

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report Nos. 50-387/91-12
50-388/91-12

Docket Nos. 50-387 and 50-388

License Nos. NPF-14 and NPF-22

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

Facility Name: Susquehanna Steam Electric Station (SSES)

Inspection at: Allentown and Berwick, Pennsylvania

Inspection Conducted: July 29 - August 2, 1991

Inspector: *Richard K. Struckmeyer* 8/28/91
Richard K. Struckmeyer, Sr. Radiation
Specialist, Effluents Radiation Protection
Section (ERPS) date

Approved by: *Robert J. Bores* 8/28/91
Robert J. Bores, Chief, ERPS, Facilities
Radiological Safety and Safeguards Branch
Division of Radiation Safety and Safeguards date

Inspection Summary: Inspection on July 29 - August 2, 1991 (Inspection Report
Numbers 50-387/91-12 and 50-388/91-12)

Areas Inspected: Routine, announced inspection of the licensee's radiological environmental monitoring program and personnel dosimetry processing program, including management controls for these programs, the licensee's program for quality control of analytical measurements, and the meteorological monitoring program.

Results: Within the areas inspected, no safety concerns or violations were identified. The licensee is implementing the above programs effectively. The licensee took effective action to obtain the services of another contract laboratory for environmental sample analyses due to inadequate performance by the former contractor.

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DETAILS

1.0 Individuals Contacted

1.1 Licensee Personnel, Corporate Office

- *W. Brensinger, Environmental Audit Coordinator, Environmental Management
- B. Carson, Health Physicist, Environmental & Chemistry Group, R&ES
- R. Doty, Supervisor, Radiological & Environmental Services (R&ES)
- *W. Hill, Health Physicist, Environmental & Chemistry Group, R&ES
- *S. Ingram, Sr. Health Physicist, Radiological Group, R&ES
- *R. Kichline, Project Licensing Specialist, Licensing
- T. Lubenesky, Sr. Technical Assistant, Radiological Group, R&ES
- *K. Shank, Supervisor, Environmental & Chemistry Group, R&ES

1.2 Licensee Personnel, Susquehanna Station

- M. Crist, Compliance
- T. Iliavis, Shift Technical Advisor
- W. Knecht, I&C
- H. Wuorio, I&C

1.3 Ecology III (Sample Collection Contractor)

- L. Imes
- B. Mangan

Other licensee personnel were also interviewed during this inspection.

* Denotes those present at exit interview on August 2, 1991.

2.0 Purpose

The purpose of this routine inspection was to review the licensee's program in the following areas.

- Implementation of the radiological environmental monitoring program.
- Processing of personnel dosimetry.

3.0 Audits

The inspector reviewed SSES Audit No. 91027, performed April 23-25, 1991, which covered the Radiological Environmental Monitoring Program (REMP), including vendor services, with respect to Technical Specification requirements. This audit identified problems with the vendor laboratory that performed sample analyses. This is discussed in more detail in section 4.1.

The inspector also reviewed SSES Audit No. 90066, performed August 6-7, 1990, of the vendor laboratory that supplies sample collection services. The vendor responded in a satisfactory manner to the observations and recommendations made by the auditors.

The audits were performed by qualified personnel and were of sufficient technical depth to properly assess the implementation of the REMP. The licensee responded appropriately and in a timely manner to audit findings.

4.0 Radiological Environmental Monitoring Program (REMP)

4.1 Program Changes

There were no significant changes in the licensee's REMP since the previous inspection conducted in July 1990, with the exception of the contractor laboratory for sample analyses. From March 1990 to January 1991, the contract for these services was held by Controls for Environmental Pollution (CEP). The licensee stated that this laboratory was unable to achieve the analytical sensitivities (LLDs) required by Technical Specifications for a number of samples. As stated in Section 2.0, this problem was identified in a licensee audit; however, the Environmental and Chemistry Group personnel responsible for the REMP already were aware of these problems, which were resolved by terminating the contract with CEP, and obtaining the services of another vendor, Teledyne Isotopes.

4.2 Direct Observation

The inspector examined selected sampling stations, including air samplers for iodines and particulates, milk sampling locations, TLD stations, discharge and intake water composite sampling stations, and vegetation sampling locations. All air sampling and composite water sampling equipment at the selected locations was operational at the time of the inspection. Milk and vegetation samples appeared to be available at selected locations. TLDs were placed at locations designated in the Offsite Dose



Calculation Manual. The environmental direct radiation monitoring program is conducted by the licensee's Radiological and Environmental Services group.

4.3 Review of Annual Reports

The inspector reviewed the Radiological Environmental Monitoring Program 1990 Annual Report. This report provided a comprehensive summary of the results of the REMP around the Susquehanna Steam Electric Station and met the Technical Specification reporting requirements.

4.4 Review of REMP Procedures

The inspector reviewed Procedure NSI-QA-2.3.1, "Radiological Environmental Program". This procedure provides instructions as to program responsibilities, as well as for sample collection, packaging, storage, transmittal, and receipt. It also contains sections pertaining to the required annual land use census, methods for making changes to the REMP, and record keeping. Based on this review, the inspector determined that the licensee has a good procedure for the conduct of the REMP.

4.5 Intercomparison of TLD Results

The U.S. Nuclear Regulatory Commission (NRC) Direct Radiation Monitoring Network is operated by the NRC (Region I) to provide continuous measurements of the ambient radiation levels around nuclear power plants throughout the United States. Each site is monitored by arranging approximately 30 to 50 thermoluminescent dosimeter (TLD) stations in two concentric rings extending to about five miles from the power plant. The monitoring results are published in NUREG-0837 quarterly.

One of the purposes of this program is to serve as a basis of comparison with similar programs conducted by individual utilities which operate nuclear power plants. Sixteen NRC TLDs are collocated with licensee TLDs at the Susquehanna plant site.

The licensee monitors the environmental radiation levels quarterly (2 TLDs at each location) using the Panasonic Model UD-801 dosimeter. This dosimeter contains 2 elements of lithium borate activated with copper, and two elements of calcium sulfate activated with thulium. The NRC uses the same model TLD. Only the calcium sulfate elements are used for routine environmental monitoring.



During this inspection the monitoring results of collocated TLDs were compared, and the results are listed in Table 1. Although there are some differences between the NRC and the licensee results, they appear to be within the expected range of variation of the TLD systems considering the variations in the respective exposure periods.

4.6 Quality Control Program for REMP

The quality control of analytical measurements is conducted by the contractor laboratory. Each of the contractor analytical laboratories participated in the EPA cross-check program, and each conducted an internal QC program. Periodic reports of QC results are supplied to the licensee. The inspector reviewed the results of QC analyses for Teledyne Isotopes and determined that while the quantity of QC analyses appeared to be adequate considering the total sample throughput, it was generally difficult to determine whether the results of the various analyses met stated limits. The inspector discussed with the licensee the value of obtaining practical, clear reports from the contractor that enable the licensee to determine without ambiguity whether the laboratory is able to meet specified limits.

With regard to QC for environmental TLD measurements, the inspector noted that the licensee calibrates its TLD reader immediately prior to reading its field TLDs, and all TLDs are read on the day of calibration. The inspector stated that this practice alone does not ensure proper quality control. The licensee should examine various data that are available from the reader. Specifically, the licensee should compare the current listing of the reader's internal parameters (obtained following calibration) to the listing made at the time of the previous calibration, in order to ensure that vital parameters were not inadvertently altered. In addition, the licensee should check the "dark current" and "reference element" data obtained during the calibration process to determine whether there is any upward trend in these data. Such trends may be indicative of deterioration of the reader or improper reassembly of the heating mechanism following cleaning. The inspector observed representative examples of these data for the most recent calibration, and found no indication of any problems.

5.0 Meteorological Monitoring Program

The inspector examined the licensee's meteorological monitoring program through direct observation, discussions with personnel, and examination of procedures and records for calibration of equipment. The equipment included the wind speed, wind direction, and temperature sensors on the primary and backup towers. The SSES technical

specifications require only the instrumentation on the primary tower. The inspector observed the sensors and their readouts in equipment houses at the base of each tower, as well as the readouts in the control room. The meteorological data are available in the control room in two formats: analogue strip charts, and digital display from a system computer. The equipment appeared to be operating properly at the time of the inspection. However, three of the five strip charts for meteorological data that were observed in the control room were not in synchronization with the current time. The licensee stated that the charts are marked with the proper time during surveillance around midnight each day, which would enable operators to determine, if necessary, the actual time any historical data were recorded. The licensee further stated that this would not normally be necessary since the primary use of strip-chart data would be to obtain the current meteorological readings, whereas historical data would be obtained from computer records.

The licensee performs calibrations of the meteorological sensors and data transmission lines semiannually. The inspector reviewed selected calibration records, with emphasis on the wind speed, wind direction, and temperature sensors. All reviewed calibration results were within the licensee's defined acceptance criteria.

The inspector had no further questions in this area.

6.0 Personnel Dosimetry Processing

The purpose of this portion of the inspection was to review the licensee's personnel dosimetry processing methods as well as the methods for assuring the quality of analytical measurements. The inspector toured the dosimetry laboratory, held discussions with personnel, and examined procedures and records for operation and calibration of the dosimetry equipment. The dosimetry program is the responsibility of the Radiological Group within Radiological and Environmental Services (R&ES). The Supervisor of R&ES reports through the Manager, Nuclear Services, to the Vice President, Nuclear Operations. The Superintendent of the Susquehanna plant also reports to the Vice President - Nuclear Operations. This arrangement provides separation of the dosimetry processing organization from the user of dosimetry services.

Dosimeters are normally exchanged on a monthly basis. Most workers are given their dosimeters at the dosimetry issuing office at the entrance to the radiological control area, and leave them there at the end of the day. Visitors to the site also receive dosimetry if they are going to enter a radiological control area.

6.1 Facilities and Equipment

The licensee utilizes the Panasonic UD-802 dosimeter and UD-710A automatic reader for its external whole-body dosimetry needs. Extremity monitoring and neutron monitoring are provided by a vendor dosimetry service. The Dosimetry Laboratory currently maintains two Panasonic UD-710A dosimeter readers for processing its dosimeters.

The output of the readers is collected by a computer, and supplied to an algorithm that analyzes the data in order to determine the type of radiation and the magnitude of the dose. The algorithm appeared to be adequate for its intended purpose.

The whole-body dosimeter used by PP&L is the standard Panasonic Model UD-802. Each dosimeter contains two lithium borate elements activated with copper, and two calcium sulfate elements activated with thulium. The four elements are read in sequence using the reader's internal heat source, and the light output of each is measured by means of a photomultiplier tube. The output of the photomultiplier tube consists of electronic pulses that are converted to preliminary uncorrected readings by means of an internal calibration factor. The preliminary readings are then translated into a true dose by means of element correction factors (ECFs) that have been determined by the licensee for each element of each TLD.

The inspector noted that the Dosimetry Laboratory facilities appeared to be adequate for processing under both routine and outage conditions. Sufficient space was available for inspection of dosimeters upon receipt in an area apart from the actual processing. Dosimeters are checked for contamination and those found to be contaminated are returned to the site for cleaning.

The inspector also noted that PP&L has entered into an agreement with two other nuclear utilities in the area to provide backup processing services should the licensee's processing facility become unavailable for an extended period due to fire or other adverse situation.

6.2 Calibrations

The Dosimetry Laboratory performs calibrations using TLDs exposed to Cs-137 gamma radiation. The exposures are made by a vendor, Dosimetry Associates, which maintains traceability of its source to the National Institute of Standards and Technology (NIST). Calibrations are performed in accordance with Procedure NSI-2.1.25, "Quality Control and Calibration of Panasonic 710A Automatic Reader",



(Rev. 4, March 1991). According to this procedure, the laboratory calibrates each reader annually, or whenever the reader fails the daily quality control check two times in succession.

Two sets of calibration badges are used; one set exposed to 500 milliroentgen (mR) for the photon counter region of the reader, and a second set to 3000 mR for the frequency counter region. A complete calibration of the reader involves processing of at least 10 frequency counter, 10 photon counter, and one shipping control badge.

Quality control (QC) of the readers includes a check of the internal parameters as well as photomultiplier tube noise and reference light counts. Readers are cleaned daily while in use. QC checks of the reader's photon counter region are performed daily using dosimeters irradiated to a known dose level using a Williston-Elin Model WE-2001 irradiator. Checks of the frequency counter region are performed at least weekly. According to procedure, at least 10 dosimeters are read. Several tests are performed automatically by the computer. If a reader fails one or more tests, a second QC check is performed. If a second failure occurs, the procedure requires recalibration of the reader.

6.3 Dose Assessment

The inspector reviewed the licensee's methods for determining whole body doses using its TLD system. The licensee stated that somewhat different algorithms are used for routine processing and for NVLAP testing. A primary difference between these algorithms is the addition of a branch in the NVLAP algorithm that determines the dose under accident conditions. The inspector found the licensee's documentation for these algorithms to be thorough, accurate, and complete.

6.4 Quality Assurance

The inspector reviewed the licensee's procedures for assuring the quality of its personnel radiation monitoring. The PP&L Nuclear Department policy requires review of procedures every two years. Assessments of the program are performed at about three year intervals by knowledgeable personnel from a contractor outside the PP&L company. In addition, surveillances are performed by the PP&L Nuclear Quality Assurance Department. The inspector reviewed Surveillance Number R12-2A, dated September 15, 1987. No items of noncompliance were identified. Four observations/recommendations were made for which no responses were required. Another surveillance is scheduled for September 1991.

The licensee participates in the NVLAP accreditation program, and has recently completed the accreditation process for all of the NVLAP categories.

PP&L personnel perform assessments of vendors, including the supplier of neutron and extremity dosimetry, once every three years. Assessments are performed by corporate dosimetry program personnel and will also include site personnel when appropriate.

An assessment of the vendor that supplies irradiation services has not been performed. The inspector stated that such an assessment should be performed. The licensee stated that an assessment will be scheduled for early in 1992.

7.0 Exit Interview

The inspector met with the licensee representatives denoted in Section 1.1 of this report on August 2, 1991. The inspector summarized the purpose, scope, and findings of the inspection.



Table 1

Environmental TLD Monitoring Results (mR/quarter)*

Monitoring Period	NRC no.: PP&L no.:	1 2B4	2 1B1	3 16B2	4 15B1	5 14B1	6 13B1
1989/1st Quarter	NRC	17.4 ± 0.7	18.7 ± 0.8	16.9 ± 0.7	16.3 ± 0.7	17.1 ± 0.7	NC**
	PP&L	16.5 ± 1.0	18.2 ± 0.5	15.7 ± 1.4	16.2 ± 0.9	17.5 ± 0.6	16.3 ± 1.1
2nd Quarter	NRC	19.9 ± 0.8	19.7 ± 0.8	18.8 ± 0.7	16.1 ± 0.7	18.1 ± 0.7	18.0 ± 0.7
	PP&L	18.3 ± 0.1	18.1 ± 1.0	17.0 ± 0.6	16.2 ± 0.6	18.8 ± 0.8	16.9 ± 1.3
3rd Quarter	NRC	18.6 ± 0.8	19.0 ± 0.8	17.4 ± 0.7	16.6 ± 0.7	18.5 ± 0.8	18.4 ± 0.8
	PP&L	15.0 ± 1.3	16.3 ± 0.8	14.4 ± 1.8	15.1 ± 1.1	16.6 ± 0.6	16.2 ± 5.4
4th Quarter	NRC	20.0 ± 0.8	19.3 ± 0.7	18.0 ± 0.7	17.8 ± 0.7	20.4 ± 0.8	19.5 ± 0.8
	PP&L	17.5 ± 0.6	17.1 ± 0.7	16.2 ± 1.7	16.0 ± 0.7	17.4 ± 1.8	16.5 ± 1.2
1990/1st Quarter	NRC	18.2 ± 0.6	18.9 ± 0.6	17.5 ± 0.6	16.9 ± 0.6	19.6 ± 0.7	18.1 ± 0.6
	PP&L	16.1 ± 0.6	17.1 ± 1.4	15.3 ± 0.9	15.8 ± 1.3	17.1 ± 0.9	15.7 ± 0.8
2nd Quarter	NRC	19.2 ± 0.7	19.0 ± 0.7	17.9 ± 0.7	17.2 ± 0.7	19.4 ± 0.8	18.0 ± 0.7
	PP&L	19.7 ± 1.4	18.9 ± 0.9	18.3 ± 2.9	17.3 ± 1.2	18.9 ± 2.1	17.5 ± 2.1
3rd Quarter	NRC	18.8 ± 0.7	19.2 ± 0.7	18.7 ± 0.7	18.0 ± 0.7	19.4 ± 0.7	18.6 ± 0.7
	PP&L	15.4 ± 1.7	17.0 ± 1.7	14.7 ± 0.9	15.3 ± 1.0	16.4 ± 1.0	15.5 ± 0.6
4th Quarter	NRC	19.3 ± 0.7	NC**	17.7 ± 0.6	17.5 ± 0.6	19.1 ± 0.7	19.1 ± 0.7
	PP&L	18.7 ± 2.7	18.3 ± 1.1	17.9 ± 2.2	16.9 ± 0.8	17.9 ± 1.1	17.5 ± 0.9

* NRC results are normalized to a 90 day quarter; PP&L results are normalized to a 91.25 day quarter.
All data are shown as Result ± 1 standard deviation

** NC = no comparison because data are not available (due to missing or damaged TLD)



Table 1, cont'd

Environmental TLD Monitoring Results (mR/quarter)*

Monitoring Period	NRC no.: PP&L no.:	7 12B5	8 11C1	9 10B4	19 3F2	23 4B1	24 5B2
1989/1st Quarter	NRC	17.4 ± 0.7	NC**	18.2 ± 0.7	18.9 ± 0.8	17.1 ± 0.7	19.1 ± 0.8
	PP&L	16.9 ± 2.2	19.4 ± 0.9	17.8 ± 1.1	17.7 ± 2.9	16.1 ± 1.0	18.1 ± 0.9
2nd Quarter	NRC	17.0 ± 0.7	20.7 ± 0.8	18.1 ± 0.7	21.1 ± 0.8	16.8 ± 0.7	19.2 ± 0.8
	PP&L	16.6 ± 0.9	19.7 ± 1.5	18.7 ± 1.3	19.1 ± 1.6	17.0 ± 1.4	19.1 ± 2.0
3rd Quarter	NRC	17.7 ± 0.7	20.8 ± 0.8	19.5 ± 0.8	20.7 ± 0.8	18.0 ± 0.7	19.8 ± 0.8
	PP&L	15.9 ± 1.8	18.4 ± 0.6	16.5 ± 1.6	17.6 ± 0.7	15.5 ± 1.3	16.7 ± 1.8
4th Quarter	NRC	18.9 ± 0.7	22.1 ± 0.8	19.2 ± 0.7	21.3 ± 0.8	17.3 ± 0.7	19.6 ± 0.8
	PP&L	16.1 ± 0.5	18.8 ± 1.3	19.7 ± 8.4	18.5 ± 0.6	16.6 ± 1.9	18.3 ± 2.5
1990/1st Quarter	NRC	17.4 ± 0.6	21.0 ± 0.7	18.6 ± 0.6	20.4 ± 0.7	18.4 ± 0.6	19.3 ± 0.6
	PP&L	15.9 ± 3.0	18.4 ± 0.9	16.7 ± 1.9	18.4 ± 1.3	15.6 ± 2.3	17.1 ± 1.6
2nd Quarter	NRC	18.0 ± 0.7	20.3 ± 0.8	19.1 ± 0.7	20.9 ± 0.8	16.7 ± 0.7	18.6 ± 0.7
	PP&L	17.7 ± 1.2	20.5 ± 1.1	19.5 ± 1.4	20.1 ± 2.2	18.2 ± 1.2	19.9 ± 1.5
3rd Quarter	NRC	18.7 ± 0.7	21.0 ± 0.7	19.6 ± 0.7	20.9 ± 0.7	18.4 ± 0.7	20.2 ± 0.7
	PP&L	15.8 ± 1.6	18.3 ± 1.6	17.2 ± 1.9	17.2 ± 1.6	15.3 ± 1.4	16.5 ± 1.7
4th Quarter	NRC	18.0 ± 0.6	20.6 ± 0.7	18.8 ± 0.7	NC**	16.9 ± 0.6	19.6 ± 0.7
	PP&L	17.7 ± 0.8	20.3 ± 1.7	18.5 ± 1.0	NC	17.8 ± 1.4	20.2 ± 1.5

* NRC results are normalized to a 90 day quarter; PP&L results are normalized to a 91.25 day quarter. All data are shown as Result ± 1 standard deviation

** NC = no comparison because data are not available (due to missing or damaged TLD)

Table 1, cont'd

Environmental TLD Monitoring Results (mR/quarter)*

Monitoring Period	NRC no.: PP&L no.:	25 6B2	26 7B4	27 8B3	35 7G2
1989/1st Quarter	NRC	16.8 ± 0.7	17.9 ± 0.7	18.3 ± 0.8	19.2 ± 0.8
	PP&L	17.6 ± 1.0	18.4 ± 1.2	17.9 ± 0.6	17.4 ± 1.3
2nd Quarter	NRC	18.8 ± 0.7	20.2 ± 0.8	19.8 ± 0.8	20.1 ± 0.8
	PP&L	17.0 ± 0.5	17.8 ± 1.9	18.4 ± 0.9	18.5 ± 1.2
3rd Quarter	NRC	19.2 ± 0.8	18.9 ± 0.8	19.8 ± 0.8	19.8 ± 0.8
	PP&L	16.9 ± 0.9	17.2 ± 1.9	16.2 ± 1.1	16.3 ± 1.6
4th Quarter	NRC	19.6 ± 0.8	19.3 ± 0.7	20.1 ± 0.8	21.6 ± 0.8
	PP&L	16.8 ± 1.1	16.7 ± 2.1	17.7 ± 1.1	18.2 ± 1.2
1990/1st Quarter	NRC	18.4 ± 0.6	18.8 ± 0.6	20.4 ± 0.7	18.9 ± 0.6
	PP&L	17.5 ± 1.6	17.1 ± 1.2	17.0 ± 0.6	17.1 ± 1.0
2nd Quarter	NRC	18.8 ± 0.7	18.7 ± 0.7	19.0 ± 0.7	19.8 ± 0.8
	PP&L	18.2 ± 1.7	18.9 ± 0.8	19.0 ± 1.6	20.1 ± 0.8
3rd Quarter	NRC	20.0 ± 0.7	20.1 ± 0.7	20.5 ± 0.7	20.2 ± 0.7
	PP&L	17.1 ± 1.3	16.7 ± 1.4	16.4 ± 1.0	17.0 ± 1.3
4th Quarter	NRC	19.9 ± 0.7	19.2 ± 0.7	19.5 ± 0.7	20.0 ± 0.7
	PP&L	18.5 ± 1.7	18.8 ± 2.3	18.9 ± 1.3	19.9 ± 1.4

* NRC results are normalized to a 90 day quarter; PP&L results are normalized to a 91.25 day quarter.
All data are shown as Result ± 1 standard deviation

** NC = no comparison because data are not available (due to missing or damaged TLD)