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Washington, DC 20555-0001

10 CFR 50.4

SUSQUEHANNA STEAM ELECTRIC STATION
ANNUAL RADIOLOGICAL ENVIRONMENTAL
OPERATING REPORT
PLA-8058

Docket No. 50-387
50-388

In accordance with the Susquehanna Steam Electric Station (SSES) Units 1 and 2 Technical Specification 5.6.2, the SSES Annual Radiological Environmental Operating Report is hereby submitted for the 2022 calendar year.

There are no new or revised regulatory commitments contained in this submittal.

If you have any questions regarding this report, please contact Ms. Melisa Krick, Manager – Nuclear Regulatory Affairs, at (570) 542-1818.

E. Casulli

Attachment: 2022 Annual Radiological Environmental Operating Report

Copy: NRC Region I
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Attachment to PLA-8058

2022 Annual Radiological Environmental Operating Report

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 and 2

Annual Radiological
Environmental Operating Report

2022

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SUSQUEHANNA STEAM ELECTRIC STATION

Units 1 & 2

2022 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

JANUARY 1 TO DECEMBER 31, 2022

Susquehanna Nuclear, LLC
Berwick, PA
April, 2023

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I. Summary

During normal operations of a nuclear power generating station there are permitted releases of small amounts of radioactive material to the environment. To monitor and determine the effects of these releases a Radiological Environmental Monitoring Program (REMP) has been established around the Susquehanna Steam Electric Station (SSES). The results of the REMP are published annually, providing a summary and interpretation of the data collected.

Applied Ecoscience, Inc. was responsible for the collection of environmental samples during 2022. Teledyne Brown Engineering (TBE) was responsible for the analysis of environmental samples during 2022. The results are discussed in this report**.** Landauer provided the dosimetry services for SSES during 2022.

This Annual Radiological Environmental Operating Report (AREOR) conducted for SSES covers the period January 1, 2022 through December 31, 2022. During that time period, 1304 analyses were performed on 1124 samples.

Historically, Tritium (H-3) has been the only man-made radionuclide detected in the environment by the Susquehanna Steam Electric Station (SSES) Radiological Environmental Monitoring Program (REMP) that is attributable to station operations.

Based on data from the 2022 Radioactive Effluent Monitoring and Control program, approximately 40 Curies of H-3 were discharged in liquid radwaste releases to the Susquehanna River and approximately 68 Curies of H-3 were discharged from the station in airborne effluent releases. Sampling of the cooling tower blowdown line was discontinued in 2022 since the cooling tower blowdown line is a subsurface pipe and is not a true REMP surface

water sample location. H-3 was not identified in any REMP surface water samples taken from the Susquehanna River during 2022. The 2022 average dilution factor for the Susquehanna River was 593, based on the annual average river flow of 6.52E+06 gpm and the annual average cooling tower blowdown flow of 1.10E+04 gpm.

H-3 was identified above analysis detection levels in precipitation samples taken on-site during 2022. Precipitation is analyzed to assess the impact of airborne effluent H-3 on groundwater activities.

H-3 was positively identified in one on-site groundwater sample (3rd quarter, monitoring well location 4S8) during 2022 at 370 pCi/liter. Assuming a Member of the Public was consuming the water from the referenced onsite monitoring well, the theoretical dose to the total body and maximum organ using the H-3 concentration of 370 pCi/liter and Regulatory Guide 1.109 methodology was determined to illustrate the effect. The calculated dose would be <0.01 mrem to the child total body and <0.01 mrem to the child liver (critical age group/organ) which is well below SSES Technical Requirements Manual (TRM) limits and applicable regulatory limits.

The REMP Sample Equipment Operability and year-to-year trend comparison is located in Appendix E, Table E-1.

The REMP was conducted in accordance with the SSES Technical Requirements Manual (TRM) and the Offsite Dose Calculation Manual (ODCM) which are based on the design objectives in 10CFR Part 50, Appendix I, Sections IV.B.2, IV.B.3 and IV.C. The Lower Limit of Detection (LLD) values required by the TRM and SSES ODCM were achieved for the 2022 reporting period. The REMP objectives were also met during this period. The concentration of radioactive material in the environment that could be attributable to SSES operations was only a small

fraction of the concentration of naturally occurring and man-made radioactivity. Since these results were comparable to the results obtained during the preoperational phase of the program and combined with historical results collected since commercial operation, it can be concluded that the levels and fluctuations were as expected and that the operation of the SSES had no significant radiological impact on the environment. Additionally, the REMP sample results for 2022 verify the adequacy of the SSES radioactive effluent control systems.

Samples of air particulates, air iodine, milk, groundwater, drinking water, vegetation, surface water, fish and sediment were collected and analyzed. External radiation dose measurements were also made in the vicinity of SSES using passive dosimeters.

Air particulate samples were analyzed for concentrations of gross beta weekly and gamma emitting nuclides quarterly. Gross beta and cosmogenically produced beryllium-7 (Be-7) were detected at levels consistent with those detected in previous years. No fission or activation products were detected.

Air charcoal cartridge samples were analyzed for iodine-131 (I-131). All results were less than the minimum detectable concentration.

Environmental gamma radiation measurements were performed quarterly using optically stimulated luminescent dosimeters (OSLD). The levels of radiation detected were consistent with those observed in previous years.

Cow milk samples were analyzed for gamma emitting nuclides. High sensitivity I-131 analyses were performed on cow milk samples. All I-131 results were below the minimum detectable concentration. Naturally occurring potassium-40 (K-40) was detected at levels consistent with those detected in previous years. No fission or activation products were detected.

Groundwater samples were analyzed for concentrations of tritium and gamma emitting nuclides. Tritium activities were detected at levels consistent with those detected in previous years. No fission or activation products were detected.

Drinking water samples were analyzed for concentrations of tritium, gross beta and gamma emitting nuclides. Gross beta activities detected were consistent with those detected in previous years. No fission or activation products were detected.

Food product (fruits, vegetables and broadleaf vegetation) samples were analyzed for concentrations of gamma emitting nuclides. Naturally occurring Be-7 and K-40 were detected at levels consistent with those detected in previous years. No fission or activation products were detected.

Surface water samples were analyzed for concentrations of tritium and gamma emitting nuclides. Tritium activities detected were consistent with those detected in previous years. No fission or activation products were detected.

Fish and shoreline sediment samples were analyzed for concentrations of gamma emitting nuclides. Naturally occurring K-40 was detected at levels consistent with those detected in previous years. Naturally occurring radium-226 (Ra-226), actinium-228 (Ac-228), and thorium-228 (Th-228) were detected in shoreline sediment at levels consistent with results in previous years. No fission or activation products were detected in fish or sediment samples.

II. The Radiological Environmental Monitoring Program

The Susquehanna Steam Electric Station (SSES) is a nuclear electrical generating station located approximately 5 miles northeast of Berwick, in Luzerne County, Pennsylvania. The station consists of two boiling-water reactor generating units. The SSES is located on approximately a 1,087-acre tract just west of the Susquehanna River. The station was constructed in the 1970's, with Unit 1 beginning commercial operation on June 8, 1983, and Unit 2 beginning commercial operation on February 12, 1985. Units 1 and 2 each generate a net 1,350 megawatts (MWe), for a total station output of 2,700 MWe.

In the 4th quarter of 2021, Susquehanna Nuclear, LLC land ownership was reduced due to land transfers to other Talen Energy entities. Impacts to the SSES REMP resulting from the above referenced land ownership changes are being implemented as appropriate by SSES Chemistry personnel. REMP changes resulting from the land transfers shall be documented in future Radiological Environmental Operating Reports.

In total Susquehanna Nuclear, LLC presently owns 1,152 acres of land. Generally, this land is characterized by open deciduous woodlands interspersed with grasslands. The area around the site is primarily rural, consisting predominately of forest and agricultural lands.

Approximately 1,087 acres of land is jointly owned between Susquehanna Nuclear, LLC (90%) and Allegheny Electric Cooperative (10%). The land use includes generation and associated maintenance facilities, laydown areas, parking lots, roads, a nature preserve (the Susquehanna Riverlands), and agricultural leases to local farmers.

To the north of the station along the Susquehanna River, Susquehanna Nuclear, LLC owns 100% of the 65-acre Gould Island.

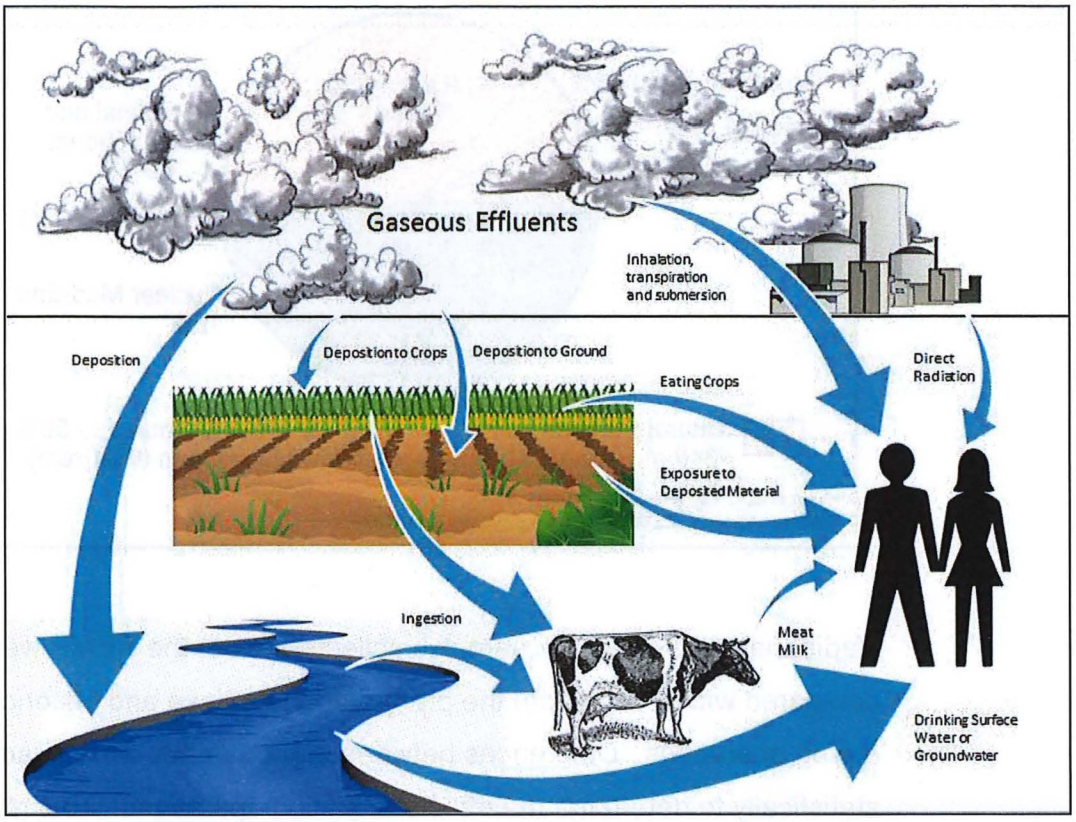
More specific information on the demography, hydrology, meteorology, and land use characteristics of the area in the vicinity of the SSES can be found in the Environmental Report [Reference 1], the Final Safety Analysis Report [Reference 2] and the Final Environmental Statement [Reference 3] for the SSES.

The SSES has maintained a Radiological Environmental Monitoring Program (REMP) since April 1972, prior to construction of both units and ten years prior to the initial operation of Unit 1 in September 1982. The purpose of the preoperational REMP (April,1972 to September 1982) was to establish a baseline for radioactivity in the local environment that could be compared with the radioactivity levels observed in various environmental media throughout the operational lifetime of the SSES. This comparison facilitates assessments of the radiological impact of the SSES operation.

The REMP supplements the results of the radioactive effluent-monitoring program by verifying that the measurable concentrations of radioactive materials and levels of radiation in the environment are not higher than expected based on the effluent measurements and modeling of the environment in the vicinity of the SSES.

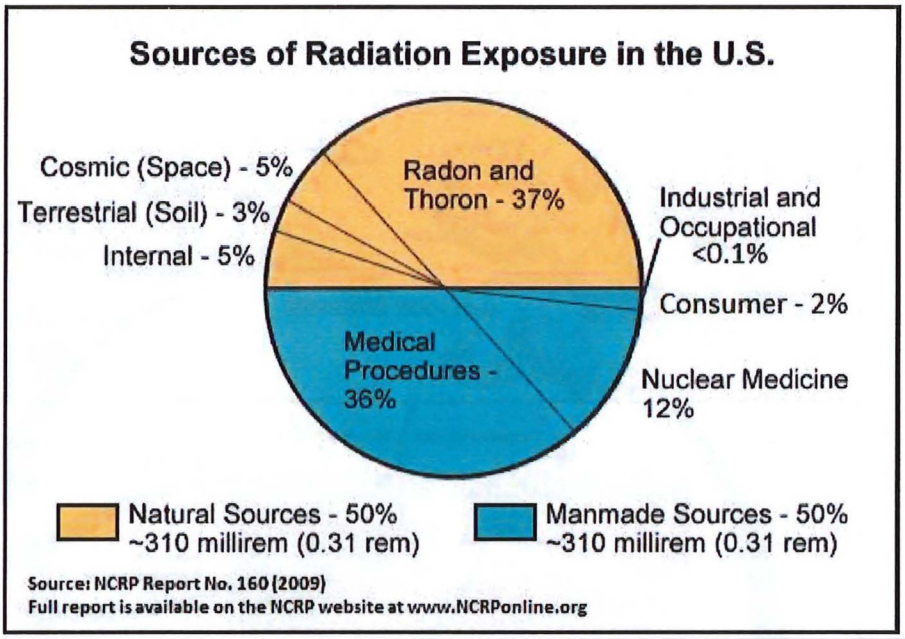
The pathways through which radiation or radioactive material may reach the public from nuclear power plants are direct exposure from the station, atmospheric, terrestrial, and aquatic pathways. (Figure 1 depicts these pathways)

Figure 1 – Radiation Pathways



People are exposed to radiation every day of their lives and have been since the dawn of mankind. Some of this radiation is naturally occurring while some is manmade. There are many factors that will determine the amount of radiation individuals will be exposed to such as where they live, medical treatments, etc. The average person in the United States is exposed to approximately 620 mrem each year. 310 mrem comes from natural sources and 310 from man-made sources. Figure 2 shows what the typical sources of radiation in the U.S.:

Figure 2 – Sources of Radiation Exposure in the U.S.



Radioanalytical data from samples collected under the REMP were compared with results from the preoperational phase and historical results during operations. Differences between these periods were examined statistically to determine the effects of station operations. This report presents the results from January 1 through December 31, 2022, for the SSES Radiological Environmental Monitoring Program (REMP).

A. Objectives of the Operational REMP

The objectives of the Operational REMP are to:

1. Document compliance with SSES REMP Technical Requirements and radiological environmental surveillances.

2. Verify proper implementation of SSES radiological effluent controls.

3. Identify, measure and evaluate trends of radionuclide concentrations in environmental pathways near SSES.

4. Assess impact of SSES Effluents on the Environment and the public.

5. Verify that SSES operations have no detrimental effects on the health and safety of the public or on the environment.

B. Implementation of the Objectives

1. In order to meet the objectives, an operational REMP was developed. Samples of various media were selected for monitoring due to the radiological dose impact to humans and other organisms. The selection of samples was based on:

   (a) Established critical pathways for the transfer of radionuclides through the environment to man, and

   (b) Experience gained during the preoperational phase. Sampling locations were determined based on local meteorology, Susquehanna River hydrology, local demography, and land uses.

2. Sampling locations were divided into two classes, indicator and control. Indicator locations were sited where it is expected that radiation and radioactive material that might originate from the station would be detectable. Control locations were selected in areas where they would be unaffected by station operations (i.e. Susquehanna River upstream from the station, >10 miles from the station in least prevalent wind directions). Fluctuations in the levels of radionuclides and direct radiation at indicator locations were evaluated with respect to analogous fluctuations at control locations. Indicator and control location data were also evaluated relative to preoperational data.

3. Appendix A, Program Summary, describes and summarizes the analytical results in accordance with the SSES Technical Specifications.

4. Appendix B, Sample Designation and Locations, describes the coding system which identifies sample type and location. Table B-1 lists the location codes, locations, latitude, longitude, and the types of samples collected at each location. Table B-2 contains sample medium, analysis and sampling details.

5. The sampling locations are indicated on the following maps:

   Map B-1, Direct Radiation Monitoring Locations Within One Mile
   Map B-2, Direct Radiation Monitoring Locations From One to Five Miles
   Map B-3, Direct Radiation Monitoring Locations Greater Than Five Miles
   Map B-4, Environmental Sampling Locations Within One Mile
   Map B-5, Environmental Sampling Locations From One to Five Miles
   Map B-6, Environmental Sampling Locations Greater Than Five Miles

II. Program Description

A. Data Interpretation

Results of analyses are grouped according to sample type and presented in Appendix C, Data Tables. All results above the Lower Limit of Detection (LLD) are at a confidence level of ± 2 sigma. This represents the range of values into which 95% of repeated analyses of

the same sample should fall. As defined in U.S. Nuclear Regulatory Commission Regulatory Guide 4.8, LLD is the smallest concentration of radioactive material in a sample that will yield a net count (above system background) that will be detected with 95% probability, with only 5% probability of falsely concluding that a blank observation represents a "real signal." LLD is normally calculated as 4.66 times the standard deviation of the background counting rate, or of the blank sample count, as appropriate, divided by counting efficiency, sample size, 2.22 (dpm per picocurie), the radiochemical yield when applicable, the radioactive decay constant and the elapsed time between sample collection and time of counting. LLD represents the capability of the measurement system.

The Minimum Detectable Concentration (MDC) is defined as the smallest concentration of radioactive material that can be detected at a given confidence level. The MDC differs from the LLD in that the MDC takes into consideration the interference caused by the presence of other nuclides while the LLD does not. MDC is an indicator of the performance of the measurement system. The MDC is set to be below the LLD.

Summaries of the radionuclide average picocurie activities and ranges are included in Table A. If a radionuclide was not detected, zero was used for that isotope in dose calculations and the activity is listed as “<MDC” (less than the minimum detectable concentration) in Table A. <MDC indicates that no activity was positively detected in any sample when samples were analyzed with techniques which achieved the required Lower Limits of Detection (LLD). The following are typical measurement laboratory MDCs for airborne and waterborne REMP samples.

Airborne REMP Typical MDCs

Radionuclide	MDC (pCi/cu.m.)
Mn-54	1.2 E-03
Fe-59	6.9 E-03
Co-58	1.8 E-03
Co-60	1.2 E-03
Zn-65	2.9 E-03
Cs-134	1.1 E-03
Cs-137	1.0 E-03
I-131	2.0 E-01

Waterborne REMP Typical MDCs

Radionuclide	MDC (pCi/L.)
H-3 (DIST)	2.5 E+02
Mn-54	3.8 E+00
Fe-59	1.1 E+01
Co-58	3.9 E+00
Co-60	4.1 E+00
Zn-65	7.8 E+00
Cs-134	3.7 E+00
Cs-137	4.0 E+00
I-131	9.4 E+00
H-3	2.5 E+02
Gross Beta	1.9 E+00

The grouped data were averaged and standard deviations calculated. Thus, the ± 2 sigma of the averaged data represent sample and not analytical variability. For reporting and calculation of averages, any result occurring at or below the LLD is considered to be at the LLD level.

B. Program Exceptions

See Exceptions Table 2022 REMP Atypical Sampling Occurrences

C. Program Changes

Surface water station 2S7 was removed from the sampling program in 2022.

2022 REMP Atypical Sampling Occurrences

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
JAN	Air	10S3	01/05/22 to 01/12/22 Power outage-date and time unknown. Loss of 1.2 hours, as determined by timer box during weekly collection. Non-continuous sampler operation.	CA #22-02 CR 2022-00893 01/12/22: No action required. Air monitor resumed normal operation when power was restored. 01/12/22: Operability verified @ 0957 hours. *Ideal sample collected for sample period: 23,500 cf.*
	Air	10S3	01/12/22 to 01/19/22 Power outage-date and time unknown. Loss of 0.8 hours, as determined by timer box during weekly collection. Non-continuous sampler operation.	CA #22-03 CR 2022-01248 01/19/22: No action required. Air monitor resumed normal operation when power was restored. 01/19/22: Operability verified @ 1005 hours. *Ideal sample collected for sample period: 23,300 cf.*
FEB	Air	12S1	02/01/22 to 02/09/22 (momentary loss of 12kV power) Momentary loss of power on 02/04/22 (time unknown). No loss of sampling time as determined by timer box. Non-continuous sampler operation.	CA #22-04 CR 2022-02124 02/04/22: No action required. Air monitor resumed normal operation when power was restored. 02/04/21: Operability verified @ 0845 hours. *Ideal sample collected for sample period: 25,900 cf.*

2022 REMP Atypical Sampling Occurrences (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
FEB (cont.)	Air	12S1	02/09/22 to 02/16/22 (momentary loss of 12kV power & timer box malfunction) Momentary loss of power on 02/13/22 @ 0520 hours. Timer box #8 found running in reverse upon arrival. Non-continuous sampler operation.	CA #22-05 CR 2022-02569 02/13/22: No action required. Air monitor resumed normal operation when power was restored. Timer box #8 replaced with timer box #7. 02/13/21: Operability verified @ 1009 hours. *Ideal sample collected for sample period: 22,800 cf.*
	Air	12S1	02/16/22 to 02/23/22 (loss of 12kV power) Power outage on 02/18/22 @ 0509 hours. Loss of 12.0 hours, as determined by timer box. Non-continuous sampler operation.	CA #22-06 CR 2022-02893 02/18/22: No action required. Air monitor resumed normal operation when power was restored. 02/19/22: Operability verified @ 1213 hours. *Ideal sample collected for sample period: 21,200 cf.*
MAR	Air	12S1	03/02/22 to 03/09/22 (loss of 12kV power) Power outage on 03/04/22 (time unknown) for maintenance. Loss of 10.7 hours, as determined by timer box. Non-continuous sampler operation.	CA #22-07 CR 2022-03645 03/04/22: No action required. Air monitor resumed normal operation when power was restored. 03/07/22: Operability verified @ 1319 hours. *Ideal sample collected for sample period: 21,500 cf.*

2022 REMP Atypical Sampling Occurrences (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
MAR (cont.)	Air	12S1	03/02/22 to 03/09/22 (momentary loss of 12kV power) Momentary loss of power on 03/08/22 @ 0200 hours. No loss of sampling time as determined by timer box. Non-continuous sampler operation.	CA #22-08 CR 2022-03807 03/08/22: No action required. Air monitor resumed normal operation when power was restored. 03/08/22: Operability verified @ 1428 hours. *Ideal sample collected for sample period: 21,500 cf.*
	Air	3S2, 13S6	03/02/22 to 03/09/22 Pumps providing inadequate flow rate upon arrival (<2.0 cfm), below the procedural range of 2.0-2.4 cfm. Adequate flow could not be achieved with maximum flow settings. Continuous sampling during sample period.	CA #22-09 CR 2022-03895 03/09/22: Pumps were replaced, and air flow restored to within procedural range. 03/09/22: Operability verified @ 1010 hours for 3S2, and 1230 hours for 13S6. *Ideal samples collected for sample period: 18,600 cf (3S2), 16,300 cf (13S6).*
MAY	Surface Water	6S6	04/26/22 to 05/02/22 (week 1 May composite) While I&C was performing monthly preventative maintenance, the PLC failed to resume the normal program. Week 1 composite sample with known stop and start time was used in May composite.	CA #22-10 CR 2022-07727 04/30/22: Week 1 sample stopped @ 1249 hours. 05/01/22: I&C restored sampler to service @ 1327 hours. 05/02/22: Operability verified @ 1057 hours. *Ideal sample collected for week 1 sample period.*

2022 REMP Atypical Sampling Occurrences (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
MAY (cont.)	Air	12S1	05/18/22 to 05/25/22 (momentary loss of 12kV power) Momentary loss of power on 05/21/22 (time unknown). No loss of sampling time as determined by timer box. Non-continuous sampler operation.	CA #22-11 CR 2022-08808 05/21/22: No action required. Air monitor resumed normal operation when power was restored. 05/21/22: Operability verified @ 1910 hours. *Ideal sample collected for sample period: 21,900 cf.*
	Air	13S6	05/18/22 to 05/25/22 Timer box malfunction. Timer box recorded only 77.4 hours for the week. No effect on monitoring. Continuous sampler operation.	CA #22-12 CR 2022-08999 05/25/22: Timer box #2 replaced with timer box #3. Equipment restored to service @ 0937 hours. 05/25/22: Operability verified @ 0939 hours. *Ideal sample collected for sample period: 21,800 cf.*
JUL	Air	12S1	07/12/22 to 07/20/22 (momentary loss of 12kV power) Momentary loss of power on 07/12/22 (time unknown). No loss of sampling time as determined by timer box. Non-continuous sampler operation.	CA #22-13 CR 2022-11024 07/12/22: No action required. Air monitor resumed normal operation when power was restored. 07/13/22: Operability verified @ 1325 hours. *Ideal sample collected for sample period: 24,100 cf.*

2022 REMP Atypical Sampling Occurrences (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
JUL (cont.)	Air	12S1	07/27/22 to 08/02/22 (momentary loss of 12kV power) Momentary loss of power on 07/31/22 @ 0858 hours. No loss of sampling time as determined by timer box. Non-continuous sampler operation.	CA #22-14 CR 2022-11712 07/31/22: No action required. Air monitor resumed normal operation when power was restored. 07/31/22: Operability verified @ 1533 hours. *Ideal sample collected for sample period: 18,100 cf.*
AUG	Air	13S6	08/02/22 to 08/09/22 Power outage- date and time unknown. Loss of 2.7 hours, as determined by timer box during weekly collection. Non-continuous sampler operation.	CA #22-15 CR 2022-12142 08/09/22: No action required. Air monitor resumed normal operation when power was restored. 08/09/22: Operability verified @ 1001 hours. *Ideal sample collected for sample period: 20,700 cf.*
SEP	Air	12S1	09/21/22 to 09/28/22 (momentary loss of 12kV power) Momentary loss of power on 09/22/22 (time unknown). No loss of sampling time as determined by timer box. Non-continuous sampler operation.	CA #22-16 CR 2022-14152 09/22/22: No action required. Air monitor resumed normal operation when power was restored. 09/22/22: Operability verified @ 0935 hours. *Ideal sample collected for sample period: 21,300 cf.*

2022 REMP Atypical Sampling Occurrences (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
SEP (cont.)	Air	3S2	09/21/22 to 09/28/22, 09/28/22 to 10/05/22, & 10/05/22 to 10/12/22 No power to sampler upon arrival on 09/28/22. Outage began on 09/22/22 @ 0900 hours, as determined by timer box during weekly collection. Power issue between breaker box and sampling unit. Non-continuous sampler operation.	CA #22-17 CR 2022-14415 09/28/22: CR generated to investigate and repair issue in power supply. 10/08/22: Sampler returned to service following repair @ 1525 hours. 10/09/22: Operability verified @ 1048 hours. *Less than ideal sample collected for sample period 09/21/22 to 09/28/22: 3,100 cf.* *No sample for sample period 09/28/22 to 10/05/22.* *Less than ideal sample collected for sample period 10/05/22 to 10/12/22: 12,300 cf.*
	Air	10S3	09/21/22 to 09/28/22 Power outage- date and time unknown. Loss of 0.3 hours, as determined by timer box during weekly collection. Non-continuous sampler operation.	CA #22-18 CR 2022-14425 09/28/22: No action required. Air monitor resumed normal operation when power was restored. 09/28/22: Operability verified @ 1022 hours. *Ideal sample collected for sample period: 22,200 cf.*
	Air	12S1	09/28/22 to 10/05/22 (momentary loss of 12kV power) Momentary loss of power on 09/28/22 @ 2352 hours. No loss of sampling time as determined by timer box. Non-continuous sampler operation.	CA #22-19 CR 2022-14461 09/28/22: No action required. Air monitor resumed normal operation when power was restored. 09/29/22: Operability verified @ 1417 hours. *Ideal sample collected for sample period: 21,500 cf.*

2022 REMP Atypical Sampling Occurrences (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
OCT	Air	13S6, 9B1	09/28/22 to 10/05/22 Power outages- dates and times unknown. Loss of 0.2 hours at 13S6, and 0.5 hours at 9B1, as determined by timer boxes during weekly collection. Non-continuous sampler operation.	CA #22-20 CR 2022-14934 10/05/22: No action required. Air monitors resumed normal operation when power was restored. 10/05/22: Operability verified @ 0948 hours for 13S6, and 1019 hours for 9B1. *Ideal samples collected for sample period: 23,300 cf (13S6), and 21,400 cf (9B1).*
	Surface Water	6S6	10/10/22 to 10/25/22 (week 3 & 4 October composite) ACS indicated error after attempted second manual sample during weekly collection on 10/10/22. Screen turned red and sensor would not indicate water was being drawn. Weeks 3 & 4 composite sample were used in October composite.	CA #22-21 CR 2022-15149 10/10/22: Requested maintenance ASAP to avoid overflow condition. 10/19/22: I&C restored sampler to service @ 1013 hours. 10/21/22: Operability verified @ 0624 hours. *Ideal samples collected for weeks 3 & 4 sample period.*
	Air	12S1	10/12/22 to 10/18/22 Power outage- date and time unknown. Loss of 1.0 hours, as determined by timer box during weekly collection. Non-continuous sampler operation.	CA #22-22 CR 2022-15503 10/18/22: No action required. Air monitor resumed normal operation when power was restored. 10/18/22: Operability verified @ 0950 hours. *Ideal sample collected for sample period: 18,400 cf.*

2022 REMP Atypical Sampling Occurrences (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
OCT (cont.)	Air	12S1	10/18/22 to 10/26/22 (momentary loss of 12kV power) Momentary loss of power on 10/18/22 (time unknown). No loss of sampling time as determined by timer box. Non-continuous sampler operation.	CA #22-23 CR 2022-15502 10/18/22: No action required. Air monitor resumed normal operation when power was restored. 10/18/22: Operability verified @ 1426 hours. *Ideal sample collected for sample period: 24,600 cf.*
	Air	10S3	10/18/22 to 10/26/22 Power outage- date and time unknown. Loss of 12.4 hours, as determined by timer box during weekly collection. Non-continuous sampler operation.	CA #22-24 CR 2022-15893 10/26/22: No action required. Air monitor resumed normal operation when power was restored. 10/26/22: Operability verified @ 1001 hours. *Ideal sample collected for sample period: 24,100 cf.*
NOV	Air	10S3	10/26/22 to 11/02/22 Timer box malfunction. Timer box recorded only 131.7 hours for the week. No effect on monitoring. Continuous sampler operation.	CA #22-25 CR 2022-16295 11/02/22: Timer box #4 replaced with timer box #12. Equipment restored to service @ 1005 hours. 11/02/22: Operability verified @ 1006 hours. *Ideal sample collected for sample period: 22,700 cf.*

2022 REMP Atypical Sampling Occurrences (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
NOV (cont.)	Air	10S3	11/15/22 to 11/22/22 Power outage- date and time unknown. Loss of 8.8 hours, as determined by timer box during weekly collection. Non-continuous sampler operation.	CA #22-26 CR 2022-17129 11/22/22: No action required. Air monitor resumed normal operation when power was restored. 11/22/22: Operability verified @ 1022 hours. *Ideal sample collected for sample period: 22,500 cf.*
	Surface Water	6S6	11/29/22 to 12/06/22 (week 1 December composite) ACS unable to pull water for manual sample during weekly collection on 11/29/22. Screen turned red and no verification aliquots could be obtained for week 5 November. No effect on week 5 November composite. Week 1 composite sample was used in December composite.	CA #22-27 CR 2022-17291 11/29/22: Requested maintenance ASAP to maintain constant monitoring. 11/30/22: I&C restored sampler to service @ 1250 hours. 11/30/22: Operability verified @ 1313 hours. *Ideal sample collected for week 1 sample period.*
	Air	12S1	11/22/22 to 11/30/22 Timer box malfunction. Timer box recorded only 136.7 hours for the week. No effect on monitoring. Continuous sampler operation.	CA #22-28 CR 2022-17349 11/30/22: Timer box #7 replaced with timer box #13. Equipment restored to service @ 1007 hours. 11/30/22: Operability verified @ 1008 hours. *Ideal sample collected for sample period: 24,700 cf.*

2022 REMP Atypical Sampling Occurrences (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
DEC	Air	8G1	12/21/22 to 12/28/22 Lower than anticipated sampling volume for sample period. Sample volume was 16,200 cf compared to other stations with 20,000 cf. No power outage indicated by timer box. No signs of malfunction. Continuous sampler operation.	CA #22-29 CR 2022-18452 12/28/22: Sampler checked during next sampling period. 01/04/23: Sampler maintained proper function during sampling period 12/28/22 to 01/04/23. Operability verified @ 1100 hours. *Ideal sample collected for sample period: 16,200 cf.*
	Air	10S3	12/21/22 to 12/28/22 Incorrect charcoal cartridge placement at air monitor for sampling period. Cartridge appears to have been loaded upside down, according to arrows on label. Continuous sampler operation.	CA #22-30 CR 2022-18467 12/28/22: CR generated. Peer check to be performed prior to weekly deployment for cartridge placement and will be incorporated into procedures. 12/28/22: Cartridge placement verification and operability verified @ 1016 hours. *Ideal sample collected for sample period: 21,500 cf.*

D. Quality Assurance Program

Teledyne Brown Engineering

The quality of the results obtained by TBE is ensured by the implementation of the Quality Assurance Program as described in the Teledyne Brown Engineering Quality Assurance Manual and the Teledyne Brown Engineering Procedure Manual.

E. Summary of Results – Inter-Laboratory Comparison Program

The TBE Laboratory analyzed Performance Evaluation (PE) samples of air particulate, air iodine, milk, soil, vegetation, and water matrices for various analytes. The PE samples supplied by Analytics Inc., Environmental Resource Associates (ERA) and Department of Energy (DOE) Mixed Analyte Performance Evaluation Program (MAPEP), were evaluated against the following pre-set acceptance criteria:

1. Analytics Evaluation Criteria

   Analytics' evaluation report provides a ratio of TBE's result and Analytics' known value. Since flag values are not assigned by Analytics, TBE evaluates the reported ratios based on internal QC requirements based on the DOE MAPEP criteria.

2. ERA Evaluation Criteria

   ERA's evaluation report provides an acceptance range for control and warning limits with associated flag values. ERA's acceptance limits are established per the USEPA, National Environmental Laboratory Accreditation Conference (NELAC), state-specific Performance Testing (PT) program requirements or ERA's SOP for

the Generation of Performance Acceptance Limits, as applicable. The acceptance limits are either determined by a regression equation specific to each analyte or a fixed percentage limit promulgated under the appropriate regulatory document.

3. DOE Evaluation Criteria

   MAPEP's evaluation report provides an acceptance range with associated flag values. MAPEP defines three levels of performance:

   - Acceptable (flag = "A") - result within ± 20% of the reference value
   - Acceptable with Warning (flag = "W") - result falls in the ± 20% to ± 30% of the reference value
   - Not Acceptable (flag = "N") – bias is greater than 30% of the reference value

   Note: The Department of Energy (DOE) Mixed Analyte Performance Evaluation Program (MAPEP) samples are created to mimic conditions found at DOE sites which do not resemble typical environmental samples obtained at commercial nuclear power facilities.

Teledyne Brown Engineering

For the TBE laboratory, 142 out of 150 analyses performed met the specified acceptance criteria. Seven analyses did not meet the specified acceptance criteria for the following reasons and were addressed through the TBE Corrective Action Program. NOTE: One analysis (soil for Tc-99) that did not meet acceptance criteria was performed for TBE information and is not on the list of required ICP analyses. A summary is found below:

1. The Analytics March 2022 AP Ce-141 result was evaluated as *Not Acceptable*. The reported value for Ce-141 was 60.9 pCi and the known result was 42.0 pCi/L (1.45 ratio of reported result vs. known; TBE's internal acceptance range is 0.70 - 1.30). This sample was used as the workgroup duplicate with a result of 45.7 (109% of known) and was also counted on a different detector with a result of 50.9 (121% of known). This was TBE's first failure for AP Ce-141. (NCR 22-04)

2. The MAPEP February 2022 Urine U-234 & U-238 results were evaluated as *Not Acceptable*. TBE's reported values of 0.142 and 0.0254 were above the known upper ranges of 0.0096 and 0.0134 respectively for U-234 and U-238. These spiked values were below TBE's typical MDC for urine client samples. The samples were re-prepped using a larger sample aliquot and counted for 60 hours as opposed to 48 hours. The recount results were 0.00732 for U-234 and 0.0119 for U-238 (both within acceptable range). MAPEP urine samples will be flagged to use a larger sample aliquot and counting time than typical client samples. MAPEP did not include any urine cross-check samples in August. (NCR 22-05)

3. The ERA MRAD September 2022 AP Pu-238 was evaluated as *Not Acceptable*. The reported value was 38.8 pCi and the known result was 29.9 (acceptance range 22.6 – 36.7). The AP filter was cut in half prior to digestion (shared with Fe-55) but should have been complete digested together and aliquotted afterwards like typical client samples. This is the first failure for AP Pu-238. (NCR 22-19)

4. The ERA October 2022 water Uranium result was evaluated as *Not Acceptable*. The reported value was 10.54 pCi/L and the known was 8.53 (acceptance range 6.60 – 9.88) or 124% of the known (acceptable for TBE QC). The 2-sigma error was 3.2, placing the reported result well within the acceptable range. This sample was used as the workgroup duplicate with a result of 8.2 +/- 2.9 pCi/L (also within the acceptable range). All other QA was reviewed with no anomalies. (NCR 22-20)

5. The Analytics AP Co-60 result was evaluated as *Not Acceptable*. The reported value was 207 pCi and the known was 147 (141% of the known). TBE's internal QC acceptance is 70 - 130%. All QA was reviewed with no anomalies. This sample was used as the workgroup duplicate and counted on a different detector with a result of 167 pCi (114% of the known). This is the first failure for AP Co-60 – average result ratio compared to the known is 109%. (NCR 22-21)

6. The MAPEP August 2022 water Tc-99 result was evaluated as *Not Acceptable*. The reported value was 1.86 +/- 0.414 Bq/L for this "false positive" test. The evaluation of the submitted result to the 3 times the uncertainty indicated a slight positive. This sample was used as the workgroup duplicate with a result of 0.88 +/- 0.374 Bq/L. All QC was reviewed, and no anomalies found. This is the first unacceptable since the resumption of reporting water Tc-99 for the 3rd quarter of 2020. TBE to known ratios have ranged from 94-109% during this time. (NCR 22-22)

The Inter-Laboratory Comparison Program provides evidence of "in

control" counting systems and methods, and that the laboratories are producing accurate and reliable data.

IV. Results and Discussion

The analytical results of the 2022 REMP samples are divided into categories based on exposure pathways: atmospheric, direct radiation, terrestrial, and aquatic. The analytical results for the 2022 REMP are summarized in Appendix A, Program Summary. The data for individual samples are presented in Appendix C, Data Tables. The data are compared to the formal preoperational environmental monitoring program data (April 1972 to September 1982) and to data during operations. The data collected demonstrates that the SSES REMP was conducted in compliance with the TRM and the SSES ODCM.

A. Atmospheric

Atmospheric REMP sampling included the collection of air particulates, air iodine and direct radiation samples.

1. Air Particulates

Air particulate samples were collected weekly at six indicator locations (3S2, 9B1, 10S3, 12E1, 12S1 and 13S6) and one control locations (8G1). Each of the samples collected for the year were analyzed for gross beta. Quarterly composites of the weekly samples from each location were analyzed for specific gamma emitters.

Gross Beta

Gross beta activity was detected in 311 of 311 of the indicator

location samples at concentrations ranging from 6 to 49 E-3 pCi/m^3 with an average concentration of 15 E-3 pCi/m^3, and in 52 of 52 of the control location samples at concentrations ranging from 6 to 27 E-3 pCi/m^3 with an average of 15 E-3 pCi/m^3. The maximum preoperational level detected was 102 E-3 pCi/m^3 with an average concentration of 62 E-3 pCi/m^3. (Table C–1, Appendix C); Historical levels of gross beta are shown in Figure C-1. Results for gross beta analysis from 1974 to current year are plotted.

Gamma Spectrometry

Gamma spectrometry was performed on each of the 28 quarterly composite samples. Beryllium-7, attributed to cosmic ray activity in the atmosphere, was detected in all 24 indicator location composites at concentrations ranging from 63 E-3 to 137 E-3 pCi/m^3 with an average concentration of 105 E-3 pCi/m^3, and in the four control location composites ranging in concentration from 69 to 129 E-3 pCi/m^3 with an average concentration of 104 E-3 pCi/m^3.

The maximum preoperational level detected was 85 E-3 pCi/m^3 with an average concentration of 74 E-3 pCi/m^3. (Table C–2, Appendix C)

All other gamma emitters were less than the LLD.

2. Air Iodine

Filtered air iodine samples were collected weekly at six indicator locations (3S2, 9B1, 10S3, 12E1, 12S1, and 13S6) and one control locations (8G1). Each of the samples collected

for the year were analyzed for I-131.

Iodine-131

Iodine-131 was not detected in any indicator location samples or control location samples. Preoperational data is not available for comparison. (Table C–3, Appendix C)

B. Direct Radiation

Ambient radiation levels in the environs were measured at each monitoring location with a pair of optically stimulated luminescent dosimeters (OSLD) composed of aluminum oxide crystals supplied and processed by Landauer. The Landauer OSLD is designed to meet the ANSI N545 Standard and ANSI/HPS Standard N13.37-2014. Packets containing OSLDs for quarterly exposure were placed in the owner-controlled area and around the site at various distances and in each land-based meteorological sector. Emphasis was placed on special interest areas such as population centers, nearby residences, and schools.

A total of 57 locations were monitored for direct radiation during 2022, including 32 site boundary locations, 14 outer distant locations, six special interest locations and five control locations.

Environmental monitoring of ambient radiation levels began prior to the commencement of SSES operation. The preoperational monitoring period data used in the calculation of dose attributable the SSES operation is from 1980-1981. The availability of preoperational direct radiation monitoring data and data for control direct radiation monitoring locations provides a basis for distinguishing between the portions of dose received from exposure to sources of natural

radiation and that which might have been from man-made sources of radiation.

Pre-operational and operational data are compared for the purpose of determining if dosimeter data may indicate a dose contribution from SSES operation. Ratios of doses for specific indicator locations to the average of the doses for control locations from operational periods are compared to their counterparts from the preoperational period. Comparison of these ratios is performed in lieu of comparing the actual operational and preoperational doses. All indicator-to-control-average dose ratios for operational periods are compared to expected ranges from 1980-81 data for indicator-to-control-average dose ratios from the same locations. If preoperational data does not exist for the location of interest, indicator-to-control-average dose ratios for operational periods are compared to data for control locations monitored during 1980-81. The purpose for these comparisons is to flag possible SSES direct radiation dose contributions and to provide input, if appropriate, for the calculation of SSES direct radiation dose contributions.

Additional details on the statistical method used for determination of direct radiation dose to a member of the public due to SSES operation (based on environmental dosimeter data) can be found in Engineering Calculation EC-ENVR-1012, Interpretation of Environmental Direct Radiation Monitoring Results – Estimation of Direct Radiation Dose to Members of the Public Attributable to SSES Fuel Cycle Operations Rev. 2.

The indicator locations annual average dose rate was 16.3 milliroentgen per standard quarter. The annual average dose rate for the control locations was 14.5 milliroentgen per standard quarter. The

preoperational average for the quarterly direct radiation readings was 17.6 milliroentgen per standard quarter.

In 2022, the maximum direct radiation dose to a member of the public calculated using the methodology in EC-ENVR-1012 was 0.796 mrem.

The results of the direct radiation measurements for 2022 confirmed that the radiation levels in the vicinity of the SSES were similar to previous years. (Table C–4, Appendix C); Figure C-2 – Ambient Radiation Levels Based on Environmental Dosimetry Data from 1973 to current year are plotted as quarterly averages.

C. Terrestrial

Terrestrial REMP sampling included the collection of milk, groundwater, drinking water, and vegetation.

1. Milk

Milk samples were collected biweekly when cows were on pasture and monthly when cows were not grazing on pasture. Animals are considered on pasture from April to October of each year. Samples were collected in new polyethylene containers and transported in ice chests with preservatives added to the milk.

Milk samples were collected at local dairy farms from 2 indicator locations (5E2 and 13E3) and one control location (10G1). Each sample was analyzed for I-131 and gamma emitters.

Iodine-131

Iodine-131 was not detected above minimum detectable concentration in any of the 60 samples analyzed. Preoperational data is not available for comparison. (Table C-5, Appendix C); Figure C-3 – Iodine-131 Activity in Milk results from 1976 to 2022 are plotted.

Gamma Spectrometry

Naturally occurring K-40 was detected in all 60 samples with concentrations for the 40 indicator location samples ranging from 1,026 to 1,432 pCi/L with an average concentration of 1,224 pCi/L, and the 20 control location sample concentrations ranging from 1129 to 1,430 pCi/L with an average concentration of 1,312 pCi/L. The maximum preoperational level detected was 1,500 pCi/L with an average concentration of 1,358 pCi/L. (Table C-5, Appendix C).
All other gamma emitters were less than the LLD.

2. Groundwater

An expanded groundwater monitoring network was initiated in 2006 for the SSES as part of a site-wide hydrogeological investigation in accordance with the Nuclear Energy Institute (NEI) Groundwater Protection Initiative (GPI). The additional groundwater monitoring wells are sampled as part of the Radiological Environmental Monitoring Program (REMP) to regularly assess groundwater quality and provide early detection of any inadvertent leaks or spills of radioactive materials that could reach groundwater. Groundwater is sampled quarterly and analyzed for H-3 and gamma activity.

Additionally, precipitation sampling was initiated in 2007 and analyzed for H-3 activity to assess the influence of station airborne H-3 emissions on groundwater H-3 activities.

Precipitation washout monitoring data is not used in dose calculations; however, the data does give a gross indication of H-3 which makes its way into surface water and soil where it eventually seeps into shallow groundwater. The annual average H-3 concentrations in precipitation, groundwater monitoring wells and surface water are summarized in Table C-7 and graphically depicted in Figure C-4 - Annual Average Tritium Activity (pCi/L) in Precipitation and Surface Water Versus Groundwater.

Groundwater samples were collected quarterly at 10 indicator locations (1S3, 1S4, 4S8, 4S9, 8S4, 7S10, 2S8, 6S11A, 6S12 and 7S11) and one control station (13S7). Each sample was analyzed for H-3 and gamma emitters.

Tritium

Tritium activity was detected above the minimum detectable concentration in 1 of the 40 indicator location samples with an concentration of 370 pCi/L. None of the four control location samples had tritium activity above the minimum detectable concentration. The maximum preoperational level detected was 119 pCi/L. (Table C–6, Appendix C); Figure C-4 – Annual Average Tritium Activity (pCi/L) in Precipitation and Surface Water Versus Groundwater results from 2007 to 2022 are plotted.

Gamma Spectrometry

Naturally occurring K-40 was not detected in any of the indicator or control samples. Preoperational data is not available for comparison. (Table C-6, Appendix C)
All other gamma emitters were less than the LLD.

3. Drinking Water

Drinking water samples were collected monthly from one location (12H2). Each sample was analyzed for gross beta, H-3 and gamma emitters.

Gross Beta

Gross beta activity was detected in seven of the 12 drinking water samples. Sample concentrations ranged from 2.2 to 3.2 pCi/L with an average concentration of 2.9 pCi/L. The maximum preoperational level detected was 2.8 pCi/L with an average concentration of 1.8 pCi/L. (Table C–8, Appendix C); Figure C-5 – Gross Beta Activity in Drinking Water results from 1977 to 2022 are plotted.

Tritium

Tritium activity was not detected in any of the samples. The maximum preoperational level detected was 194 pCi/L with an average of 132 pCi/L. (Table C–8, Appendix C)

Gamma Spectrometry

Naturally occurring K-40 was not detected in any of the samples. Preoperational data is not available for comparison. (Table C–8, Appendix C)

All other gamma emitters were less than the LLD.

4. Food Products

Food products from two indicator locations (11D1 and 11S6) were collected throughout the growing season. All samples (fruit, vegetable, and broadleaf) were analyzed for gamma emitters and included soybeans, corn, swiss chard and collards.

Gamma Spectrometry

Naturally occurring Be-7, attributed to cosmic ray activity in the atmosphere, was detected in eight of the 12 indicator location samples with concentrations ranging from 311 to 983 pCi/kg wet with an average concentration of 665 pCi/kg wet. Preoperational data is not available for comparison.

Naturally occurring K-40 was detected in all 12 indicator location samples with concentrations ranging from 2,598 to 14,660 pCi/kg wet with an average concentration of 4,389 pCi/kg wet. The maximum preoperational level detected was 4,800 pCi/kg wet with an average concentration of 2,140 pCi/kg wet.

Naturally occurring Ac-228 was not detected in any of the indicator or control locations. Preoperational data is not available for comparison.

Naturally occurring Th-228 was not detected in any of the indicator or control locations. Preoperational data is not available for comparison. (Table C-9, Appendix C)

All other gamma emitters were less than the LLD.

D. Aquatic

Aquatic samples include surface water, fish, and sediment samples.

1. Surface Water

Surface water samples were collected routinely at one indicator location (6S5) and one control location (6S6). Each sample was analyzed for H-3 and gamma emitters.

Tritium

Tritium activity was detected in none of the 12 indicator location samples. Tritium was not detected in any of the 12 control location samples. The maximum preoperational level detected was 319 pCi/L, with an average concentration of 140 pCi/L. (Table C-10, Appendix C) Figure C-6 – Tritium Activity in Surface Water, results from 1972 to 2022 are plotted.

Gamma Spectrometry

Naturally occurring K-40 was not detected in any of the indicator location or control location samples. Preoperational data is not available for comparison. Iodine-131 was not detected in any of the indicator or control samples. The maximum preoperational level detected was 0.43 pCi/L, with an average concentration of 0.33 pCi/L. (Table C-10, Appendix C)

All other gamma emitters were less than the LLD.

2. Fish

Edible species of fish were collected in the spring and fall of 2022 at two indicator locations (IND [Susquehanna River] and LTAW (only collected in the fall)) and one control location (2H [Susquehanna River]). Each sample was analyzed for gamma emitters.

Gamma Spectrometry

Naturally occurring K-40 was detected in all indicator location samples at concentrations ranging from 2,342 to 4,929 pCi/kg wet with an average concentration of 3,525 pCi/kg wet, and in all control location samples at concentrations ranging from 2,788 to 4,030 pCi/kg wet with an average concentration of 3,475 pCi/kg wet. The maximum preoperational level detected was 3,600 pCi/kg dry with an average concentration of 3,871 pCi/kg dry. (Table C–11, Appendix C)

All other gamma emitters were less than the LLD.

3. Shoreline Sediment

Sediment samples were collected from the Susquehanna River in the spring and fall at two indicator locations (7B and 12F) and one control location (2B). Each sample was analyzed for gamma emitters.

Gamma Spectroscopy

Naturally occurring K-40 was detected in all four of the indicator location samples at concentrations ranging from 8,246 to 15,330 pCi/kg dry with an average concentration of 11,210 pCi/kg dry, and in all of the control location samples with concentrations ranging from 10,160 to 11,500 pCi/kg dry with an average concentration of 10,830 pCi/kg dry. The maximum preoperational level detected was 11,000 pCi/kg dry with an average concentration of 8,500 pCi/kg dry.

Cesium-137 was not detected in any of the indicator or control location samples. The maximum preoperational level detected was 210 pCi/kg dry with an average concentration of 110 pCi/kg dry.

Naturally occurring Ra-226 was detected in one of the indicator location samples with a concentration of 3,465 pCi/kg dry and none of the control location samples. The maximum preoperational level detected was 1,900 pCi/kg dry with an average concentration of 700 pCi/kg dry.

Naturally occurring Ac-228 was detected in all four indicator location samples at concentrations ranging from 716 to 1,567 pCi/kg dry with an average concentration of 10,540 pCi/kg dry, and in both of the control location samples at concentrations

ranging from 800 to 1,043 pCi/kg dry with an average concentration of 921 pCi/kg dry. Preoperational data is not available for comparison.

Naturally occurring Th-228 was detected in all of the four indicator location samples at concentrations ranging from 671 to 1,014 pCi/kg dry with an average concentration of 846 pCi/kg dry, and in both of the control location samples at concentrations ranging from 614 and 1,157 pCi/kg dry with an average concentration of 886 pCi/kg dry. The maximum preoperational level detected was 3,200 pCi/kg dry with an average concentration of 1,300 pCi/kg dry. (Table C 12, Appendix C)

All other gamma emitters were less than the LLD.

E. Land Use Census

SYNOPSIS OF 2022 LAND USE CENSUS

Applied Ecoscience, Inc. conducted a Land Use Census during the 2022 growing season around SSES to comply with the ODCM. The purpose of the survey was to document the nearest milk animal, residence and garden greater than 50 m^2 (approximately 500 ft^2) producing broad leaf vegetation within a distance of 8 km (approximately 5 miles) in each of the 16 meteorological sectors surrounding the SSES.

Distance in Miles from the SUSQUEHANNA NUCLEAR Reactor Buildings				
Meteorological Sector		Nearest Residence July-Aug, 2022 miles	Nearest Garden July-Sept, 2022 miles	Nearest Dairy Farm July-Aug, 2022 miles
1	N	1.3	3.2	>5.0
2	NNE	1.0	2.3 [a,c,e]	>5.0
3	NE	0.9	2.7	>5.0
4	ENE	2.1	2.4 [a,c]	>5.0
5	E	1.6	4.9	4.5 [d]
6	ESE	0.5	3.1	>5.0
7	SE	0.6	0.6	>5.0
8	SSE	0.7	2.9	>5.0
9	S	1.1	3.5	>5.0
10	SSW	0.9	1.3 [a,c]	>5.0 [d]
11	SW	1.5	4.2	>5.0
12	WSW	1.3	1.3	1.7
13	W	1.4	3.2	5.0
14	WNW	1.1	3.6	>5.0
15	NW	0.8	2.3	>5.0
16	NNW	0.7	4.0	>5.0

a Chickens raised for consumption at this location
b Ducks raised for consumption at this location
c Eggs consumed from chickens at this location
d Fruits/vegetables raised for consumption at this location
e Beef cattle raised for consumption at this location
f Rabbits raised for consumption at this location.

The 2022 Land Use Census results are summarized in the above table.

V. Annotations to Previous AREOR

There are no annotations to the previous AREOR.

VI. Conclusions

The Radiological Environmental Monitoring Program for SSES was conducted during 2022 in accordance with the SSES TRM and ODCM. The LLD values required by the TRM and ODCM were achieved for this reporting period (See Appendix A and Appendix C). The objectives of the program were also met during this period. The data collected assists in demonstrating that SSES was operated in compliance with TRM and ODCM requirements.

The concentration of radioactive material in the environment that could be attributable to SSES operations was only a small fraction of the concentration of naturally occurring and man-made radioactivity. Since these results were comparable to the results obtained during the preoperational phase of the program, which ran from 1972 to 1982, and with results collected since commercial operation, it is concluded that operation of the SSES had no significant radiological impact on the health and safety of the public or the environment.

From the results obtained, it can be concluded that the levels and fluctuations of radioactivity in environmental samples were as expected for the environment surrounding the SSES.

VII. References

[1] Annual Radiological Environmental Operating Report, January 1 to December 31, 2022, prepared by Teledyne Brown Engineering, Knoxville TN.

[2] Final Safety Analysis Report

[3] Final Environmental Statement

[4] Susquehanna Steam Electric Station, 2022 Land Use Census. Prepared for Susquehanna Nuclear, LLC, Berwick, PA. December 2022. Applied Ecoscience, Inc. Berwick, PA.

[5] Susquehanna Nuclear, LLC. Radiological Environmental Monitoring Program, ODCM-QA-008, Rev. 21.

[6] United States Nuclear Regulatory Commission. “An Acceptable Radiological Environmental Monitoring Program.” Radiological Assessment Branch Technical Position. November 1979, Revision 1. USNRC, Washington, DC.

[7] NCRP Report No. 160, “Ionizing Radiation Exposure of the Population of the United States”, (2009).

[8] Engineering Calculation EC-ENVR-1012, Interpretation of Environmental Direct Radiation Monitoring Results – Estimation of Direct Radiation Dose to Members of the Public Attributable to SSES Fuel Cycle Operations, Rev. 2. May 2013

APPENDIX A

PROGRAM SUMMARY

TABLE A
SUMMARY OF DATA FOR SSES
OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
NAME OF FACILITY: SUSQUEHANNA STEAM ELECTRIC STATION
LOCATION OF FACILITY: LUZERNE COUNTY, PENNSYLVANIA

Reporting Period: December 29, 2021 to January 6, 2023

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSIS PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN (3) RANGE	CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASURMENTS (4)
Air Particulates (E-3 pCi/m^3)	GR-B	363	10	1.529E+01 (311/311) (5.960E+00 - 4.910E+01)	13S6 0.4 MILES W	1.571E+01 (52/52) (7.430E+00 - 2.330E+01)	1.448E+01 (52/52) (5.920E+00 - 2.740E+01)	0
	GAMMA	28						
	BE-7	28	N/A	1.054E+02 (24/24) (6.306E+01 - 1.373E+02)	10S3 0.6 MILES SSW	1.124E+02 (4/4) (8.401E+01 - 1.267E+02)	1.038E+02 (4/4) (6.932E+01 - 1.291E+02)	0
	K-40	28	N/A	<MDC (0/24)		<MDC	<MDC (0/4)	0
	CS-134	28	50	<MDC (0/24)		<MDC	<MDC (0/4)	0
	CS-137	28	60	<MDC (0/24)		<MDC	<MDC (0/4)	0
Charcoal (E-3 pCi/m^3)	GAMMA	363						
	I-131	363	70	<MDC (0/311)		<MDC	<MDC (0/52)	0
Ambient Radiation (mR/std. qtr.)	OSLD	226	N/A	1.627E+01 (206/206) (8.493E+00 - 4.166E+01)	9S2 0.2 MILES S	3.948E+01 (4/4) (3.554E+01 - 4.166E+01)	1.447E+01 (20/20) (1.228E+01 - 1.793E+01)	0
Milk (pCi/Liter)	I-131	60	1	<MDC (0/40)		<MDC	<MDC (0/20)	0
	GAMMA	60						
	K-40	60	N/A	1.224E+03 (40/40) (1.026E+03 - 1.432E+03)	10G1 C 14 MILES SSW	1.312E+03 (20/20) (1.129E+03 - 1.430E+03)	1.312E+03 (20/20) (1.129E+03 - 1.430E+03)	0
	CS-134	60	15	<MDC (0/40)		<MDC	<MDC (0/20)	0

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Milk (cont'd) (pCi/Liter)	CS-137	60	18	<MDC	(0/40)	<MDC			<MDC	(0/20)	0
	BA-140	60	60	<MDC	(0/40)	<MDC			<MDC	(0/20)	0
	LA-140	60	15	<MDC	(0/40)	<MDC			<MDC	(0/20)	0
	TH-228	60	N/A	<MDC	(0/40)	<MDC			<MDC	(0/20)	0
Ground Water (pCi/Liter)	H-3	44	2000	3.700E+02 (3.700E+02)	(1/40)	4S8 0.1 MILES ENE	3.700E+02 (3.700E+02)	(1/4)	<MDC	(0/4)	0
	GAMMA	44									
	K-40	44	N/A	<MDC	(0/40)	<MDC			<MDC	(0/4)	0
	MN-54	44	15	<MDC	(0/40)	<MDC			<MDC	(0/4)	0
	CO-58	44	15	<MDC	(0/40)	<MDC			<MDC	(0/4)	0
	FE-59	44	30	<MDC	(0/40)	<MDC			<MDC	(0/4)	0
	CO-60	44	15	<MDC	(0/40)	<MDC			<MDC	(0/4)	0

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Ground Water (cont'd) (pCi/Liter)	ZN-65	44	30	<MDC	(0/40)	<MDC		<MDC	(0/4)	0
	NB-95	44	15	<MDC	(0/40)	<MDC		<MDC	(0/4)	0
	ZR-95	44	30	<MDC	(0/40)	<MDC		<MDC	(0/4)	0
	I-131	44	15	<MDC	(0/40)	<MDC		<MDC	(0/4)	0
	CS-134	44	15	<MDC	(0/40)	<MDC		<MDC	(0/4)	0
	CS-137	44	18	<MDC	(0/40)	<MDC		<MDC	(0/4)	0
	BA-140	44	60	<MDC	(0/40)	<MDC		<MDC	(0/4)	0
	LA-140	44	15	<MDC	(0/40)	<MDC		<MDC	(0/4)	0
	TH-228	44	N/A	<MDC	(0/40)	<MDC		<MDC	(0/4)	0
Drinking Water (pCi/Liter)	GR-B	12	4	2.889E+00 (2.230E+00 - 3.220E+00)	(7/12)	12H2 26 MILES WSW	2.889E+00 (2.230E+00 - 3.220E+00)	(7/12)	N/A	0
	H-3	12	2000	<MDC	(0/12)	<MDC			N/A	0

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Drinking Water (cont'd)	GAMMA	12							
(pCi/Liter)	K-40	12	N/A	<MDC	(0/12)	<MDC		N/A	0
	MN-54	12	15	<MDC	(0/12)	<MDC		N/A	0
	CO-58	12	15	<MDC	(0/12)	<MDC		N/A	0
	FE-59	12	30	<MDC	(0/12)	<MDC		N/A	0
	CO-60	12	15	<MDC	(0/12)	<MDC		N/A	0
	ZN-65	12	30	<MDC	(0/12)	<MDC		N/A	0
	NB-95	12	15	<MDC	(0/12)	<MDC		N/A	0
	ZR-95	12	30	<MDC	(0/12)	<MDC		N/A	0
	I-131	12	15	<MDC	(0/12)	<MDC		N/A	0
	CS-134	12	15	<MDC	(0/12)	<MDC		N/A	0

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Drinking Water (cont'd) (pCi/Liter)	CS-137	12	18	<MDC	(0/12)	<MDC			N/A	0
	BA-140	12	60	<MDC	(0/12)	<MDC			N/A	0
	LA-140	12	15	<MDC	(0/12)	<MDC			N/A	0
Food/Garden Crops (pCi/kg wet)	GAMMA	12								
	BE-7	12	N/A	6.650E+02 (3.112E+02 - 9.828E+02)	(8/12)	11S6 0.5 MILES SW	6.650E+02 (3.112E+02 - 9.828E+02)	(8/10)	N/A	0
	K-40	12	N/A	4.389E+03 (2.598E+03 - 1.466E+04)	(12/12)	11D1 3.3 MILES SW	8.749E+03 (2.838E+03 - 1.466E+04)	(2/2)	N/A	0
	MN-54	12	N/A	<MDC	(0/12)	<MDC			N/A	0
	CO-58	12	N/A	<MDC	(0/12)	<MDC			N/A	0
	FE-59	12	N/A	<MDC	(0/12)	<MDC			N/A	0
	CO-60	12	N/A	<MDC	(0/12)	<MDC			N/A	0
	ZN-65	12	N/A	<MDC	(0/12)	<MDC			N/A	0

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Food/Garden Crops (cont'd) (pCi/kg wet)	NB-95	12	N/A	<MDC	(0/12)	<MDC		N/A	0
	ZR-95	12	N/A	<MDC	(0/12)	<MDC		N/A	0
	I-131	12	60	<MDC	(0/12)	<MDC		N/A	0
	CS-134	12	60	<MDC	(0/12)	<MDC		N/A	0
	CS-137	12	80	<MDC	(0/12)	<MDC		N/A	0
	BA-140	12	N/A	<MDC	(0/12)	<MDC		N/A	0
	LA-140	12	N/A	<MDC	(0/12)	<MDC		N/A	0
	AC-228	12	N/A	<MDC	(0/12)	<MDC		N/A	0
	TH-228	12	N/A	<MDC	(0/12)	<MDC		N/A	0

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Surface Water (pCi/Liter)	H-3	24	2000	<MDC	(0/12)	<MDC		<MDC	(0/12)	0
	GAMMA	24								
	K-40	24	N/A	<MDC	(0/12)	<MDC		<MDC	(0/12)	0
	MN-54	24	15	<MDC	(0/12)	<MDC		<MDC	(0/12)	0
	CO-58	24	15	<MDC	(0/12)	<MDC		<MDC	(0/12)	0
	FE-59	24	30	<MDC	(0/12)	<MDC		<MDC	(0/12)	0
	CO-60	24	15	<MDC	(0/12)	<MDC		<MDC	(0/12)	0
	ZN-65	24	30	<MDC	(0/12)	<MDC		<MDC	(0/12)	0
	NB-95	24	15	<MDC	(0/12)	<MDC		<MDC	(0/12)	0
	ZR-95	24	30	<MDC	(0/12)	<MDC		<MDC	(0/12)	0
	I-131	24	15	<MDC	(0/12)	<MDC		<MDC	(0/12)	0

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Surface Water (cont'd) (pCi/Liter)	CS-134	24	15	<MDC	(0/12)	<MDC			<MDC	(0/12)	0
	CS-137	24	18	<MDC	(0/12)	<MDC			<MDC	(0/12)	0
	BA-140	24	60	<MDC	(0/12)	<MDC			<MDC	(0/12)	0
	LA-140	24	15	<MDC	(0/12)	<MDC			<MDC	(0/12)	0
	TH-228	24	N/A	<MDC	(0/12)	<MDC			<MDC	(0/12)	0
Fish (pCi/kg wet)	GAMMA	14									
	K-40	14	N/A	3.525E+03 (2.342E+03 - 4.929E+03)	(8/8)	LTAW 0.7 MILES NE-ESE	3.722E+03 (2.514E+03 - 4.929E+03)	(2/2)	3.475E+03 (2.788E+03 - 4.030E+03)	(6/6)	0
	MN-54	14	130	<MDC	(0/8)	<MDC			<MDC	(0/6)	0
	CO-58	14	130	<MDC	(0/8)	<MDC			<MDC	(0/6)	0
	FE-59	14	260	<MDC	(0/8)	<MDC			<MDC	(0/6)	0
	CO-60	14	130	<MDC	(0/8)	<MDC			<MDC	(0/6)	0

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Fish (cont'd) (pCi/kg wet)	ZN-65	14	260	<MDC	(0/8)	<MDC			<MDC	(0/6)	0
	CS-134	14	130	<MDC	(0/8)	<MDC			<MDC	(0/6)	0
	CS-137	14	150	<MDC	(0/8)	<MDC			<MDC	(0/6)	0
Sediment (pCi/kg dry)	GAMMA	6									
	K-40	6	N/A	1.121E+04 (8.246E+03 - 1.533E+04)	(4/4)	12F 6.9 MILES WSW	1.216E+04 (8.987E+03 - 1.533E+04)	(2/2)	1.083E+04 (1.016E+04 - 1.150E+04)	(2/2)	0
	CS-134	6	150	<MDC	(0/4)	<MDC			<MDC	(0/2)	0
	CS-137	6	180	<MDC	(0/4)	<MDC			<MDC	(0/2)	0
	RA-226	6	N/A	3.465E+03 (3.465E+3)	(1/4)	12F 6.9 MILES WSW	3.465E+03 (3.465E+3)	(1/2)	<MDC	(0/2)	0
	AC-228	6	N/A	1.054E+03 (7.162E+02 - 1.567E+03)	(4/4)	12F 6.9 MILES WSW	1.223E+03 (8.795E+02 - 1.567E+03)	(2/2)	9.213E+02 (7.996E+02 - 1.043E+03)	(2/2)	0
	TH-228	6	N/A	8.464E+02 (6.705E+02 - 1.014E+03)	(4/4)	2B C 1.6 MILES NNE	8.857E+02 (6.143E+02 - 1.157E+03)	(2/2)	8.857E+02 (6.143E+02 - 1.157E+03)	(2/2)	0

1. The total number of analyses does not include duplicates, splits or repeated analyses.
2. The Technical Requirement LLDs are shown when applicable.
3. The mean and range are based on all results above MDC. The ratio indicated in parentheses is the total number of results used to calculate the mean to the total number of samples.
4. USNRC Reporting Levels are specified in the Technical Requirements (i.e., when Reporting Levels in Technical Requirements are exceeded).

APPENDIX B

SAMPLE DESIGNATION

AND

LOCATIONS

SAMPLE DESIGNATION

All distances from the SSES to monitoring locations are measured from the standby gas treatment vent at 44200/N34117 (Pa. Grid System). The location codes are based on both distance and direction from the SSES. The letters in the location codes indicate if the monitoring locations are on site (within the site boundary) or, if they are not on site, the approximate distances of the location from the SSES as described below:

S	=	On site	E	=	4 – 5 miles
A	=	< 1 mile	F	=	5 – 10 miles
B	=	1 – 2 miles	G	=	10 – 20 miles
C	=	2 – 3 miles	H	=	> 20 miles
D	=	3 – 4 miles			

The numbers preceding the letters in the location codes provide the direction of the monitoring locations from the SSES by indicating the sectors in which they are located. A total number of 16 sectors (numbered one through 16) equally divide an imaginary circle on a map of the SSES and its vicinity, with the SSES at the center of the circle. The middle of sector one is directed due North (N). Moving clockwise from sector one, the sector immediately adjacent to sector one is sector two, the middle of which is directed due north, north east (NNE). Continuing to move clockwise the sector number increases to 16, which is the north northwest sector (NNW).

TABLE B-1

SAMPLING LOCATIONS

Specific information about the individual sampling locations are given in Table B-1. Maps B-1 through B-6 show the locations of sampling stations with respect to the Site. A Portable Global Positioning System (GPS) was used to provide the coordinates of sampling locations.

STATION CODE	STATION LOCATION	LATITUDINAL	LONGITUDINAL	SAMPLE TYPE
LESS THAN ONE MILE FROM THE SSES		DEG.	DEG.	
6S5	0.9 mi.ESE;	41.084639	-76.130642	Surface water
6S6 **	0.8 mi.ESE;	41.088115	-76.131637	Surface water
LTAW	0.7 mi.NE-ESE;	41.098356	-76.135401	Fish
10S3	0.6 mi. SSW;	41.085264	-76.152128	Air
12S1	0.4 mi.WSW;	41.088436	-76.154314	Air
13S6	0.4 mi.W;	41.091771	-76.153869	Air
3S2	0.5 mi NE;	41.095716	-76.140207	Air
1S4	0.1 mi N;	41.093302	-76.145853	Ground water
2S8	0.1 mi.NNE;	41.094991	-76..044207	Ground water
6S11A	0.4 mi.ESE;	41.083448	-76.133412	Ground water
6S12	0.8 mi.ESE;	41.083411	-76.116935	Ground water
7S11	0.3 mi.SE;	41.083527	-76.133513	Ground water
1S3	0.1 mi N;	41.093640	-76.146076	Ground water
4S8	0.1 mi.ENE;	41.092306	-76.144283	Ground water
4S9	0.3 mi.E;	41.093369	-76.141644	Ground water
8S4	0.1 mi.SSE;	41.091424	-76.145531	Ground water
7S10	0.3 mi.SE;	41.089736	-76.142783	Ground water
13S7	0.2 mi.W;	41.091236	-76.149647	Ground water
11S6	0.5 mi.SW;	41.085305	-76.152022	Broadleaf
Site 1	0.1 mi.ESE;	41.092275	-76.145022	Precipitation
Site 2	0.1 mi.SSE;	41.091309	-76.145708	Precipitation
Site 3	0.1 mi.WSW;	41.091243	-76.147345	Precipitation
Site 4	0.1 mi.NW;	41.093321	-76.147316	Precipitation

**** Control Location**

TABLE B-1 (cont'd)

SAMPLING LOCATIONS

STATION CODE	STATION LOCATION	LATITUDINAL	LONGITUDINAL	SAMPLE TYPE
FROM ONE to FIVE MILES FROM THE SSES		DEG.	DEG.	
IND	0.9 mi.ESE;	41.085141	-76.130174	Fish
IND	1.4 mi.ESE;	41.075618	-76.132682	Fish
2B **	1.6 mi.NNE;	41.112441	-76.134758	Sediment
7B	1.2 mi.SE;	41.078924	-76.131548	Sediment
9B1	1.3 mi. SSW;	41.085264	-76.152128	Air
12E1	4.7 mi.WSW;	41.072418	-76.230554	Air
5E2	4.5 mi.E;	41.085184	-76.061099	Milk
13E3	5.0 mi.W;	41.100259	-76.241102	Milk
11D1	3.3 mi.SW;	41.055212	-76.186797	Food Products
** Control Location				
GREATER THAN FIVE MILES FROM THE SSES				
12H2	26 mi.WSW;	40.947192	-76.604524	Drinking water
2H **	30 mi.NNE;	41.459508	-75.853096	Fish
12F	6.9 mi.WSW;	41.041323	-76.255396	Sediment
8G1 **	12 mi.SSE;	40.928886	-76.055092	Air
10G1 **	14 mi.SSW;	40.934847	-76.284449	Milk

TABLE B-1 (cont'd)

SAMPLING LOCATIONS

STATION CODE	STATION LOCATION	LATITUDINAL	LONGITUDINAL	SAMPLE TYPE
OSLD LOCATIONS				
LESS THAN ONE MILE FROM THE SSES		DEG.	DEG.	
1S2	0.2 mi.N;	41.09566	-76.146121	OSLD
2S2	0.9 mi.NNE;	41.10207	-76.141192	OSLD
2S3	0.2 mi.NNE;	41.09486	-76.144101	OSLD
3S2	0.5 mi.NE;	41.09574	-76.140086	OSLD
3S3	0.9 mi.NE;	41.10183	-76.133127	OSLD
4S3	0.2 mi.ENE;	41.09322	-76.141934	OSLD
4S6	0.7 mi.ENE;	41.09687	-76.133807	OSLD
5S4	0.8 mi.E;	41.09286	-76.131604	OSLD
5S7	0.3 mi.E;	41.09199	-76.141165	OSLD
6S4	0.2 mi.ESE;	41.09132	-76.142616	OSLD
6S9	0.2 mi.ESE;	41.09067	-76.142966	OSLD
7S6	0.2 mi.SE;	41.08972	-76.14359	OSLD
7S7	0.4 mi.SE;	41.08745	-76.142033	OSLD
8S2	0.2 mi.SSE;	41.08907	-76.14437	OSLD
9S2	0.2 mi.S;	41.08952	-76.14322	OSLD
10S1	0.4 mi.SSW;	41.08663	-76.150082	OSLD
10S2	0.2 mi.SSW;	41.08894	-76.147881	OSLD
11S7	0.4 mi.SWN;	41.08832	-76.15297	OSLD
12S1	0.4 mi.WSW;	41.0887	-76.154112	OSLD
12S3	0.4 mi.WSW;	41.08968	-76.153192	OSLD
13S2	0.4 mi.W;	41.09198	-76.153166	OSLD
13S5	0.4 mi.W;	41.09179	-76.153167	OSLD
13S6	0.4 mi.W;	41.09177	-76.154073	OSLD
14S5	0.5 mi.WNW;	41.09503	-76.153787	OSLD
15S5	0.4 mi.NW;	41.09576	-76.15103	OSLD
16S1	0.3 mi.NNW;	41.09611	-76.147388	OSLD
16S2	0.3 mi.NNW;	41.09599	-76.148922	OSLD
6A4 *	0.6 mi.ESE;	41.08791	-76.136795	OSLD

TABLE B-1 (cont'd)

SAMPLING LOCATIONS

STATION CODE	STATION LOCATION	LATITUDINAL	LONGITUDINAL	SAMPLE TYPE
LESS THAN ONE MILE FROM THE SSES		DEG.	DEG.	
8A3	0.9 mi.SSE;	41.07982	-76.1139078	OSLD
15A3 *	0.9 mi.NW;	41.10003	-76.1585	OSLD
16A2 *	0.8 mi.NNW;	41.1025	-76.151595	OSLD
FROM ONE to FIVE MILES FROM THE SSES				
12S7	1.1 mi.WSW;	41.08621	-76.165914	OSLD
8B2 *	1.4 mi.SSE;	41.07483	-76.130724	OSLD
9B1	1.3 mi.S;	41.07356	-76.147874	OSLD
10B3 *	1.7 mi.SSW;	41.07064	-76.156646	OSLD
1D5	4.0 mi.N;	41.14936	-76.144346	OSLD
8D3	4.0 mi.SSE;	41.03824	-76.121683	OSLD
9D4	3.6 mi.S;	41.04015	-76.144529	OSLD
10D1	3.0 mi.SSW;	41.05446	-76.175026	OSLD
12D2	3.7 mi.WSW;	41.07363	-76.213306	OSLD
14D1	3.6 mi.WNW;	41.10706	-76.211891	OSLD
3E1	4.7 mi NE;	41.13953	-76.082398	OSLD
4E2	4.7 mi.ENE;	41.12157	-76.064115	OSLD
5E2	4.5 mi. E;	41.08539	-76.060486	OSLD
6E1	4.7 mi.ESE;	41.07275	-76.059529	OSLD
7E1	4.2 mi.SE;	41.04891	-76.090309	OSLD
11E1	4.7 mi. SW;	41.05188	-76.218713	OSLD
12E1 *	4.7 mi.WSW;	41.0725	-76.230331	OSLD
13E4	4.1 mi.W;	41.08962	-76.223726	OSLD

* Special Interest Area (other than controls)

TABLE B-1 (cont'd)

SAMPLING LOCATIONS

STATION CODE	STATION LOCATION	LATITUDINAL	LONGITUDINAL	SAMPLE TYPE
GREATER THAN FIVE MILES FROM THE SSES		DEG.	DEG.	
2F1	5.9 mi.NNE;	41.16796	-76.09146	OSLD
15F1	5.4 mi.NW;	41.15595	-76.202506	OSLD
16F1	7.8 mi.NNW;	41.18985	-76.229283	OSLD
3G4 **	17 mi.NE;	41.23431	-76.869061	OSLD
4G1 **	14 mi.ENE;	41.13898	-75.885121	OSLD
7G1 **	14 mi.SE;	40.94636	-76.974184	OSLD
12G1 **	15 mi.WSW;	41.0262	-76.411566	OSLD
12G4 **	10 mi. WSW;	40.03868	-76.327731	OSLD

* Special Interest Area (other than controls)

** Control Location

TABLE B-2

SUSQUEHANNA STEAM ELECTRIC STATION RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Sample Medium	Analysis	Sampling Method	Collection Procedure Number	Analytical Procedure Number
Ambient Radiation	Dosimeter	Quarterly	SSES, HP-TP-205	Landauer Procedure L313, Inlight Dosimeter Analysis
Air	Gross Beta	Weekly	Applied Ecoscience, Appendix 2	TBE-2008 Gross Alpha and/or Gross Beta Activity in Various Matrices.
Air	I-131	Weekly	Applied Ecoscience, Appendix 2	TBE-2012 Radioiodine in Various Matrices
Air	Gamma	Quarterly	Applied Ecoscience, Appendix 2	TBE-2007 Gamma Emitting Radioisotope Analysis
Drinking Water	Gross Beta	Monthly	Applied Ecoscience, Appendix 5	TBE-2008 Gross Alpha and/or Gross Beta Activity in Various Matrices.
Surface & Drinking Water	Tritium	Monthly	Applied Ecoscience, Appendix 3, 4, 5, 6, & 7	TBE-2010 Tritium and Carbon-14 Analysis by Liquid Scintillation.
Surface & Drinking Water	Gamma	Monthly	Applied Ecoscience, Appendix 3, 4, 5, 6, & 7	TBE-2007 Gamma Emitting Radioisotope Analysis.
Ground Water	Tritium	Quarterly	Applied Ecoscience, Appendix 8	TBE-2010 Tritium and Carbon-14 Analysis by Liquid Scintillation
Ground Water	Gamma	Quarterly	Applied Ecoscience, Appendix 8	TBE-2007 Gamma Emitting Radioisotope Analysis

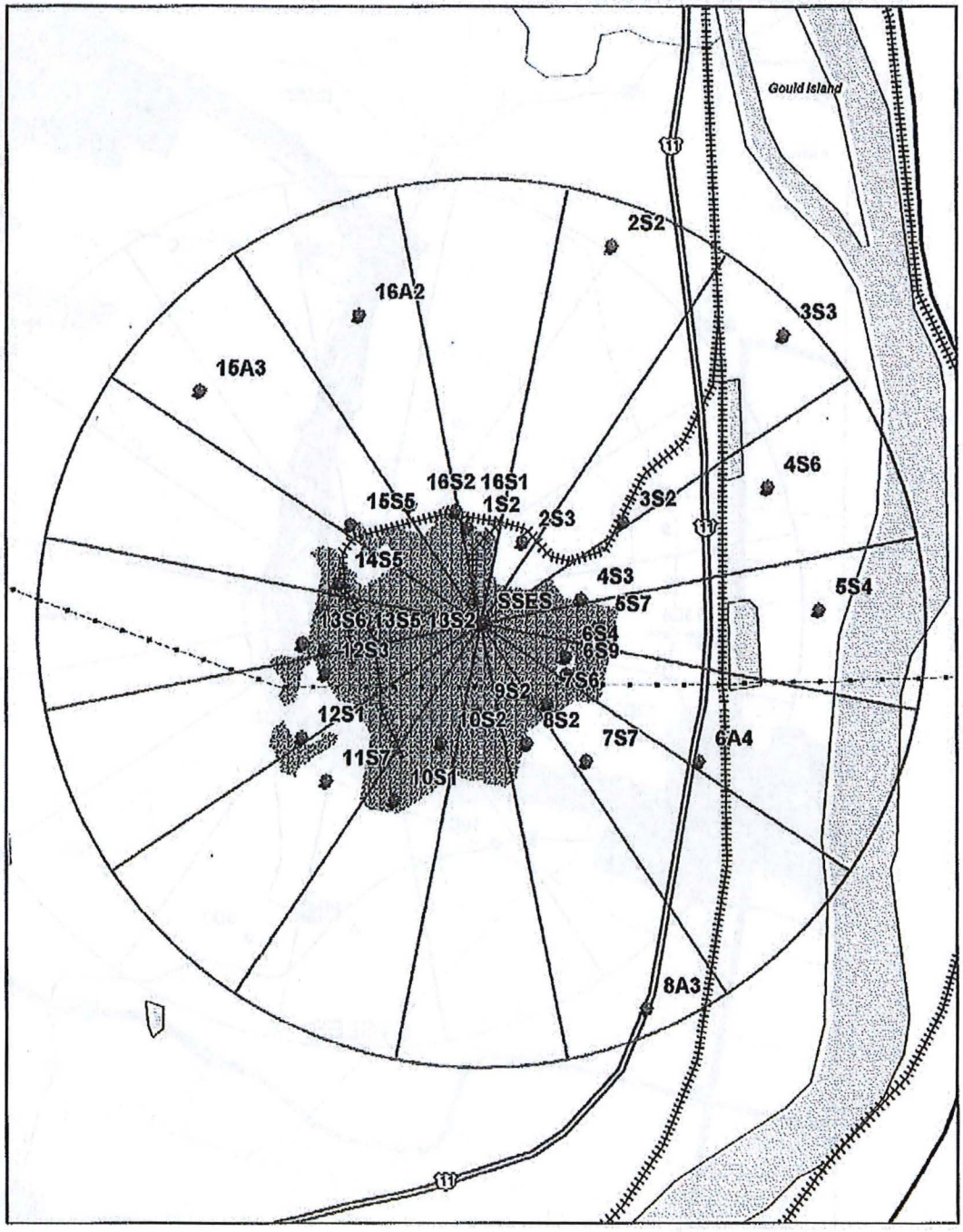
TABLE B-2 (cont'd)

SUSQUEHANNA STEAM ELECTRIC STATION RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Sample Medium	Analysis	Sampling Method	Collection Procedure Number	Analytical Procedure Number
Precipitation	Tritium	Monthly (Apr – Nov) / Quarterly	Applied Ecoscience, Appendix 10	TBE-2010 Tritium and Carbon-14 Analysis by Liquid Scintillation
Milk	Gamma	Monthly/Bi-Weekly	Applied Ecoscience, Appendix 9	TBE-2007 Gamma Emitting Radioisotope Analysis
Milk	I-131	Monthly/Bi-Weekly	Applied Ecoscience, Appendix 9	TBE-2012 Radioiodine in Various Matrices
Fish	Gamma	Semi-Annually (Spring/Fall)	Applied Ecoscience, Appendix 11	TBE-2007 Gamma Emitting Radioisotope Analysis
Sediment	Gamma	Semi-Annually (Spring/Fall)	Applied Ecoscience, Appendix 12	TBE-2007 Gamma Emitting Radioisotope Analysis
Fruits & Vegetables	Gamma	In Season (When available)	Applied Ecoscience, Appendix 13 Applied Ecoscience, Appendix 15	TBE-2007 Gamma Emitting Radioisotope Analysis

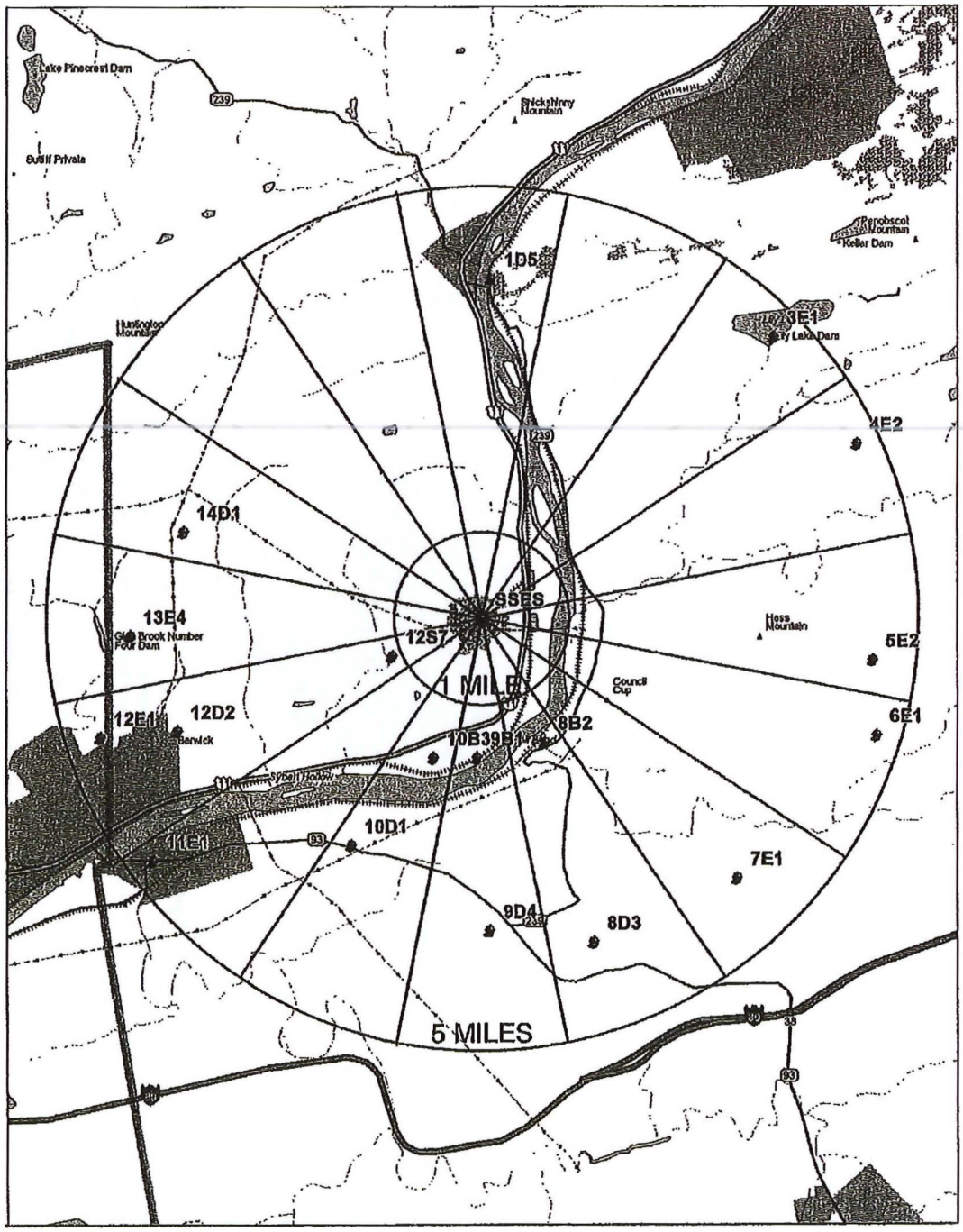
MAP B-1

Direct Radiation Monitoring Locations Within One Mile



MAP B-2

Direct Radiation Monitoring Locations From One to Five Miles

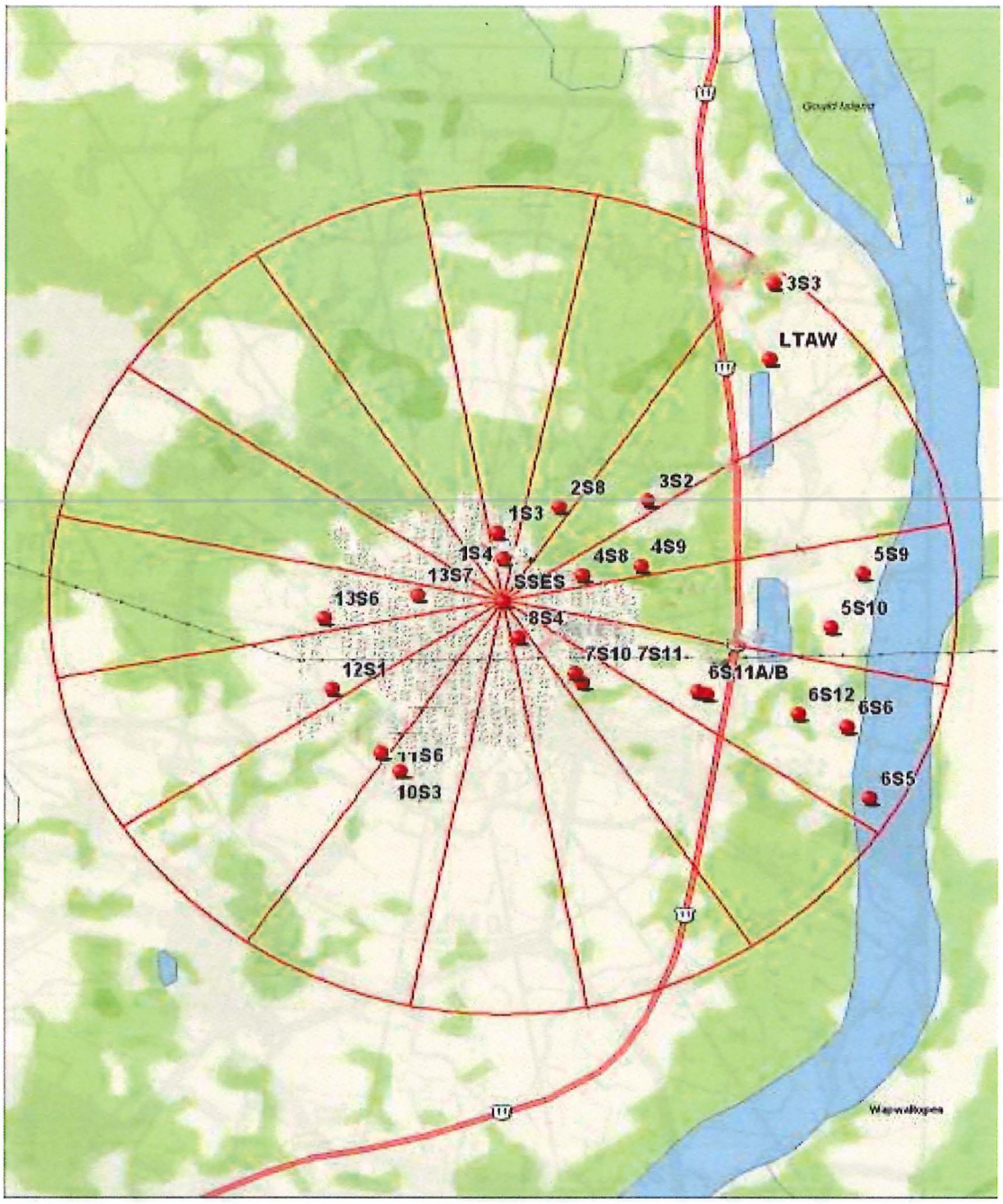


MAP B-3

Direct Radiation Monitoring Locations Greater Than Five Miles

MAP B-4

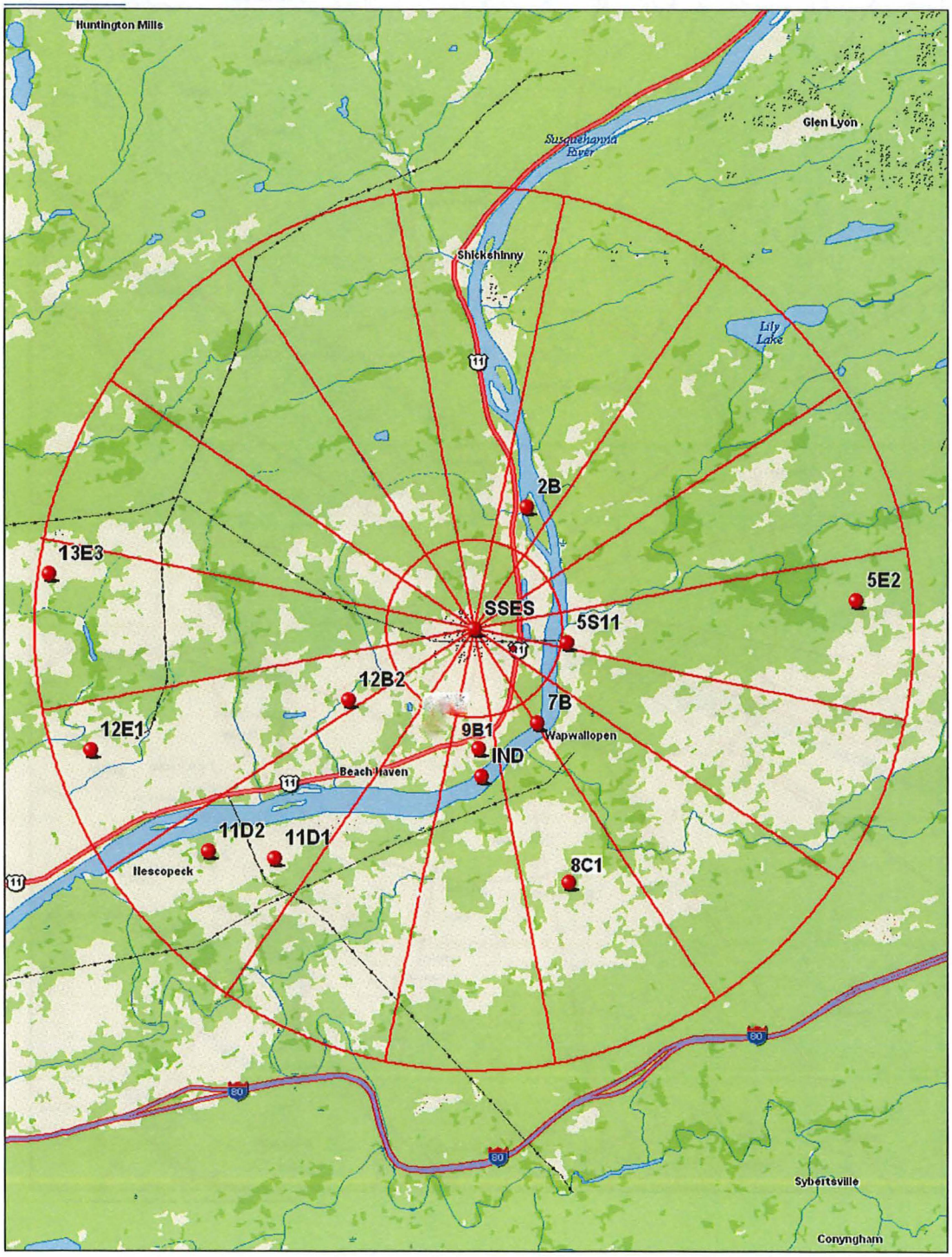
Environmental Sampling Locations Within One Mile



MAP B-5

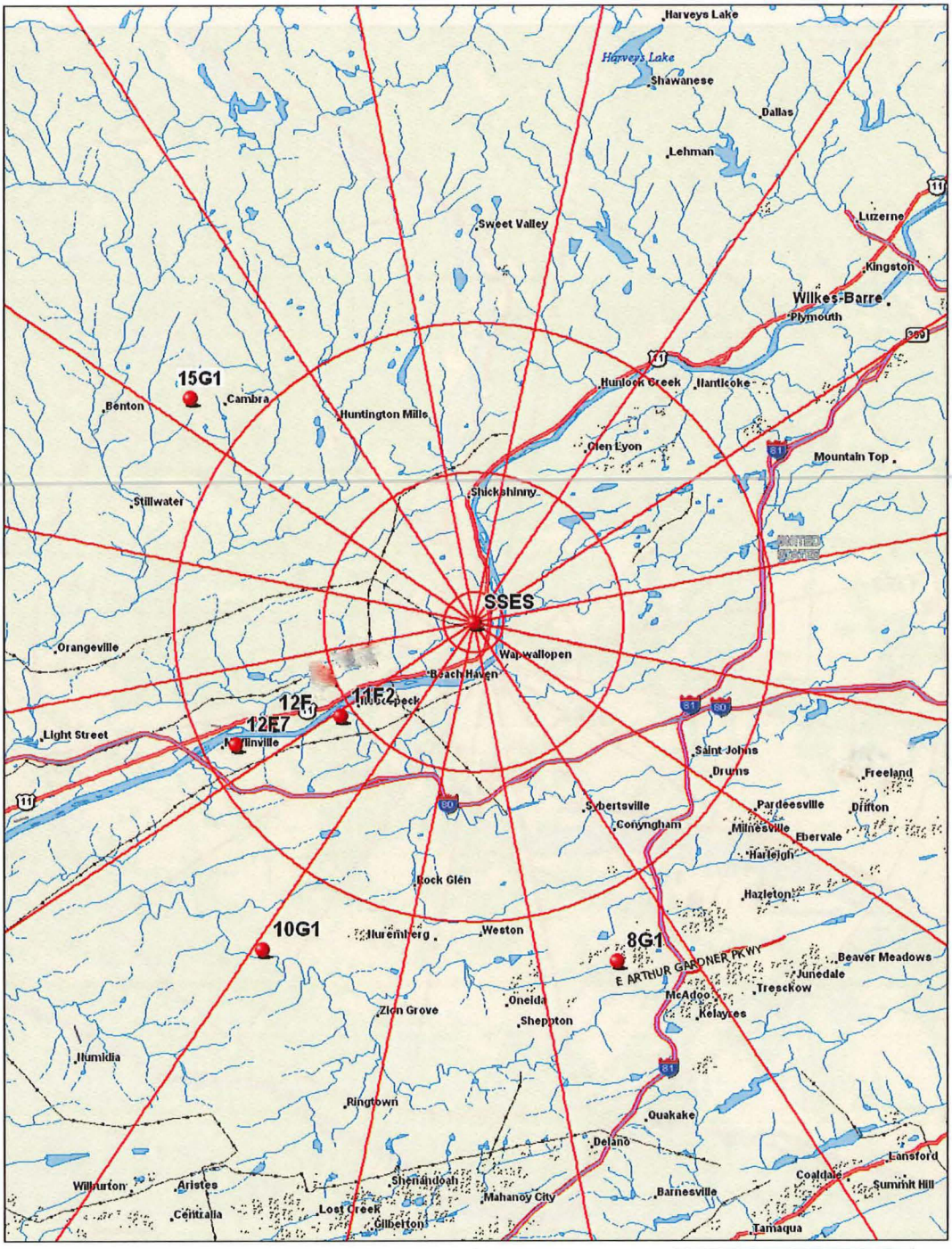
Environmental Sampling Locations

From One to Five Miles



MAP B-6

Environmental Sampling Locations Greater Than Five Miles



APPENDIX C

DATA TABLES

TABLE C-1 **GROSS BETA ANALYSES OF AIR PARTICULATE FILTERS**
SUSQUEHANNA STEAM ELECTRIC STATION, 2022

Results in units of E-03 pCi/cu.m. ± 2 sigma

COLLECTION PERIOD	3S2	8G1	12E1	12S1	13S6	9B1
12/29/21 - 01/05/22	17 ± 3	13 ± 2	18 ± 3	17 ± 2	18 ± 3	15 ± 2
01/05/22 - 01/12/22	21 ± 3	25 ± 3	21 ± 3	21 ± 3	23 ± 3	22 ± 3
01/12/22 - 01/19/22	23 ± 3	20 ± 3	24 ± 3	22 ± 3	23 ± 3	20 ± 3
01/19/22 - 01/26/22	17 ± 3	20 ± 3	19 ± 3	17 ± 2	21 ± 3	19 ± 3
01/26/22 - 02/01/22	19 ± 3	20 ± 3	22 ± 3	18 ± 3	19 ± 3	16 ± 3
02/01/22 - 02/09/22	14 ± 2	11 ± 2	13 ± 2	13 ± 2	14 ± 2	15 ± 2
02/09/22 - 02/16/22	15 ± 2	14 ± 2	15 ± 2	15 ± 2	15 ± 3	15 ± 2
02/16/22 - 02/23/22	17 ± 3	15 ± 2	14 ± 2	14 ± 2	16 ± 3	13 ± 2
02/23/22 - 03/02/22	15 ± 2	16 ± 2	15 ± 2	17 ± 2	17 ± 2	16 ± 2
03/02/22 - 03/09/22	17 ± 3	15 ± 2	16 ± 2	14 ± 2	19 ± 3	14 ± 2
03/09/22 - 03/16/22	15 ± 2	16 ± 2	14 ± 2	13 ± 2	18 ± 3	16 ± 2
03/16/22 - 03/23/22	17 ± 2	12 ± 2	13 ± 2	14 ± 2	17 ± 2	16 ± 2
03/23/22 - 03/30/22	8 ± 2	8 ± 2	8 ± 2	7 ± 2	9 ± 2	8 ± 2
03/30/22 - 04/06/22	13 ± 2	11 ± 2	16 ± 2	11 ± 2	14 ± 2	13 ± 2
04/06/22 - 04/13/22	7 ± 2	7 ± 2	7 ± 2	6 ± 2	7 ± 2	7 ± 2
04/13/22 - 04/20/22	10 ± 2	9 ± 2	10 ± 2	10 ± 2	12 ± 2	11 ± 2
04/20/22 - 04/27/22	17 ± 2	16 ± 2	15 ± 2	18 ± 3	15 ± 2	14 ± 2
04/27/22 - 05/04/22	15 ± 2	16 ± 2	15 ± 2	17 ± 2	15 ± 2	14 ± 2
05/04/22 - 05/11/22	15 ± 2	14 ± 2	15 ± 2	16 ± 2	16 ± 2	15 ± 2
05/11/22 - 05/18/22	7 ± 2	6 ± 2	8 ± 2	6 ± 2	9 ± 2	7 ± 2
05/18/22 - 05/25/22	14 ± 2	14 ± 2	13 ± 2	15 ± 2	15 ± 2	13 ± 2
05/25/22 - 06/01/22	12 ± 2	15 ± 2	11 ± 2	14 ± 2	13 ± 2	13 ± 2
06/01/22 - 06/08/22	17 ± 3	14 ± 2	15 ± 2	14 ± 2	16 ± 3	15 ± 2
06/08/22 - 06/15/22	11 ± 2	11 ± 2	10 ± 2	10 ± 2	11 ± 2	12 ± 2
06/15/22 - 06/22/22	11 ± 2	9 ± 2	9 ± 2	10 ± 2	10 ± 2	9 ± 2
06/22/22 - 06/29/22	10 ± 2	8 ± 2	9 ± 2	9 ± 2	9 ± 2	10 ± 2
06/29/22 - 07/06/22	17 ± 3	20 ± 3	19 ± 3	16 ± 3	19 ± 3	17 ± 2
07/06/22 - 07/12/22	11 ± 2	14 ± 3	12 ± 2	13 ± 3	15 ± 3	14 ± 3
07/12/22 - 07/20/22	15 ± 2	16 ± 2	13 ± 2	15 ± 2	18 ± 2	14 ± 2
07/20/22 - 07/27/22	19 ± 3	19 ± 3	17 ± 2	19 ± 3	19 ± 3	20 ± 3
07/27/22 - 08/02/22	21 ± 3	17 ± 3	20 ± 3	17 ± 3	17 ± 3	20 ± 3
08/02/22 - 08/09/22	17 ± 2	15 ± 2	16 ± 2	13 ± 2	18 ± 3	14 ± 2
08/09/22 - 08/17/22	14 ± 2	15 ± 2	15 ± 2	16 ± 2	16 ± 2	14 ± 2
08/17/22 - 08/24/22	17 ± 2	15 ± 2	17 ± 2	16 ± 2	19 ± 3	16 ± 2
08/24/22 - 08/31/22	23 ± 3	22 ± 3	24 ± 3	21 ± 3	22 ± 3	24 ± 3
08/31/22 - 09/07/22	13 ± 2	10 ± 2	12 ± 2	12 ± 2	14 ± 2	15 ± 2
09/07/22 - 09/14/22	11 ± 2	12 ± 2	14 ± 2	12 ± 2	12 ± 2	11 ± 2
09/14/22 - 09/21/22	19 ± 2	20 ± 3	20 ± 3	18 ± 3	17 ± 2	20 ± 3
09/21/22 - 09/28/22	49 ± 12	12 ± 2	18 ± 2	17 ± 2	14 ± 2	17 ± 2
09/28/22 - 10/05/22	(a)	11 ± 2	11 ± 2	9 ± 2	11 ± 2	11 ± 2
10/05/22 - 10/12/22	21 ± 4	20 ± 3	19 ± 3	18 ± 3	20 ± 2	17 ± 2
10/12/22 - 10/18/22	18 ± 3	19 ± 3	23 ± 3	20 ± 3	21 ± 3	22 ± 3
10/18/22 - 10/26/22	12 ± 2	13 ± 2	16 ± 2	15 ± 2	14 ± 2	15 ± 2
10/26/22 - 11/02/22	9 ± 2	10 ± 2	10 ± 2	11 ± 2	12 ± 2	13 ± 2
11/02/22 - 11/09/22	17 ± 2	14 ± 2	19 ± 2	19 ± 2	19 ± 2	18 ± 2
11/09/22 - 11/15/22	11 ± 2	10 ± 2	11 ± 2	9 ± 2	9 ± 2	12 ± 2
11/15/22 - 11/22/22	13 ± 2	13 ± 2	16 ± 2	13 ± 2	15 ± 2	14 ± 2
11/22/22 - 11/30/22	20 ± 2	18 ± 2	21 ± 2	21 ± 2	22 ± 3	24 ± 3
11/30/22 - 12/07/22	16 ± 2	15 ± 2	18 ± 2	19 ± 2	18 ± 2	17 ± 2
12/07/22 - 12/14/22	12 ± 2	10 ± 2	16 ± 2	16 ± 2	15 ± 2	15 ± 2
12/14/22 - 12/21/22	11 ± 2	12 ± 2	13 ± 2	11 ± 2	10 ± 2	11 ± 2
12/21/22 - 12/28/22	15 ± 2	27 ± 3	20 ± 2	17 ± 2	19 ± 2	20 ± 2
AVERAGE	16 ± 12	14 ± 9	15 ± 8	15 ± 8	16 ± 8	15 ± 8

(a) Sample unable to be obtained due to no power at the station.

TABLE C-1 **GROSS BETA ANALYSES OF AIR PARTICULATE FILTERS**
SUSQUEHANNA STEAM ELECTRIC STATION, 2022

Results in units of E-03 pCi/cu.m. ± 2 sigma

COLLECTION PERIOD	10S3
12/29/21 - 01/05/22	16 ± 2
01/05/22 - 01/12/22	22 ± 3
01/12/22 - 01/19/22	23 ± 3
01/19/22 - 01/26/22	19 ± 3
01/26/22 - 02/01/22	20 ± 3
02/01/22 - 02/09/22	13 ± 2
02/09/22 - 02/16/22	13 ± 2
02/16/22 - 02/23/22	15 ± 2
02/23/22 - 03/02/22	15 ± 2
03/02/22 - 03/09/22	15 ± 2
03/09/22 - 03/16/22	15 ± 2
03/16/22 - 03/23/22	16 ± 2
03/23/22 - 03/30/22	8 ± 2
03/30/22 - 04/06/22	11 ± 2
04/06/22 - 04/13/22	8 ± 2
04/13/22 - 04/20/22	11 ± 2
04/20/22 - 04/27/22	14 ± 2
04/27/22 - 05/04/22	16 ± 2
05/04/22 - 05/11/22	15 ± 2
05/11/22 - 05/18/22	7 ± 2
05/18/22 - 05/25/22	14 ± 2
05/25/22 - 06/01/22	13 ± 2
06/01/22 - 06/08/22	16 ± 3
06/08/22 - 06/15/22	12 ± 2
06/15/22 - 06/22/22	10 ± 2
06/22/22 - 06/29/22	10 ± 2
06/29/22 - 07/06/22	17 ± 3
07/06/22 - 07/12/22	12 ± 3
07/12/22 - 07/20/22	17 ± 2
07/20/22 - 07/27/22	21 ± 3
07/27/22 - 08/02/22	19 ± 3
08/02/22 - 08/09/22	16 ± 2
08/09/22 - 08/17/22	16 ± 2
08/17/22 - 08/24/22	19 ± 2
08/24/22 - 08/31/22	26 ± 3
08/31/22 - 09/07/22	15 ± 2
09/07/22 - 09/14/22	13 ± 2
09/14/22 - 09/21/22	21 ± 3
09/21/22 - 09/28/22	16 ± 2
09/28/22 - 10/05/22	12 ± 2
10/05/22 - 10/12/22	20 ± 3
10/12/22 - 10/18/22	25 ± 3
10/18/22 - 10/26/22	12 ± 2
10/26/22 - 11/02/22	11 ± 2
11/02/22 - 11/09/22	18 ± 2
11/09/22 - 11/15/22	13 ± 2
11/15/22 - 11/22/22	14 ± 2
11/22/22 - 11/30/22	23 ± 2
11/30/22 - 12/07/22	18 ± 2
12/07/22 - 12/14/22	15 ± 2
12/14/22 - 12/21/22	12 ± 2
12/21/22 - 12/28/22	18 ± 2
AVERAGE	15 ± 9

TABLE C-2 GAMMA SPECTROSCOPIC ANALYSES OF COMPOSITED AIR PARTICULATE FILTERS SUSQUEHANNA STEAM ELECTRIC STATION, 2022

Results in units of E-03 pCi/cu.m. ± 2 sigma

SITE	COLLECTION PERIOD	Be-7	K-40	Cs-134	Cs-137
8G1	12/29/21 - 03/30/22	108 ± 18	< 12	< 1	< 1
	03/30/22 - 06/29/22	129 ± 26	< 27	< 1	< 1
	06/29/22 - 09/28/22	109 ± 18	< 17	< 1	< 1
	09/28/22 - 12/28/22	69 ± 16	< 20	< 1	< 1
	AVERAGE	104 ± 50	-	-	-
3S2	12/29/21 - 03/30/22	118 ± 19	< 14	< 1	< 1
	03/30/22 - 06/29/22	106 ± 27	< 30	< 2	< 1
	06/29/22 - 09/22/22	134 ± 24	< 18	< 1	< 1
	10/08/22 - 12/28/22	68 ± 15	< 16	< 1	< 1
	AVERAGE	106 ± 56	-	-	-
12E1	12/29/21 - 03/30/22	98 ± 18	< 16	< 1	< 1
	03/30/22 - 06/29/22	108 ± 22	< 20	< 1	< 1
	06/29/22 - 09/28/22	122 ± 34	< 29	< 1	< 1
	09/28/22 - 12/28/22	70 ± 18	< 19	< 1	< 1
	AVERAGE	100 ± 44	-	-	-
12S1	12/29/21 - 03/30/22	106 ± 21	< 20	< 1	< 1
	03/30/22 - 06/29/22	109 ± 19	< 16	< 1	< 1
	06/29/22 - 09/28/22	128 ± 22	< 20	< 1	< 1
	09/28/22 - 12/28/22	63 ± 23	< 22	< 1	< 1
	AVERAGE	102 ± 55	-	-	-
13S6	12/29/21 - 03/30/22	108 ± 20	< 19	< 1	< 1
	03/30/22 - 06/29/22	97 ± 17	< 15	< 1	< 1
	06/29/22 - 09/28/22	137 ± 25	< 19	< 1	< 1
	09/28/22 - 12/28/22	70 ± 17	< 20	< 1	< 1
	AVERAGE	103 ± 56	-	-	-
9B1	12/29/21 - 03/30/22	114 ± 23	< 18	< 1	< 1
	03/30/22 - 06/29/22	117 ± 21	< 14	< 1	< 1
	06/29/22 - 09/28/22	134 ± 23	< 21	< 1	< 1
	09/28/22 - 12/28/22	72 ± 17	< 16	< 1	< 1
	AVERAGE	109 ± 53	-	-	-
10S3	12/29/21 - 03/30/22	124 ± 24	< 24	< 1	< 1
	03/30/22 - 06/29/22	127 ± 19	< 16	< 1	< 1
	06/29/22 - 09/28/22	115 ± 22	< 17	< 0	< 1
	09/28/22 - 12/28/22	84 ± 19	< 14	< 1	< 1
	AVERAGE	112 ± 39	-	-	-

TABLE C-3 **IODINE-131 ANALYSES OF AIR IODINE SAMPLES**
SUSQUEHANNA STEAM ELECTRIC STATION, 2022

Results in units of E-03 pCi/cu.m. ± 2 sigma

COLLECTION PERIOD	3S2	8G1	12E1	12S1	13S6	9B1
12/29/21 - 01/05/22	< 4	< 10	< 10	< 10	< 10	< 19
01/05/22 - 01/12/22	< 4	< 14	< 8	< 8	< 8	< 9
01/12/22 - 01/19/22	< 8	< 19	< 16	< 15	< 15	< 9
01/19/22 - 01/26/22	< 8	< 14	< 13	< 12	< 13	< 7
01/26/22 - 02/01/22	< 10	< 17	< 19	< 18	< 19	< 8
02/01/22 - 02/09/22	< 4	< 7	< 7	< 7	< 7	< 8
02/09/22 - 02/16/22	< 12	< 20	< 13	< 12	< 8	< 9
02/16/22 - 02/23/22	< 11	< 14	< 12	< 12	< 7	< 7
02/23/22 - 03/02/22	< 12	< 18	< 12	< 12	< 8	< 9
03/02/22 - 03/09/22	< 19	< 9	< 9	< 9	< 12	< 9
03/09/22 - 03/16/22	< 8	< 9	< 16	< 16	< 16	< 4
03/16/22 - 03/23/22	< 4	< 6	< 7	< 7	< 7	< 7
03/23/22 - 03/30/22	< 8	< 20	< 19	< 19	< 13	< 10
03/30/22 - 04/06/22	< 9	< 12	< 7	< 11	< 18	< 12
04/06/22 - 04/13/22	< 12	< 14	< 14	< 13	< 14	< 7
04/13/22 - 04/20/22	< 12	< 9	< 19	< 19	< 20	< 18
04/20/22 - 04/27/22	< 3	< 10	< 8	< 8	< 8	< 17
04/27/22 - 05/04/22	< 6	< 8	< 12	< 13	< 13	< 20
05/04/22 - 05/11/22	< 3	< 11	< 8	< 8	< 8	< 18
05/11/22 - 05/18/22	< 9	< 13	< 3	< 8	< 9	< 8
05/18/22 - 05/25/22	< 9	< 10	< 16	< 17	< 18	< 17
05/25/22 - 06/01/22	< 5	< 12	< 11	< 11	< 12	< 5
06/01/22 - 06/08/22	< 8	< 9	< 8	< 8	< 8	< 8
06/08/22 - 06/15/22	< 4	< 9	< 7	< 8	< 8	< 19
06/15/22 - 06/22/22	< 3	< 4	< 7	< 7	< 7	< 9
06/22/22 - 06/29/22	< 5	< 9	< 10	< 11	< 11	< 18
06/29/22 - 07/06/22	< 9	< 4	< 9	< 9	< 9	< 9
07/06/22 - 07/12/22	< 7	< 8	< 16	< 17	< 17	< 16
07/12/22 - 07/20/22	< 5	< 3	< 10	< 11	< 11	< 7
07/20/22 - 07/27/22	< 14	< 8	< 13	< 14	< 6	< 20
07/27/22 - 08/02/22	< 17	< 19	< 19	< 10	< 8	< 18
08/02/22 - 08/09/22	< 10	< 12	< 10	< 10	< 4	< 14
08/09/22 - 08/17/22	< 18	< 10	< 18	< 18	< 16	< 18
08/17/22 - 08/24/22	< 19	< 7	< 18	< 19	< 9	< 14
08/24/22 - 08/31/22	< 15	< 8	< 16	< 8	< 15	< 17
08/31/22 - 09/07/22	< 19	< 9	< 19	< 10	< 18	< 19
09/07/22 - 09/14/22	< 12	< 17	< 17	< 18	< 18	< 9
09/14/22 - 09/21/22	< 4	< 10	< 11	< 11	< 10	< 5
09/21/22 - 09/28/22	< 31	< 10	< 10	< 10	< 8	< 4
09/28/22 - 10/05/22	(a)	< 10	< 10	< 11	< 5	< 4
10/05/22 - 10/12/22	< 10	< 16	< 6	< 3	< 6	< 7
10/12/22 - 10/18/22	< 9	< 8	< 8	< 9	< 19	< 4
10/18/22 - 10/26/22	< 18	< 8	< 8	< 8	< 9	< 8
10/26/22 - 11/02/22	< 9	< 11	< 11	< 12	< 18	< 5
11/02/22 - 11/09/22	< 9	< 10	< 10	< 10	< 18	< 4
11/09/22 - 11/15/22	< 8	< 12	< 12	< 5	< 17	< 13
11/15/22 - 11/22/22	< 9	< 18	< 18	< 10	< 19	< 19
11/22/22 - 11/30/22	< 11	< 8	< 11	< 12	< 5	< 8
11/30/22 - 12/07/22	< 8	< 9	< 8	< 4	< 9	< 6
12/07/22 - 12/14/22	< 11	< 20	< 11	< 5	< 12	< 9
12/14/22 - 12/21/22	< 20	< 18	< 20	< 10	< 10	< 19
12/21/22 - 12/28/22	< 9	< 12	< 18	< 18	< 20	< 17
AVERAGE	-	-	-	-	-	-

(a) Sample unable to be obtained due to no power at the station.

TABLE C-3 **IODINE-131 ANALYSES OF AIR IODINE SAMPLES**
SUSQUEHANNA STEAM ELECTRIC STATION, 2022

Results in units of E-03 pCi/cu.m. ± 2 sigma

COLLECTION PERIOD	10S3
12/29/21 - 01/05/22	< 9
01/05/22 - 01/12/22	< 8
01/12/22 - 01/19/22	< 15
01/19/22 - 01/26/22	< 12
01/26/22 - 02/01/22	< 18
02/01/22 - 02/09/22	< 7
02/09/22 - 02/16/22	< 12
02/16/22 - 02/23/22	< 11
02/23/22 - 03/02/22	< 12
03/02/22 - 03/09/22	< 3
03/09/22 - 03/16/22	< 16
03/16/22 - 03/23/22	< 7
03/23/22 - 03/30/22	< 19
03/30/22 - 04/06/22	< 11
04/06/22 - 04/13/22	< 14
04/13/22 - 04/20/22	< 19
04/20/22 - 04/27/22	< 8
04/27/22 - 05/04/22	< 13
05/04/22 - 05/11/22	< 8
05/11/22 - 05/18/22	< 9
05/18/22 - 05/25/22	< 17
05/25/22 - 06/01/22	< 12
06/01/22 - 06/08/22	< 4
06/08/22 - 06/15/22	< 8
06/15/22 - 06/22/22	< 7
06/22/22 - 06/29/22	< 11
06/29/22 - 07/06/22	< 4
07/06/22 - 07/12/22	< 17
07/12/22 - 07/20/22	< 11
07/20/22 - 07/27/22	< 13
07/27/22 - 08/02/22	< 19
08/02/22 - 08/09/22	< 10
08/09/22 - 08/17/22	< 18
08/17/22 - 08/24/22	< 18
08/24/22 - 08/31/22	< 16
08/31/22 - 09/07/22	< 19
09/07/22 - 09/14/22	< 17
09/14/22 - 09/21/22	< 11
09/21/22 - 09/28/22	< 10
09/28/22 - 10/05/22	< 10
10/05/22 - 10/12/22	< 6
10/12/22 - 10/18/22	< 8
10/18/22 - 10/26/22	< 4
10/26/22 - 11/02/22	< 11
11/02/22 - 11/09/22	< 10
11/09/22 - 11/15/22	< 12
11/15/22 - 11/22/22	< 19
11/22/22 - 11/30/22	< 11
11/30/22 - 12/07/22	< 8
12/07/22 - 12/14/22	< 11
12/14/22 - 12/21/22	< 18
12/21/22 - 12/28/22	< 19
AVERAGE	-

TABLE C-4 ENVIRONMENTAL OPTICALLY STIMULATED LUMINESCENCE DOSIMETRY RESULTS SUSQUEHANNA STEAM ELECTRIC STATION, 2022

Results (1) are in mR/std. qtr (2) ± 2 sigma (3)

LOCATION	First Quarter 1/19/2022 to 3/24/2022	Second Quarter 3/24/2022 to 7/1/2022	Third Quarter 7/1/2022 to 10/1/2022	Fourth Quarter 10/1/2022 to 1/6/2023
ONSITE				
1S2	17.7 ± 0.2	(4)	25.3 ± 0.8	25.6 ± 0.6
2S2	12.1 ± 1.3	13.1 ± 0.1	13.5 ± 0.6	12.5 ± 0.8
2S3	19.9 ± 0.6	(4)	23.0 ± 0.1	17.0 ± 0.5
3S2	12.4 ± 1.5	12.6 ± 0.5	13.3 ± 0.8	11.3 ± 2.6
3S3	13.3 ± 2.0	13.4 ± 0.5	13.7 ± 0.7	9.4 ± 3.2
4S3	19.3 ± 0.5	17.7 ± 0.1	20.8 ± 0.7	18.5 ± 2.1
4S6	10.8 ± 1.0	13.2 ± 1.4	15.4 ± 1.7	11.8 ± 1.6
5S4	10.1 ± 1.0	11.9 ± 1.7	12.4 ± 0.3	10.8 ± 4.1
5S7	15.9 ± 1.9	14.5 ± 0.2	16.8 ± 1.2	17.3 ± 4.3
6S4	22.0 ± 3.7	22.6 ± 1.4	21.7 ± 2.1	22.7 ± 1.1
6S9	16.8 ± 5.2	21.2 ± 1.0	22.4 ± 0.3	20.2 ± 0.8
7S6	16.3 ± 2.2	21.2 ± 1.7	23.5 ± 1.0	19.6 ± 1.0
7S7	10.5 ± 0.3	13.8 ± 0.1	12.7 ± 0.4	9.7 ± 1.3
8S2	21.3 ± 0.8	19.0 ± 1.0	22.0 ± 0.7	22.5 ± 3.1
9S2	39.4 ± 1.5	35.5 ± 3.7	41.4 ± 1.7	41.7 ± 1.1
10S1	12.7 ± 1.3	13.1 ± 0.7	13.8 ± 1.5	13.6 ± 0.1
10S2	25.6 ± 0.2	24.6 ± 1.1	25.7 ± 0.3	20.8 ± 3.9
11S7	13.0 ± 0.3	13.9 ± 0.6	14.2 ± 1.5	12.6 ± 1.9
12S1	13.3 ± 2.7	16.6 ± 0.6	15.6 ± 0.3	13.9 ± 0.5
12S3	18.4 ± 3.2	18.7 ± 0.5	19.4 ± 1.3	17.7 ± 1.2
12S7	14.7 ± 0.7	14.3 ± 0.6	15.1 ± 1.2	12.5 ± 0.7
13S2	19.9 ± 3.3	18.9 ± 0.9	22.1 ± 2.8	17.6 ± 4.9
13S5	16.5 ± 2.9	21.3 ± 2.7	20.8 ± 0.7	15.7 ± 1.2
13S6	16.1 ± 0.2	18.7 ± 0.0	18.0 ± 0.3	17.7 ± 1.2
14S5	16.2 ± 0.1	10.2 ± 1.2	18.4 ± 0.3	14.7 ± 2.1
15S5	15.1 ± 0.5	16.9 ± 0.2	17.4 ± 1.4	12.9 ± 1.4
16S1	21.6 ± 0.2	21.5 ± 4.2	22.9 ± 0.1	22.0 ± 2.8
16S2	17.3 ± 2.7	17.9 ± 0.5	21.6 ± 0.8	18.9 ± 0.5

See the comments at the end of this table.

TABLE C-4 ENVIRONMENTAL OPTICALLY STIMULATED LUMINESCENCE DOSIMETRY RESULTS SUSQUEHANNA STEAM ELECTRIC STATION, 2022

Results (1) are in mR/std. qtr (2) ± 2 sigma (3)

LOCATION	First Quarter 1/19/2022 to 3/24/2022	Second Quarter 3/24/2022 to 7/1/2022	Third Quarter 7/1/2022 to 10/1/2022	Fourth Quarter 10/1/2022 to 1/6/2023
0-1 MILE OFFSITE				
6A4	12.4 ± 2.8	16.7 ± 0.9	17.1 ± 1.1	14.9 ± 0.4
8A3	15.2 ± 2.0	14.6 ± 2.6	15.0 ± 0.1	13.7 ± 2.9
15A3	9.3 ± 3.3	11.7 ± 0.1	12.8 ± 1.2	10.8 ± 1.9
16A2	10.5 ± 1.0	11.3 ± 1.1	12.8 ± 1.0	9.4 ± 0.8
1-2 MILES OFFSITE				
8B2	12.9 ± 1.6	13.5 ± 0.5	14.9 ± 1.4	15.1 ± 0.3
9B1	14.2 ± 1.1	17.2 ± 0.5	14.3 ± 0.3	10.4 ± 3.0
10B3	31.0 ± 3.2	13.3 ± 0.5	12.8 ± 0.1	10.0 ± 1.6
3-4 MILES OFFSITE				
1D5	15.2 ± 0.4	13.4 ± 1.4	17.3 ± 0.2	17.1 ± 0.3
8D3	10.6 ± 1.7	13.2 ± 0.0	14.3 ± 0.6	14.6 ± 0.8
9D4	13.3 ± 1.9	13.9 ± 0.3	16.8 ± 0.1	16.2 ± 1.4
10D1	13.2 ± 0.2	15.2 ± 0.6	15.2 ± 0.6	15.3 ± 1.4
12D2	20.4 ± 2.7	17.7 ± 0.1	18.7 ± 1.7	18.3 ± 0.2
14D1	12.8 ± 0.8	14.2 ± 2.7	15.4 ± 2.2	13.3 ± 1.0
4-5 MILES OFFSITE				
3E1	11.0 ± 2.1	11.9 ± 0.1	13.4 ± 0.0	13.1 ± 3.6
4E2	15.3 ± 1.2	15.4 ± 0.0	17.3 ± 0.1	16.7 ± 0.1
5E2	14.1 ± 0.9	14.8 ± 0.4	16.1 ± 0.8	17.4 ± 2.8
6E1	16.2 ± 0.1	15.7 ± 0.4	17.4 ± 1.7	18.0 ± 0.7
7E1	14.4 ± 0.3	14.5 ± 1.0	14.9 ± 1.2	16.2 ± 1.8
11E1	8.5 ± 0.9	10.5 ± 1.4	11.3 ± 1.2	10.8 ± 0.3
12E1	10.2 ± 0.9	12.1 ± 0.6	12.1 ± 0.6	12.0 ± 1.1
13E4	15.8 ± 2.5	18.5 ± 0.1	16.9 ± 0.2	15.6 ± 0.6

See the comments at the end of this table.

TABLE C-4 ENVIRONMENTAL OPTICALLY STIMULATED LUMINESCENCE DOSIMETRY RESULTS SUSQUEHANNA STEAM ELECTRIC STATION, 2022

Results (1) are in mR/std. qtr (2) ± 2 sigma (3)

LOCATION	First Quarter 1/19/2022 to 3/24/2022	Second Quarter 3/24/2022 to 7/1/2022	Third Quarter 7/1/2022 to 10/1/2022	Fourth Quarter 10/1/2022 to 1/6/2023
5-10 MILES OFFSITE				
2F1	13.8 ± 2.8	12.7 ± 0.9	16.6 ± 1.4	15.3 ± 2.3
15F1	13.3 ± 2.9	16.6 ± 0.1	16.8 ± 0.7	13.4 ± 0.9
16F1	14.9 ± 0.6	17.6 ± 1.2	19.6 ± 2.0	12.1 ± 3.9
10-20 MILES OFFSITE				
3G4	15.7 ± 1.4	14.6 ± 1.6	15.9 ± 0.6	17.9 ± 0.3
4G1	15.0 ± 1.0	15.3 ± 0.6	15.9 ± 1.7	15.5 ± 0.9
7G1	12.3 ± 0.1	13.0 ± 0.6	13.4 ± 0.2	13.3 ± 2.3
12G1	13.3 ± 1.3	12.5 ± 0.9	13.0 ± 1.4	12.6 ± 0.8
12G4	13.4 ± 1.7	14.8 ± 2.3	16.3 ± 1.2	15.7 ± 1.4

See the comments at the end of this table.

LOCATION				
INDICATOR				
Average (5)	15.7 ± 10.8	16.0 ± 8.7	17.5 ± 10.0	15.8 ± 10.5
CONTROL				
Average (5)	13.9 ± 2.8	14.0 ± 2.5	14.9 ± 3.2	15.0 ± 4.2

COMMENTS

(1) Individual monitor location results are normally the average of the elemental doses of four elements from the two dosimeters assigned to each monitoring location.
(2) A standard (std.) quarter (qtr.) is considered to be 91.25 days. Results obtained for monitoring periods of other durations are normalized by multiplying them by 91.25/x, where x is the actual duration in days of the period.
(3) Uncertainties for individual monitoring location results are two standard deviations of the elemental doses of four elements from the two dosimeters assigned to each monitoring location, representing the variability between the elemental doses of each of the four dosimeter elements.
(4) No measurement could be made at this location because the dosimeters were lost, stolen, or damaged. Refer to Appendix A of the Annual Radiological Environmental Operating Report for an explanation of program exceptions to REMP.
(5) Uncertainties associated with quarterly indicator and control averages are two standard deviations, representing the variability between the results of the individual monitoring locations.

TABLE C-5 IODINE-131 AND GAMMA SPECTROSCOPIC ANALYSES OF MILK SUSQUEHANNA STEAM ELECTRIC STATION, 2022

Results in pCi/Liter ± 2 sigma

SITE	COLLECTION DATE	I-131	<----------GAMMA EMITTERS----------> K-40	Cs-134	Cs-137	Ba-140	La-140	Th-228
10G1	01/10/22	< 0.7	1235 ± 161	< 7	< 8	< 31	< 9	< 13
	02/07/22	< 0.9	1323 ± 162	< 6	< 7	< 27	< 9	< 15
	03/07/22	< 0.6	1393 ± 223	< 8	< 9	< 32	< 11	< 14
	04/11/22	< 1.0	1384 ± 171	< 7	< 8	< 27	< 6	< 15
	04/24/22	< 0.8	1195 ± 195	< 9	< 10	< 42	< 12	< 19
	05/09/22	< 0.9	1334 ± 174	< 6	< 7	< 23	< 7	< 15
	05/23/22	< 0.8	1430 ± 132	< 4	< 6	< 17	< 6	< 10
	06/06/22	< 0.6	1313 ± 191	< 7	< 8	< 24	< 9	< 14
	06/20/22	< 1.0	1249 ± 200	< 7	< 9	< 34	< 11	< 13
	07/05/22	< 0.8	1384 ± 193	< 8	< 8	< 26	< 12	< 14
	07/18/22	< 0.7	1387 ± 218	< 6	< 9	< 29	< 11	< 15
	08/01/22	< 0.6	1416 ± 227	< 6	< 7	< 35	< 10	< 12
	08/16/22	< 0.7	1254 ± 148	< 7	< 7	< 31	< 9	< 13
	08/29/22	< 0.8	1243 ± 176	< 6	< 7	< 24	< 7	< 10
	09/12/22	< 0.9	1129 ± 182	< 7	< 8	< 27	< 7	< 14
	09/26/22	< 0.8	1391 ± 201	< 8	< 7	< 23	< 8	< 14
	10/10/22	< 0.4	1374 ± 195	< 6	< 8	< 36	< 12	< 16
	10/22/22	< 0.8	1161 ± 94	< 3	< 4	< 13	< 4	< 6
	11/07/22	< 0.8	1337 ± 181	< 7	< 6	< 23	< 9	< 13
	12/05/22	< 0.6	1302 ± 179	< 7	< 8	< 23	< 8	< 12
	AVERAGE	-	1312 ± 176	-	-	-	-	-
13E3	01/10/22	< 0.8	1262 ± 184	< 6	< 9	< 31	< 7	< 16
	02/07/22	< 0.7	1192 ± 188	< 5	< 9	< 32	< 12	< 13
	03/08/22	< 0.8	1270 ± 183	< 7	< 9	< 33	< 6	< 15
	04/11/22	< 0.6	1174 ± 164	< 6	< 7	< 23	< 5	< 15
	04/24/22	< 0.7	1113 ± 159	< 7	< 8	< 34	< 11	< 13
	05/09/22	< 0.7	1209 ± 164	< 5	< 6	< 30	< 7	< 15
	05/23/22	< 0.8	1158 ± 91	< 3	< 4	< 13	< 5	< 6
	06/06/22	< 0.5	1351 ± 184	< 7	< 9	< 28	< 12	< 16
	06/20/22	< 0.9	1355 ± 183	< 6	< 9	< 31	< 9	< 16
	07/05/22	< 0.9	1160 ± 165	< 6	< 7	< 31	< 12	< 10
	07/18/22	< 0.7	1291 ± 160	< 7	< 8	< 27	< 11	< 13
	08/01/22	< 0.6	1151 ± 152	< 7	< 8	< 26	< 10	< 12
	08/16/22	< 0.7	1269 ± 193	< 6	< 8	< 30	< 11	< 15
	08/29/22	< 0.9	1284 ± 139	< 6	< 7	< 25	< 7	< 10
	09/12/22	< 0.8	1182 ± 151	< 7	< 8	< 25	< 9	< 12
	09/26/22	< 1.0	1244 ± 188	< 7	< 7	< 27	< 9	< 14
	10/10/22	< 0.3	1355 ± 161	< 7	< 7	< 31	< 8	< 17
	10/22/22	< 0.9	1186 ± 91	< 3	< 4	< 15	< 4	< 6
	11/07/22	< 0.8	1217 ± 160	< 7	< 7	< 29	< 8	< 14
	12/05/22	< 0.7	1124 ± 183	< 7	< 7	< 30	< 9	< 14
	AVERAGE	-	1227 ± 150	-	-	-	-	-

TABLE C-5 IODINE-131 AND GAMMA SPECTROSCOPIC ANALYSES OF MILK SUSQUEHANNA STEAM ELECTRIC STATION, 2022

Results in pCi/Liter ± 2 sigma

SITE	COLLECTION DATE	I-131	<----------GAMMA EMITTERS---------->					
			K-40	Cs-134	Cs-137	Ba-140	La-140	Th-228
5E2	01/10/22	< 0.8	1219 ± 159	< 6	< 7	< 24	< 9	< 14
	02/07/22	< 0.7	1339 ± 167	< 7	< 6	< 25	< 9	< 13
	03/07/22	< 0.8	1246 ± 191	< 7	< 9	< 32	< 11	< 17
	04/11/22	< 0.8	1168 ± 150	< 6	< 7	< 25	< 11	< 11
	04/24/22	< 0.6	1247 ± 181	< 7	< 8	< 28	< 11	< 17
	05/09/22	< 0.8	1145 ± 139	< 6	< 6	< 25	< 8	< 10
	05/23/22	< 0.8	1220 ± 82	< 3	< 3	< 12	< 4	< 6
	06/06/22	< 0.6	1090 ± 200	< 6	< 6	< 24	< 8	< 13
	06/20/22	< 0.9	1131 ± 173	< 8	< 10	< 31	< 10	< 16
	07/06/22	< 0.7	1187 ± 153	< 6	< 6	< 25	< 6	< 12
	07/18/22	< 0.9	1413 ± 188	< 8	< 10	< 28	< 7	< 14
	08/01/22	< 0.9	1116 ± 158	< 6	< 9	< 32	< 11	< 13
	08/16/22	< 0.7	1376 ± 179	< 7	< 9	< 34	< 7	< 14
	08/29/22	< 0.5	1240 ± 184	< 7	< 10	< 25	< 7	< 14
	09/12/22	< 0.8	1432 ± 183	< 6	< 9	< 30	< 9	< 15
	09/26/22	< 0.8	1223 ± 125	< 4	< 5	< 18	< 5	< 9
	10/10/22	< 0.6	1026 ± 160	< 7	< 8	< 24	< 9	< 14
	10/22/22	< 0.9	1249 ± 79	< 3	< 3	< 14	< 4	< 7.4
	11/07/22	< 0.7	1162 ± 174	< 7	< 7	< 29	< 8	< 13
	12/05/22	< 0.8	1188 ± 151	< 5	< 6	< 22	< 7	< 11
	AVERAGE	-	1221 ± 210	-	-	-	-	-

TABLE C-6 TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF GROUNDWATER SUSQUEHANNA STEAM ELECTRIC STATION, 2022

Results in pCi/Liter ± 2 sigma

SITE	COLLECTION DATE	H-3	<----------GAMMA EMITTERS----------> K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140	Th-228
2S8	01/28/22	< 377	< 119	< 6	< 6	< 17	< 6	< 11	< 7	< 10	< 8	< 6	< 6	< 25	< 8	< 10
	05/05/22	< 368	< 114	< 6	< 7	< 19	< 8	< 14	< 5	< 13	< 8	< 6	< 5	< 25	< 7	< 13
	07/21/22	< 345	< 105	< 5	< 6	< 14	< 8	< 10	< 5	< 8	< 8	< 6	< 5	< 22	< 8	< 11
	10/09/22	< 372	< 44	< 2	< 3	< 7	< 3	< 6	< 3	< 5	< 4	< 2	< 3	< 11	< 4	< 5
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13S7	02/02/22	< 384	< 145	< 5	< 6	< 16	< 6	< 16	< 6	< 8	< 11	< 7	< 8	< 30	< 10	< 11
	05/03/22	< 361	< 110	< 6	< 5	< 13	< 5	< 15	< 6	< 12	< 10	< 6	< 6	< 31	< 12	< 12
	07/19/22	< 332	< 120	< 8	< 8	< 24	< 8	< 19	< 8	< 16	< 13	< 7	< 9	< 39	< 14	< 16
	10/11/22	< 374	< 147	< 7	< 6	< 23	< 9	< 13	< 6	< 12	< 10	< 5	< 7	< 35	< 12	< 13
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1S3	02/02/22	< 380	< 116	< 6	< 7	< 17	< 6	< 13	< 8	< 12	< 11	< 4	< 6	< 29	< 11	< 12
	05/03/22	< 368	< 126	< 6	< 5	< 16	< 6	< 15	< 7	< 10	< 10	< 7	< 6	< 28	< 10	< 13
	07/19/22	< 330	< 96	< 6	< 4	< 15	< 8	< 13	< 5	< 10	< 7	< 6	< 7	< 27	< 6	< 10
	10/11/22	< 365	< 126	< 7	< 5	< 17	< 7	< 14	< 7	< 15	< 9	< 6	< 7	< 25	< 13	< 10
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4S8	02/02/22	< 385	< 115	< 7	< 7	< 22	< 7	< 17	< 9	< 8	< 13	< 7	< 7	< 35	< 10	< 12
	05/03/22	< 366	< 108	< 7	< 7	< 19	< 6	< 12	< 8	< 12	< 11	< 7	< 7	< 32	< 14	< 12
	07/19/22	370 ± 245	< 128	< 7	< 7	< 22	< 10	< 14	< 7	< 10	< 7	< 5	< 6	< 26	< 7	< 14
	10/11/22	< 368	< 143	< 8	< 7	< 15	< 8	< 13	< 9	< 11	< 12	< 7	< 9	< 27	< 13	< 15
	AVERAGE	370 ± 0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4S9	02/07/22	< 362	< 112	< 6	< 5	< 19	< 6	< 14	< 5	< 9	< 8	< 6	< 7	< 27	< 8	< 13
	05/05/22	< 374	< 110	< 7	< 9	< 19	< 7	< 13	< 8	< 11	< 11	< 6	< 7	< 36	< 8	< 11
	07/21/22	< 351	< 124	< 5	< 5	< 21	< 8	< 11	< 7	< 9	< 7	< 6	< 6	< 27	< 12	< 12
	10/09/22	< 376	< 43	< 2	< 2	< 6	< 2	< 5	< 2	< 4	< 3	< 2	< 2	< 10	< 3	< 5
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6S11A	01/31/22	< 377	< 165	< 9	< 8	< 25	< 11	< 17	< 9	< 16	< 12	< 9	< 9	< 36	< 12	< 16
	05/09/22	< 364	< 110	< 7	< 5	< 15	< 4	< 11	< 6	< 11	< 6	< 6	< 7	< 23	< 8	< 11
	07/19/22	< 343	< 128	< 7	< 6	< 18	< 8	< 11	< 7	< 10	< 9	< 6	< 7	< 29	< 7	< 11
	10/11/22	< 381	< 133	< 5	< 6	< 23	< 8	< 15	< 8	< 14	< 9	< 6	< 7	< 29	< 10	< 12
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE C-6 TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF GROUNDWATER SUSQUEHANNA STEAM ELECTRIC STATION, 2022

Results in pCi/Liter ± 2 sigma

SITE	COLLECTION DATE	H-3	<----------GAMMA EMITTERS---------->													
			K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140	Th-228
6S12	01/31/22	< 375	< 98	< 6	< 6	< 17	< 7	< 14	< 7	< 12	< 7	< 6	< 6	< 25	< 8	< 11
	05/09/22	< 365	< 99	< 7	< 7	< 16	< 7	< 15	< 8	< 14	< 8	< 7	< 5	< 23	< 9	< 13
	07/20/22	< 345	< 114	< 7	< 6	< 18	< 8	< 10	< 7	< 11	< 9	< 6	< 8	< 31	< 13	< 12
	10/12/22	< 387	< 176	< 7	< 8	< 19	< 10	< 13	< 9	< 15	< 11	< 7	< 8	< 37	< 9	< 16
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7S10	02/03/22	< 386	< 135	< 7	< 5	< 22	< 7	< 9	< 7	< 11	< 15	< 6	< 8	< 36	< 11	< 15
	05/06/22	< 354	< 136	< 7	< 7	< 18	< 6	< 14	< 7	< 9	< 10	< 7	< 6	< 27	< 10	< 16
	07/21/22	< 348	< 113	< 9	< 7	< 22	< 11	< 27	< 10	< 19	< 13	< 11	< 11	< 40	< 14	< 18
	10/13/22	< 368	< 171	< 7	< 7	< 17	< 7	< 15	< 10	< 10	< 11	< 7	< 9	< 37	< 10	< 13
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7S11	02/03/22	< 380	< 124	< 5	< 5	< 15	< 7	< 14	< 7	< 11	< 11	< 7	< 7	< 31	< 12	< 13
	05/06/22	< 367	< 77	< 3	< 4	< 11	< 4	< 8	< 4	< 8	< 6	< 4	< 4	< 20	< 5	< 7
	07/21/22	< 335	< 97	< 4	< 5	< 13	< 5	< 11	< 6	< 11	< 7	< 6	< 7	< 19	< 10	< 12
	10/13/22	< 384	< 34	< 5	< 6	< 16	< 7	< 14	< 6	< 12	< 9	< 6	< 7	< 24	< 9	< 13
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8S4	02/02/22	< 373	< 86	< 5	< 5	< 18	< 6	< 10	< 7	< 13	< 13	< 5	< 6	< 30	< 7	< 12
	05/03/22	< 387	< 98	< 4	< 6	< 7	< 4	< 12	< 6	< 10	< 9	< 4	< 5	< 24	< 13	< 12
	07/19/22	< 394	< 121	< 7	< 7	< 17	< 7	< 12	< 8	< 12	< 10	< 7	< 6	< 30	< 7	< 14
	10/11/22	< 385	< 163	< 7	< 8	< 20	< 7	< 16	< 8	< 14	< 11	< 7	< 7	< 28	< 14	< 12
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1S4	02/02/22	< 357	< 87	< 4	< 5	< 16	< 5	< 9	< 5	< 9	< 8	< 4	< 4	< 24	< 7	< 7
	05/03/22	< 364	< 121	< 7	< 6	< 17	< 8	< 12	< 5	< 12	< 8	< 6	< 9	< 28	< 11	< 13
	07/19/22	< 326	< 115	< 6	< 5	< 15	< 6	< 14	< 6	< 11	< 11	< 6	< 6	< 28	< 9	< 11
	10/11/22	< 377	< 131	< 7	< 6	< 16	< 7	< 11	< 7	< 13	< 11	< 7	< 6	< 34	< 7	< 14
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE C-7

ANNUAL AVERAGE TRITIUM CONCENTRATION IN PRECIPITATION, MONITORING WELLS AND LAKE TOOK-A-WHILE (LTAW) SURFACE WATER DATA SUSQUEHANNA STEAM ELECTRIC STATION, 2022

Results in pCi/Liter ± 2 sigma

SITE	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Precip Sites 3S2**, 12S1**, 8G1** (offsite, controls)	62*	49	40	38	82	63	51	39	45	32	45	**	**	**	**
Precip Sites 1 and 2 (onsite, East of Station Reactor Bldgs)	370	230*	193	216	242	182	142	250	206	251	325	333	252	336	273
Precipitation Sites 3 and 4 (onsite, West of Station Reactor Bldgs)	414	404*	350	233	169	151	231	258	197	383	494	355	350	382	467
1S3 - MW-1 (43')	248	150	252	131	164	197	115	169	175	130	218	253	200	187	182
1S4 - Tap Water Sample	Not sampled	Not sampled	Not sampled	Not sampled	Not sampled	Not sampled	Not sampled	Not sampled	Not sampled	Not sampled	Not sampled	Not sampled	28	44	-17
4S8 - MW-2 (45')	292	154	190	173	137	202	187	138	154	138	191	196	239	194	282
4S9 - MW-3 (94')	127	54	150	64	80	135	94	180	125	55	109	92	77	86	102
8S4 - MW-4 (111')	172	66	105	68	81	109	60	162	145	91	102	155	96	109	181
7S10 - MW-5 (36')	171	69	96	-6	74	106	68	70	73	51	93	125	86	82	62
13S7 - MW-6 (16')	142	134	143	34	80	111	71	79	111	107	122	120	150	110	83
2S8 - MW-7 (85')	Not installed	Not installed	Not installed	22	54	72	70	70	74	56	37	71	63	35	86
6S11A - MW-8A (14')	177	82	165	58	15	72	103	110	63	38	50	83	72	48	30
6S11B - MW-8B (19')	Dry well	Dry well	Dry well	Dry well	Dry well	Dry well	Dry well	Dry well	Dry well	Dry well	Dry well	Dry well	Dry well	Dry well	Dry well
6S12 - MW-9 (28')	30	-44	45	18	6	60	21	57	70	5	27	50	47	41	9
7S11 - MW-10 (132')	3	-27	-9	1	-1	23	29	55	13	1	33	16	3	7	23
**12F3 - Groundwater Control	26	-53	-2	5	-6	45	-26	20	41	61	82	**	**	**	**
**LTAW- Surface Water	179	104	110	132	132	145	27	73	89	77	135	**	**	**	**

* Revised values to reflect full scope of precipitation data.

** Stations were discontinued after 5/30/18.

TABLE C-8 GROSS BETA, TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF DRINKING WATER SUSQUEHANNA STEAM ELECTRIC STATION, 2022

Results in pCi/Liter ± 2 sigma

	COLLECTION PERIOD				<----------GAMMA EMITTERS---------->												
SITE	START	STOP	Gr-B	H-3	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140
12H2	12/28/21	01/25/22	3.2 ± 1.5	< 156	< 18	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 7	< 2	< 2	< 14	< 5
12H2	01/25/22	02/22/22	3.2 ± 1.4	< 340	< 30	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 6	< 1	< 1	< 12	< 4
12H2	02/22/22	03/29/22	< 1.9	< 360	< 26	< 2	< 2	< 5	< 1	< 3	< 2	< 3	< 11	< 1	< 2	< 17	< 6
12H2	03/29/22	04/26/22	< 1.9	< 362	< 23	< 1	< 2	< 5	< 1	< 3	< 2	< 3	< 6	< 1	< 2	< 13	< 4
12H2	04/26/22	05/31/22	< 1.8	< 377	< 25	< 1	< 2	< 5	< 2	< 3	< 2	< 3	< 12	< 1	< 2	< 18	< 7
12H2	05/31/22	06/28/22	2.6 ± 1.5	< 382	< 16	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 9	< 1	< 2	< 17	< 6
12H2	06/28/22	07/26/22	2.6 ± 1.5	< 342	< 17	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 9	< 2	< 2	< 17	< 6
12H2	07/26/22	08/30/22	3.2 ± 1.7	< 381	< 31	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 9	< 2	< 2	< 16	< 6
12H2	08/30/22	09/27/22	3.2 ± 1.7	< 345	< 31	< 2	< 2	< 6	< 2	< 4	< 2	< 3	< 9	< 2	< 2	< 17	< 7
12H2	09/27/22	10/25/22	< 2.0	< 370	< 31	< 1	< 2	< 5	< 2	< 3	< 2	< 3	< 7	< 2	< 2	< 13	< 5
12H2	10/25/22	11/29/22	< 2.3	< 395	< 28	< 1	< 2	< 5	< 1	< 3	< 2	< 3	< 15	< 1	< 1	< 20	< 7
12H2	11/29/22	12/27/22	2.2 ± 1.2	< 334	< 15	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 9	< 1	< 2	< 16	< 5
		AVERAGE	2.9 ± 0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE C-9 **GAMMA SPECTROSCOPIC ANALYSES OF FOOD PRODUCTS (FRUITS, VEGETABLES AND BROADLEAF)**
SUSQUEHANNA STEAM ELECTRIC STATION, 2022

Results in pCi/kg (wet) ± 2 sigma

SITE	COLLECTION DATE	SAMPLE TYPE	Be-7	K-40	I-131	Cs-134	Cs-137	Ac-228	Th-228
11D1	12/02/22	Soybeans	< 256	14660 ± 981	< 50	< 31	< 34	< 134	< 55
	12/02/22	Corn	< 278	2838 ± 629	< 37	< 25	< 23	< 146	< 58
	AVERAGE		-	8749 ± 16719	-	-	-	-	-
11S6	06/27/22	Swiss Chard	311 ± 191	4695 ± 613	< 24	< 17	< 23	< 112	< 45
	06/27/22	Collard	< 204	3105 ± 445	< 24	< 21	< 22	< 75	< 36
	07/27/22	Swiss Chard	983 ± 272	5352 ± 633	< 30	< 25	< 24	< 100	< 53
	07/27/22	Collard	456 ± 178	3434 ± 491	< 26	< 22	< 24	< 105	< 39
	08/30/22	Swiss Chard	< 206	2598 ± 346	< 19	< 14	< 14	< 64	< 33
	08/30/22	Collard	561 ± 148	4181 ± 466	< 16	< 13	< 15	< 71	< 35
	09/26/22	Swiss Chard	831 ± 273	2624 ± 492	< 30	< 21	< 28	< 87	< 46
	09/26/22	Collard	686 ± 184	3322 ± 479	< 24	< 21	< 17	< 85	< 38
	10/18/22	Swiss Chard	753 ± 193	2827 ± 435	< 20	< 15	< 17	< 66	< 34
	10/18/22	Collard	739 ± 187	3026 ± 435	< 20	< 16	< 17	< 85	< 35
	AVERAGE		665 ± 429	3516 ± 1858	-	-	-	-	-

TABLE C-10 **TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF SURFACE WATER**
SUSQUEHANNA STEAM ELECTRIC STATION, 2022

Results in pCi/Liter ± 2 sigma

SITE	COLLECTION PERIOD	H-3	<----------GAMMA EMITTERS---------->													
			K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140	Th-228
6S6	12/28/21 - 01/25/22	< 156	< 37	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 6	< 1	< 2	< 12	< 4	< 3
	01/25/22 - 02/22/22	< 350	< 15	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 6	< 1	< 2	< 13	< 5	< 2
	02/22/22 - 03/29/22	< 351	< 10	< 1	< 1	< 3	< 1	< 2	< 1	< 2	< 8	< 1	< 1	< 13	< 4	< 2
	03/29/22 - 04/26/22	< 385	< 10	< 1	< 1	< 3	< 1	< 2	< 1	< 2	< 5	< 1	< 1	< 9	< 3	< 2
	04/26/22 - 05/31/22	< 381	< 19	< 1	< 1	< 4	< 1	< 2	< 1	< 2	< 9	< 1	< 1	< 13	< 4	< 3
	05/31/22 - 06/28/22	< 391	< 33	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 10	< 2	< 2	< 17	< 5	< 3
	06/28/22 - 07/26/22	< 352	< 24	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 8	< 1	< 1	< 15	< 5	< 3
	07/26/22 - 08/30/22	< 387	< 24	< 1	< 2	< 5	< 2	< 3	< 2	< 3	< 9	< 1	< 1	< 16	< 6	< 3
	08/30/22 - 09/27/22	< 394	< 13	< 2	< 2	< 6	< 2	< 4	< 2	< 3	< 9	< 1	< 2	< 16	< 6	< 3
	09/27/22 - 10/25/22	< 326	< 30	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 7	< 2	< 2	< 14	< 5	< 3
	10/25/22 - 11/29/22	< 396	< 13	< 2	< 2	< 7	< 2	< 3	< 2	< 3	< 12	< 1	< 1	< 17	< 7	< 2
	11/30/22 - 12/27/22	< 343	< 14	< 1	< 2	< 5	< 2	< 3	< 2	< 3	< 9	< 1	< 2	< 16	< 6	< 3
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6S5	01/04/22 - 01/25/22	< 148	< 43	< 2	< 2	< 8	< 2	< 5	< 3	< 5	< 7	< 2	< 3	< 18	< 6	< 4
	01/31/22 - 02/22/22	< 353	< 27	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 5	< 1	< 2	< 11	< 4	< 3
	03/01/22 - 03/29/22	< 339	< 32	< 2	< 2	< 6	< 2	< 3	< 2	< 3	< 8	< 1	< 2	< 16	< 6	< 3
	04/05/22 - 04/26/22	< 370	< 15	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 5	< 1	< 2	< 11	< 4	< 3
	05/02/22 - 05/31/22	< 353	< 17	< 2	< 2	< 7	< 2	< 4	< 2	< 4	< 11	< 2	< 2	< 20	< 7	< 3
	06/07/22 - 06/28/22	< 382	< 27	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 7	< 2	< 2	< 14	< 5	< 3
	07/05/22 - 07/26/22	< 351	< 34	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 8	< 2	< 2	< 15	< 5	< 3
	08/02/22 - 08/30/22	< 391	< 33	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 7	< 2	< 2	< 13	< 5	< 3
	09/06/22 - 09/27/22	< 343	< 15	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 7	< 1	< 2	< 13	< 5	< 3
	10/04/22 - 10/25/22	< 320	< 15	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 7	< 2	< 2	< 14	< 5	< 3
	11/01/22 - 11/29/22	< 390	< 17	< 2	< 2	< 6	< 2	< 3	< 2	< 3	< 10	< 1	< 2	< 16	< 6	< 3
	12/06/22 - 12/27/22	< 340	< 20	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 9	< 2	< 2	< 17	< 6	< 3
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE C-11 **GAMMA SPECTROSCOPIC ANALYSIS OF FISH**
SUSQUEHANNA STEAM ELECTRIC STATION, 2022

Results in pCi/kg (wet) ± 2 sigma

SITE	COLLECTION DATE	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Cs-134	Cs-137
2H									
Channel catfish	05/12/22	3811 ± 766	< 49	< 46	< 148	< 41	< 87	< 48	< 41
Quillback	05/12/22	3061 ± 858	< 47	< 59	< 126	< 51	< 111	< 44	< 51
Smallmouth Bass	05/12/22	2788 ± 863	< 52	< 39	< 71	< 47	< 85	< 48	< 39
Walleye	10/07/22	3635 ± 1276	< 86	< 69	< 179	< 77	< 209	< 76	< 88
Smallmouth Bass	10/07/22	4030 ± 1048	< 70	< 73	< 218	< 90	< 153	< 63	< 75
Quillback	10/07/22	3526 ± 1360	< 80	< 77	< 143	< 67	< 169	< 64	< 87
	AVERAGE	3475 ± 935	-	-	-	-	-	-	-
IND									
Channel catfish	05/11/22	3398 ± 870	< 45	< 42	< 129	< 44	< 112	< 41	< 47
Quillback	05/11/22	2342 ± 920	< 56	< 50	< 177	< 51	< 110	< 60	< 49
Smallmouth Bass	05/11/22	3517 ± 1102	< 39	< 50	< 164	< 52	< 101	< 47	< 47
Walleye	10/06/22	4627 ± 1252	< 96	< 96	< 193	< 82	< 174	< 83	< 79
Smallmouth Bass	10/06/22	3432 ± 1034	< 81	< 80	< 132	< 76	< 117	< 71	< 67
Quillback	10/06/22	3439 ± 1030	< 39	< 58	< 164	< 80	< 146	< 59	< 62
	AVERAGE	3459 ± 1448	-	-	-	-	-	-	-
LTAW									
Largemouth Bass	12/05/22	4929 ± 1208	< 65	< 54	< 159	< 77	< 116	< 55	< 64
Brown Trout	12/05/22	2514 ± 1147	< 77	< 86	< 181	< 86	< 139	< 75	< 87
	AVERAGE	3722 ± 3415	-	-	-	-	-	-	-

TABLE C-12 GAMMA SPECTROSCOPIC ANALYSES OF SHORELINE SEDIMENT SUSQUEHANNA STEAM ELECTRIC STATION, 2022

Results in pCi/kg (dry) ± 2 sigma

SITE	COLLECTION DATE	K-40	Cs-134	Cs-137	Ra-226	Ac-228	Th-228
2B	03/31/22	11500 ± 1217	< 65	< 66	< 1650	800 ± 318	1157 ± 179
	09/19/22	10160 ± 1708	< 85	< 100	< 1995	1043 ± 305	614 ± 173
	AVERAGE	10830 ± 1895	-			921 ± 344	886 ± 767
7B	03/31/22	8246 ± 1096	< 51	< 62	< 1310	716 ± 225	671 ± 113
	09/19/22	12270 ± 1696	< 58	< 80	< 1351	1055 ± 383	1014 ± 122
	AVERAGE	10258 ± 5691	-	-		886 ± 479	842 ± 486
12F	03/31/22	8987 ± 1194	< 41	< 67	3465 ± 1191	880 ± 289	817 ± 90
	09/19/22	15330 ± 2719	< 133	< 158	< 3363	1567 ± 484	885 ± 275
	AVERAGE	12159 ± 8970	-	-	3465 ± 0	1223 ± 972	851 ± 96

FIGURE C-1 - GROSS BETA ACTIVITY IN AIR PARTICULATES

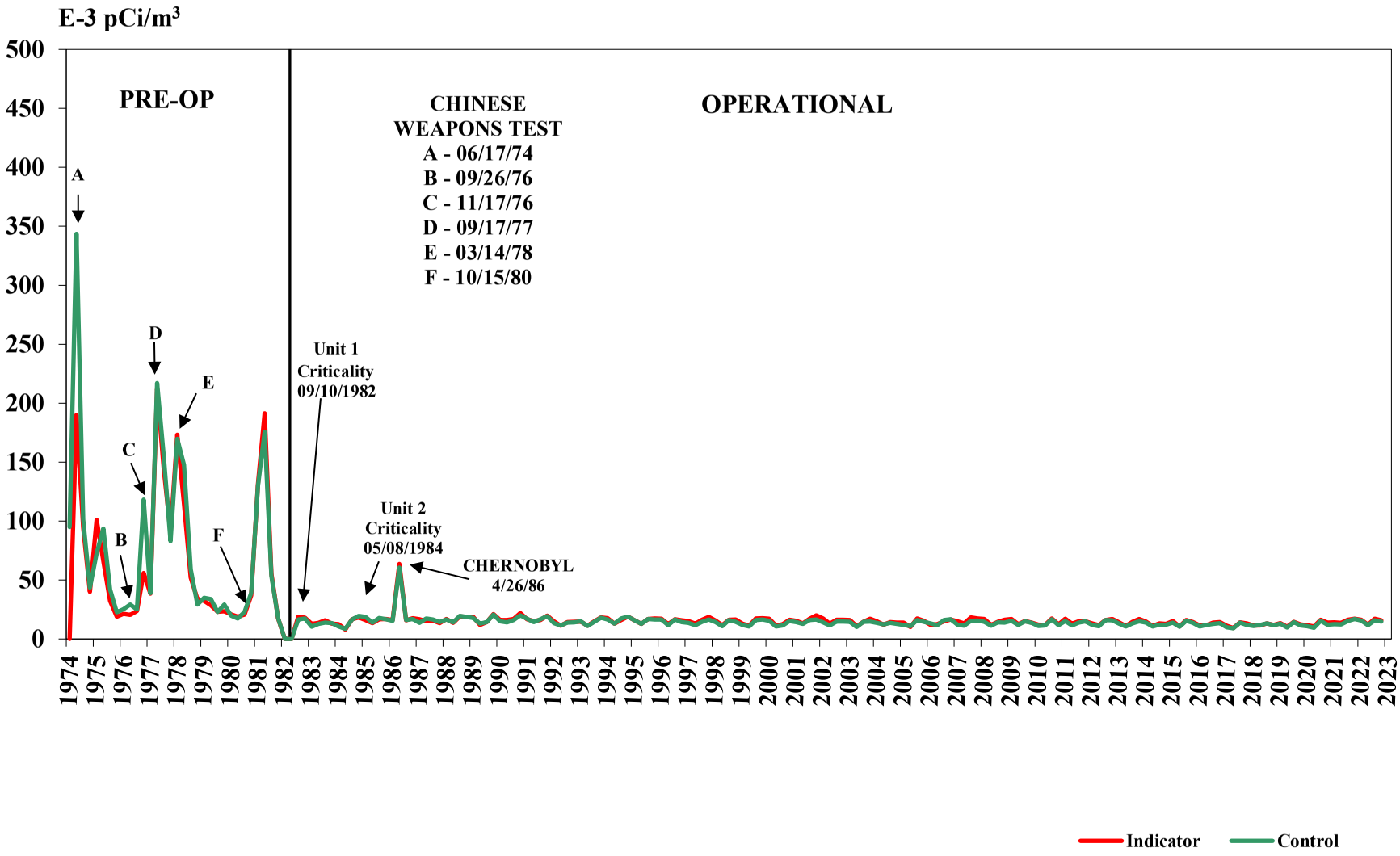


FIGURE C-2 - AMBIENT RADIATION LEVELS BASED ON ENVIRONMENTAL DOSIMETRY DATA

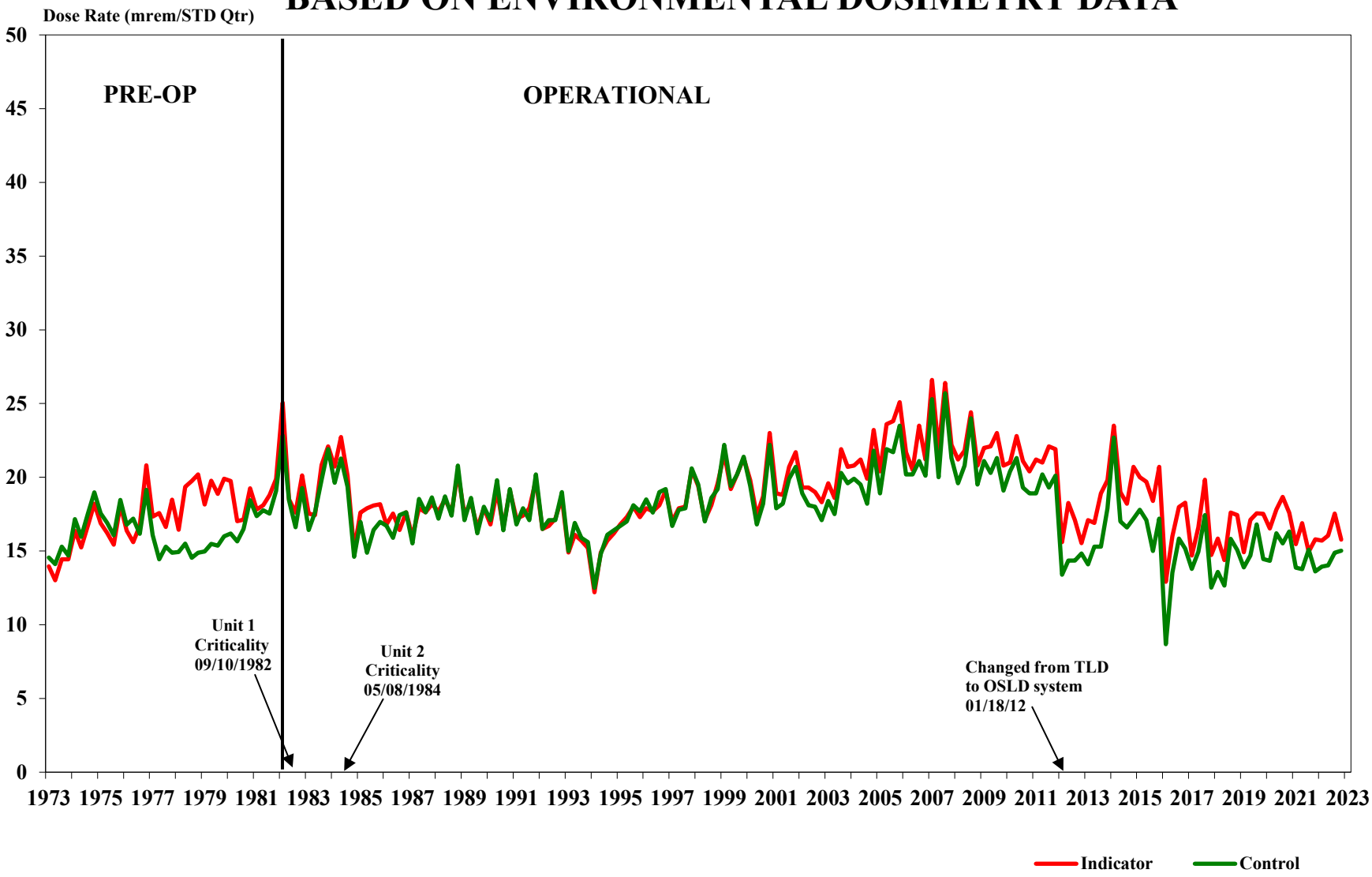


FIGURE C-3 - IODINE-131 ACTIVITY IN MILK

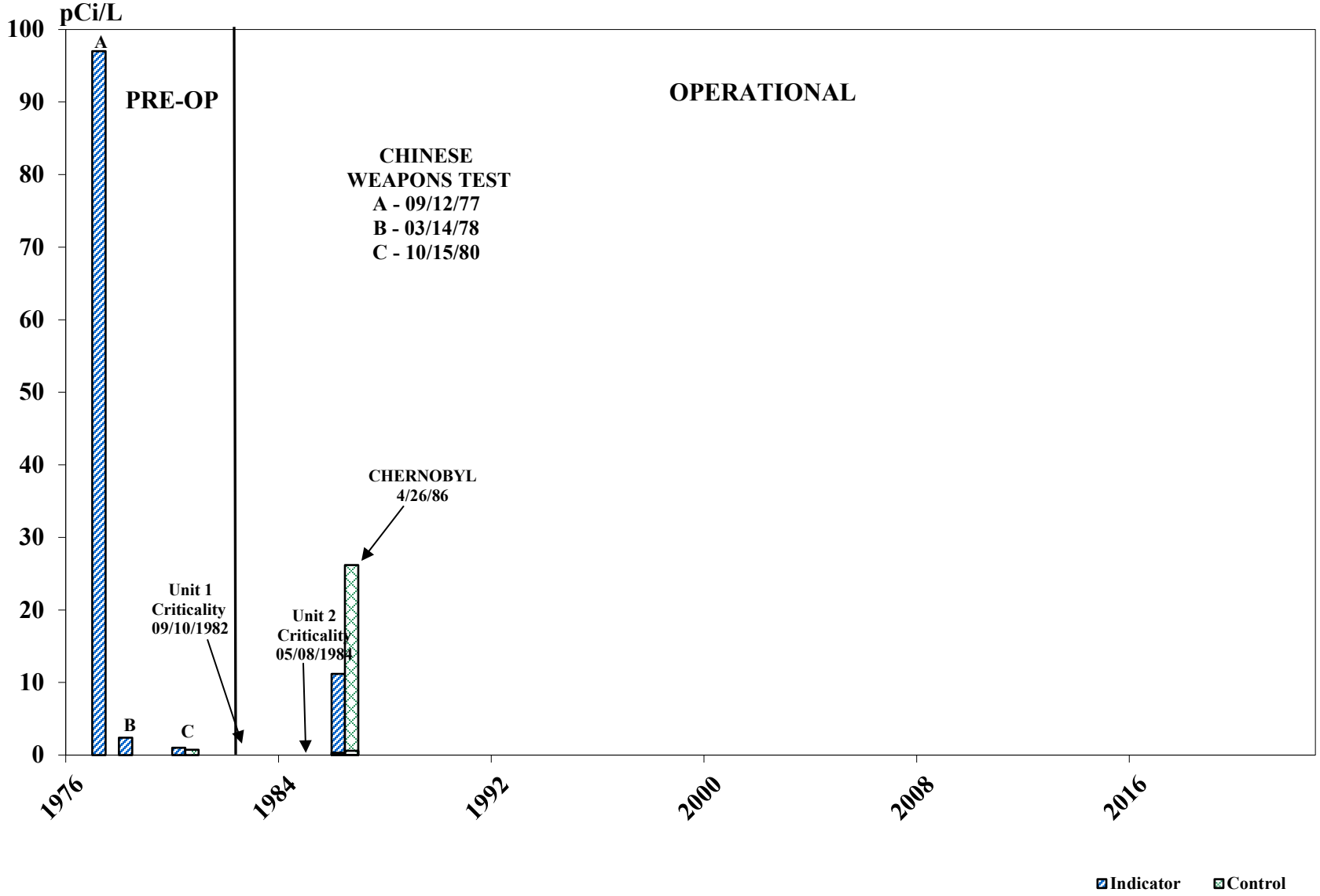


FIGURE C-4 - ANNUAL AVERAGE TRITIUM ACTIVITY IN PRECIPITATION AND SURFACE WATER VERSUS GROUND WATER

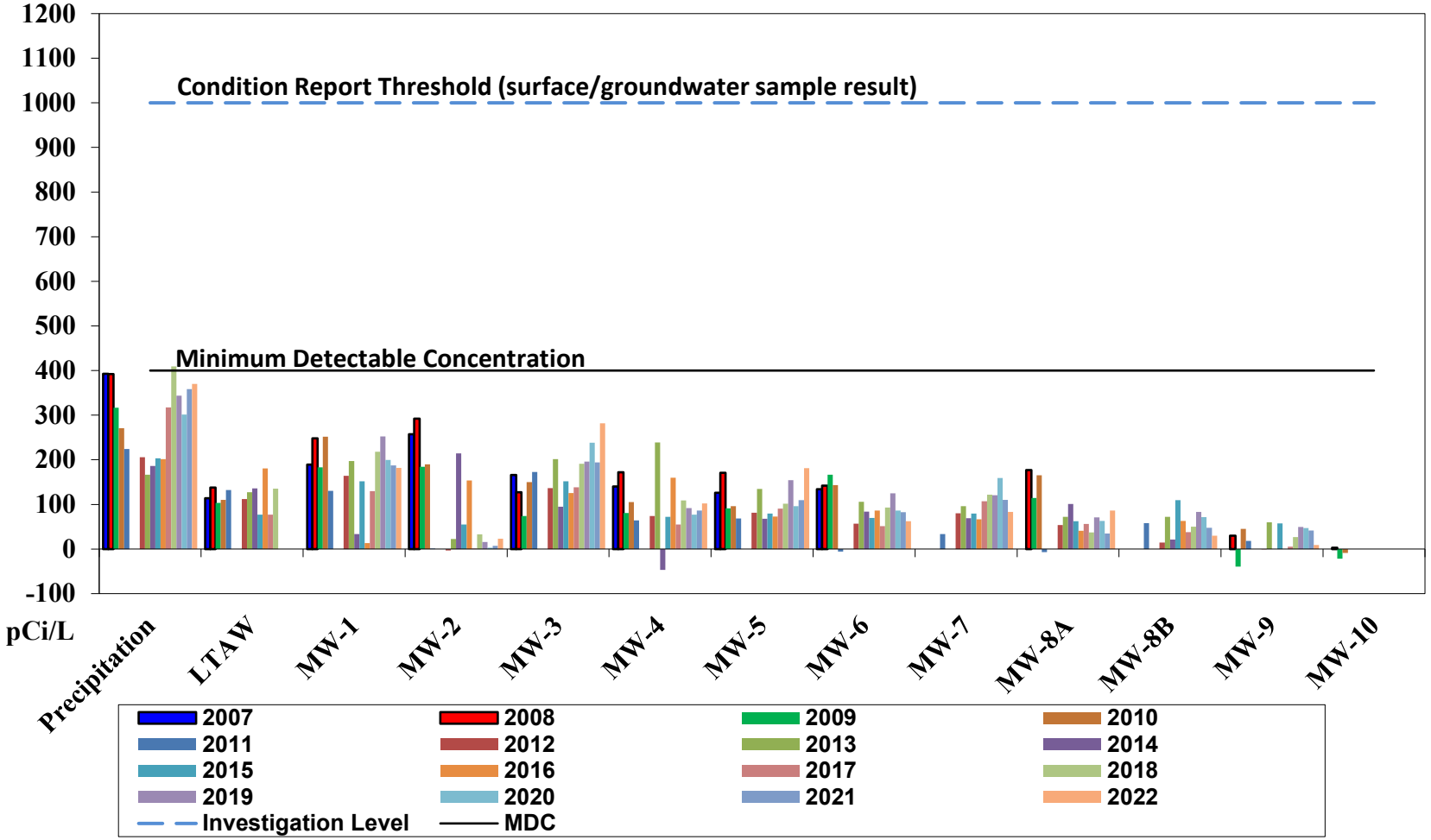


FIGURE C-5 - GROSS BETA ACTIVITY IN DRINKING WATER

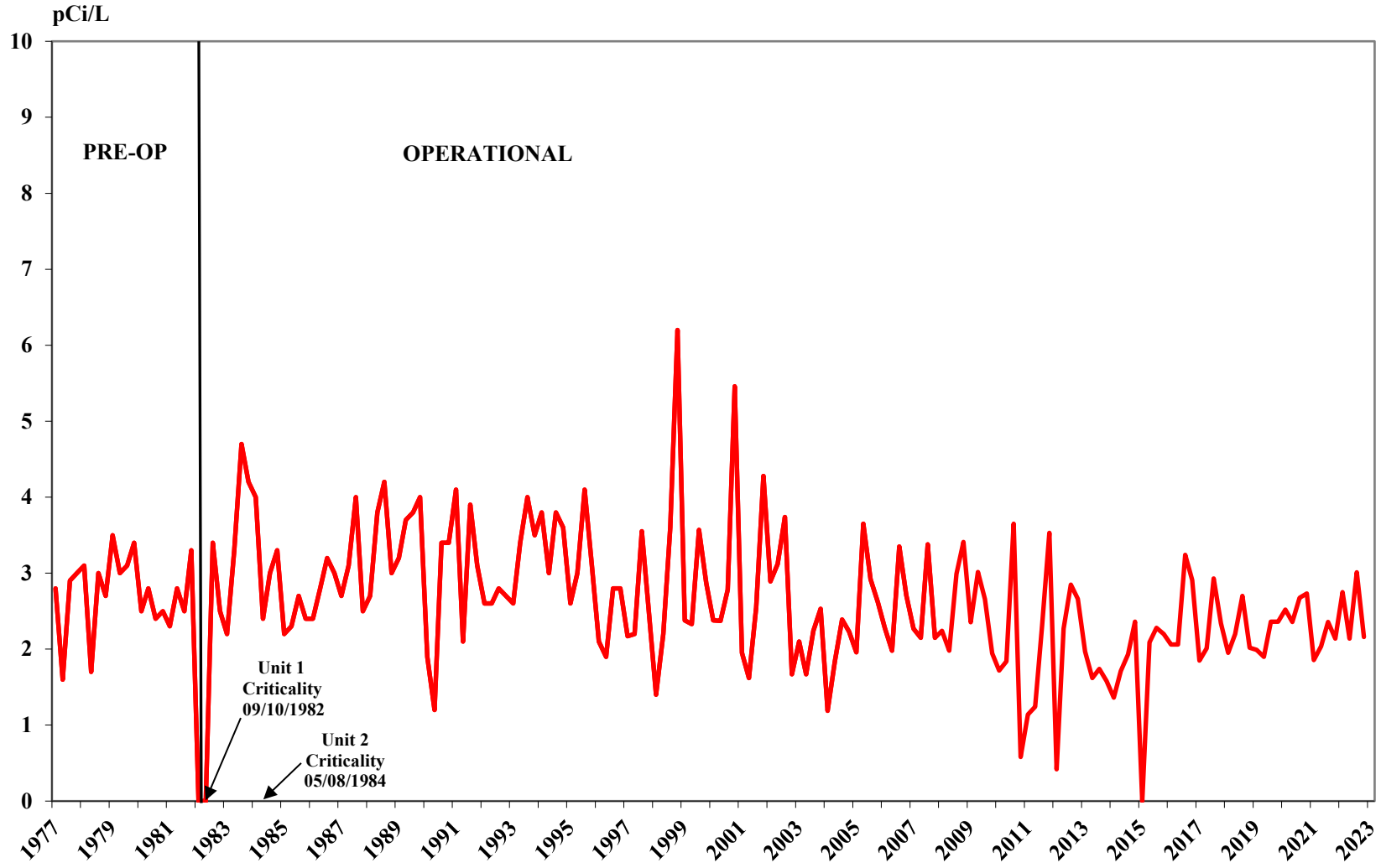
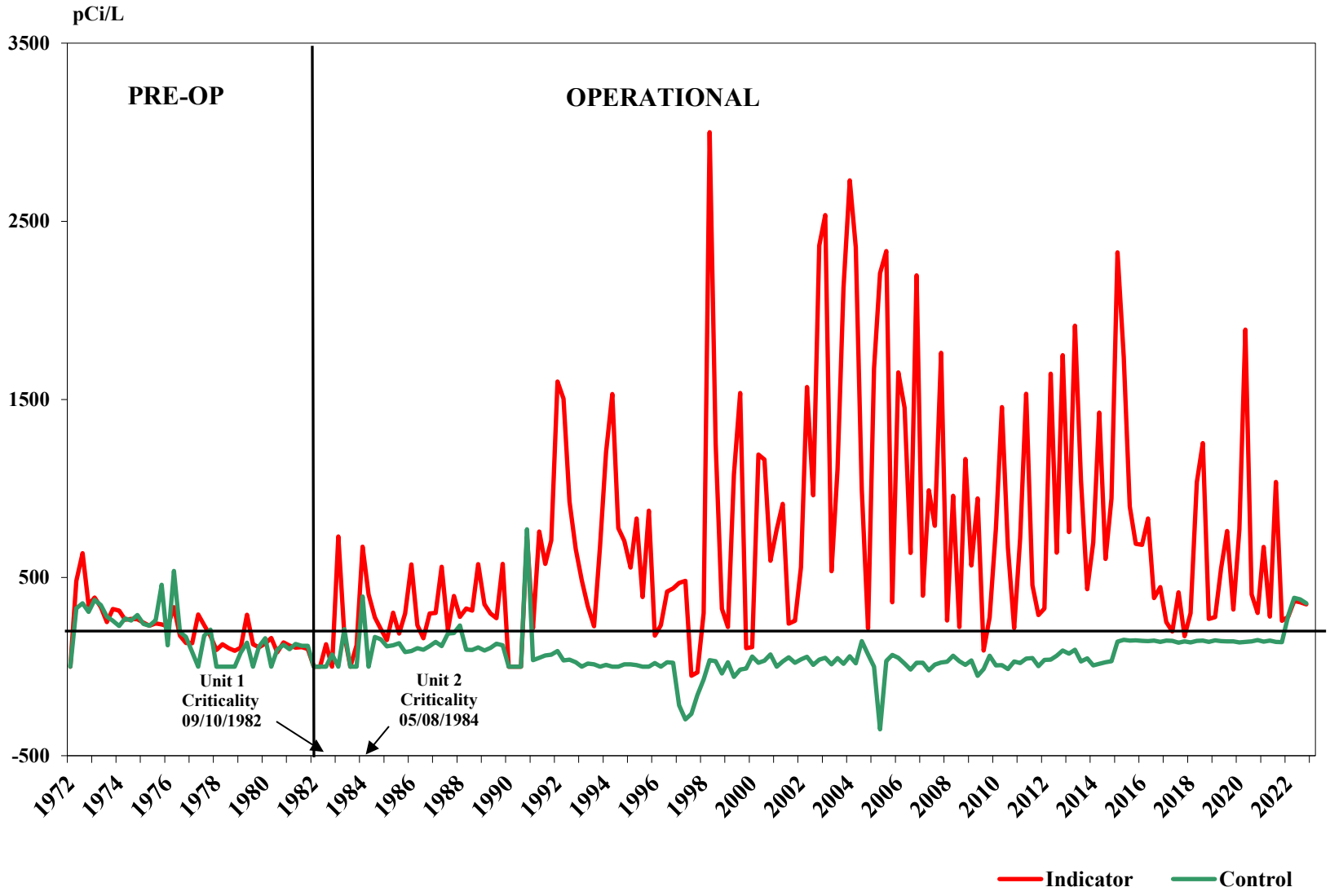


FIGURE C-6 - TRITIUM ACTIVITY IN SURFACE WATER



APPENDIX D

SUMMARY OF RESULTS FROM ANALYTICS, ENVIRONMENTAL RESOURCE ASSOCIATES (ERA), AND DEPARTMENT OF ENERGY (DOE) – MIXED ANALYTE PERFORMANCE EVALUATION PROGRAM (MAPEP)

Table D-1 Analytics Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Ratio of TBE to Analytics Result	Evaluation [b]
March 2022	E13706	Milk	Sr-89	pCi/L	80.3	96.8	0.83	A
			Sr-90	pCi/L	12.7	12.6	1.01	A
	E13707	Milk	Ce-141	pCi/L	62.3	65	0.96	A
			Co-58	pCi/L	158	164	0.96	A
			Co-60	pCi/L	286	302	0.95	A
			Cr-51	pCi/L	314	339	0.93	A
			Cs-134	pCi/L	155	182	0.85	A
			Cs-137	pCi/L	210	223	0.94	A
			Fe-59	pCi/L	211	185	1.14	A
			I-131	pCi/L	88.0	96.7	0.91	A
			Mn-54	pCi/L	169	164	1.03	A
			Zn-65	pCi/L	238	246	0.97	A
	E13708	Charcoal	I-131	pCi	79.9	87.1	0.92	A
	E13709	AP	Ce-141	pCi	60.9	42.0	1.45	N[1]
			Co-58	pCi	118	107	1.11	A
			Co-60	pCi	218	196	1.11	A
			Cr-51	pCi	251	221	1.14	A
			Cs-134	pCi	129	118	1.09	A
			Cs-137	pCi	156	145.0	1.07	A
			Fe-59	pCi	124	120.0	1.03	A
			Mn-54	pCi	120	107	1.12	A
			Zn-65	pCi	162	160	1.01	A
	E13710	Soil	Ce-141	pCi/g	0.123	0.103	1.19	A
			Co-58	pCi/g	0.254	0.263	0.97	A
			Co-60	pCi/g	0.493	0.483	1.02	A
			Cr-51	pCi/g	0.603	0.543	1.11	A
			Cs-134	pCi/g	0.268	0.292	0.92	A
			Cs-137	pCi/g	0.399	0.431	0.93	A
			Fe-59	pCi/g	0.320	0.296	1.08	A
			Mn-54	pCi/g	0.263	0.263	1.00	A
			Zn-65	pCi/g	0.407	0.395	1.03	A
	E13711	AP	Sr-89	pCi	83.2	97.4	0.85	A
			Sr-90	pCi	12.7	12.7	1.00	A

(a) The Analytics known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation

(b) Analytics evaluation based on TBE internal QC limits:

A = Acceptable - reported result falls within ratio limits of 0.80-1.20

W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30

N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

Table D-1 Analytics Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [(a)]	Ratio of TBE to Analytics Result	Evaluation [(b)]
September 2022	E13712	Milk	Sr-89	pCi/L	71.1	89.1	0.80	A
			Sr-90	pCi/L	12.0	13.6	0.88	A
	E13713	Milk	Ce-141	pCi/L	148	161	0.92	A
			Co-58	pCi/L	178	189	0.94	A
			Co-60	pCi/L	229	260	0.88	A
			Cr-51	pCi/L	486	456	1.07	A
			Cs-134	pCi/L	220	252	0.87	A
			Cs-137	pCi/L	203	222	0.92	A
			Fe-59	pCi/L	174	173	1.01	A
			I-131	pCi/L	75.9	94.2	0.81	A
			Mn-54	pCi/L	269	282	0.95	A
			Zn-65	pCi/L	364	373	0.97	A
	E13714	Charcoal	I-131	pCi	81.4	83.6	0.97	A
	E13715	AP	Ce-141	pCi	102	91	1.12	A
			Co-58	pCi	118	107	1.11	A
			Co-60	pCi	207	147	1.41	N[(2)]
			Cr-51	pCi	310	257	1.21	W
			Cs-134	pCi	148	142	1.04	A
			Cs-137	pCi	137	125	1.10	A
			Fe-59	pCi	115	98	1.18	A
			Mn-54	pCi	168	159	1.05	A
			Zn-65	pCi	240	211	1.14	A
	E13716	Soil	Ce-141	pCi/g	0.288	0.284	1.01	A
			Co-58	pCi/g	0.320	0.334	0.96	A
			Co-60	pCi/g	0.445	0.459	0.97	A
			Cr-51	pCi/g	0.883	0.805	1.10	A
			Cs-134	pCi/g	0.410	0.446	0.92	A
			Cs-137	pCi/g	0.447	0.465	0.96	A
			Fe-59	pCi/g	0.314	0.305	1.03	A
			Mn-54	pCi/g	0.489	0.499	0.98	A
			Zn-65	pCi/g	0.666	0.660	1.01	A
	E13717	AP	Sr-89	pCi	87.5	98.3	0.89	A
			Sr-90	pCi	12.6	15.0	0.84	A

(a) The Analytics known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation

(b) Analytics evaluation based on TBE internal QC limits:

A = Acceptable - reported result falls within ratio limits of 0.80-1.20

W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30

N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

Table D-2 DOE's Mixed Analyte Performance Evaluation Program (MAPEP)
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Acceptance Range	Evaluation [b]
February 2022	22-GrF46	AP	Gross Alpha	Bq/sample	0.402	1.20	0.36 - 2.04	A
			Gross Beta	Bq/sample	0.669	0.68	0.341 - 1.022	A
	22-MaS46	Soil	Ni-63	Bq/kg	645	780	546 - 1014	A
			Tc-99	Bq/kg	526	778	545 - 1011	N(3)
	22-MaW46	Water	Ni-63	Bq/L	28.6	34.0	23.8 - 44.2	A
			Tc-99	Bq/L	8.59	7.90	5.5 - 10.3	A
	22-RdV46	Vegetation	Cs-134	Bq/sample	6.61	7.61	5.33 - 9.89	A
			Cs-137	Bq/sample	1.50	1.52	1.06 - 1.98	A
			Co-57	Bq/sample	5.11	5.09	3.56 - 6.62	A
			Co-60	Bq/sample	0.0162		*(1)*	A
			Mn-54	Bq/sample	2.42	2.59	1.81 - 3.37	A
			Sr-90	Bq/sample	0.684	0.789	0.552 - 1.026	A
			Zn-65	Bq/sample	1.44	1.47	1.03 - 1.91	A
August 2022	22-MaS47	Soil	Ni-63	Bq/kg	14.6		*(1)*	A
			Tc-99	Bq/kg	994	1000	700 - 1300	A
	22-MaW47	Water	Ni-63	Bq/L	24.4	32.9	23.0 - 42.8	A
			Tc-99	Bq/L	1.9		*(1)*	N(4)
	25-RdV47	Vegetation	Cs-134	Bq/sample	0.032		*(1)*	A
			Cs-137	Bq/sample	0.891	1.08	0.758 - 1.408	A
			Co-57	Bq/sample	0.006		*(1)*	A
			Co-60	Bq/sample	4.04	4.62	3.23 - 6.01	A
			Mn-54	Bq/sample	2.01	2.43	1.70 - 3.16	A
			Sr-90	Bq/sample	1.25	1.60	1.12 - 2.08	W
			Zn-65	Bq/sample	6.16	7.49	5.24 - 9.74	A

(a) The MAPEP known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation

(b) DOE/MAPEP evaluation:

A = Acceptable - reported result falls within ratio limits of 0.80-1.20
W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30
N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

(1) False positive test
(2) Sensitivity evaluation
(3) Tc-99 soil cross-checks done for TBE information only - not required
*(4) See **NCR 22-22***

Table D-3 ERA Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Acceptance Limits	Evaluation [b]
March 2022	MRAD-36	Water	Am-241	pCi/L	68.3	74.6	51.2 - 95.4	A
			Fe-55	pCi/L	797	1140	670 - 1660	A
			Pu-238	pCi/L	146	147	88.4 - 190	A
			Pu-239	pCi/L	69.9	71.9	44.5 - 88.6	A
		Soil	Sr-90	pCi/kg	8050	6720	2090 - 10500	A
		AP	Fe-55	pCi/filter	148	127	46.4 - 203	A
			Pu-238	pCi/filter	29.9	29.6	22.3 - 36.4	A
			Pu-239	pCi/filter	51.6	49.7	37.2 - 60.0	A
			U-234	pCi/filter	59.9	67.3	49.9 - 78.9	A
			U-238	pCi/filter	59.0	66.7	50.4 - 79.6	A
			GR-A	pCi/filter	95.6	94.2	49.2 - 155	A
			GR-B	pCi/filter	71.2	66.8	40.5 - 101	A
April 2022	RAD-129	Water	Ba-133	pCi/L	61.7	62.9	52.3 - 69.2	A
			Cs-134	pCi/L	80.9	81.6	68.8 - 89.8	A
			Cs-137	pCi/L	37.4	36.6	32.1 - 43.3	A
			Co-60	pCi/L	103	97.4	87.7 - 109	A
			Zn-65	pCi/L	318	302	272 - 353	A
			GR-A	pCi/L	26.9	20.8	10.4 - 28.3	A
			GR-B	pCi/L	49.7	51.0	34.7 - 58.1	A
			U-Nat	pCi/L	56.3	68.9	56.3 - 75.8	A
			H-3	pCi/L	17,000	18,100	15,800 - 19,000	A
			Sr-89	pCi/L	65.3	67.9	55.3 - 76.1	A
			Sr-90	pCi/L	42.1	42.7	31.5 - 49.0	A
			I-131	pCi/L	25.7	26.2	21.8 - 30.9	A
September 2022	MRAD-37	Water	Am-241	pCi/L	111	96.2	66.0 - 123	A
			Fe-55	pCi/L	850	926	544 - 1350	A
			Pu-238	pCi/L	62.1	52.6	31.6 - 68.2	A
			Pu-239	pCi/L	139.5	117	72.5 - 144	A
		Soil	Sr-90	pCi/kg	3350	6270	1950 - 9770	A
			U-234	pCi/kg	1684	3350	1570 - 4390	A
			U-238	pCi/kg	1658	3320	1820 - 4460	N(2)
		AP	Fe-55	pCi/filter	71.9	122	44.5 - 195	A
			Pu-238	pCi/filter	38.8	29.9	22.6 - 36.7	N(1)
			Pu-239	pCi/filter	14.5	13.0	9.73 - 15.7	A
			U-234	pCi/filter	78.0	71.5	53.0 - 83.8	A
			U-238	pCi/filter	79.7	70.9	53.5 - 84.6	A
			GR-A	pCi/filter	62.8	55.5	29.0 - 91.4	A
			GR-B	pCi/filter	70.9	64.8	39.3 - 97.9	A
October 2022	RAD-131	Water	Ba-133	pCi/L	76.2	79.4	66.6 - 87.3	A
			Cs-134	pCi/L	28.0	30.5	23.9 - 33.6	A
			Cs-137	pCi/L	202	212	191 - 235	A
			Co-60	pCi/L	52.4	51.4	46.3 - 59.1	A
			Zn-65	pCi/L	216	216	194 - 253	A
			GR-A	pCi/L	19.7	16.9	8.28 - 23.7	A
			GR-B	pCi/L	49.8	53.0	36.1 - 60.0	A
			U-Nat	pCi/L	10.54	8.53	6.60 - 9.88	N(3)
			H-3	pCi/L	13,900	15,100	13,200 - 16,600	A
			Sr-89	pCi/L	59.7	64.5	52.3 - 72.5	A
			Sr-90	pCi/L	32.9	37.3	27.4 - 43.0	A
			I-131	pCi/L	26.9	24.4	20.2 - 28.9	A

(a) The ERA known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation.

(b) ERA evaluation:
A = Acceptable - Reported value falls within the Acceptance Limits
N = Not Acceptable - Reported value falls outside of the Acceptance Limits

*(1) See **NCR 22-19***

(2) U soil cross-checks done for TBE information only - not required

*(3) See **NCR 22-20***

APPENDIX E

REMP SAMPLE EQUIPMENT OPERABILITY TRENDING

TABLE E-1
REMP SAMPLING EQUIPMENT OPERABILITY TRENDING
SUSQUEHANNA STEAM ELECTRIC STATION

Percent (%) Operability

SAMPLING MEDIA	SAMPLE LOCATION	DESCRIPTION	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Air Particulate & Charcoal	3S2	SSES Backup Met. Tower	99.9	100	99	100	99.9	99.9	100.0	99.4	99.9	95.5
	12S1	West Building	99.9	100	100	100	99.1	99.7	99.9	99.9	99.9	99.7
	13S6	Former Laydown Area, West of Confers Lane	99.9	100	97	100	100	99.9	99.9	99.9	99.9	99.9
	12E1	Berwick Hospital	100.0	100	98	99.1	100	100	100	100.0	100	100
	6G1	Freeland Substation	99.9	100	90*	100	100	100	No longer in service	No longer in service	No longer in service	No longer in service
	8G1	PPL System Facilities Center, Humboldt Industrial Park	99.9	100	100	99.2	99.9	99.9	99.9	99.9	99.9	100
	10S3	E of Confers Lane, S of Towers Club	-	-	-	100	99.5	99.9	99.2	98.9	99.9	99.7
	9B1	Transmission Line, E of Route 11	-	-	-	100	99.9	99.9	99.9	100.0	99.9	99.9
Drinking Water	12H2	Danville Water Company	100.0	100	100	100	100	100	98.1	100.0	100	100.0
Surface Water	2S7	Cooling Tower Blowdown Discharge Line	98.1	69**	100	99.1	100	100	99.9	99.9	93.0	No longer in service
	6S6	River Water Intake Line	93.2	93	98	99.7	99.9	99.9	99.9	88.1***	94.0	99.4

* Planned power outage by Electric Utilities
** Auto- Compsite sampler problems, March through June. New Auto- Compsite sampler installed in July.
*** Auto- Compsite sampler taken OOS 8/30/20. New Auto- Compsite sampler installed, placed in service 10/13/20.