U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report Nos.: 50-387/94-13
50-388/94-14

Docket Nos.: 50-387
50-388

License Nos.: NPF-14
NPF-22

Licensee: Pennsylvania Power and Light Company
2 North Ninth Street
Allentown, Pennsylvania 18101

Facility Name: Susquehanna Steam Electric Station, Units 1 and 2

Inspection At: Berwick, Pennsylvania

Inspection Conducted: June 27 - July 1, 1994

Inspector: J. T. Kottan — 7-14-94
J. Kottan, Laboratory Specialist — Date
Effluents Radiation Protection Section (ERPS)

Approved By: J. C. Jang — 7-14-94
J. C. Jang, Chief, ERPS — Date
Facilities Radiological Safety and Safeguards Branch

Areas Inspected: Announced inspection of the radiological chemistry program. Areas reviewed included: Confirmatory Measurements - Radiological, Laboratory QA/QC, and Audits.

Results: The licensee had in place effective programs for measuring radioactivity in process and effluent samples. No safety concerns or violations of regulatory requirements were identified.

Details

1.0 Individual Contacted

Principal Licensee Employees

* T. Dalpiaz, Manager, Nuclear Maintenance
D. Heffelfinger, Coordinating Engineer, NQA Quality Verification
R. Hock, Health Physicist
* H. Lloyd, Compliance Engineer
C. Markley, Chemistry Supervisor
* R. Prego, Supervisor, Site Quality Verification
* B. Rhoads, Supervisor, Chemistry Support
J. Schmidt, Senior NQA Analyst
* G. Stanley, Vice President, Nuclear Operations
* R. Takacs, Senior Chemist
* D. Wright, Chemistry Foreman

NRC Employees

* D. Mannai, Resident Inspector
* D. Munford, Co-op Student

* Denotes those present at the exit meeting on July 1, 1994.

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

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 samples and effluent samples.

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

3.0 Radiochemical Confirmatory Measurements

During the inspection, liquid, airborne particulate (filter) and iodine (charcoal cartridge), and gas samples were analyzed by the licensee's chemistry department and the NRC for the purpose of intercomparison. The samples were actual split samples with the exception of the particulate filter and offgas post treatment samples. In these cases, the samples could not be split and the same samples were analyzed by the licensee and the

NRC. Also, the licensee could not provide a charcoal cartridge sample which contained radioiodine. Therefore, an NRC spiked charcoal cartridge was submitted to the licensee for analysis. 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 samples were analyzed by the licensee using routine methods and equipment and by the NRC Region I Mobile Radiological Measurements Laboratory. Joint analyses of actual effluent samples were used to verify the licensee's capability to measure radioactivity concentrations 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, H-3, Fe-55, 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 a liquid sample split between the licensee and the NRC during a previous inspection on August 26-30, 1991 (Inspection Nos. 50-387/91-16 and 50-388/91-16) were also compared during this inspection.

The licensee's health physics department performed gamma spectrometry analyses of in-plant samples for radiation protection purposes. During this inspection, the charcoal cartridge and particulate filter samples were also analyzed by the licensee's health physics department and compared with the NRC results. These types of samples were those normally analyzed by this department.

The comparisons for all of the above sample results that were available indicated that all of the measurements were in agreement under the criteria used for comparing results. During the previous inspection in this area, the licensee's health physics result of the charcoal cartridge was in disagreement. This was determined to be due to the fact that the licensee calibrated the charcoal cartridge with radioactivity uniformly distributed throughout the cartridge (rather than with some gradient of radioactivity across the depth of the cartridge; or a "face loaded" cartridge), but analyzed the cartridge as if it were, in fact, face loaded. During this inspection, the licensee's health physics charcoal cartridge result was in agreement with the NRC result. The licensee had reviewed the method of charcoal cartridge calibration, as committed to during the previous inspection, and was now calibrating the health physics gamma spectrometry system with a "face loaded" charcoal cartridge. No safety concerns or violations were identified in this area. The data are presented in Table I.

4.0 Laboratory QA/QC

The licensee's laboratory QA/QC program was described in Procedure CH-AD-006, "Chemistry Program Quality Assurance." This procedure defined the licensee's laboratory QA/QC program in general terms, and specific procedures implemented

various aspects of the program. The following specific procedures were reviewed by the inspector.

- CH-QC-001, "Criteria for Comparing Radiochemical Measurements (Split Samples)
- CH-QC-002, "Interlaboratory Quality Control Program"
- CH-QC-003, "Intralaboratory Quality Control"
- CH-QC-005, "Replicate Sampling and Analysis"
- CH-QC-006, "Control of Chemistry Test Equipment"
- CH-GI-011, "Instrument Checks"

These procedures provided for the control of analytical results through a number of mechanisms including: reagent control, standards control, instrument control, sampling control, and participation in interlaboratory QC programs. The licensee trended the performance of the gamma spectrometry system and liquid scintillation counter through the use of control charts and analyzed spiked and replicate samples as part of the intralaboratory QC program. The interlaboratory QC program consisted of the quarterly analysis of unknown samples received from an outside laboratory. The licensee also participated in an interlaboratory program with the National Institute of Standards and Technology (NIST). Additionally, the licensee submitted spiked samples to the vendor laboratory used for the analyses of effluent samples requiring radiochemical separations.

The inspector reviewed selected data generated by the licensee's laboratory QA/QC program for 1993 and 1994 to date, and, based on this review, noted that the licensee was implementing the laboratory QA/QC program as required. The licensee's laboratory QA/QC program was comprehensive, the QC data were reviewed in a timely manner, detailed monthly reports were generated which discussed the QC results, and the QC data were used in a proactive manner to improve the licensee's measurement processes.

Also, subsequent to the previous inspection in this area the licensee placed into service a new computer-based gamma spectrometry system. This system contained QC software for maintaining a data base of QC checks and printing control charts. Based on discussions with the licensee during the previous inspection, the inspector had determined that the software would identify an out-of-control data point, but not other trends taking place within the control chart. This necessitated that the control charts be reviewed on a daily basis. The licensee had committed to a daily review of the control charts to address this concern. During this inspection, through a review of data and discussions with licensee personnel, the inspector determined that the licensee was reviewing the control charts daily as committed.

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

5.0 Audit Activities

The inspector reviewed Audit 93-061, Chemistry Program, which was performed from April 26 - June 7, 1993. The inspector also discussed this audit with the leader of the audit team that performed the audit. Based on this review and discussion, the inspector determined that this audit was conducted using a pre-audit plan, a detailed checklist, and the audit was performance-based. Additionally, the inspector reviewed Audit 93-151, Effluent Release and Solid Radioactive Waste Process Control Programs, which was performed from November 8 - December 3, 1993, and noted that additional aspects of the chemistry program were included in this audit as well.

The inspector reviewed surveillances of specific chemistry activities which were conducted in 1993 and 1994 to date. An 18-month surveillance plan was maintained and included areas such as instruments, QA program, reagents, and standards. A monthly schedule was then used to track specific surveillance activities. A review of Surveillance Report Number 93-073, Standby Liquid Control, dated September 15, 1993, indicated that the surveillance was of good technical depth and scope.

Based on the above reviews and discussions, the inspector determined there was independent oversight and assessment of chemistry activities. 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 of this report at the conclusion of the inspection on July 1, 1994. The inspector summarized the purpose, scope and findings of the inspection. The licensee acknowledged the inspection findings.

TABLE I

Susquehanna Radiochemistry Test Results

SAMPLE	ISOTOPE	NRC VALUE	LICENSEE VALUE	COMPARISON
		Results in microCuries per milliliter		
Unit 2 Reactor Water	I-132	(1.1±0.2)E-4	(1.17±0.13)E-4	Agreement
1315 hrs	I-133	(3.1±0.5)E-5	(3.4±0.8)E-5	Agreement
06/28/94	Tc-99m	(1.090±0.002)E-2	(1.10±0.06)E-2	Agreement
(Detector No. 3)	Na-24	(1.550±0.005)E-2	(1.59±0.08)E-2	Agreement
Unit 2 Reactor Water	Mn-54	(1.67±0.03)E-4	(1.56±0.10)E-4	Agreement
Particulate Filter	Mn-56	(3.91±0.10)E-4	(4.1±0.2)E-4	Agreement
0840 hrs	Fe-59	(4.4±0.4)E-5	(4.3±0.3)E-5	Agreement
06/28/94	Co-60	(2.75±0.04)E-4	(2.74±0.10)E-4	Agreement
(Detector No. 2)	Na-24	(8.5±0.3)E-5	(8.8±0.5)E-5	Agreement
		Results in total microCuries		
Unit 2 Offgas	Ar-41	(7.6±0.6)E-3	(8.3±1.1)E-3	Agreement
Pre-Treatment	Xe-135m	(2.4±0.2)E-2	(3.4±0.3)E-2	Agreement
1202 hrs	Xe-138	(1.41±0.09)E-1	(1.39±0.10)E-1	Agreement
06/29/94				
(Detector No. 3)				
First Count				
Unit 2 Offgas	Kr-85m	(1.88±0.10)E-3	(2.14±0.11)E-3	Agreement
Pre-Treatment	Kr-87	(1.29±0.11)E-2	(1.33±0.09)E-2	Agreement
1202 hrs	Kr-88	(7.1±0.5)E-3	(7.9±0.4)E-3	Agreement
06/29/94	Xe-135	(5.48±0.14)E-3	(6.1±0.3)E-3	Agreement
(Detector No. 3)				
Second Count				

TABLE I

Susquehanna Radiochemistry Test Results

SAMPLE	ISOTOPE	NRC VALUE	LICENSEE VALUE	COMPARISON
		Results in microCuries per milliliter		
Unit 1 Offgas Post-Treatment 0945 hrs 06/29/94 (Detector No. 2)	Ar-41	(5.46±0.10)E-6	(5.9±0.4)E-6	Agreement
	Kr-85m	(1.27±0.12)E-7	(1.5±0.2)E-7	Agreement
	Xe-133	(2.9±0.3)E-7	(2.5±0.3)E-7	Agreement
Liquid Radwaste A&B Collection Tank 1310 hrs 06/29/94 (Detector No. 3)	Cr-51	(1.43±0.02)E-4	(1.47±0.08)E-4	Agreement
	Mn-54	(2.325±0.007)E-4	(2.37±0.13)E-4	Agreement
	Co-58	(5.4±0.2)E-6	(6.4±0.7)E-6	Agreement
	Fe-59	(3.21±0.06)E-5	(3.6±0.2)E-5	Agreement
	Co-60	(7.44±0.04)E-5	(8.1±0.3)E-5	Agreement
	Zn-65	(1.90±0.07)E-5	(1.9±0.2)E-5	Agreement
	Tc-99m	(4.85±0.02)E-5	(5.2±0.3)E-5	Agreement
	Na-24	(1.453±0.006)E-4	(1.55±0.08)E-4	Agreement
Liquid Radwaste A&B Collection Tank 1310 hrs 06/29/94 (Detector No. 2)	Cr-51	(1.43±0.02)E-4	(1.48±0.09)E-4	Agreement
	Mn-54	(2.325±0.007)E-4	(1.97±0.11)E-4	Agreement
	Co-58	(5.4±0.2)E-6	(6.0±1.0)E-6	Agreement
	Fe-59	(3.21±0.06)E-5	(2.76±0.13)E-5	Agreement
	Co-60	(7.44±0.04)E-5	(7.4±0.3)E-5	Agreement
	Zn-65	(1.90±0.07)E-5	(2.0±0.2)E-5	Agreement
	Na-24	(1.453±0.006)E-4	(1.61±0.09)E-4	Agreement

TABLE I

Susquehanna Radiochemistry Test Results

SAMPLE	ISOTOPE	NRC VALUE	LICENSEE VALUE	COMPARISON
		Results in microCuries per milliliter		
Liquid Radwaste C&D Collection Tank 0140 hrs 07/15/93	Fe-55	(1.07±0.01)E-5	(1.2±0.1)E-5	Agreement
	Gross Alpha	(6±2)E-8	<5E-9	No Comparison
	H-3	(8.51±0.10)E-3	(7.90±?)E-3	Agreement
	Sr-89	(2±3)E-8	<2E-8	No Comparison
	Sr-90	(-3±6)E-9	<7E-9	No Comparison
		Results in total microCuries		
NRC Spiked Charcoal Cartridge (Detector No. 3)	Ba-133	(2.32±0.03)E-2	(2.13±0.08)E-2	Agreement
NRC Spiked Charcoal Cartridge (Health Physics Analysis)	Ba-133	(2.32±0.03)E-2	(2.10±0.15)E-2	Agreement
		Results in microCuries per milliliter		
Unit 2 Reactor Water Particulate Filter 0840 hrs 06/28/94 (Health Physics Analysis)	Mn-54	(1.67±0.03)E-4	(1.62±0.08)E-4	Agreement
	Fe-59	(4.4±0.4)E-5	(4.3±0.3)E-5	Agreement
	Co-60	(2.75±0.04)E-4	(2.80±0.14)E-4	Agreement
	Na-24	(8.5±0.3)E-5	(8.7±0.5)E-5	Agreement

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 the 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 Comparison[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

*No comparison due to the large uncertainty of the result.

1.Resolution = (NRC Reference Value/Reference Value Uncertainty)

2.Ratio = (Licensee Value/NRC Reference Value)