

[1]Analysis performed in duplicate

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)

ATTACHMENT 2

Criteria for Comparing Analytical Measurements

This attachment provides criteria for comparing result 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 BNL known value are considered to be in agreement. Licensee values outside the plus or minus two standard deviation range but within plus or minus three standard deviation range (±3Sd) of the BNL 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 BNL known value are in disagreement. The standard deviations were computed using the average percent standard deviation values of each analyte in Table 2.1.

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

Analyte	Agreement Range	Qualified Agreement Range
	Values in parts per billion (ppb)	
Chloride	2.8-3.2	2.7-3.3
	5.7-6.7	5.5-6.9
	4.4-5.1	4.2-5.3
Sulfate	1.7-2.1	1.6-2.2
	3.4-4.2	3.3-4.3
	5.4-6.6	5.2-6.8
Silica	22.2-26.8	21.0-28.0
	50.0-60.0	47.3-62.5
	73.0-88.0	69.0-92.0
	Values in parts per million (ppm)	
Boron	20.2-21.0	19.9-21.3
	58.5-61.1	57.9-61.7
	100-104	99-105
Iron	0.179-0.217	0.169-0.227
	0.524-0.636	0.496-0.664
	0.708-0.860	0.672-0.896
	5.24-6.36	4.96-6.64

ATTACHMENT 2 (continued)

Analyte	Agreement Range	Qualified Agreement Range
Copper	0.180-0.218	0.171-0.227
	0.538-0.652	0.510-0.680
	0.732±0.888	0.694-0.926
Nickel	0.190-0.216	0.184-0.222
	0.572-0.648	0.553-0.667
	0.756-0.856	0.732-0.880
Chromium	0.181-0.219	0.171-0.229
	0.542-0.658	0.512-0.688
	0.73-0.89	0.69-0.93