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May 28, 2024

Attn: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

10 CFR 50.4

SUSQUEHANNA STEAM ELECTRIC STATION
ANNUAL RADIOLOGICAL ENVIRONMENTAL
OPERATING REPORT
PLA-8122

Docket No. 50-387
50-388

Reference: *1) Susquehanna letter to NRC, "Susquehanna Steam Electric Station Annual Radiological Environmental Operating Report (PLA-8095)," dated April 22, 2024 (ADAMS Accession No. ML24113A284)*

In Reference 1, Susquehanna Nuclear, LLC (Susquehanna), submitted the 2023 Annual Radiological Environmental Operating Report in accordance with the SSES Units 1 and 2 Technical Specification 5.6.2. That report inadvertently omitted the last three pages from Table A, Summary of Data for Susquehanna Steam Electric Station. This omission has been documented in the Susquehanna Corrective Action Program. The correctly collated report is attached. This report supersedes the report provided in Reference 1 in its entirety.

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

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

E. Casulli

Attachment: 2023 Annual Radiological Environmental Operating Report

Copy: NRC Region I
Mr. H. Anagnostopoulos, NRC Region I
Ms. J. England, NRC Senior Resident Inspector
Ms. A. Klett, NRC Project Manager
Mr. M. Shields, PA DEP/BRP

Attachment to PLA-8122

2023 Annual Radiological Environmental Operating Report

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 and 2

Annual Radiological
Environmental Operating Report

2023

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4/4/24

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SUSQUEHANNA STEAM ELECTRIC STATION

Units 1 & 2

2023 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

JANUARY 1 TO DECEMBER 31, 2023

Susquehanna Nuclear, LLC
Berwick, PA
April, 2023

TABLE OF CONTENTS

TABLE OF CONTENTS (cont'd)

LIST OF TABLES

LIST OF TABLES (cont'd)

LIST OF MAPS

LIST OF FIGURES

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 2023. Teledyne Brown Engineering (TBE) was responsible for the analysis of environmental samples during 2023. The results are discussed in this report**.** Landauer provided the dosimetry services for SSES during 2023.

This Annual Radiological Environmental Operating Report (AREOR) conducted for SSES covers the period January 1, 2023 through December 31, 2023. During that time period, 1352 analyses were performed on 1163 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 2023 Radioactive Effluent Monitoring and Control program, approximately 14 Curies of H-3 were discharged in liquid radwaste releases to the Susquehanna River and approximately 55 Curies of H-3 were discharged from the station in airborne effluent releases. H-3 was not identified in any REMP surface water samples taken from the Susquehanna River during 2023. The 2023 average dilution factor for the Susquehanna

River was 613, based on the annual average river flow of 7.04E+06 gpm and the annual average cooling tower blowdown flow of 1.15E+04 gpm.

H-3 was identified above analysis detection levels in precipitation samples taken on-site during 2023. Precipitation is analyzed to assess the impact of airborne effluent H-3 on groundwater activities.

H-3 was not identified in any on-site groundwater samples during 2023. Assuming a Member of the Public was consuming the water from the highest Minimum Detectable Concentration (MDC) of an onsite monitoring well sample, the theoretical dose to the total body and maximum organ using the H-3 concentration of 398 pCi/liter and Regulatory Guide 1.109 methodology [Reference 9] was determined to illustrate the effect. The calculated dose would be <0.02 mrem to the child total body and <0.02 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) [Reference 5] 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 2023 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 2023 verify the adequacy of the SSES radioactive effluent control systems.

Samples of air particulates, air iodine, milk, groundwater, drinking water, food products, 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 not detected above

minimum detectable concentration. 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 were not detected above the minimum detectable concentration. 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.

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.

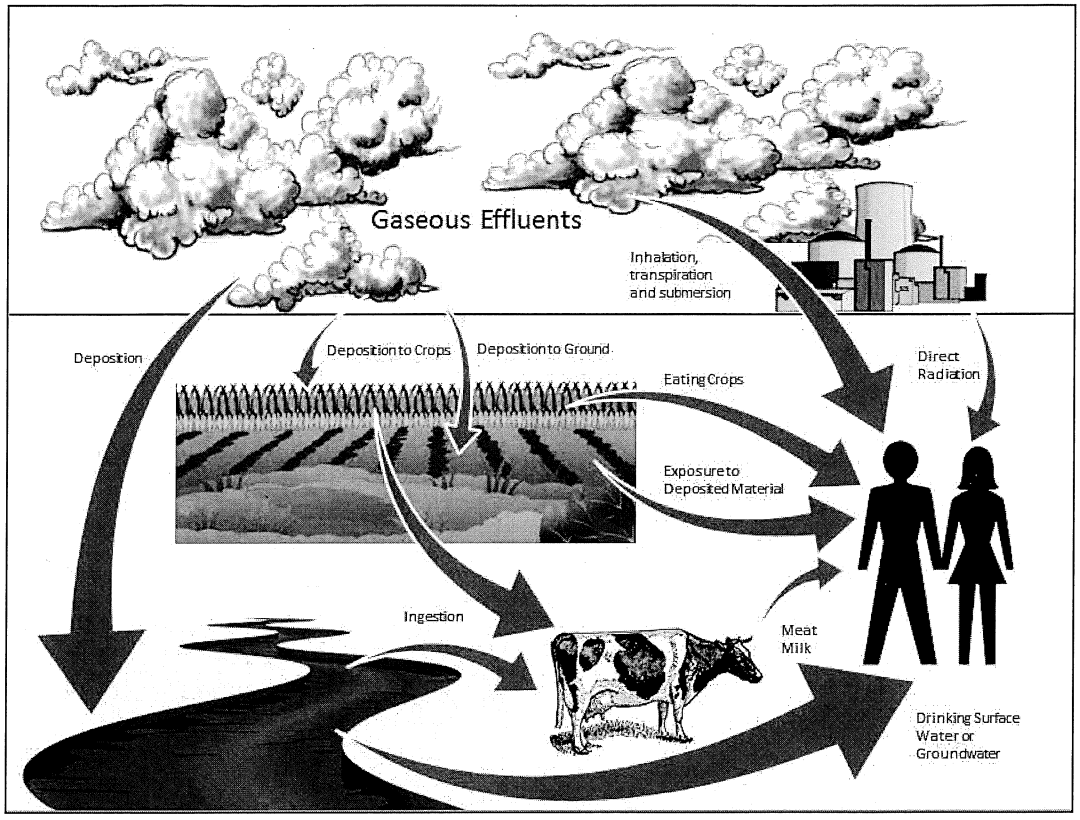
More specific information on the demography, hydrology, meteorology, and land use characteristics of the area in the vicinity of the SSES can be found in the Environmental Report [Reference 1], the Final Safety Analysis Report [Reference 2] and the Final Environmental Statement [Reference 3] for the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

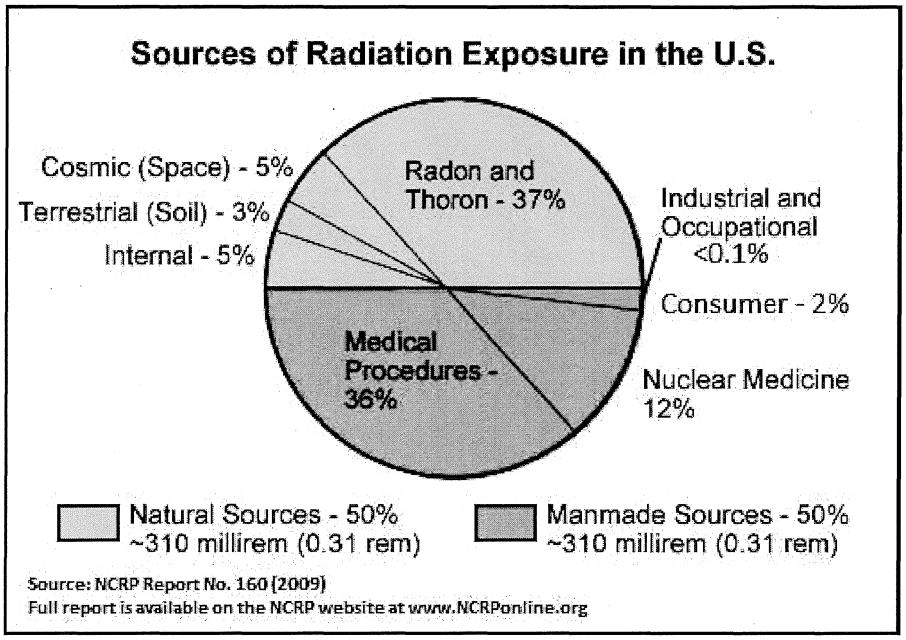
The pathways through which radiation or radioactive material may reach the public from nuclear power plants are direct exposure from the station, atmospheric, terrestrial, and aquatic pathways. (Figure 1 depicts these pathways)

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, 2023, 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

III. 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 [Reference 6], 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	1.1 E-03
Fe-59	6.6 E-03
Co-58	1.8 E-03
Co-60	1.1 E-03
Zn-65	2.8 E-03
Cs-134	1.0 E-03
Cs-137	9.7 E-04
I-131	3.2 E-01

Waterborne REMP Typical MDCs

Radionuclide	MDC (pCi/L.)
H-3 (DIST)	2.5 E+02
Mn-54	3.7 E+00
Fe-59	1.1 E+01
Co-58	3.8 E+00
Co-60	4.1 E+00
Zn-65	7.7 E+00
Cs-134	3.7 E+00
Cs-137	4.0 E+00
I-131	9.5 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 2023 REMP Atypical Sampling Occurrences

C. Program Changes

In 2023, Direct Radiation Monitoring locations 9S3 and 9S4 and surface water grab sample locations 4S7 and LTAW were added to the REMP in 2023.

2023 REMP Atypical Sampling Occurrences

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
JAN	Air	10S3	01/11/23 to 01/18/23 Power outage-date and time unknown. Loss of 0.4 hours, as determined by timer box during weekly collection. Non-continuous sampler operation.	CA #23-02 CR 2023-01221 01/18/23: No action required. Air monitor resumed normal operation when power was restored. 01/18/23: Operability verified @ 0947 hours. *Ideal sample collected for sample period: 23,200 cf.*
	Surface Water	6S6	01/23/23 to 01/31/23 (week 5 January composite) While I&C was performing monthly preventative maintenance on 01/26/23, sampler flow lines were found to be clogged. Composite sampler continued to collect samples from water in flow line. Week 5 composite sample was used in January composite.	CA #23-03 CR 2023-01684 01/26/23: I&C restored sampler to service @ 1358 hours. 01/27/23: Operability verified @ 1335 hours. *Ideal sample collected for week 5 sample period.*
FEB	Air	12S1	02/01/23 to 02/08/23 Pump malfunction during sampling period. Surge protector was tripped upon arrival and pump would not restart. Sampler ran for 46.9 hours for sampling period, according to the timer box. Non-continuous sampling during sample period.	CA #23-04 CR 2023-02351 02/08/23: Pump would not restart and was replaced. 02/08/23: Operability verified @ 1340 hours. *Less than ideal sample collected for sample period: 6,200 cf.*

2023 REMP Atypical Sampling Occurrences (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
MAR	Surface Water	6S6	03/07/23 to 03/13/23 (weeks 2 & 3 March composite) While I&C was performing monthly preventative maintenance on 03/13/23, sampler flow indicator was found cracked and leaking. March week 2 stop on 03/13/23 @ 0955 hours. Weeks 2 & 3 composite samples were used in March composite.	CA #23-05 CR 2023-03946 & CR 2023-03961 03/13/23: I&C replaced flow indicator and restored sampler to service @ 1307 hours (week 3 March start). 03/13/23: Operability verified @ 1413 hours. *Ideal samples collected for weeks 2 & 3 sample periods.*
APR	Air	3S2	04/19/23 to 04/26/23 Power outage began on 04/25/23 @ 0650 hours. Breaker was tripped in back-up Met Tower upon arrival. Pump malfunction during sampling period. Metal shavings found in AP/C cabinet. Loss of 30.3 hours, as determined by timer box. Non-continuous sampler operation.	CA #23-06 CR 2023-07890 04/26/23: Operations reset breaker @ 1336 hours. Air monitor resumed normal operation when power was restored, and pump was replaced. 04/26/23: Operability verified @ 1337 hours. *Ideal sample collected for sample period: 17,500 cf.*
MAY	Surface Water	6S6	04/25/23 to 05/02/23 (week 1 May composite) Operations reported ACS overflow at river intake on 04/27/23. Invalid sample due to unknown time frame of overflow. No visible leaks in sample lines inside ACS. Week 1 delayed start composite sample used in May composite. 5S9 grab sample sent for comparative analysis.	CA #23-07 CR 2023-07950 04/28/23: Sample container emptied and new start time of 1613 hours for week 1 May composite. Operability verified @ 1613 hours. 04/28/23: Grab sample collected @ 5S9 @ 1651 hours. *Ideal sample volume collected for week 1 May composite.*

2023 REMP Atypical Sampling Occurrences (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
MAY (cont.)	Surface Water	6S6	04/28/23 to 05/02/23 (week 1 May composite) Diminished flow (<2 gpm) at ACS during week 1 May collection. Week 1 delayed start composite sample used in May composite.	CA #23-08 CR 2023-08265 05/02/23: Generated CR requesting FIN/I&C perform maintenance ASAP. 05/18/23: I&C began maintenance on ACS lines. 05/24/23: Sampler restored to service and operability verified @ 0929 hours. *Ideal sample volume collected for week 1 May composite.*
	Surface Water	6S6	05/15/23 to 05/29/23 (weeks 4 & 5 May composite) Plastic pipe broke while I&C performed maintenance on sampler. Weeks 4 & 5 composite samples with known stop and start times were used in May composite. Grab sample @ 5S9 collected 05/18/23 was sent for comparative analysis.	CA #23-09 CR 2023-09467 05/18/23: Week 4 May composite early stop @ 1227 hours. Grab sample @ 5S9 collected @ 1618 hours. 05/24/23: Sampler returned to service and operability verified @ 0929 hours. (Week 5 May composite start time.) *Ideal sample volumes collected for weeks 4 & 5 May composite.*
JUN	Surface Water	6S6	05/29/23 to 06/05/23 (week 1 June composite) Continuous water flow while I&C was performing monthly preventative maintenance on 06/05/23. Week 1 composite sample with known stop date and time was used in June composite. Grab sample collected 06/07/23 was sent for comparative analysis.	CA #23-10 CR 2023-10316 06/05/23: Week 1 sample stopped @ 1353 hours. 06/07/23: I&C restored sampler to service @ 1124 hours (week 2 June delayed start time). Operability verified @ 1140 hours. 06/07/23: Grab sample @ 5S9 collected @ 1227 hours. *Ideal sample collected for week 1 June composite.*

2023 REMP Atypical Sampling Occurrences (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
JUN (cont.)	Surface Water	6S6	06/07/23 to 06/12/23 (week 2 June composite) Greater than normal sample volume for week 2 June sampling period. Sample was contained in collection container. Week 2 June composite sample used in June composite.	CA #23-11 CR 2023-10557 06/12/23: Request FIN/I&C perform maintenance ASAP to avoid future overflow conditions. 06/27/23: I&C performed maintenance. Operability verified @ 1318 hours. *Ideal sample collected for week 2 June composite.*
	Air	3S2, 13S6, 12S1, 10S3, 12E1, 8G1, 9B1	06/06/23 to 06/12/23 Excessive filter loading due to smoke from Canadian wildfires. Less than ideal sample volumes and less than procedural flow rates for all locations for sampling period. Continuous sampler operation.	CA #23-12 CR 2023-10564 06/12/23: Samplers resumed normal operation when filters were exchanged for next sampling period. 06/12/23: Operability verified @ 1147 hours (3S2), 1158 hours (13S6), 1204 hours (12S1), 1212 hours (10S3), 1238 hours (12E1), 1329 hours (8G1), and 1221 hours (9B1). *Less than ideal samples collected for sample period: 7,700 cf (3S2), 7,800 cf (13S6), 7,500 cf (12S1), 8,100 cf (10S3), 6,900 cf (12E1), 10,200 cf (8G1), and 6,600 cf (9B1).*
AUG	Air	9B1	07/26/23 to 08/02/23 Timer box malfunction. Timer box failed to advance past 0.1 hours for the week. No effect on monitoring. Continuous sampler operation.	CA #23-13 CR 2023-12773 08/02/23: Timer box reset and monitored. Equipment restored to service @ 1003 hours. 08/02/23: Operability verified @ 1015 hours. *Ideal sample collected for sample period: 23,100 cf.*

2023 REMP Atypical Sampling Occurrences (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
AUG (cont.)	Air	12S1	08/16/23 to 08/23/23 (Loss of 12kV power) No power at air monitor upon arrival or departure. Loss of power on 08/23/23 @ 0005 hours. Loss of 9.8 hours of sampling as determined by timer box. Non-continuous sampler operation.	CA #23-14 CR 2023-13780 08/24/23: Air monitor resumed normal operation when power was restored @ 1415 hours. Late start for sampling period 08/23/23 to 08/30/23. 08/24/23: Operability verified @ 1932 hours. *Ideal sample collected for sample period: 21,200 cf.*
SEP	Air	12S1	09/06/23 to 09/12/23 (Loss of 12kV power) Loss of power on 09/08/23 @ 1020 hours. Loss of 2.5 hours, as determined by timer box for sampling period. Non-continuous sampler operation.	CA #23-15 CR 2023-14670 09/08/23: Air monitor resumed normal operation when power was restored. 09/11/23: Operability verified @ 1915 hours. *Ideal sample collected for sample period: 18,000 cf.*
	Air	9B1	09/06/23 to 09/12/23 Timer box malfunction. Timer box failed to advance past 48.1 hours for sampling period. No effect on monitoring. Continuous sampler operation.	CA #23-16 CR 2023-14817 09/12/23: Timer box #9 replaced with timer box #7. Equipment restored to service @ 0744 hours. 09/12/23: Operability verified @ 0750 hours. *Ideal sample collected for sample period: 19,200 cf.*

2023 REMP Atypical Sampling Occurrences (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
OCT	Air	9B1	10/03/23 to 10/11/23 Power outage- date and time unknown. Loss of 12.3 hours, as determined by timer box during weekly collection. Non-continuous sampler operation.	CA #23-17 CR 2023-16326 10/11/23: No action required. Air monitor resumed normal operation when power was restored. 10/11/23: Operability verified @ 1007 hours. *Ideal sample collected for sample period: 25,000 cf.*
NOV	Surface Water	6S6	11/06/23 to 11/20/23 (weeks 2 & 3 November composite) No sample flow at ACS upon arrival for week 2 November composite collection. Inadequate sample volumes for weeks 2 & 3 November composite. 5S9 grab samples collected for weeks 2 & 3 November.	CA #23-18 CR 2023-17829 11/14/23: Request I&C perform maintenance ASAP. 11/14/23: 5S9 grab sample collected @ 1212 hours. 11/20/23: 5S9 grab sample collected @ 1120 hours. 11/20/23: I&C performed maintenance and restored operability of sampler. Operability verified @ 1512 hours (week 4 November start). *Inadequate sample volumes collected for weeks 2 & 3 November composite. 5S9 grab composite sent for analysis for weeks 2 & 3.*
	Air	9B1	11/15/23 to 11/21/23 Timer box malfunction. Timer box failed to advance past 53.6 hours for sampling period. No effect on monitoring. Continuous sampler operation.	CA #23-19 CR 2023-18110 11/21/23: Timer box #7 replaced with timer box #2. 11/21/23: Operability verified @ 1018 hours. *Ideal sample collected for sample period: 19,200 cf.*

2023 REMP Atypical Sampling Occurrences (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
1st Q	Direct Radiation	12S7	1st Quarter 2023 Environmental dosimeters were missing at REMP location 12S7 during the 1st quarter exchange. Telephone pole dosimeters were attached to appeared to have been struck by a vehicle.	CR 2023-07549 04/22/23: Searched immediate area for missing dosimeters. New dosimeter receptacle was secured to pole, and 2nd quarter dosimeters were installed.
4th Q	Direct Radiation	9D4	4th Quarter 2023 One of the two required environmental dosimeters at REMP location 9D4 were not analyzed for the 4th quarter of 2023, as it was possibly lost in transit or at the analytical vendor's facility. Both dosimeters for location 9D4 were placed, retrieved, and shipped to the analytical vendor by SSES personnel.	CR 2024-02103 The analytical vendor confirmed that they could not locate the dosimeter at their processing facility and their receiving department did not have a record of receipt of the missing dosimeter. CR for tracking and trending of occurrence.

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, 124 out of 131 analyses performed met the specified acceptance criteria. Seven analyses did not meet the specified acceptance criteria and were addressed through the TBE Corrective Action Program. A summary is found below:

1. The MAPEP February 2023 Soil Ni-63 result was evaluated as Not Acceptable. TBE's reported value was 294 Bq/kg and the known result was 1130 Bq/kg (range 791 - 1469). The sample was reprepped by a different (senior) lab technician with results of 1120 & 1250 Bq. It was determined that there was a difference between the two techs during the sample prep (technique) and the procedure was revised to reflect these differences including using a specific aliquot amount. (NCR 23-08)

2. The MAPEP February 2023 vegetation Sr-90 result was evaluated as Not Acceptable. The reported value was 0.05 Bq (not detected) and the known result was a "false positive". This was considered to be a statistical failure because TBE's reported result with 3 times the uncertainty resulted in a slightly positive net result (0.03194 Bq/kg). The reported result was significantly below TBE's average detection limit for vegetation samples. (NCR 23-09)

3. The ERA RAD February 2023 water Ba-133 result was evaluated as Not Acceptable. The reported value was 26.0 pCi/L and the known was 22.3 (acceptance range 17.1 – 25.8 pCi) or 117% of the known (acceptable for TBE QC). The sample was used as the workgroup duplicate with a result of 25.4 (114%). The sample had also been counted on a different detector with a result of 21.9 (98%). The was TBE's first failure for Ba-133. (NCR 23-10)

4. The MAPEP August 2023 soil Fe-55 result was evaluated as Not Acceptable. The reported value was 346 Bq/kg and the known result was 1280 (acceptance range of 896-1664 Bq/kg). This was TBE's initial evaluation for Fe-55 in soils. The result

was received at the end of December and the root cause in under investigation. No client samples were associated with this cross-check. (CAR 23-31)

5. The Analytics September 2023 milk Sr-90 result was evaluated as Not Acceptable. The reported result was 7.28 pCi/L and the known result was 12.8 (57% of known). This sample was used as the workgroup duplicate and the carrier yields for both samples were 107% and 75%. The LCS recovery for the workgroup was at 106%. The ERA drinking water Sr-90 cross check that was analyzed around the same time was acceptable at 108%. There was no explanation for the failure. This is the first low biased failure for Sr-90 milk. The last failure (high) was in 2016. (NCR 23-24)

6. The ERA RAD October 2023 water Gross Alpha result was evaluated as Not Acceptable. The reported result was 53.2 pCi/L and the known result was 70.6 (acceptable range of 54.0 – 87.2 pCi/L). The reported result was the workgroup duplicate and was within 75% of the known value (within TBE QC range). The original result was 63.3 pCi/L (90% of the known). Because the LCS result was biased slightly high, the decision was made to report the lower value. (NCR 23-20)

7. The ERA RAD October 2023 water I-131 result was evaluated as Not Acceptable. The reported value was 23.5 pCi/L and the known result was 29.7 (acceptable range of 25.8 – 33.6) The reported result was 79% of the known, which is within the acceptable TBE QC range. The workgroup was reviewed with no anomalies found. The LCS/LCSD results were 109% and 86.1%. The sample was not processed in a timely manner as per the ERA instructions which stated to analyze shortly after

receipt due to the short half-life. Going forward, the QA &/or Lab Mgr. will ensure that this analysis is started sooner. (NCR 23-21)

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 2023 REMP samples are divided into categories based on exposure pathways: atmospheric, direct radiation, terrestrial, and aquatic. The analytical results for the 2023 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 318 of 318 of the indicator location samples at concentrations ranging from 6 to 27 E-3 pCi/m^3 with an average concentration of 15 E-3 pCi/m^3, and in 53 of 53 of the control location samples at concentrations ranging from 5 to 23 E-3 pCi/m^3 with an average of 13 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 56 E-3 to 126 E-3 pCi/m^3 with an average concentration of 89 E-3 pCi/m^3, and in the four control location composites ranging in concentration from 63 to 102 E-3 pCi/m^3 with an average concentration of 82 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 59 locations were monitored for direct radiation during 2023, including 34 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 [Reference 8].

The indicator locations annual average dose rate was 16.5 milliroentgen per standard quarter. The annual average dose rate for the control locations was 14.4 milliroentgen per standard quarter. The preoperational average for the quarterly direct radiation readings was 17.6 milliroentgen per standard quarter.

In 2023, the maximum direct radiation dose to a member of the public calculated using the methodology in EC-ENVR-1012 [Reference 8] was 0.763 mrem.

The results of the direct radiation measurements for 2023 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 food products.

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 2023 are plotted.

Gamma Spectrometry

Naturally occurring K-40 was detected in all 60 samples with concentrations for the 40 indicator location samples ranging from 1,056 to 1,595 pCi/L with an average concentration of 1,257 pCi/L, and the 20 control location sample concentrations ranging from 1,028 to 2,009 pCi/L with an average concentration of 1,302 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 not detected above the minimum detectable concentration in any of the indicator or control samples. 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 2023 are plotted.

Gamma Spectrometry

Naturally occurring K-40 was detected in one of the control samples with a concentration of 96 pCi/L. The 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. Drinking Water control samples have not been obtained/analyzed because there are no upstream locations available in reasonable proximity to SSES. As an alternative to an upstream control location, Surface Water pathway control samples are obtained from the Susquehanna River via an auto-composite sampler at the SSES Intake Structure. Surface Water control samples serve as control samples for the Drinking Water pathway since the Surface Water control samples are from the Susquehanna River.

Gross Beta

Gross beta activity was detected in two of the 12 drinking water samples. Sample concentrations ranged from 2.7 to 3.0 pCi/L with an average concentration of 2.8 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 2023 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 three indicator locations (11D1, 11S6, and 12F7) were collected throughout the growing season. All samples (fruit, vegetable, and broadleaf) were analyzed for gamma emitters and included soybeans, corn, Swiss chard, pumpkin, potatoes, string beans, and collards.

Gamma Spectrometry

Naturally occurring Be-7, attributed to cosmic ray activity in the atmosphere, was detected in five of the 17 indicator location samples with concentrations ranging from 497 to 1,037 pCi/kg wet with an average concentration of 692 pCi/kg wet. Preoperational data is not available for comparison.

Naturally occurring K-40 was detected in all 17 indicator location samples with concentrations ranging from 1,764 to

17,550 pCi/kg wet with an average concentration of 4,332 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 three indicator locations (6S5, 4S7, and LTAW) and two control locations (6S6 and 5S9). Each sample was analyzed for H-3 and gamma emitters.

Tritium

Tritium activity was detected in none of the 18 indicator location samples. Tritium was not detected in any of the 15 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 2023 are plotted.

Gamma Spectrometry

Naturally occurring K-40 was not detected in any of the indicator location samples. Two control locator samples had K-40 detected with an average concentration 24.6 pCi/L and ranging from of 24.1 to 25.2 pCi/L. Preoperational data is not available for comparison. Iodine-131 was not detected in any of the indicator or control samples. Naturally occurring Th-228 was detected in one of 21 indicator samples with a concentration of 4.8 pCi/L. 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 2023 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 2,358 to 4,937 pCi/kg wet with an average concentration of 3,729 pCi/kg wet, and in all control location samples at concentrations ranging from

2,466 to 3,629 pCi/kg wet with an average concentration of 3,156 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 8,672 to 14,420 pCi/kg dry with an average concentration of 11,370 pCi/kg dry, and in all of the control location samples with concentrations ranging from 15,470 to 17,170 pCi/kg dry with an average concentration of 16,320 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 control location samples with a concentration of 2,678 pCi/kg dry and

none of the indicator 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 1,029 to 1,525 pCi/kg dry with an average concentration of 1,273 pCi/kg dry, and in both of the control location samples at concentrations ranging from 1,045 to 1,986 pCi/kg dry with an average concentration of 1,516 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 832 to 1,616 pCi/kg dry with an average concentration of 1,053 pCi/kg dry, and in both of the control location samples at concentrations ranging from 1,254 and 1,562 pCi/kg dry with an average concentration of 1,408 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 2023 LAND USE CENSUS

Applied Ecoscience, Inc. conducted a Land Use Census during the 2023 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-Sept, 2023 miles	Nearest Garden June-Oct, 2023 miles	Nearest Dairy Farm July-Nov, 2023 miles
1	N	1.3	4.0	>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 2023 Land Use Census results are summarized in the above table.

V. Annotations to Previous AREOR

In the 2015 Radiological Environmental Operating Report on Table C-4, the quarterly average values for direct radiation Indicator and Control locations were incorrect. The values in the above referenced report were incorrectly reported as the same values listed for direct radiation Indicator and Control locations from the 2014 Radiological Environmental Operating Report.

Below are the updated 2015 quarterly average values for direct radiation Indicator and Control locations.

2015 Table C-4 Updated Quarterly Averages

Location	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Indicator Average	19.7 ± 9.9	19.8 ± 9.2	18.2 ± 10.2	23.3 ± 7.9
Control Average	18.1 ± 3.2	17.1 ± 2.7	15.3 ± 2.7	13.9 ± 2.0

VI. Conclusions

The Radiological Environmental Monitoring Program for SSES was conducted during 2023 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, 2023, prepared by Teledyne Brown Engineering, Knoxville TN.

[2] Final Safety Analysis Report

[3] Final Environmental Statement

[4] Susquehanna Steam Electric Station, 2023 Land Use Census. Prepared for Susquehanna Nuclear, LLC, Berwick, PA. December 2023. 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

[9] Regulatory Guide 1.109, Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I, Rev. 1 October 1977

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 28, 2022 to January 3, 2024

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	371	10	1.482E+01 (318/318) (5.520E+00 - 2.670E+01)	10S3 0.6 MILES SSW	1.566E+01 (53/53) (6.360E+00 - 2.350E+01)	1.348E+01 (53/53) (4.840E+00 - 2.330E+01)	0
	GAMMA	28						
	BE-7	28	N/A	8.890E+01 (24/24) (5.621E+01 - 1.258E+02)	13S6 0.4 MILES W	9.466E+01 (4/4) (7.892E+01 - 1.102E+02)	8.185E+01 (4/4) (6.321E+01 - 1.017E+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	371						
	I-131	371	70	<MDC (0/318)		<MDC	<MDC (0/53)	0
Ambient Radiation (mR/std. qtr.)	OSLD	235	N/A	1.648E+01 (215/215) (8.790E+00 - 3.999E+01)	9S2 0.2 MILES S	3.843E+01 (4/4) (3.646E+01 - 3.999E+01)	1.438E+01 (20/20) (1.092E+01 - 1.914E+01)	0
Milk (pCi/Liter)	I-131	60	1	<MDC (0/40)		<MDC	<MDC (0/20)	0
	GAMMA	60						
	K-40	60	N/A	1.257E+03 (40/40) (1.056E+03 - 1.595E+03)	10G1 C 14 MILES SSW	1.302E+03 (20/20) (1.028E+03 - 2.009E+03)	1.302E+03 (20/20) (1.028E+03 - 2.009E+03)	0
	CS-134	60	15	<MDC (0/40)		<MDC	<MDC (0/20)	0

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LOCATION OF FACILITY: LUZERNE COUNTY, PENNSYLVANIA

Reporting Period: December 28, 2022 to January 3, 2024

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)
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	<MDC	(0/40)	<MDC			<MDC	(0/4)	0
	GAMMA	44									
	K-40	44	N/A	<MDC	(0/40)	13S7 C 0.2 MILES W	9.605E+01 (9.605E+01)	(1/4)	9.605E+01 (9.605E+01)	(1/4)	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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LOCATION OF FACILITY: LUZERNE COUNTY, PENNSYLVANIA

Reporting Period: December 28, 2022 to January 3, 2024

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)
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	2.815E+00 (2/12) (2.670E+00 - 2.960E+00)		12H2 26 MILES WSW	2.815E+00 (2/12) (2.670E+00 - 2.960E+00)	N/A		0
	H-3	12	2000	<MDC	(0/12)	<MDC		N/A		0

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 28, 2022 to January 3, 2024

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)
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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Reporting Period: December 28, 2022 to January 3, 2024

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)
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 17						
	BE-7 17	N/A	6.924E+02 (5/17) (4.970E+02 - 1.037E+03)	11S6 0.5 MILES SW	6.924E+02 (5/10) (4.970E+02 - 1.037E+03)	N/A	0
	K-40 17	N/A	4.332E+03 (17/17) (1.764E+03 - 1.755E+04)	12F7 8.3 MILES WSW	6.244E+03 (4/4) (1.854E+03 - 1.755E+04)	N/A	0
	MN-54 17	N/A	<MDC (0/17)	<MDC		N/A	0
	CO-58 17	N/A	<MDC (0/17)	<MDC		N/A	0
	FE-59 17	N/A	<MDC (0/17)	<MDC		N/A	0
	CO-60 17	N/A	<MDC (0/17)	<MDC		N/A	0
	ZN-65 17	N/A	<MDC (0/17)	<MDC		N/A	0

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Reporting Period: December 28, 2022 to January 3, 2024

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)
Food/Garden Crops (cont'd) (pCi/kg wet)	NB-95	17	N/A	<MDC	(0/17)	<MDC	N/A	0
	ZR-95	17	N/A	<MDC	(0/17)	<MDC	N/A	0
	I-131	17	60	<MDC	(0/17)	<MDC	N/A	0
	CS-134	17	60	<MDC	(0/17)	<MDC	N/A	0
	CS-137	17	80	<MDC	(0/17)	<MDC	N/A	0
	BA-140	17	N/A	<MDC	(0/17)	<MDC	N/A	0
	LA-140	17	N/A	<MDC	(0/17)	<MDC	N/A	0
	AC-228	17	N/A	<MDC	(0/17)	<MDC	N/A	0
	TH-228	17	N/A	<MDC	(0/17)	<MDC	N/A	0

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Reporting Period: December 28, 2022 to January 3, 2024

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)
Surface Water (pCi/Liter)	H-3	33	2000	<MDC	(0/18)	<MDC			<MDC	(0/15)	0
	GAMMA	33									
	K-40	33	N/A	<MDC	(0/18)	6S6 C 0.8 MILES ESE	2.46E+01 (2.408E+01 - 2.519E+01)	(2/12)	2.46E+01 (2.408E+01 - 2.519E+01)	(2/15)	0
	MN-54	33	15	<MDC	(0/18)	<MDC			<MDC	(0/15)	0
	CO-58	33	15	<MDC	(0/18)	<MDC			<MDC	(0/15)	0
	FE-59	33	30	<MDC	(0/18)	<MDC			<MDC	(0/15)	0
	CO-60	33	15	<MDC	(0/18)	<MDC			<MDC	(0/15)	0
	ZN-65	33	30	<MDC	(0/18)	<MDC			<MDC	(0/15)	0
	NB-95	33	15	<MDC	(0/18)	<MDC			<MDC	(0/15)	0
	ZR-95	33	30	<MDC	(0/18)	<MDC			<MDC	(0/15)	0
	I-131	33	15	<MDC	(0/18)	<MDC			<MDC	(0/15)	0

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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)
Surface Water (cont'd) (pCi/Liter)	CS-134	33	15	<MDC	(0/18)	<MDC			<MDC	(0/15)	0
	CS-137	33	18	<MDC	(0/18)	<MDC			<MDC	(0/15)	0
	BA-140	33	60	<MDC	(0/18)	<MDC			<MDC	(0/15)	0
	LA-140	33	15	<MDC	(0/18)	<MDC			<MDC	(0/15)	0
	TH-228	33	N/A	4.808E+00 (4.808E+00)	(1/18)	6S5 0.9 MILES ESE	4.808E+00 (4.808E+00)	(1/12)	<MDC	(0/15)	0
Fish (pCi/kg wet)	GAMMA	14									
	K-40	14	N/A	3.729E+03 (2.358E+03 - 4.937E+03)	(8/8)	LTAW 0.7 MILES NE-ESE	4.447E+03 (3.957E+03 - 4.937E+03)	(2/2)	3.156E+03 (2.466E+03 - 3.629E+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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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)
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	1.137E+04 (4/4) (8.672E+03 - 1.442E+04)	2B 1.6 MILES NNE	1.632E+04 (2/2) (1.547E+04 - 1.717E+04)	1.632E+04 (2/2) (1.547E+04 - 1.717E+04)	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	<MDC (0/4)	2B 1.6 MILES NNE	2.678E+03 (1/2) (2.678E+03)	2.678E+03 (1/2) (2.678E+03)	0
	AC-228 6	N/A	1.273E+03 (4/4) (1.029E+03 - 1.525E+03)	2B 1.6 MILES NNE	1.516E+03 (2/2) (1.045E+03 - 1.986E+03)	1.516E+03 (2/2) (1.045E+03 - 1.986E+03)	0
	TH-228 6	N/A	1.053E+03 (4/4) (8.320E+02 - 1.616E+03)	2B 1.6 MILES NNE	1.408E+03 (2/2) (1.254E+03 - 1.562E+03)	1.408E+03 (2/2) (1.254E+03 - 1.562E+03)	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
5S9**	0.8 mi. E	41.093292	-76.130472	Surface water
LTAW	0.7 mi.NE-ESE;	41.098356	-76.135401	Fish. Surface water
4S7	0.4 mi. ENE	41.094418	-76.138236	Surface water
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
12F7	8.3 mi.WSW	41.036689	-76.286776	Food Products
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
9S3	0.3 mi. S	41.087544	-76.145369	OSLD
9S4	0.4 mi. S	41.086672	-76.146280	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 4	TBE-2008 Gross Alpha and/or Gross Beta Activity in Various Matrices.
Surface & Drinking Water	Tritium	Monthly / Quarterly (Grab)	Applied Ecoscience, Appendix 3, 4, 5, 13	TBE-2010 Tritium and Carbon-14 Analysis by Liquid Scintillation.
Surface & Drinking Water	Gamma	Monthly / Quarterly (Grab)	Applied Ecoscience, Appendix 3, 4, 5, 13	TBE-2007 Gamma Emitting Radioisotope Analysis.
Ground Water	Tritium	Quarterly	Applied Ecoscience, Appendix 6	TBE-2010 Tritium and Carbon-14 Analysis by Liquid Scintillation
Ground Water	Gamma	Quarterly	Applied Ecoscience, Appendix 6	TBE-2007 Gamma Emitting Radioisotope Analysis

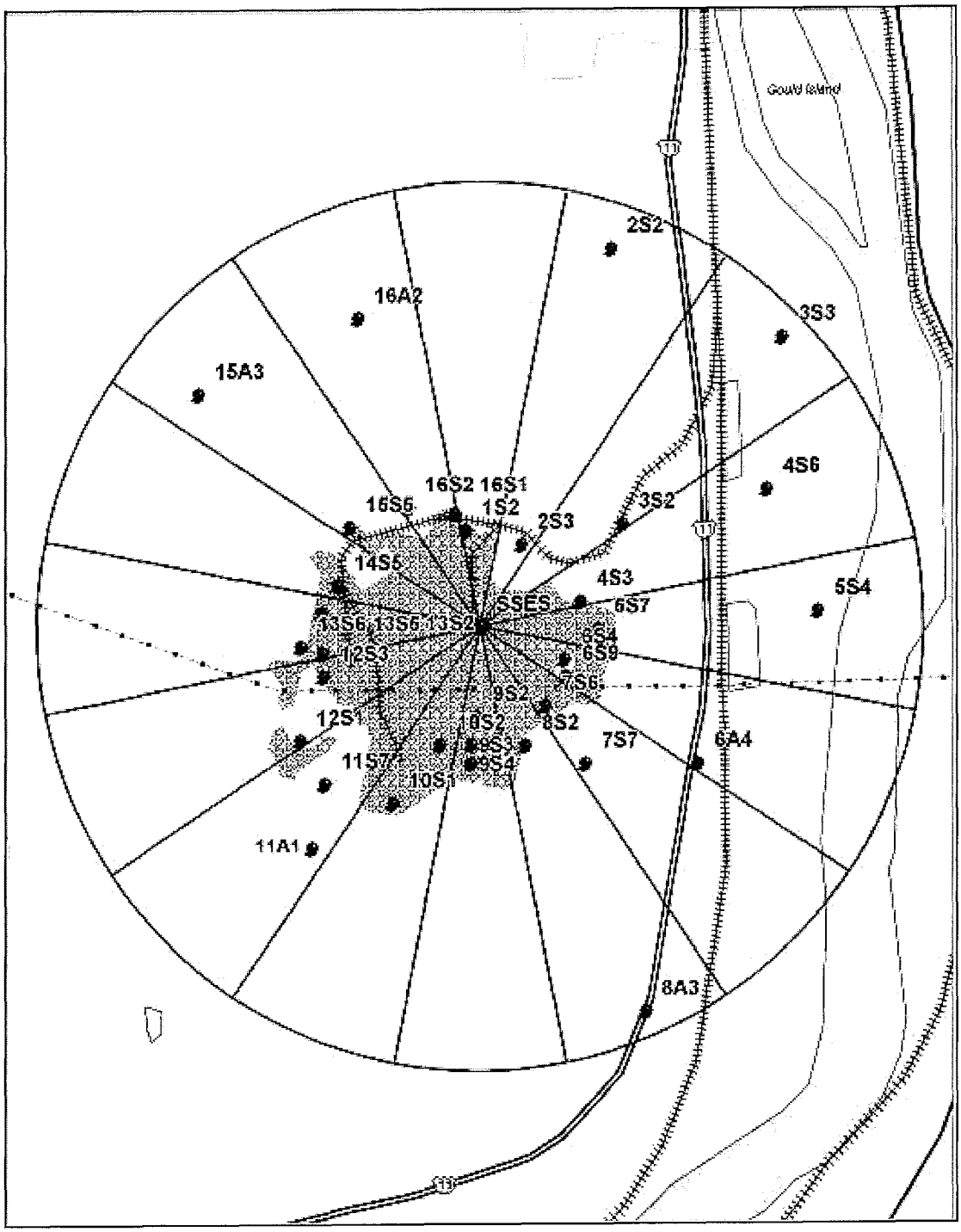
TABLE B-2 (cont'd)

SUSQUEHANNA STEAM ELECTRIC STATION RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Sample Medium	Analysis	Sampling Method	Collection Procedure Number	Analytical Procedure Number
Precipitation	Tritium	(Apr – Nov) / Quarterly	Applied Ecoscience, Appendix 8	TBE-2010 Tritium and Carbon-14 Analysis by Liquid Scintillation
Milk	Gamma	Monthly / Bi-Weekly	Applied Ecoscience, Appendix 7	TBE-2007 Gamma Emitting Radioisotope Analysis
Milk	I-131	Monthly / Bi-Weekly	Applied Ecoscience, Appendix 7	TBE-2012 Radioiodine in Various Matrices
Fish	Gamma	Semi-Annually (Spring/Fall)	Applied Ecoscience, Appendix 9	TBE-2007 Gamma Emitting Radioisotope Analysis
Sediment	Gamma	Semi-Annually (Spring/Fall)	Applied Ecoscience, Appendix 10	TBE-2007 Gamma Emitting Radioisotope Analysis
Fruits & Vegetables	Gamma	In Season (When available)	Applied Ecoscience, Appendix 11 Applied Ecoscience, Appendix 12	TBE-2007 Gamma Emitting Radioisotope Analysis

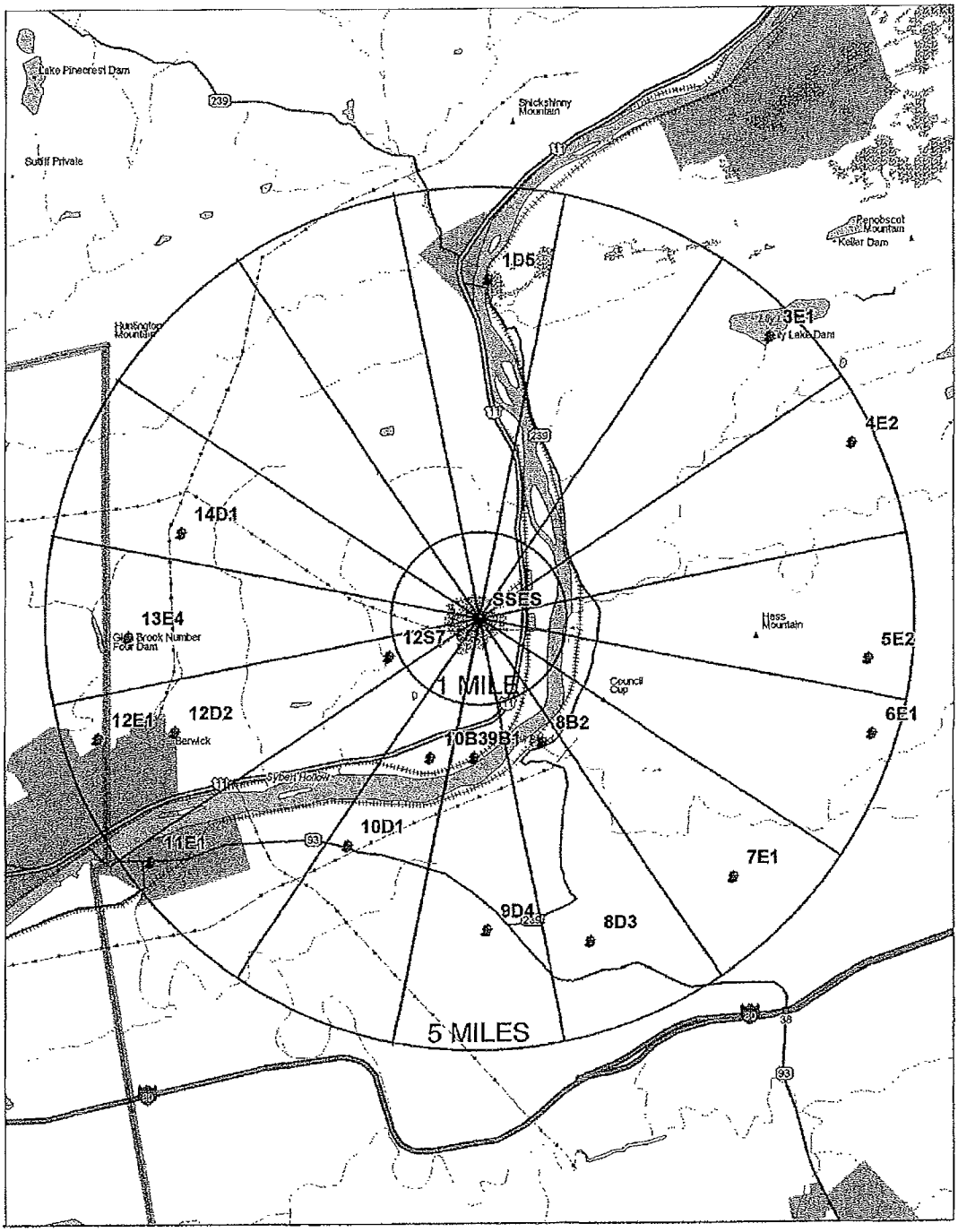
MAP B-1

Direct Radiation Monitoring Locations Within One Mile



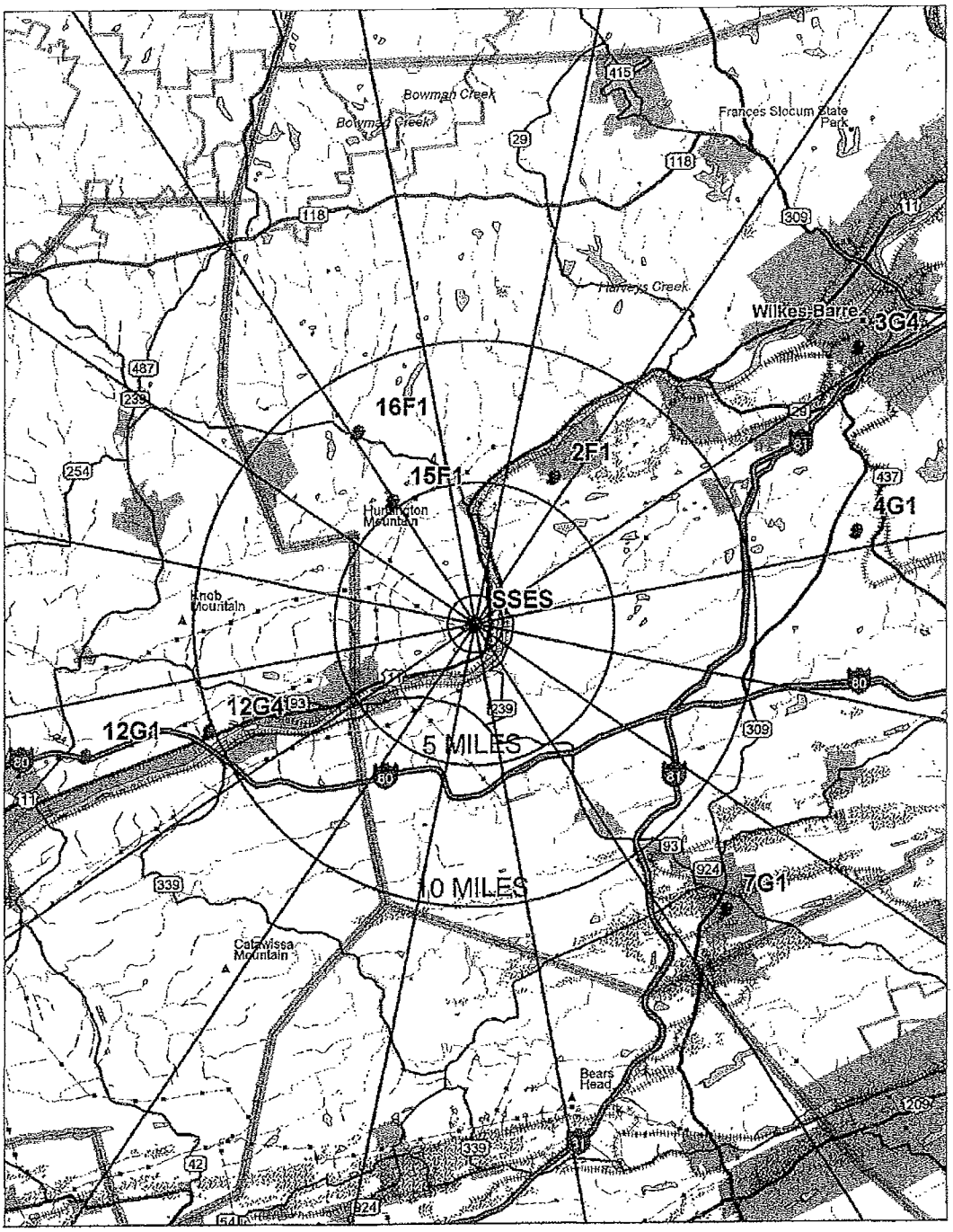
MAP B-2

Direct Radiation Monitoring Locations From One to Five Miles



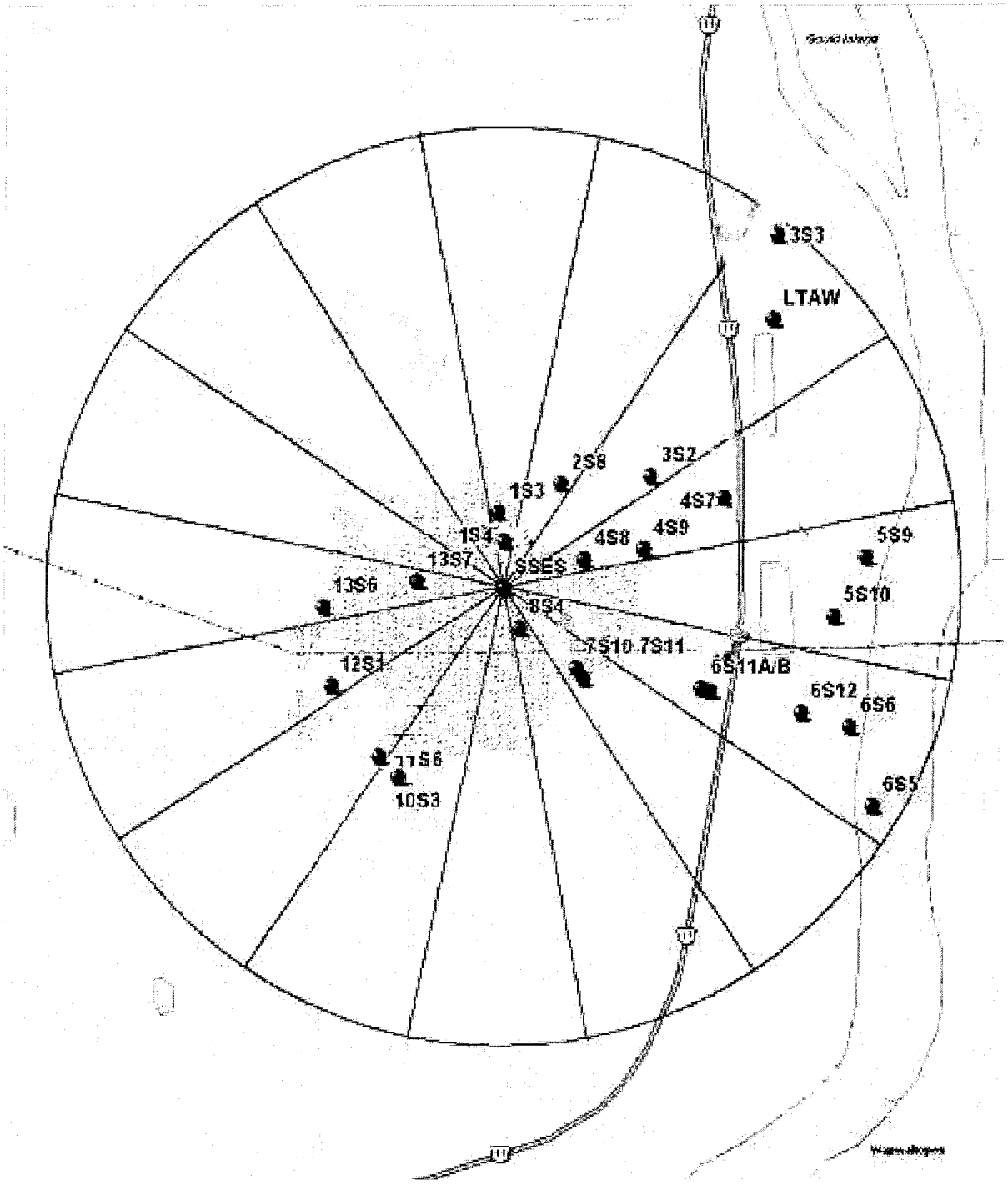
MAP B-3

Direct Radiation Monitoring Locations Greater Than Five Miles



MAP B-4

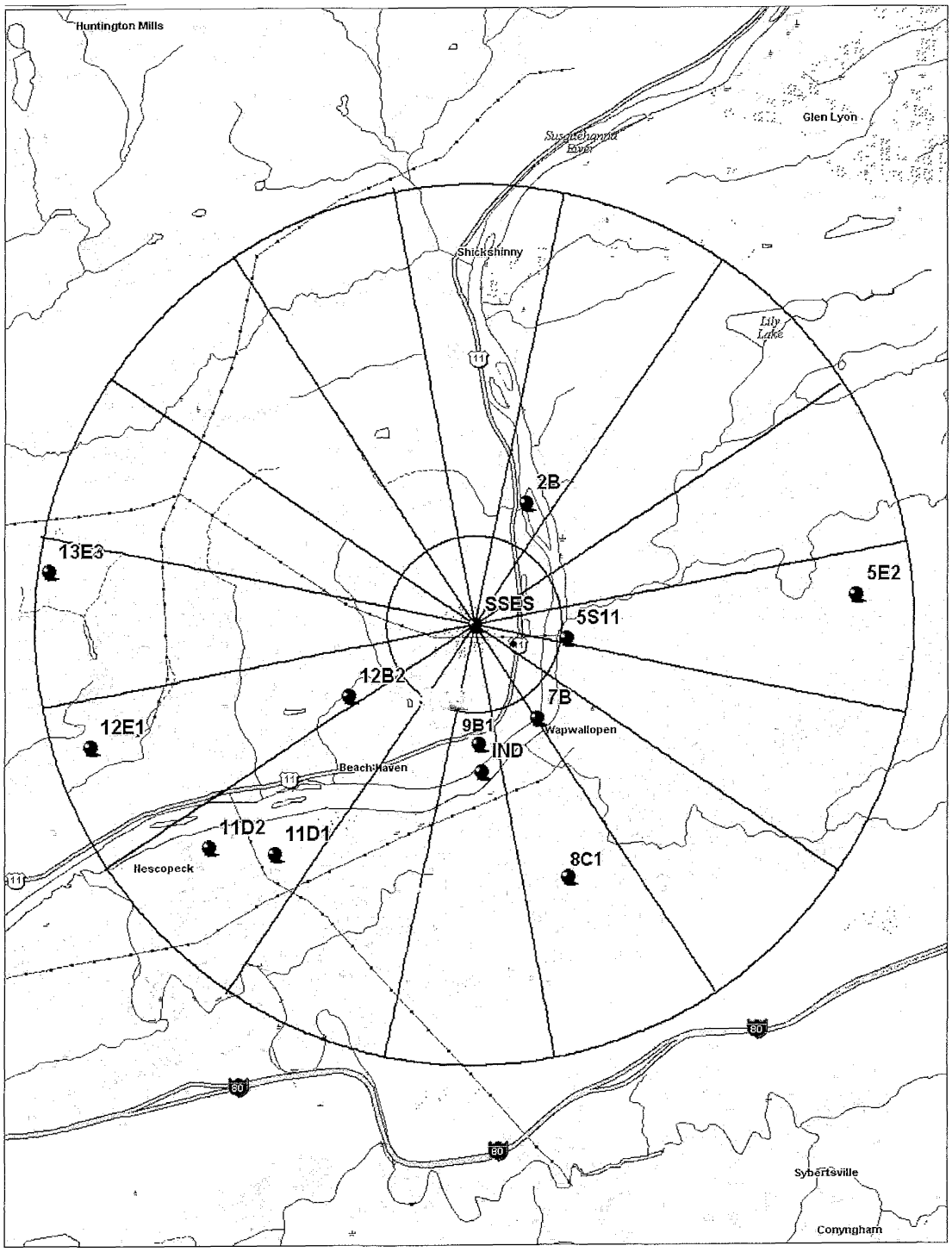
Environmental Sampling Locations Within One Mile



MAP B-5

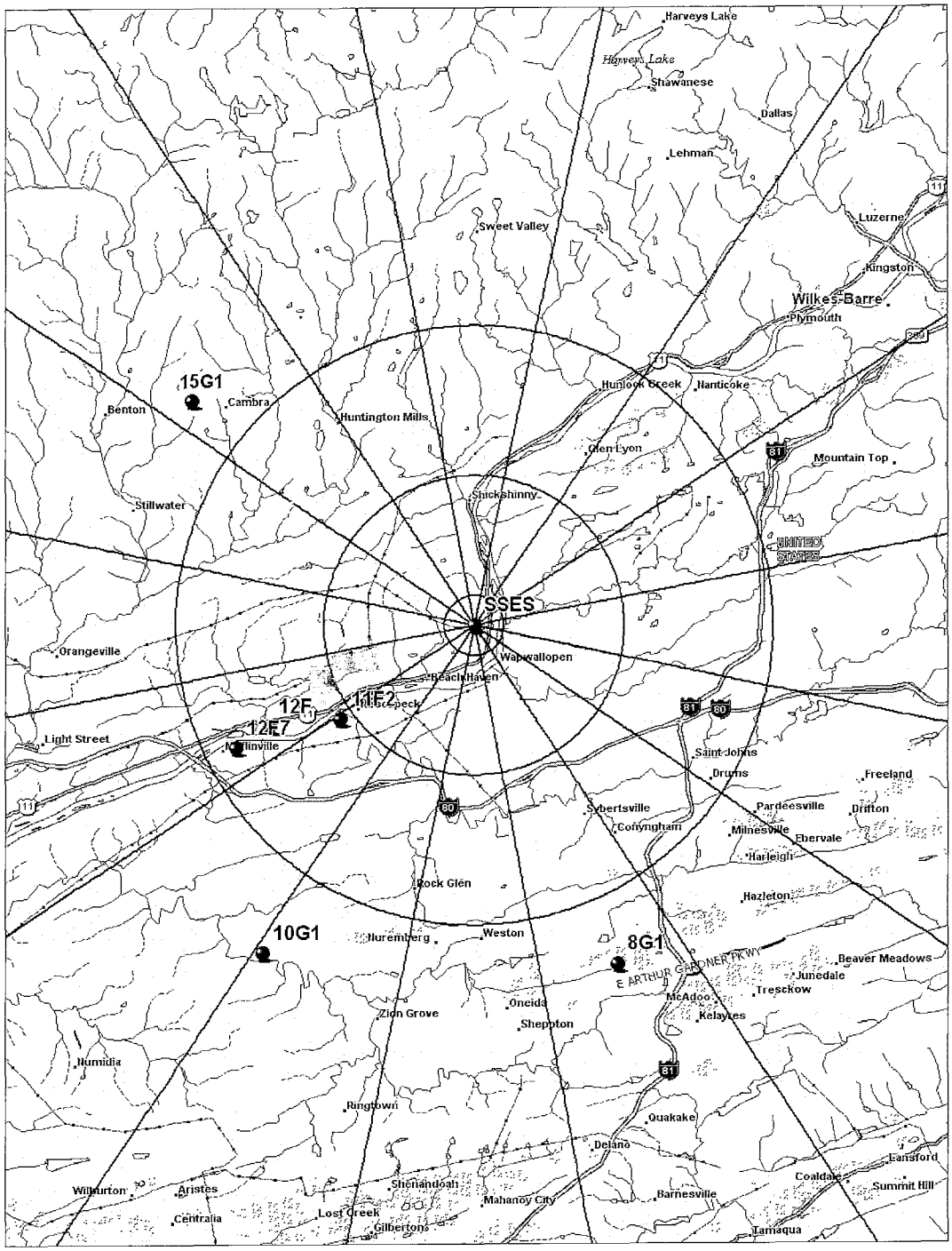
Environmental Sampling Locations

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, 2023

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

COLLECTION PERIOD	3S2	8G1	12E1	12S1	13S6	9B1
12/28/22 - 01/04/23	18 ± 3	12 ± 2	21 ± 3	22 ± 3	22 ± 3	20 ± 3
01/04/23 - 01/11/23	14 ± 2	12 ± 2	14 ± 2	16 ± 2	17 ± 2	16 ± 2
01/11/23 - 01/18/23	11 ± 2	11 ± 2	14 ± 2	12 ± 2	11 ± 2	12 ± 2
01/18/23 - 01/24/23	6 ± 2	7 ± 2	7 ± 2	6 ± 2	6 ± 2	6 ± 2
01/24/23 - 02/01/23	14 ± 2	10 ± 2	14 ± 2	15 ± 2	14 ± 2	13 ± 2
02/01/23 - 02/08/23	12 ± 2	13 ± 2	17 ± 2	20 ± 6	16 ± 2	15 ± 2
02/08/23 - 02/15/23	17 ± 2	16 ± 2	16 ± 2	17 ± 2	19 ± 2	16 ± 2
02/15/23 - 02/22/23	13 ± 2	15 ± 2	16 ± 2	17 ± 2	16 ± 2	14 ± 2
02/22/23 - 02/28/23	11 ± 2	12 ± 2	15 ± 2	13 ± 2	13 ± 2	12 ± 2
02/28/23 - 03/08/23	9 ± 2	8 ± 2	11 ± 2	9 ± 2	9 ± 2	9 ± 2
03/08/23 - 03/15/23	8 ± 2	7 ± 2	8 ± 2	8 ± 2	9 ± 2	9 ± 2
03/15/23 - 03/22/23	16 ± 2	15 ± 2	17 ± 2	17 ± 2	17 ± 2	18 ± 2
03/22/23 - 03/29/23	15 ± 2	13 ± 2	15 ± 2	15 ± 2	16 ± 2	13 ± 2
03/29/23 - 04/05/23	18 ± 2	16 ± 2	16 ± 2	15 ± 2	20 ± 3	19 ± 2
04/05/23 - 04/12/23	16 ± 2	17 ± 2	21 ± 3	19 ± 3	19 ± 3	19 ± 3
04/12/23 - 04/19/23	14 ± 2	11 ± 2	15 ± 2	14 ± 2	15 ± 2	13 ± 2
04/19/23 - 04/26/23	12 ± 2	9 ± 2	14 ± 2	12 ± 2	11 ± 2	13 ± 2
04/26/23 - 05/03/23	6 ± 2	5 ± 2	6 ± 2	8 ± 2	8 ± 2	8 ± 2
05/03/23 - 05/10/23	7 ± 2	8 ± 2	10 ± 2	8 ± 2	7 ± 2	8 ± 2
05/10/23 - 05/17/23	13 ± 2	14 ± 2	16 ± 2	14 ± 2	14 ± 2	15 ± 2
05/17/23 - 05/24/23	11 ± 2	13 ± 2	13 ± 2	12 ± 2	13 ± 2	14 ± 2
05/24/23 - 05/30/23	10 ± 2	9 ± 2	9 ± 2	11 ± 2	12 ± 2	12 ± 2
05/30/23 - 06/06/23	13 ± 2	11 ± 2	17 ± 2	14 ± 2	16 ± 2	15 ± 2
06/06/23 - 06/12/23	18 ± 5	16 ± 4	25 ± 6	19 ± 5	22 ± 5	27 ± 6
06/12/23 - 06/20/23	10 ± 2	10 ± 2	12 ± 2	11 ± 2	11 ± 2	12 ± 2
06/20/23 - 06/28/23	7 ± 2	9 ± 2	9 ± 2	9 ± 2	9 ± 2	8 ± 2
06/28/23 - 07/05/23	16 ± 2	18 ± 2	20 ± 2	18 ± 2	20 ± 2	16 ± 2
07/05/23 - 07/11/23	14 ± 2	15 ± 2	17 ± 2	16 ± 3	18 ± 3	16 ± 2
07/11/23 - 07/18/23	17 ± 2	20 ± 3	19 ± 3	17 ± 2	20 ± 3	18 ± 2
07/18/23 - 07/26/23	14 ± 2	16 ± 2	15 ± 2	14 ± 2	16 ± 2	16 ± 2
07/26/23 - 08/02/23	14 ± 2	16 ± 2	15 ± 2	16 ± 2	18 ± 3	14 ± 2
08/02/23 - 08/09/23	14 ± 2	15 ± 2	16 ± 2	13 ± 2	14 ± 2	14 ± 2
08/09/23 - 08/16/23	15 ± 2	16 ± 2	18 ± 2	18 ± 2	16 ± 2	15 ± 2
08/16/23 - 08/23/23	13 ± 2	14 ± 2	14 ± 2	15 ± 2	15 ± 2	13 ± 2
08/23/23 - 08/30/23	12 ± 2	13 ± 2	13 ± 2	14 ± 2	13 ± 2	13 ± 2
08/30/23 - 09/06/23	20 ± 3	20 ± 3	22 ± 3	17 ± 2	22 ± 3	20 ± 2
09/06/23 - 09/12/23	20 ± 3	18 ± 3	19 ± 3	21 ± 3	22 ± 3	21 ± 3
09/12/23 - 09/20/23	13 ± 2	14 ± 2	14 ± 2	13 ± 2	16 ± 2	15 ± 2
09/20/23 - 09/27/23	11 ± 2	9 ± 2	11 ± 2	11 ± 2	12 ± 2	12 ± 2
09/27/23 - 10/03/23	15 ± 3	15 ± 3	14 ± 2	12 ± 2	14 ± 3	15 ± 3
10/03/23 - 10/11/23	19 ± 2	17 ± 2	18 ± 2	17 ± 2	18 ± 2	18 ± 2
10/11/23 - 10/18/23	8 ± 2	10 ± 2	10 ± 2	10 ± 2	8 ± 2	11 ± 2
10/18/23 - 10/25/23	10 ± 2	12 ± 2	13 ± 2	13 ± 2	13 ± 2	11 ± 2
10/25/23 - 11/01/23	17 ± 2	16 ± 2	19 ± 2	16 ± 2	16 ± 2	16 ± 2
11/01/23 - 11/08/23	24 ± 3	23 ± 3	23 ± 3	24 ± 3	24 ± 3	22 ± 3
11/08/23 - 11/15/23	14 ± 2	15 ± 2	15 ± 2	15 ± 2	16 ± 2	16 ± 2
11/15/23 - 11/21/23	16 ± 3	16 ± 3	18 ± 3	19 ± 3	19 ± 3	23 ± 3
11/21/23 - 11/29/23	13 ± 2	13 ± 2	13 ± 2	12 ± 2	13 ± 2	12 ± 2
11/29/23 - 12/06/23	21 ± 3	19 ± 2	20 ± 2	19 ± 2	18 ± 2	20 ± 2
12/06/23 - 12/13/23	16 ± 2	16 ± 2	13 ± 2	14 ± 2	16 ± 2	14 ± 2
12/13/23 - 12/20/23	14 ± 2	15 ± 2	17 ± 2	16 ± 2	16 ± 2	15 ± 2
12/20/23 - 12/27/23	17 ± 2	15 ± 2	17 ± 2	14 ± 2	17 ± 2	17 ± 2
12/27/23 - 01/03/24	11 ± 2	11 ± 2	12 ± 2	13 ± 2	12 ± 2	14 ± 2
AVERAGE	14 ± 8	13 ± 7	15 ± 8	14 ± 7	15 ± 8	15 ± 8

TABLE C-1 **GROSS BETA ANALYSES OF AIR PARTICULATE FILTERS**
SUSQUEHANNA STEAM ELECTRIC STATION, 2023

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

COLLECTION PERIOD	10S3
12/28/22 - 01/04/23	21 ± 3
01/04/23 - 01/11/23	15 ± 2
01/11/23 - 01/18/23	12 ± 2
01/18/23 - 01/24/23	6 ± 2
01/24/23 - 02/01/23	12 ± 2
02/01/23 - 02/08/23	15 ± 2
02/08/23 - 02/15/23	18 ± 2
02/15/23 - 02/22/23	15 ± 2
02/22/23 - 02/28/23	15 ± 3
02/28/23 - 03/08/23	11 ± 2
03/08/23 - 03/15/23	8 ± 2
03/15/23 - 03/22/23	18 ± 2
03/22/23 - 03/29/23	18 ± 2
03/29/23 - 04/05/23	18 ± 2
04/05/23 - 04/12/23	21 ± 3
04/12/23 - 04/19/23	13 ± 2
04/19/23 - 04/26/23	11 ± 2
04/26/23 - 05/03/23	9 ± 2
05/03/23 - 05/10/23	8 ± 2
05/10/23 - 05/17/23	17 ± 2
05/17/23 - 05/24/23	12 ± 2
05/24/23 - 05/30/23	13 ± 2
05/30/23 - 06/06/23	17 ± 2
06/06/23 - 06/12/23	21 ± 5
06/12/23 - 06/20/23	13 ± 2
06/20/23 - 06/28/23	11 ± 2
06/28/23 - 07/05/23	19 ± 2
07/05/23 - 07/11/23	19 ± 3
07/11/23 - 07/18/23	21 ± 3
07/18/23 - 07/26/23	18 ± 2
07/26/23 - 08/02/23	16 ± 2
08/02/23 - 08/09/23	16 ± 2
08/09/23 - 08/16/23	18 ± 2
08/16/23 - 08/23/23	16 ± 2
08/23/23 - 08/30/23	17 ± 2
08/30/23 - 09/06/23	21 ± 3
09/06/23 - 09/12/23	21 ± 3
09/12/23 - 09/20/23	17 ± 2
09/20/23 - 09/27/23	11 ± 2
09/27/23 - 10/03/23	16 ± 3
10/03/23 - 10/11/23	18 ± 2
10/11/23 - 10/18/23	10 ± 2
10/18/23 - 10/25/23	12 ± 2
10/25/23 - 11/01/23	17 ± 2
11/01/23 - 11/08/23	24 ± 3
11/08/23 - 11/15/23	17 ± 2
11/15/23 - 11/21/23	23 ± 3
11/21/23 - 11/29/23	13 ± 2
11/29/23 - 12/06/23	20 ± 3
12/06/23 - 12/13/23	16 ± 2
12/13/23 - 12/20/23	18 ± 2
12/20/23 - 12/27/23	18 ± 2
12/27/23 - 01/03/24	12 ± 2
AVERAGE	16 ± 8

TABLE C-2 GAMMA SPECTROSCOPIC ANALYSES OF COMPOSITED AIR PARTICULATE FILTERS SUSQUEHANNA STEAM ELECTRIC STATION, 2023

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

SITE	COLLECTION PERIOD	Be-7	K-40	Cs-134	Cs-137
8G1	12/28/22 - 03/29/23	76 ± 16	< 16	< 1	< 1
	03/29/23 - 06/28/23	87 ± 23	< 23	< 2	< 1
	06/28/23 - 10/03/23	102 ± 19	< 20	< 1	< 1
	10/03/23 - 01/03/24	63 ± 13	< 20	< 1	< 1
	AVERAGE	82 ± 33	-	-	-
3S2	12/28/22 - 03/29/23	56 ± 19	< 19	< 1	< 1
	03/29/23 - 06/28/23	95 ± 25	< 15	< 1	< 1
	06/28/23 - 10/03/23	102 ± 19	< 17	< 1	< 1
	10/03/23 - 01/03/24	78 ± 24	< 20	< 1	< 1
	AVERAGE	83 ± 41	-	-	-
12E1	12/28/22 - 03/29/23	83 ± 21	< 23	< 1	< 1
	03/29/23 - 06/28/23	121 ± 23	< 23	< 1	< 1
	06/28/23 - 10/03/23	92 ± 19	< 17	< 1	< 1
	10/03/23 - 01/03/24	73 ± 19	< 19	< 1	< 1
	AVERAGE	92 ± 41	-	-	-
12S1	12/28/22 - 03/29/23	85 ± 24	< 21	< 2	< 1
	03/29/23 - 06/28/23	113 ± 24	< 22	< 1	< 1
	06/28/23 - 10/03/23	87 ± 15	< 14	< 1	< 1
	10/03/23 - 01/03/24	62 ± 14	< 10	< 1	< 1
	AVERAGE	87 ± 41	-	-	-
13S6	12/28/22 - 03/29/23	79 ± 18	< 16	< 1	< 1
	03/29/23 - 06/28/23	110 ± 25	< 20	< 1	< 1
	06/28/23 - 10/03/23	95 ± 18	< 16	< 1	< 1
	10/03/23 - 01/03/24	95 ± 16	< 12	< 1	< 1
	AVERAGE	95 ± 26	-	-	-
9B1	12/28/22 - 03/29/23	69 ± 18	< 14	< 1	< 1
	03/29/23 - 06/28/23	92 ± 21	< 16	< 1	< 1
	06/28/23 - 10/03/23	126 ± 20	< 18	< 1	< 1
	10/03/23 - 01/03/24	64 ± 18	< 19	< 1	< 1
	AVERAGE	88 ± 57	-	-	-
10S3	12/28/22 - 03/29/23	84 ± 21	< 21	< 1	< 1
	03/29/23 - 06/28/23	107 ± 23	< 18	< 1	< 1
	06/28/23 - 10/03/23	92 ± 19	< 9	< 1	< 1
	10/03/23 - 01/03/24	75 ± 16	< 13	< 1	< 1
	AVERAGE	89 ± 27	-	-	-

TABLE C-3 **IODINE-131 ANALYSES OF AIR IODINE SAMPLES**
SUSQUEHANNA STEAM ELECTRIC STATION, 2023

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

COLLECTION PERIOD	3S2	8G1	12E1	12S1	13S6	9B1
12/28/22 - 01/04/23	< 9	< 15	< 9	< 9	< 9	< 8
01/04/23 - 01/11/23	< 15	< 26	< 15	< 7	< 16	< 28
01/11/23 - 01/18/23	< 21	< 20	< 21	< 9	< 22	< 21
01/18/23 - 01/24/23	< 19	< 21	< 20	< 21	< 19	< 20
01/24/23 - 02/01/23	< 11	< 20	< 19	< 20	< 20	< 19
02/01/23 - 02/08/23	< 30	< 20	< 28	< 55	< 29	< 19
02/08/23 - 02/15/23	< 31	< 35	< 34	< 34	< 31	< 33
02/15/23 - 02/22/23	< 23	< 9	< 21	< 21	< 21	< 17
02/22/23 - 02/28/23	< 23	< 22	< 21	< 21	< 16	< 11
02/28/23 - 03/08/23	< 20	< 19	< 18	< 18	< 19	< 18
03/08/23 - 03/15/23	< 15	< 24	< 33	< 33	< 34	< 23
03/15/23 - 03/22/23	< 21	< 22	< 22	< 22	< 21	< 9
03/22/23 - 03/29/23	< 28	< 26	< 27	< 27	< 12	< 26
03/29/23 - 04/05/23	< 17	< 18	< 16	< 8	< 17	< 17
04/05/23 - 04/12/23	< 23	< 20	< 20	< 20	< 22	< 14
04/12/23 - 04/19/23	< 23	< 31	< 22	< 22	< 9	< 17
04/19/23 - 04/26/23	< 11	< 17	< 20	< 19	< 19	< 11
04/26/23 - 05/03/23	< 30	< 21	< 20	< 21	< 29	< 9
05/03/23 - 05/10/23	< 33	< 32	< 31	< 31	< 32	< 31
05/10/23 - 05/17/23	< 26	< 21	< 21	< 20	< 26	< 9
05/17/23 - 05/24/23	< 8	< 17	< 16	< 16	< 16	< 17
05/24/23 - 05/30/23	< 31	< 12	< 31	< 31	< 31	< 31
05/30/23 - 06/06/23	< 10	< 14	< 35	< 34	< 13	< 34
06/06/23 - 06/12/23	< 49	< 41	< 28	< 50	< 48	< 30
06/12/23 - 06/20/23	< 17	< 7	< 17	< 17	< 17	< 17
06/20/23 - 06/28/23	< 19	< 13	< 32	< 34	< 23	< 33
06/28/23 - 07/05/23	< 35	< 8	< 18	< 19	< 36	< 19
07/05/23 - 07/11/23	< 19	< 12	< 8	< 20	< 19	< 6
07/11/23 - 07/18/23	< 7	< 17	< 13	< 18	< 10	< 17
07/18/23 - 07/26/23	< 26	< 23	< 22	< 23	< 11	< 9
07/26/23 - 08/02/23	< 11	< 27	< 27	< 28	< 13	< 11
08/02/23 - 08/09/23	< 18	< 25	< 25	< 25	< 8	< 10
08/09/23 - 08/16/23	< 20	< 25	< 20	< 20	< 21	< 24
08/16/23 - 08/23/23	< 22	< 23	< 23	< 24	< 23	< 10
08/23/23 - 08/30/23	< 29	< 30	< 29	< 14	< 31	< 29
08/30/23 - 09/06/23	< 22	< 34	< 34	< 35	< 23	< 14
09/06/23 - 09/12/23	< 30	< 31	< 29	< 31	< 13	< 31
09/12/23 - 09/20/23	< 21	< 17	< 17	< 17	< 21	< 12
09/20/23 - 09/27/23	< 24	< 8	< 22	< 22	< 22	< 22
09/27/23 - 10/03/23	< 25	< 16	< 17	< 17	< 27	< 9
10/03/23 - 10/11/23	< 21	< 9	< 21	< 22	< 9	< 9
10/11/23 - 10/18/23	< 10	< 30	< 25	< 25	< 25	< 31
10/18/23 - 10/25/23	< 33	< 21	< 21	< 21	< 35	< 16
10/25/23 - 11/01/23	< 11	< 38	< 22	< 22	< 23	< 41
11/01/23 - 11/08/23	< 12	< 21	< 21	< 10	< 15	< 22
11/08/23 - 11/15/23	< 11	< 19	< 19	< 19	< 13	< 19
11/15/23 - 11/21/23	< 27	< 31	< 30	< 20	< 20	< 30
11/21/23 - 11/29/23	< 28	< 38	< 28	< 27	< 11	< 38
11/29/23 - 12/06/23	< 28	< 14	< 27	< 26	< 29	< 13
12/06/23 - 12/13/23	< 36	< 30	< 30	< 30	< 38	< 12
12/13/23 - 12/20/23	< 19	< 15	< 19	< 19	< 10	< 14
12/20/23 - 12/27/23	< 12	< 16	< 16	< 15	< 14	< 7
12/27/23 - 01/03/24	< 16	< 25	< 26	< 10	< 9	< 27
AVERAGE	-	-	-	-	-	-

TABLE C-3 **IODINE-131 ANALYSES OF AIR IODINE SAMPLES**
SUSQUEHANNA STEAM ELECTRIC STATION, 2023

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

COLLECTION PERIOD	10S3
12/28/22 - 01/04/23	< 4
01/04/23 - 01/11/23	< 15
01/11/23 - 01/18/23	< 21
01/18/23 - 01/24/23	< 13
01/24/23 - 02/01/23	< 19
02/01/23 - 02/08/23	< 29
02/08/23 - 02/15/23	< 15
02/15/23 - 02/22/23	< 10
02/22/23 - 02/28/23	< 23
02/28/23 - 03/08/23	< 20
03/08/23 - 03/15/23	< 34
03/15/23 - 03/22/23	< 22
03/22/23 - 03/29/23	< 28
03/29/23 - 04/05/23	< 16
04/05/23 - 04/12/23	< 21
04/12/23 - 04/19/23	< 22
04/19/23 - 04/26/23	< 20
04/26/23 - 05/03/23	< 22
05/03/23 - 05/10/23	< 14
05/10/23 - 05/17/23	< 22
05/17/23 - 05/24/23	< 17
05/24/23 - 05/30/23	< 31
05/30/23 - 06/06/23	< 34
06/06/23 - 06/12/23	< 47
06/12/23 - 06/20/23	< 17
06/20/23 - 06/28/23	< 34
06/28/23 - 07/05/23	< 20
07/05/23 - 07/11/23	< 20
07/11/23 - 07/18/23	< 18
07/18/23 - 07/26/23	< 24
07/26/23 - 08/02/23	< 29
08/02/23 - 08/09/23	< 26
08/09/23 - 08/16/23	< 10
08/16/23 - 08/23/23	< 24
08/23/23 - 08/30/23	< 31
08/30/23 - 09/06/23	< 34
09/06/23 - 09/12/23	< 30
09/12/23 - 09/20/23	< 17
09/20/23 - 09/27/23	< 22
09/27/23 - 10/03/23	< 16
10/03/23 - 10/11/23	< 21
10/11/23 - 10/18/23	< 25
10/18/23 - 10/25/23	< 21
10/25/23 - 11/01/23	< 22
11/01/23 - 11/08/23	< 23
11/08/23 - 11/15/23	< 23
11/15/23 - 11/21/23	< 32
11/21/23 - 11/29/23	< 30
11/29/23 - 12/06/23	< 12
12/06/23 - 12/13/23	< 32
12/13/23 - 12/20/23	< 20
12/20/23 - 12/27/23	< 17
12/27/23 - 01/03/24	< 27
AVERAGE	-

TABLE C-4 ENVIRONMENTAL OPTICALLY STIMULATED LUMINESCENCE DOSIMETRY RESULTS SUSQUEHANNA STEAM ELECTRIC STATION, 2023

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

LOCATION	First Quarter 1/6/2023 to 4/21/2023	Second Quarter 4/21/2023 to 7/27/2023	Third Quarter 7/27/2023 to 10/3/2023	Fourth Quarter 10/3/2023 to 1/5/2024
ONSITE				
1S2	28.0 ± 2.0	28.5 ± 3.7	22.8 ± 0.6	23.8 ± 3.8
2S2	14.3 ± 0.7	15.2 ± 0.2	13.2 ± 2.2	11.9 ± 0.1
2S3	21.6 ± 0.3	23.6 ± 4.3	20.8 ± 3.4	20.2 ± 1.7
3S2	12.3 ± 0.9	11.1 ± 3.2	14.0 ± 1.7	12.2 ± 1.3
3S3	12.9 ± 0.9	14.6 ± 0.1	13.2 ± 0.3	13.3 ± 1.5
4S3	19.6 ± 0.7	19.8 ± 1.9	19.7 ± 1.6	18.5 ± 1.2
4S6	14.7 ± 1.0	14.3 ± 0.9	9.6 ± 0.5	13.0 ± 1.8
5S4	11.2 ± 1.7	13.9 ± 0.5	13.1 ± 1.0	11.2 ± 1.4
5S7	16.7 ± 0.7	15.5 ± 3.4	16.8 ± 1.0	14.8 ± 0.1
6S4	23.3 ± 1.0	22.4 ± 3.1	20.9 ± 2.8	21.7 ± 2.0
6S9	20.5 ± 1.4	24.5 ± 1.3	19.8 ± 2.2	20.9 ± 0.8
7S6	18.9 ± 0.9	22.5 ± 0.9	19.1 ± 3.4	20.3 ± 3.6
7S7	13.0 ± 0.1	11.1 ± 0.5	10.6 ± 0.8	12.4 ± 0.1
8S2	21.6 ± 0.2	24.1 ± 4.3	17.1 ± 1.4	20.5 ± 0.8
9S2	36.5 ± 6.8	38.9 ± 0.9	40.0 ± 0.6	38.4 ± 6.0
9S3	19.2 ± 0.9	20.0 ± 1.0	18.2 ± 0.1	18.7 ± 2.6
9S4	14.7 ± 0.2	16.6 ± 1.0	17.8 ± 0.7	15.0 ± 0.5
10S1	13.5 ± 1.0	10.3 ± 2.1	12.5 ± 0.9	12.3 ± 0.5
10S2	21.9 ± 0.1	25.0 ± 1.1	23.1 ± 0.6	23.7 ± 2.1
11S7	14.6 ± 0.1	15.5 ± 1.1	14.1 ± 1.3	14.0 ± 1.6
12S1	15.9 ± 0.9	16.1 ± 1.8	18.0 ± 1.1	15.5 ± 0.3
12S3	18.6 ± 0.2	20.3 ± 2.4	19.7 ± 4.0	16.4 ± 0.7
12S7	(4) (4)	11.9 ± 1.4	12.8 ± 0.1	12.3 ± 0.4
13S2	21.3 ± 1.0	25.3 ± 2.5	19.5 ± 2.3	18.2 ± 0.2
13S5	20.3 ± 1.0	20.7 ± 3.3	16.8 ± 0.9	20.4 ± 0.5
13S6	18.3 ± 1.8	21.5 ± 0.6	18.6 ± 2.6	18.8 ± 3.6
14S5	16.1 ± 1.3	20.7 ± 0.3	16.3 ± 0.7	14.5 ± 1.9
15S5	17.3 ± 0.3	18.2 ± 3.0	15.1 ± 2.4	15.6 ± 1.3
16S1	23.4 ± 0.7	19.4 ± 0.3	23.1 ± 2.2	22.0 ± 3.0
16S2	19.0 ± 0.7	21.0 ± 3.3	18.7 ± 3.2	18.8 ± 2.3

See the comments at the end of this table.

TABLE C-4 ENVIRONMENTAL OPTICALLY STIMULATED LUMINESCENCE DOSIMETRY RESULTS SUSQUEHANNA STEAM ELECTRIC STATION, 2023

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

LOCATION	First Quarter 1/6/2023 to 4/21/2023	Second Quarter 4/21/2023 to 7/27/2023	Third Quarter 7/27/2023 to 10/3/2023	Fourth Quarter 10/3/2023 to 1/5/2024
0-1 MILE OFFSITE				
6A4	14.7 ± 0.5	17.4 ± 2.9	14.6 ± 0.9	16.7 ± 1.7
8A3	16.3 ± 1.1	14.3 ± 1.5	14.0 ± 1.2	12.2 ± 2.0
15A3	12.5 ± 0.1	13.9 ± 1.7	12.1 ± 1.7	10.5 ± 0.7
16A2	12.3 ± 0.1	12.7 ± 3.9	12.1 ± 3.0	11.4 ± 1.4
1-2 MILES OFFSITE				
8B2	12.1 ± 1.9	15.6 ± 3.1	10.8 ± 2.2	10.7 ± 2.4
9B1	10.2 ± 0.8	9.9 ± 1.9	8.8 ± 1.6	9.8 ± 0.8
10B3	13.4 ± 0.7	11.9 ± 0.7	12.3 ± 0.8	11.3 ± 1.2
3-4 MILES OFFSITE				
1D5	14.0 ± 0.9	17.7 ± 3.3	12.6 ± 0.8	14.1 ± 1.5
8D3	12.7 ± 0.6	16.7 ± 2.6	14.2 ± 0.1	12.1 ± 2.4
9D4	14.5 ± 0.4	18.0 ± 0.1	12.0 ± 2.0	14.0 ± 0.0
10D1	14.4 ± 0.1	17.5 ± 1.1	15.2 ± 1.5	14.4 ± 0.9
12D2	19.2 ± 0.7	17.8 ± 5.6	17.5 ± 1.2	20.0 ± 0.7
14D1	13.9 ± 0.9	15.9 ± 1.3	13.2 ± 3.1	11.5 ± 0.5
4-5 MILES OFFSITE				
3E1	10.5 ± 0.4	15.1 ± 3.5	9.7 ± 0.6	11.6 ± 0.7
4E2	15.0 ± 0.6	17.7 ± 1.6	16.8 ± 0.3	14.1 ± 0.5
5E2	15.5 ± 0.9	16.2 ± 1.9	12.5 ± 0.9	13.3 ± 2.5
6E1	15.6 ± 1.6	17.1 ± 0.7	15.5 ± 2.0	14.1 ± 1.8
7E1	14.2 ± 0.4	16.7 ± 1.3	13.6 ± 0.9	14.9 ± 0.3
11E1	11.7 ± 0.5	12.6 ± 1.2	9.1 ± 2.2	10.7 ± 0.2
12E1	13.9 ± 0.5	14.1 ± 1.6	11.2 ± 0.1	12.0 ± 0.2
13E4	17.9 ± 0.6	17.0 ± 5.3	15.8 ± 4.5	15.0 ± 0.5

See the comments at the end of this table.

TABLE C-4 ENVIRONMENTAL OPTICALLY STIMULATED LUMINESCENCE DOSIMETRY RESULTS SUSQUEHANNA STEAM ELECTRIC STATION, 2023

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

LOCATION	First Quarter 1/6/2023 to 4/21/2023	Second Quarter 4/21/2023 to 7/27/2023	Third Quarter 7/27/2023 to 10/3/2023	Fourth Quarter 10/3/2023 to 1/5/2024
5-10 MILES OFFSITE				
2F1	12.5 ± 0.7	16.9 ± 3.2	12.7 ± 0.7	14.4 ± 1.2
15F1	15.9 ± 1.4	16.4 ± 0.3	16.4 ± 2.0	15.5 ± 2.9
16F1	17.2 ± 0.1	16.6 ± 1.3	15.4 ± 4.6	18.1 ± 1.1
10-20 MILES OFFSITE				
3G4	16.4 ± 1.2	19.1 ± 0.3	14.4 ± 0.6	17.7 ± 0.4
4G1	14.0 ± 1.7	18.4 ± 2.0	13.8 ± 1.8	17.9 ± 1.2
7G1	12.9 ± 1.8	16.1 ± 0.3	11.5 ± 2.1	11.3 ± 2.7
12G1	13.7 ± 1.2	14.1 ± 0.1	11.7 ± 1.7	12.0 ± 1.4
12G4	12.5 ± 1.2	17.3 ± 0.3	11.9 ± 0.3	10.9 ± 0.6

See the comments at the end of this table.

LOCATION				
INDICATOR				
Average (5)	16.6 ± 10.1	17.7 ± 17.0	15.8 ± 14.1	15.8 ± 12.8
CONTROL				
Average (5)	13.9 ± 3.2	17.0 ± 2.1	12.6 ± 3.3	13.9 ± 3.4

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, 2023**

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	01/09/23	< 0.8	1089 ± 196	< 7	< 10	< 29	< 10	< 14
	02/06/23	< 0.9	1216 ± 195	< 7	< 8	< 42	< 15	< 15
	03/06/23	< 0.5	1419 ± 186	< 7	< 7	< 26	< 6	< 14
	04/10/23	< 0.9	1626 ± 142	< 5	< 5	< 20	< 7	< 10
	04/24/23	< 0.7	1028 ± 167	< 7	< 9	< 32	< 10	< 16
	05/07/23	< 0.6	1304 ± 156	< 7	< 9	< 41	< 14	< 15
	05/22/23	< 0.7	1269 ± 197	< 7	< 8	< 25	< 8	< 13
	06/04/23	< 0.9	1308 ± 190	< 5	< 7	< 37	< 15	< 12
	06/19/23	< 0.7	2009 ± 212	< 8	< 8	< 27	< 7	< 14
	07/03/23	< 0.9	1284 ± 134	< 5	< 6	< 21	< 5	< 8.3
	07/16/23	< 0.9	1281 ± 156	< 6	< 7	< 28	< 5	< 11
	07/31/23	< 0.9	1280 ± 173	< 7	< 8	< 28	< 11	< 15
	08/13/23	< 0.9	1152 ± 169	< 7	< 8	< 31	< 11	< 13
	08/28/23	< 0.8	1155 ± 167	< 6	< 9	< 24	< 8	< 14
	09/10/23	< 0.7	1146 ± 177	< 7	< 7	< 30	< 7	< 12
	09/25/23	< 0.9	1298 ± 159	< 7	< 8	< 26	< 10	< 13
	10/09/23	< 0.8	1346 ± 180	< 7	< 8	< 32	< 8	< 18
	10/22/23	< 0.8	1264 ± 164	< 6	< 9	< 27	< 9	< 13
	11/06/23	< 0.5	1335 ± 163	< 8	< 7	< 24	< 9	< 13
	12/04/23	< 0.8	1238 ± 156	< 6	< 6	< 19	< 6	< 11
	AVERAGE	-	1302 ± 417	-	-	-	-	-
13E3	01/09/23	< 0.9	1279 ± 150	< 8	< 7	< 27	< 9	< 16
	02/06/23	< 0.7	1112 ± 186	< 6	< 7	< 44	< 11	< 14
	03/06/23	< 0.8	1081 ± 186	< 6	< 9	< 31	< 10	< 12
	04/10/23	< 0.8	1595 ± 130	< 6	< 6	< 23	< 7	< 12
	04/24/23	< 0.6	1289 ± 180	< 6	< 9	< 30	< 7	< 16
	05/07/23	< 0.6	1295 ± 185	< 7	< 9	< 31	< 12	< 15
	05/22/23	< 0.8	1134 ± 179	< 6	< 8	< 26	< 7	< 13
	06/04/23	< 0.8	1264 ± 193	< 7	< 9	< 37	< 8	< 15
	06/19/23	< 0.7	1116 ± 169	< 7	< 9	< 25	< 7	< 12
	07/03/23	< 0.7	1430 ± 111	< 5	< 5	< 22	< 6	< 11
	07/16/23	< 0.7	1192 ± 170	< 6	< 7	< 24	< 10	< 12
	07/31/23	< 0.8	1328 ± 152	< 5	< 6	< 21	< 8	< 12
	08/13/23	< 0.8	1166 ± 186	< 8	< 8	< 29	< 9	< 12
	08/28/23	< 0.7	1424 ± 207	< 8	< 9	< 27	< 9	< 13
	09/10/23	< 0.8	1217 ± 188	< 7	< 6	< 33	< 13	< 15
	09/25/23	< 0.9	1183 ± 196	< 8	< 8	< 25	< 8	< 14
	10/09/23	< 0.9	1260 ± 188	< 5	< 7	< 27	< 7	< 15
	10/22/23	< 0.7	1413 ± 145	< 8	< 8	< 28	< 10	< 16
	11/06/23	< 0.6	1478 ± 150	< 6	< 7	< 25	< 9	< 12
	12/04/23	< 0.9	1339 ± 172	< 7	< 8	< 25	< 6	< 13
	AVERAGE	-	1280 ± 274	-	-	-	-	-

TABLE C-5 **IODINE-131 AND GAMMA SPECTROSCOPIC ANALYSES OF MILK SUSQUEHANNA STEAM ELECTRIC STATION, 2023**

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	01/09/23	< 0.8	1366 ± 187	< 5	< 7	< 33	< 9	< 13
	02/06/23	< 0.8	1198 ± 171	< 7	< 8	< 33	< 11	< 15
	03/06/23	< 0.5	1056 ± 153	< 8	< 9	< 28	< 9	< 14
	04/10/23	< 0.9	1203 ± 117	< 4	< 5	< 18	< 4	< 9
	04/24/23	< 0.7	1269 ± 176	< 7	< 8	< 31	< 6	< 16
	05/07/23	< 0.9	1153 ± 214	< 8	< 8	< 38	< 10	< 13
	05/22/23	< 0.9	1163 ± 171	< 5	< 7	< 29	< 8	< 15
	06/04/23	< 0.7	1288 ± 185	< 8	< 8	< 29	< 7	< 13
	06/19/23	< 0.8	1148 ± 172	< 6	< 6	< 19	< 4	< 12
	07/03/23	< 0.7	1405 ± 145	< 5	< 7	< 25	< 5	< 11
	07/16/23	< 0.9	1135 ± 145	< 5	< 6	< 25	< 5	< 12
	07/31/23	< 0.6	1076 ± 144	< 6	< 8	< 28	< 7	< 12
	08/13/23	< 0.8	1397 ± 170	< 7	< 8	< 32	< 13	< 12
	08/28/23	< 0.8	1169 ± 207	< 7	< 9	< 28	< 7	< 13
	09/10/23	< 0.8	1258 ± 152	< 6	< 8	< 29	< 10	< 14
	09/25/23	< 0.9	1251 ± 161	< 7	< 7	< 26	< 7	< 16
	10/09/23	< 0.9	1175 ± 194	< 8	< 7	< 38	< 10	< 14
	10/22/23	< 0.8	1315 ± 199	< 7	< 6	< 30	< 11	< 14
	11/06/23	< 0.9	1389 ± 123	< 4	< 5	< 20	< 6	< 8.5
	12/04/23	< 0.8	1267 ± 154	< 7	< 9	< 31	< 7	< 16
	AVERAGE	-	1234 ± 208	-	-	-	-	-

TABLE C-6 **TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF GROUNDWATER SUSQUEHANNA STEAM ELECTRIC STATION, 2023**

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	01/20/23	< 242	< 64	< 6	< 9	< 16	< 9	< 13	< 9	< 14	< 10	< 7	< 9	< 29	< 10	< 14
	04/27/23	< 347	< 80	< 4	< 5	< 10	< 7	< 8	< 6	< 9	< 9	< 5	< 5	< 26	< 7	< 10
	07/19/23	< 386	< 111	< 6	< 6	< 16	< 6	< 11	< 8	< 11	< 12	< 6	< 7	< 30	< 8	< 13
	10/26/23	< 398	< 77	< 4	< 4	< 10	< 5	< 11	< 5	< 7	< 8	< 5	< 4	< 20	< 7	< 10
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13S7	01/17/23	< 377	< 122	< 7	< 7	< 18	< 6	< 15	< 6	< 12	< 9	< 9	< 6	< 25	< 8	< 14
	04/25/23	< 386	< 85	< 6	< 7	< 19	< 6	< 11	< 7	< 12	< 7	< 6	< 6	< 22	< 10	< 13
	07/25/23	< 377	< 16	< 2	< 2	< 5	< 2	< 4	< 2	< 3	< 3	< 1	< 2	< 7	< 3	< 3
	10/24/23	< 361	96 ± 56	< 7	< 7	< 21	< 8	< 18	< 8	< 13	< 12	< 7	< 7	< 29	< 8	< 13
	AVERAGE	-	96 ± 0	-	-	-	-	-	-	-	-	-	-	-	-	-
1S3	01/17/23	< 377	< 101	< 5	< 7	< 13	< 5	< 14	< 6	< 7	< 11	< 6	< 6	< 31	< 8	< 11
	04/25/23	< 386	< 136	< 5	< 6	< 20	< 7	< 14	< 7	< 12	< 8	< 7	< 7	< 28	< 11	< 14
	07/26/23	< 368	< 112	< 6	< 6	< 18	< 7	< 10	< 6	< 12	< 9	< 6	< 5	< 30	< 11	< 13
	10/24/23	< 382	< 128	< 7	< 7	< 16	< 8	< 13	< 6	< 13	< 10	< 6	< 6	< 25	< 10	< 11
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4S8	01/17/23	< 376	< 132	< 8	< 7	< 15	< 7	< 19	< 9	< 13	< 13	< 10	< 8	< 37	< 9	< 17
	04/25/23	< 390	< 124	< 7	< 8	< 18	< 10	< 12	< 5	< 13	< 10	< 5	< 9	< 28	< 9	< 14
	07/25/23	< 373	< 106	< 8	< 6	< 15	< 7	< 15	< 6	< 12	< 11	< 6	< 7	< 34	< 10	< 11
	10/24/23	< 377	< 128	< 7	< 7	< 20	< 9	< 15	< 8	< 11	< 11	< 8	< 8	< 36	< 9	< 16
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4S9	01/20/23	< 240	< 137	< 6	< 6	< 21	< 7	< 12	< 7	< 13	< 9	< 6	< 7	< 29	< 11	< 12
	04/27/23	< 360	< 110	< 5	< 5	< 17	< 6	< 11	< 6	< 10	< 10	< 5	< 5	< 26	< 10	< 11
	07/19/23	< 384	< 108	< 5	< 5	< 14	< 7	< 10	< 6	< 9	< 11	< 5	< 5	< 27	< 7	< 12
	10/30/23	< 375	< 52	< 7	< 6	< 17	< 9	< 15	< 8	< 13	< 13	< 8	< 7	< 38	< 12	< 15
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6S11A	01/17/23	< 381	< 115	< 7	< 6	< 19	< 8	< 14	< 7	< 9	< 7	< 7	< 7	< 25	< 10	< 11
	04/25/23	< 395	< 146	< 6	< 7	< 17	< 9	< 12	< 6	< 11	< 8	< 6	< 8	< 25	< 8	< 12
	07/20/23	< 388	< 135	< 4	< 7	< 13	< 6	< 14	< 7	< 9	< 9	< 7	< 6	< 30	< 14	< 12
	10/30/23	< 369	< 104	< 5	< 6	< 18	< 8	< 15	< 6	< 13	< 14	< 6	< 6	< 32	< 13	< 14
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE C-6 **TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF GROUNDWATER SUSQUEHANNA STEAM ELECTRIC STATION, 2023**

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	01/20/23	< 244	< 90	< 6	< 5	< 15	< 6	< 15	< 7	< 10	< 10	< 6	< 5	< 23	< 9	< 13
	04/27/23	< 342	< 101	< 5	< 7	< 15	< 7	< 12	< 7	< 10	< 8	< 5	< 6	< 26	< 8	< 9
	07/20/23	< 381	< 83	< 5	< 5	< 13	< 4	< 11	< 6	< 8	< 9	< 4	< 5	< 29	< 7	< 9
	10/30/23	< 377	< 88	< 5	< 6	< 17	< 5	< 11	< 7	< 12	< 9	< 5	< 7	< 29	< 12	< 11
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7S10	01/16/23	< 373	< 129	< 6	< 8	< 21	< 5	< 13	< 8	< 11	< 9	< 7	< 6	< 25	< 10	< 15
	04/27/23	< 358	< 87	< 5	< 4	< 13	< 6	< 10	< 7	< 9	< 8	< 5	< 5	< 24	< 8	< 10
	07/20/23	< 386	< 97	< 6	< 6	< 14	< 7	< 12	< 7	< 8	< 10	< 6	< 6	< 31	< 12	< 10
	10/26/23	< 368	< 96	< 5	< 5	< 14	< 5	< 11	< 6	< 9	< 8	< 4	< 5	< 20	< 8	< 10
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7S11	01/16/23	< 379	< 119	< 7	< 6	< 15	< 6	< 15	< 6	< 10	< 11	< 6	< 7	< 31	< 8	< 13
	04/27/23	< 361	< 108	< 5	< 6	< 16	< 6	< 9	< 5	< 9	< 8	< 5	< 6	< 24	< 7	< 12
	07/20/23	< 385	< 115	< 6	< 5	< 14	< 7	< 12	< 6	< 12	< 11	< 5	< 6	< 31	< 10	< 10
	10/26/23	< 397	< 77	< 5	< 5	< 12	< 6	< 9	< 5	< 8	< 7	< 4	< 5	< 22	< 7	< 8
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8S4	01/17/23	< 394	< 132	< 6	< 4	< 19	< 7	< 13	< 5	< 10	< 8	< 5	< 6	< 28	< 9	< 12
	04/25/23	< 386	< 127	< 8	< 10	< 14	< 8	< 23	< 12	< 14	< 11	< 8	< 8	< 30	< 12	< 17
	07/26/23	< 369	< 139	< 6	< 7	< 20	< 7	< 15	< 7	< 10	< 11	< 6	< 6	< 32	< 11	< 12
	10/24/23	< 396	< 108	< 7	< 8	< 23	< 5	< 17	< 8	< 13	< 10	< 8	< 7	< 34	< 11	< 12
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1S4	01/17/23	< 370	< 156	< 7	< 7	< 18	< 7	< 12	< 6	< 15	< 8	< 8	< 9	< 28	< 9	< 17
	04/25/23	< 386	< 130	< 6	< 6	< 17	< 8	< 10	< 8	< 13	< 9	< 5	< 7	< 29	< 9	< 12
	07/25/23	< 371	< 90	< 5	< 5	< 15	< 4	< 11	< 5	< 10	< 9	< 5	< 5	< 24	< 6	< 10
	10/24/23	< 376	< 98	< 8	< 7	< 15	< 6	< 11	< 7	< 13	< 10	< 8	< 7	< 30	< 8	< 12
	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, 2023

Results in pCi/Liter ± 2 sigma

SITE	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
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	275
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	387
1S3 - MW-1 (43')	248	150	252	131	164	197	115	169	175	130	218	253	200	187	182	168
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	41
4S8 - MW-2 (45')	292	154	190	173	137	202	187	138	154	138	191	196	239	194	282	106
4S9 - MW-3 (94')	127	54	150	64	80	135	94	180	125	55	109	92	77	86	102	205
8S4 - MW-4 (111')	172	66	105	68	81	109	60	162	145	91	102	155	96	109	181	148
7S10 - MW-5 (36')	171	69	96	-6	74	106	68	70	73	51	93	125	86	82	62	207
13S7 - MW-6 (16')	142	134	143	34	80	111	71	79	111	107	122	120	150	110	83	179
2S8 - MW-7 (85')	Not installed	Not installed	Not installed	22	54	72	70	70	74	56	37	71	63	35	86	62
6S11A - MW-8A (14')	177	82	165	58	15	72	103	110	63	38	50	83	72	48	30	44
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	Dry well
6S12 - MW-9 (28')	30	-44	45	18	6	60	21	57	70	5	27	50	47	41	9	76
7S11 - MW-10 (132')	3	-27	-9	1	-1	23	29	55	13	1	33	16	3	7	23	-29
**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	**	**	**	**	20

* 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, 2023**

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	12/27/22 -	01/31/23	< 1.8	< 352	< 42	< 2	< 2	< 7	< 2	< 4	< 2	< 4	< 15	< 2	< 2	< 24	< 7
12H2	01/31/23 -	02/27/23	< 1.9	< 376	< 29	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 7	< 2	< 2	< 14	< 5
12H2	02/27/23 -	03/28/23	< 2.2	< 361	< 15	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 9	< 1	< 2	< 17	< 6
12H2	03/28/23 -	04/24/23	< 1.9	< 387	< 19	< 2	< 2	< 7	< 2	< 4	< 2	< 4	< 8	< 2	< 2	< 17	< 6
12H2	04/24/23 -	05/29/23	< 1.9	< 380	< 25	< 2	< 2	< 6	< 2	< 3	< 2	< 3	< 9	< 1	< 2	< 17	< 5
12H2	05/29/23 -	06/27/23	< 2.5	< 350	< 36	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 10	< 2	< 2	< 18	< 5
12H2	06/27/23 -	07/24/23	2.7 ± 1.5	< 369	< 25	< 1	< 2	< 5	< 2	< 3	< 2	< 3	< 7	< 1	< 2	< 13	< 4
12H2	07/24/23 -	08/29/23	< 2.3	< 385	< 36	< 2	< 2	< 6	< 2	< 3	< 2	< 3	< 14	< 1	< 2	< 20	< 6
12H2	08/29/23 -	09/26/23	< 2.1	< 361	< 16	< 2	< 2	< 6	< 2	< 3	< 2	< 3	< 8	< 1	< 2	< 16	< 6
12H2	09/26/23 -	10/31/23	3.0 ± 1.3	< 381	< 33	< 2	< 2	< 6	< 2	< 3	< 2	< 3	< 12	< 2	< 2	< 19	< 7
12H2	10/31/23 -	11/28/23	< 1.9	< 276	< 12	< 1	< 1	< 4	< 1	< 3	< 1	< 2	< 7	< 1	< 1	< 12	< 4
12H2	11/28/23 -	12/26/23	< 1.9	< 346	< 15	< 2	< 2	< 6	< 2	< 3	< 2	< 3	< 9	< 2	< 2	< 17	< 6
		AVERAGE	2.8 ± 0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE C-9 **GAMMA SPECTROSCOPIC ANALYSES OF FOOD PRODUCTS (FRUITS, VEGETABLES AND BROADLEAF) SUSQUEHANNA STEAM ELECTRIC STATION, 2023**

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	11/21/23	Soybeans	< 200	11580 ± 907	< 38	< 18	< 27	< 113	< 41
	11/21/23	Corn	< 213	2759 ± 473	< 51	< 30	< 26	< 89	< 47
	11/21/23	Pumpkin	< 164	1764 ± 362	< 39	< 20	< 22	< 83	< 37
	AVERAGE		-	5368 ± 10806	-	-	-	-	-
11S6	06/19/23	Swiss Chard	< 231	2670 ± 439	< 27	< 18	< 20	< 94	< 46
	06/19/23	Collard	< 176	3566 ± 423	< 25	< 21	< 23	< 91	< 41
	07/24/23	Swiss Chard	585 ± 219	4743 ± 630	< 37	< 16	< 22	< 102	< 36
	07/24/23	Collard	1037 ± 231	3780 ± 477	< 48	< 22	< 25	< 105	< 46
	08/21/23	Swiss Chard	< 289	3553 ± 583	< 24	< 23	< 20	< 100	< 39
	08/21/23	Collard	< 249	2574 ± 445	< 26	< 22	< 24	< 89	< 46
	09/25/23	Swiss Chard	545 ± 243	2074 ± 467	< 29	< 20	< 24	< 84	< 38
	09/25/23	Collard	798 ± 347	2476 ± 604	< 35	< 28	< 27	< 118	< 55
	10/22/23	Swiss Chard	497 ± 245	3158 ± 544	< 26	< 21	< 21	< 88	< 45
	10/22/23	Collard	< 445	3977 ± 675	< 48	< 35	< 41	< 168	< 73
	AVERAGE		692 ± 449	3257 ± 1635	-	-	-	-	-
12F7	08/08/23	String Beans	< 203	1854 ± 435	< 32	< 20	< 23	< 99	< 40
	11/15/23	Soybeans	< 268	17550 ± 1252	< 28	< 27	< 31	< 145	< 46
	11/15/23	Potatoes	< 188	3601 ± 552	< 24	< 23	< 22	< 88	< 39
	12/04/23	Corn	< 153	1972 ± 456	< 24	< 13	< 19	< 103	< 33
	AVERAGE		-	6244 ± 15158	-	-	-	-	-

TABLE C-10 **TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF SURFACE WATER**
SUSQUEHANNA STEAM ELECTRIC STATION, 2023

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	12/27/22 - 01/31/23	< 357	< 14	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 12	< 2	< 2	< 20	< 6	< 3
	01/31/23 - 02/27/23	< 379	< 27	< 2	< 2	< 5	< 2	< 4	< 2	< 3	< 7	< 2	< 2	< 15	< 5	< 3
	02/27/23 - 03/28/23	< 372	< 14	< 1	< 2	< 4	< 2	< 3	< 2	< 3	< 10	< 1	< 1	< 16	< 6	< 3
	03/28/23 - 04/24/23	< 398	< 29	< 2	< 2	< 5	< 2	< 4	< 2	< 3	< 8	< 2	< 2	< 17	< 5	< 4
	04/28/23 - 05/29/23	< 385	< 20	< 2	< 2	< 7	< 2	< 4	< 2	< 4	< 10	< 2	< 2	< 19	< 7	< 4
	05/29/23 - 06/27/23	< 352	< 14	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 9	< 2	< 2	< 16	< 6	< 3
	06/27/23 - 07/24/23	< 371	24 ± 15	< 1	< 1	< 3	< 1	< 2	< 1	< 2	< 5	< 1	< 1	< 10	< 3	< 2
	07/24/23 - 08/29/23	< 395	< 35	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 13	< 2	< 2	< 20	< 8	< 3
	08/29/23 - 09/26/23	< 391	< 15	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 8	< 1	< 2	< 15	< 5	< 3
	09/26/23 - 10/31/23	< 380	25 ± 16	< 1	< 1	< 4	< 2	< 3	< 1	< 2	< 9	< 1	< 1	< 14	< 5	< 2
	10/31/23 - 11/28/23	< 269	< 13	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 9	< 1	< 2	< 15	< 5	< 3
	11/28/23 - 12/26/23	< 353	< 16	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 9	< 2	< 2	< 16	< 6	< 3
	AVERAGE	-	25 ± 2	-	-	-	-	-	-	-	-	-	-	-	-	-
6S5	01/03/23 - 01/31/23	< 357	< 17	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 11	< 2	< 2	< 18	< 6	< 3
	02/07/23 - 02/27/23	< 373	< 35	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 6	< 2	< 2	< 14	< 5	< 4
	03/07/23 - 03/28/23	< 375	< 21	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 8	< 2	< 2	< 18	< 6	< 3
	04/04/23 - 04/24/23	< 395	< 47	< 3	< 3	< 7	< 3	< 5	< 3	< 5	< 9	< 2	< 3	< 18	< 6	< 5
	05/02/23 - 05/29/23	< 391	< 45	< 2	< 2	< 7	< 3	< 4	< 2	< 4	< 9	< 2	< 2	< 17	< 6	< 4
	06/06/23 - 06/27/23	< 354	< 29	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 13	< 2	< 2	< 23	< 7	< 3
	07/03/23 - 07/24/23	< 383	< 16	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 5	< 1	< 2	< 12	< 4	< 3
	08/01/23 - 08/29/23	< 398	< 17	< 2	< 2	< 6	< 2	< 3	< 2	< 4	< 10	< 2	< 2	< 19	< 6	< 3
	09/05/23 - 09/26/23	< 392	< 31	< 2	< 2	< 6	< 2	< 4	< 2	< 3	< 7	< 2	< 2	< 16	< 5	< 3
	10/02/23 - 10/31/23	< 370	< 32	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 10	< 2	< 2	< 20	< 7	< 3
	11/06/23 - 11/28/23	< 279	< 35	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 6	< 2	< 2	< 14	< 5	< 3
	12/05/23 - 12/26/23	< 372	< 18	< 2	< 2	< 6	< 2	< 3	< 2	< 3	< 7	< 2	< 2	< 14	< 5	5 ± 3
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5 ± 0
4S7	05/01/23 - 05/01/23	< 371	< 146	< 6	< 7	< 10	< 8	< 14	< 6	< 8	< 6	< 5	< 8	< 23	< 11	< 13
	07/24/23 - 07/24/23	< 376	< 36	< 2	< 2	< 5	< 2	< 4	< 2	< 3	< 3	< 2	< 2	< 9	< 3	< 3
	10/30/23 - 10/30/23	< 382	< 97	< 6	< 5	< 15	< 6	< 12	< 6	< 9	< 9	< 5	< 5	< 22	< 11	< 14
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LTAW	05/01/23 - 05/01/23	< 377	< 100	< 5	< 6	< 21	< 7	< 14	< 8	< 9	< 9	< 6	< 7	< 23	< 5	< 14
	07/24/23 - 07/24/23	< 384	< 18	< 2	< 2	< 5	< 2	< 4	< 2	< 3	< 4	< 2	< 2	< 10	< 3	< 4
	10/30/23 - 10/30/23	< 384	< 146	< 6	< 7	< 21	< 8	< 15	< 7	< 10	< 9	< 8	< 6	< 30	< 9	< 14
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE C-10 **TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF SURFACE WATER SUSQUEHANNA STEAM ELECTRIC STATION, 2023**

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
5S9	04/28/23 - 05/18/23	< 380	< 14	< 1	< 2	< 5	< 2	< 3	< 2	< 3	< 11	< 1	< 1	< 17	< 6	< 3
	06/07/23 - 06/07/23	< 347	< 15	< 1	< 2	< 5	< 2	< 3	< 2	< 3	< 14	< 1	< 1	< 20	< 6	< 2
	11/14/23 - 11/20/23	< 268	< 29	< 2	< 2	< 5	< 2	< 4	< 2	< 3	< 7	< 2	< 2	< 14	< 5	< 3
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE C-11 **GAMMA SPECTROSCOPIC ANALYSIS OF FISH**
SUSQUEHANNA STEAM ELECTRIC STATION, 2023

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	04/14/23	3198 ± 1054	< 45	< 56	< 122	< 66	< 130	< 59	< 54
Quillback	04/14/23	3318 ± 902	< 63	< 61	< 191	< 54	< 111	< 48	< 53
Smallmouth Bass	04/14/23	2466 ± 1208	< 76	< 75	< 198	< 86	< 102	< 67	< 78
Channel Catfish	10/05/23	3192 ± 1056	< 74	< 77	< 231	< 69	< 189	< 82	< 71
Smallmouth Bass	10/05/23	3629 ± 910	< 57	< 53	< 135	< 70	< 135	< 49	< 60
Quillback	10/05/23	3132 ± 1004	< 65	< 40	< 190	< 69	< 134	< 52	< 54
	AVERAGE	3156 ± 764	-	-	-	-	-	-	-
IND									
Channel Catfish	04/13/23	2358 ± 913	< 59	< 52	< 143	< 69	< 130	< 42	< 55
Quillback	04/13/23	3025 ± 766	< 58	< 53	< 116	< 50	< 110	< 45	< 53
Smallmouth Bass	04/13/23	4504 ± 979	< 68	< 78	< 188	< 74	< 146	< 71	< 78
Channel Catfish	10/04/23	3930 ± 1238	< 82	< 78	< 232	< 100	< 165	< 89	< 80
Quillback	10/04/23	2927 ± 1031	< 73	< 77	< 190	< 67	< 151	< 77	< 65
Smallmouth Bass	10/04/23	4192 ± 1153	< 50	< 75	< 195	< 55	< 149	< 60	< 66
	AVERAGE	3489 ± 1680	-	-	-	-	-	-	-
LTAW									
Gizzard Shad	10/05/23	3957 ± 920	< 41	< 44	< 191	< 57	< 136	< 38	< 60
Largemouth Bass	10/05/23	4937 ± 1093	< 60	< 65	< 195	< 64	< 155	< 62	< 72
	AVERAGE	4447 ± 1386	-	-	-	-	-	-	-

TABLE C-12 **GAMMA SPECTROSCOPIC ANALYSES OF SHORELINE SEDIMENT SUSQUEHANNA STEAM ELECTRIC STATION, 2023**

Results in pCi/kg (dry) ± 2 sigma

SITE	COLLECTION DATE	K-40	Cs-134	Cs-137	Ra-226	Ac-228	Th-228
2B	04/13/23	15470 ± 1994	< 84	< 105	2678 ± 1642	1045 ± 440	1254 ± 178
	10/02/23	17170 ± 2307	< 142	< 145	< 3146	1986 ± 476	1562 ± 289
	AVERAGE	16320 ± 2404	-	-	2678 ± 0	1516 ± 1331	1408 ± 436
7B	04/13/23	8850 ± 1394	< 99	< 89	< 2338	1152 ± 268	866 ± 215
	10/02/23	13550 ± 1985	< 102	< 123	< 2931	1385 ± 385	1616 ± 270
	AVERAGE	11200 ± 6647	-	-	-	1269 ± 330	1241 ± 1061
12F	04/13/23	8672 ± 1590	< 90	< 119	< 2218	1029 ± 346	832 ± 192
	10/02/23	14420 ± 2219	< 89	< 103	< 2309	1525 ± 512	897 ± 258
	AVERAGE	11546 ± 8129	-	-	-	1277 ± 701	864 ± 91

FIGURE C-1 - GROSS BETA ACTIVITY IN AIR PARTICULATES

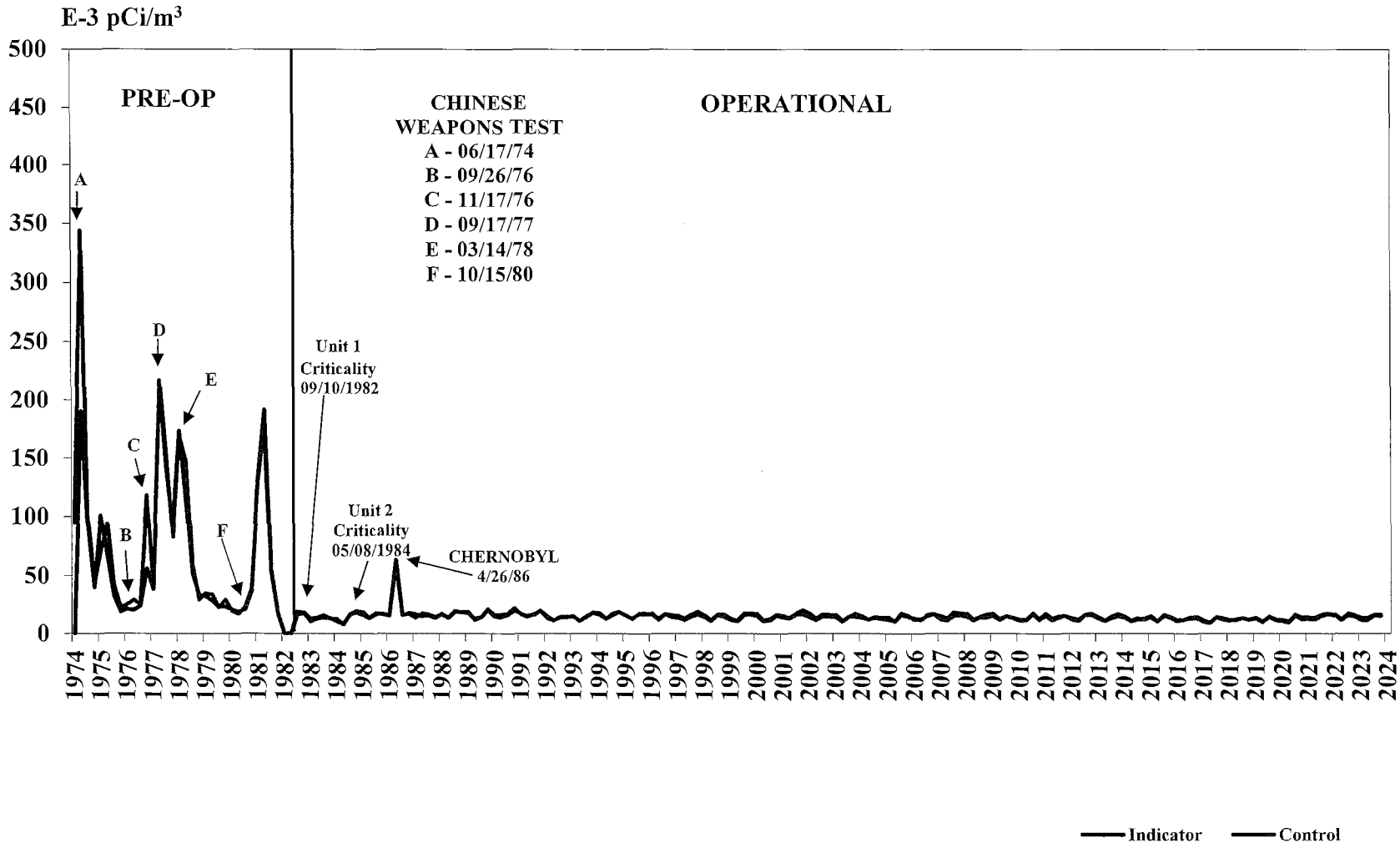


FIGURE C-2 - AMBIENT RADIATION LEVELS BASED ON ENVIRONMENTAL DOSIMETRY DATA

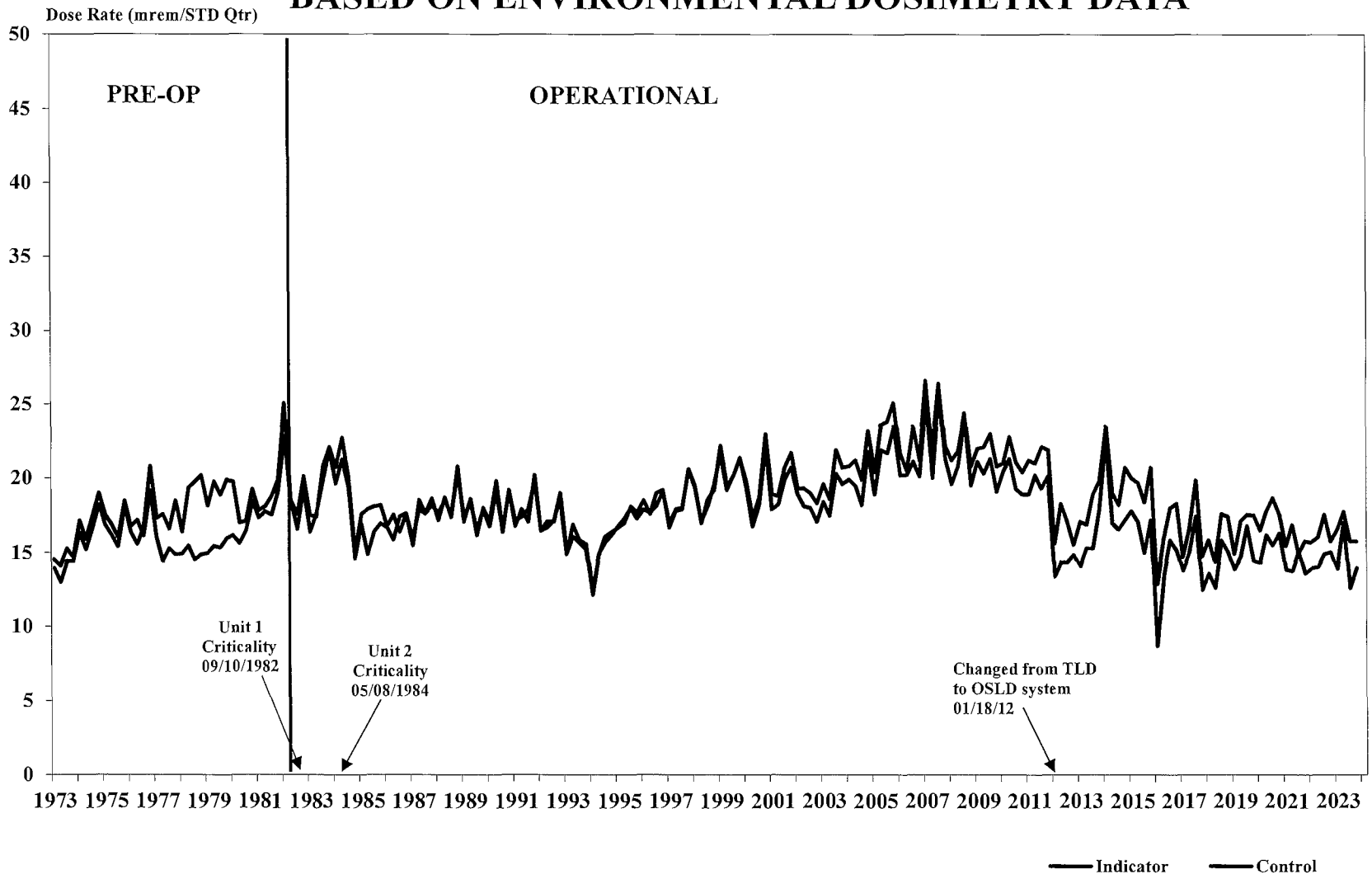


FIGURE C-3 - IODINE-131 ACTIVITY IN MILK

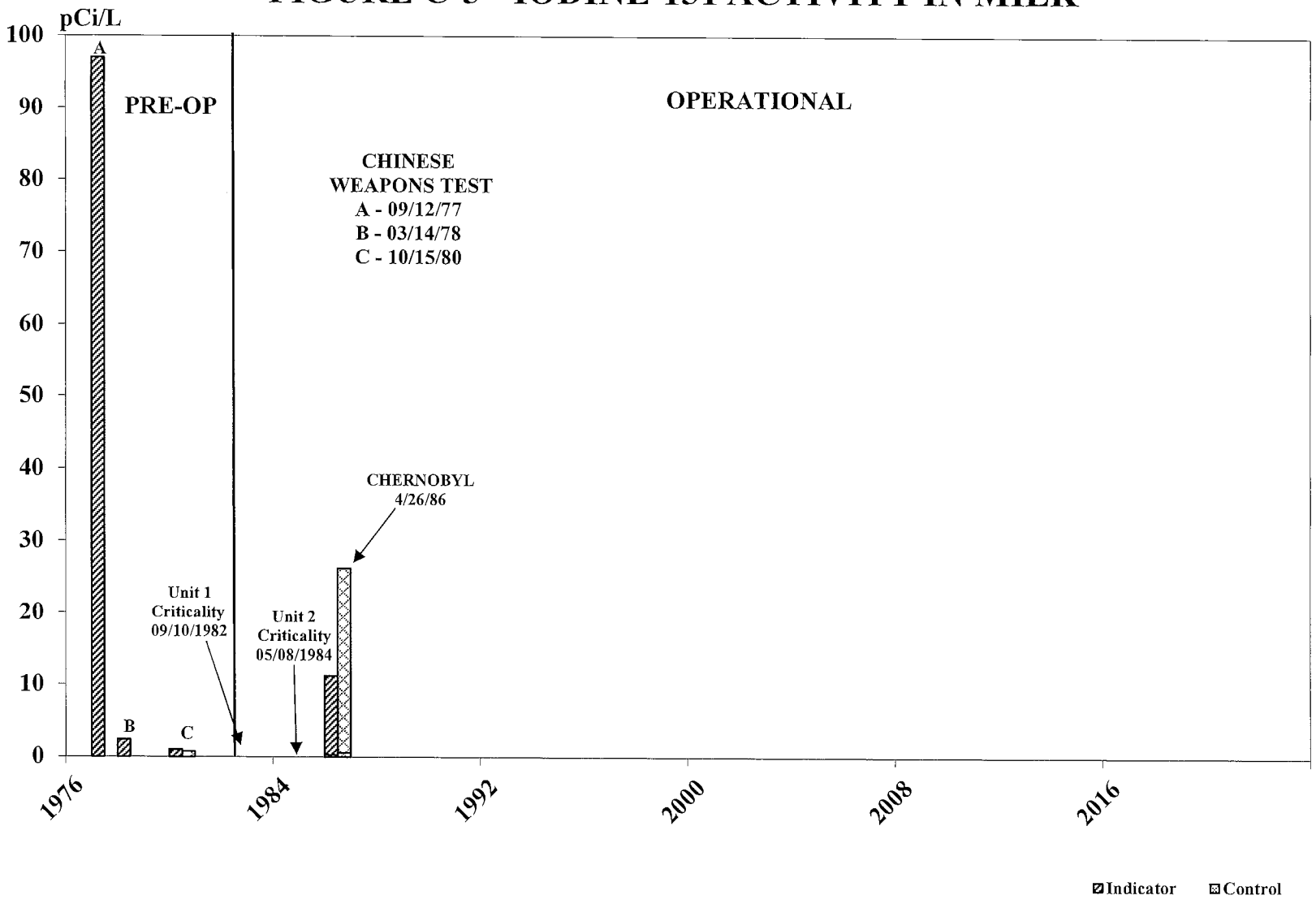


FIGURE C-4 - ANNUAL AVERAGE TRITIUM ACTIVITY IN PRECIPITATION AND SURFACE WATER VERSUS GROUND WATER

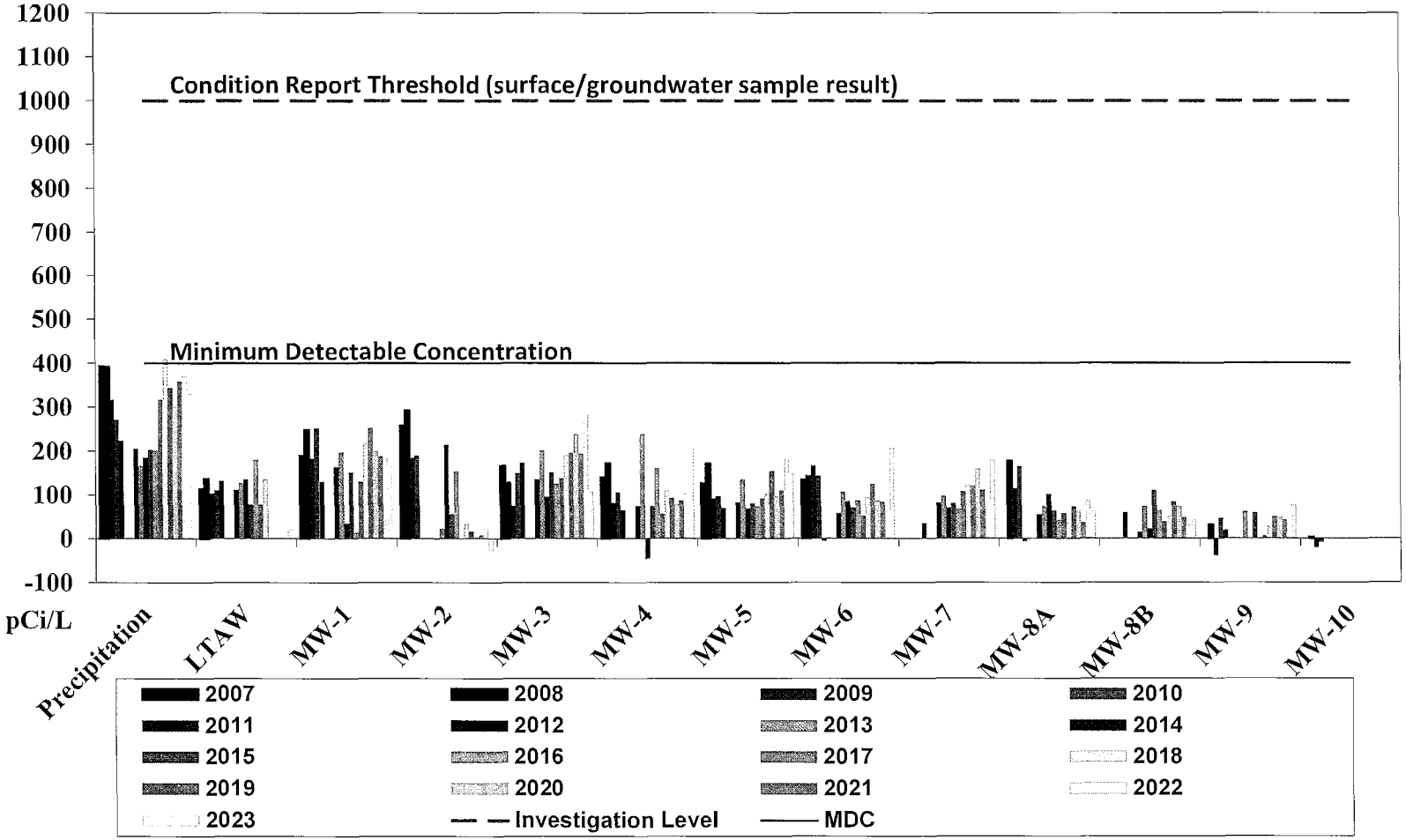


FIGURE C-5 - GROSS BETA ACTIVITY IN DRINKING WATER

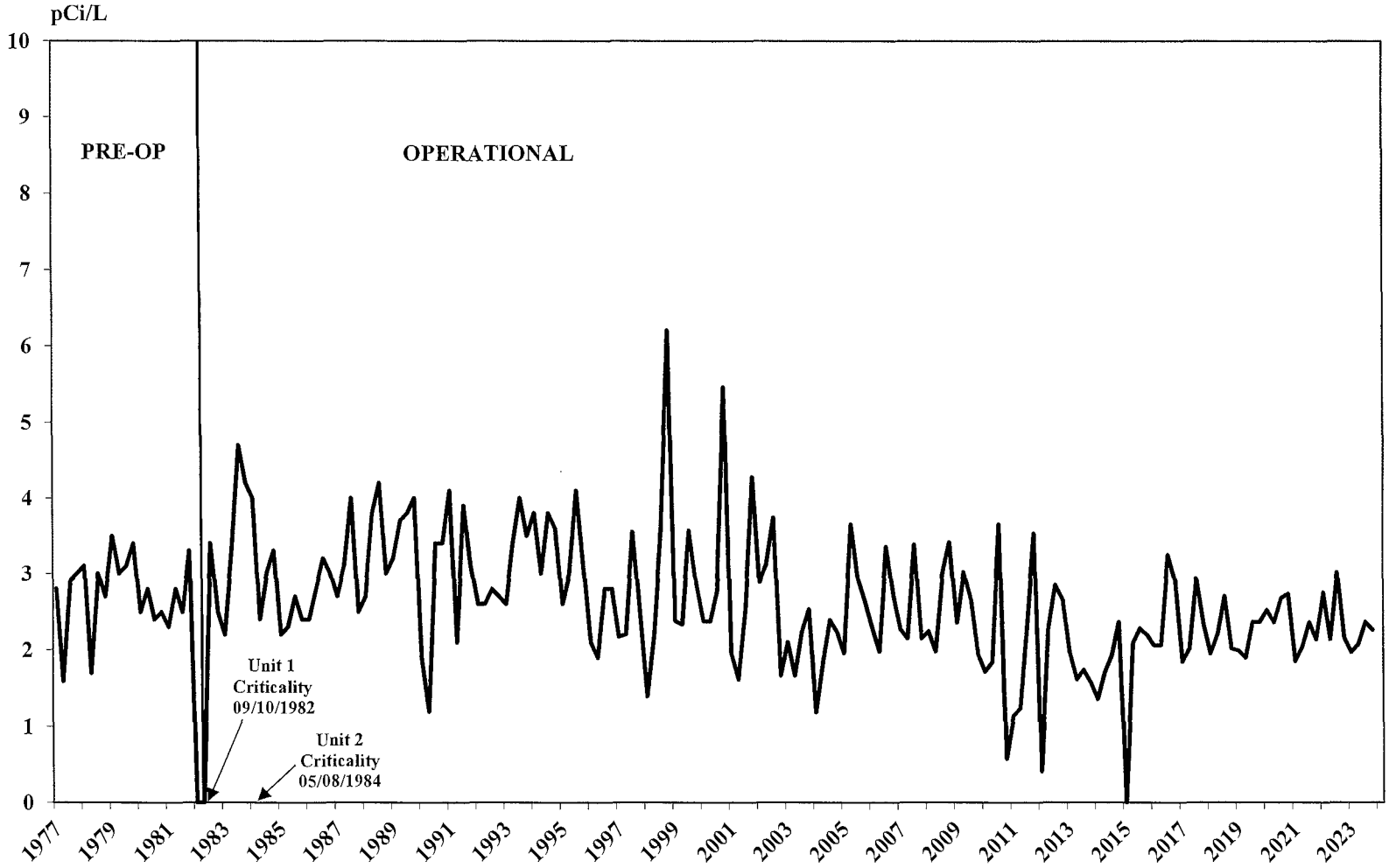
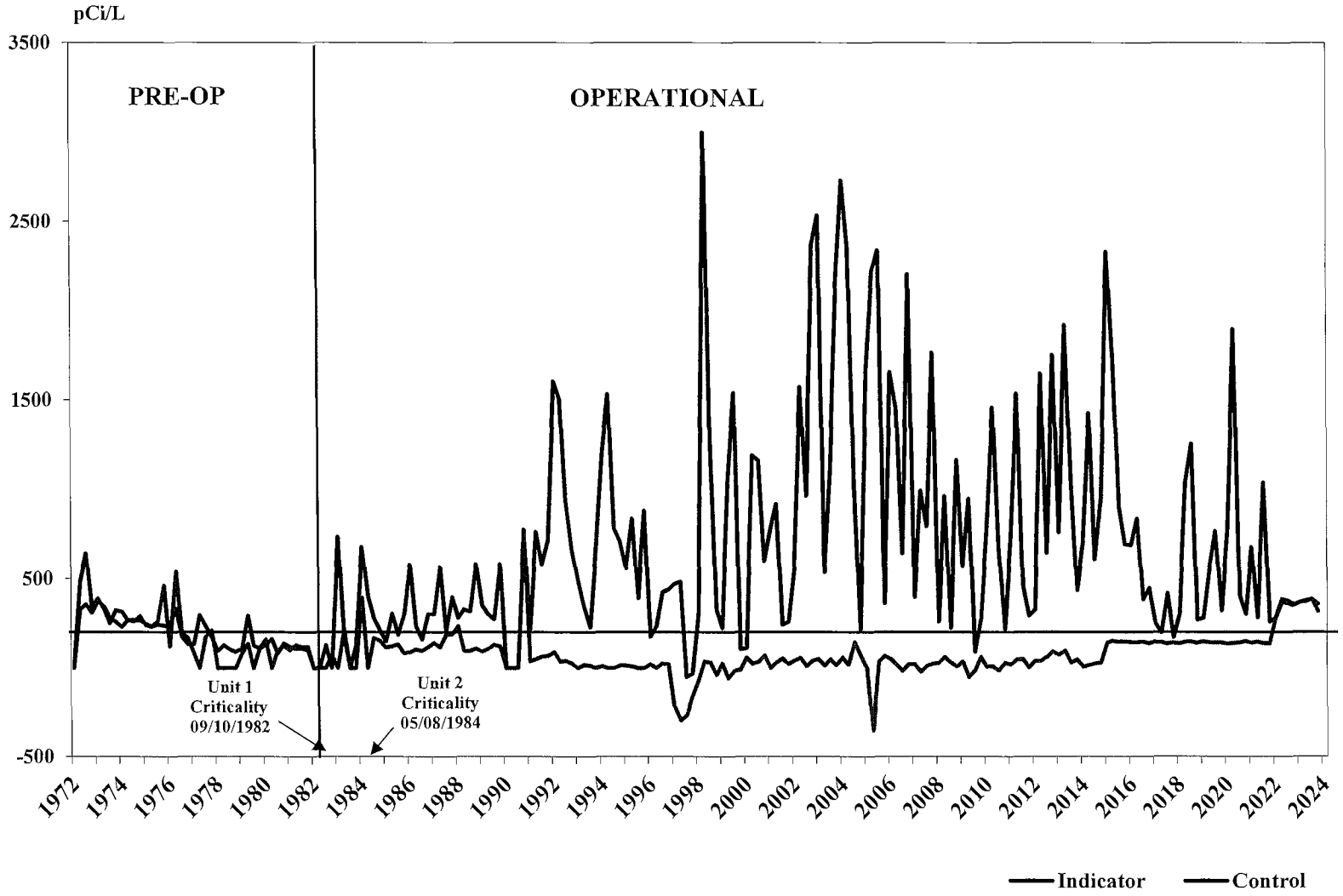


FIGURE C-6 - TRITIUM ACTIVITY IN SURFACE WATER



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 2023	E13826	Milk	Sr-89	pCi/L	70.5	93.1	0.76	W
			Sr-90	pCi/L	12.3	14.7	0.84	A
	E13827	Milk	Ce-141	pCi/L	127	139	0.91	A
			Co-58	pCi/L	119	131	0.91	A
			Co-60	pCi/L	250	279	0.90	A
			Cr-51	pCi/L	246	302	0.82	A
			Cs-134	pCi/L	172	200	0.86	A
			Cs-137	pCi/L	125	140	0.89	A
			Fe-59	pCi/L	122	122	1.00	A
			I-131	pCi/L	70.2	82.0	0.86	A
			Mn-54	pCi/L	165	180	0.92	A
			Zn-65	pCi/L	306	306	1.00	A
	E13828	Charcoal	I-131	pCi	79.0	89.9	0.88	A
	E13829	AP	Ce-141	pCi	91.9	87.8	1.05	A
			Co-58	pCi	87.5	82.5	1.06	A
			Co-60	pCi	199	176	1.13	A
			Cr-51	pCi	218	191	1.14	A
			Cs-134	pCi	119	126	0.94	A
			Cs-137	pCi	92.4	88.7	1.04	A
			Fe-59	pCi	95.5	76.9	1.24	W
			Mn-54	pCi	120	113	1.06	A
			Zn-65	pCi	179	193	0.93	A
	E13830	Soil	Ce-141	pCi/g	0.224	0.220	1.02	A
			Co-58	pCi/g	0.193	0.207	0.93	A
			Co-60	pCi/g	0.406	0.441	0.92	A
			Cr-51	pCi/g	0.464	0.477	0.97	A
			Cs-134	pCi/g	0.334	0.316	1.06	A
			Cs-137	pCi/g	0.270	0.288	0.94	A
			Fe-59	pCi/g	0.183	0.193	0.95	A
			Mn-54	pCi/g	0.263	0.284	0.93	A
			Zn-65	pCi/g	0.475	0.484	0.98	A
	E13831	AP	Sr-89	pCi	99.4	90.8	1.09	A
			Sr-90	pCi	14.6	14.3	1.02	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 2023	E13832	Milk	Sr-89	pCi/L	49.8	71.4	0.70	W
			Sr-90	pCi/L	7.28	12.8	0.57	N[(1)]
	E13833	Milk	Ce-141	pCi/L	93.4	104	0.90	A
			Co-58	pCi/L	58.2	65.8	0.88	A
			Co-60	pCi/L	190	223	0.85	A
			Cr-51	pCi/L	207	205	1.01	A
			Cs-134	pCi/L	96.0	114	0.84	A
			Cs-137	pCi/L	121	141	0.86	A
			Fe-59	pCi/L	78.8	78.8	1.00	A
			I-131	pCi/L	27.9	37.4	0.75	W
			Mn-54	pCi/L	128	146	0.88	A
			Zn-65	pCi/L	185	203	0.91	A
	E13834	Charcoal	I-131	pCi	76.9	78.7	0.98	A
	E13835	AP	Ce-141	pCi	91.9	87.1	1.05	A
			Co-58	pCi	58.7	55.2	1.06	A
			Co-60	pCi	200	187	1.07	A
			Cr-51	pCi	192	172	1.12	A
			Cs-134	pCi	89.6	96	0.94	A
			Cs-137	pCi	109	119	0.92	A
			Fe-59	pCi	68.3	66.1	1.03	A
			Mn-54	pCi	129	123	1.05	A
			Zn-65	pCi	163	171	0.96	A
	E13836	Soil	Ce-141	pCi/g	0.228	0.184	1.24	W
			Co-58	pCi/g	0.103	0.116	0.89	A
			Co-60	pCi/g	0.364	0.394	0.92	A
			Cr-51	pCi/g	0.371	0.362	1.02	A
			Cs-134	pCi/g	0.176	0.202	0.87	A
			Cs-137	pCi/g	0.285	0.315	0.90	A
			Fe-59	pCi/g	0.140	0.139	1.00	A
			Mn-54	pCi/g	0.237	0.259	0.92	A
			Zn-65	pCi/g	0.349	0.359	0.97	A
	E13837	AP	Sr-89	pCi	74.6	80.2	0.93	A
			Sr-90	pCi	13.9	14.4	0.96	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

(1) See **NCR 23-24**

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 2023	23-MaS48	Soil	Ni-63	Bq/kg	294	1130	791 - 1469	N[3]
	23-MaSU48	Urine	Cs-134	Bq/L	9.92	10	6.7 - 12.4	A
			Cs-137	Bq/L	0.0994		(1)	A
			Co-57	Bq/L	9.35	8.67	6.07 - 11.27	A
			Co-60	Bq/L	9.03	8.13	5.69 - 10.57	A
			Mn-54	Bq/L	11.80	10.0	7.0 - 13.0	A
			U-234	Bq/L	0.01		Not spiked	
			U-238	Bq/L	0.01		Not spiked	
			Zn-65	Bq/L	10.60	9.29	6.50 - 12.08	A
	23-MaW48	Water	Ni-63	Bq/L	23.1	27.3	19.1 - 35.5	A
	23-RdV48	Vegetation	Cs-134	Bq/sample	5.6	7.6	5.32 - 9.88	W
			Cs-137	Bq/sample	0.03		*(1)*	A
			Co-57	Bq/sample	5.9	6.9	4.85 - 9.01	A
			Co-60	Bq/sample	5.00	6.51	4.56 - 8.46	W
			Mn-54	Bq/sample	6.08	8.03	5.62 - 10.44	W
			Sr-90	Bq/sample	0.05		*(1)*	N[4]
			Zn-65	Bq/sample	5.49	7.43	*5.20 - 9.66*	W
August 2023	23-MaS49	Soil	Fe-55	Bq/kg	346	1280	896 - 1664	N[5]
			Ni-63	Bq/kg	1260	1370	959 - 1781	A
	23-MaW49	Water	Ni-63	Bq/L	1.0	1	*(2)*	A
	23-RdV49	Vegetation	Cs-134	Bq/sample	3.860	4.98	3.49 - 6.47	W
			Cs-137	Bq/sample	0.027		*(1)*	A
			Co-57	Bq/sample	3.88	4.24	2.97 - 5.51	A
			Co-60	Bq/sample	2.37	2.79	1.95 - 3.63	A
			Mn-54	Bq/sample	2.04	2.56	1.79 - 3.33	W
			Sr-90	Bq/sample	0.96	1.17	0.82 - 1.52	A
			Zn-65	Bq/sample	-0.514		*(1)*	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) See **NCR 23-08**

(4) See **NCR 23-09**

(5) Initial evaluation - See **CAR 23-31**

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 2023	MRAD-38	Water	Am-241	pCi/L	28.1	32.1	22.0 - 41.0	A
			Fe-55	pCi/L	1180	1380	811 - 2010	A
			Pu-238	pCi/L	65.6	70.7	42.5 - 91.6	A
			Pu-239	pCi/L	82.9	92.4	57.2 - 114	A
		Soil	Sr-90	pCi/kg	2630	2580	803 - 4020	A
		AP	GR-A	pCi/filter	69.6	76.8	40.1 - 127	A
			GR-B	pCi/filter	36.8	32.8	19.9 - 49.6	A
April 2023	RAD-133	Water	Ba-133	pCi/L	26.0	22.3	17.1 - 25.8	N(1)
			Cs-134	pCi/L	72.1	77.6	63.4 - 85.4	A
			Cs-137	pCi/L	62.1	63.1	56.8 - 72.2	A
			Co-60	pCi/L	32.6	30.3	26.7 - 36.1	A
			Zn-65	pCi/L	253	242	218 - 283	A
			GR-A	pCi/L	34.2	29.2	14.9 - 38.2	A
			GR-B	pCi/L	64.3	60.7	41.8 - 67.4	A
			U-Nat	pCi/L	61.75	62.7	51.2 - 69.0	A
			H-3	pCi/L	13,300	12700	11,100 - 14,000	A
			Sr-89	pCi/L	67.0	61.1	49.2 - 69.0	A
			Sr-90	pCi/L	36.5	36.0	26.4 - 41.5	A
			I-131	pCi/L	24.3	28.7	23.9 - 33.6	A
September 2023	MRAD-39	Water	Am-241	pCi/L	54.0	71.0	48.7 - 90.8	A
			Fe-55	pCi/L	2430	2630	1550 - 3830	A
			Pu-238	pCi/L	172	177	106 - 229	A
			Pu-239	pCi/L	171	182	113 - 224	A
		Soil	Sr-90	pCi/kg	9580	6800	2120 - 10,600	A
		AP	GR-A	pCi/filter	82.2	79.8	41.7 - 131	A
			GR-B	pCi/filter	54.3	42.6	25.8 - 64.4	A
October 2023	RAD-135	Water	Ba-133	pCi/L	86.3	92.2	73.8 - 111	A
			Cs-134	pCi/L	38.4	41.2	27.9 - 54.5	A
			Cs-137	pCi/L	194	199	161 - 237	A
			Co-60	pCi/L	49.5	47.8	33.8 - 61.8	A
			Zn-65	pCi/L	59.7	57.0	23.7 - 90.3	A
			GR-A	pCi/L	53.2	70.6	54.0 - 87.2	N(2)
			GR-B	pCi/L	46.9	42.2	30.5 - 53.9	A
			U-Nat	pCi/L	51.26	51.7	45.9- 57.5	A
			H-3	pCi/L	20,100	22,900	19,700 - 26,100	A
			Sr-89	pCi/L	51.1	38.2	25.2 - 51.2	A
			Sr-90	pCi/L	31.7	35.7	30.3 - 41.1	A
			I-131	pCi/L	23.5	29.7	25.8 - 33.6	N(3)

(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 23-10***
*(2) See **NCR 23-20***
*(3) See **NCR 23-21***

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	2023
Air Particulate	3S2	SSES Backup Met. Tower	99.9	100	99	100	99.9	99.9	100.0	99.4	99.9	95.5	99.7
& Charcoal	12S1	West Building	99.9	100	100	100	99.1	99.7	99.9	99.9	99.9	99.7	98.1
	13S6	Former Laydown Area, West of Confers Lane	99.9	100	97	100	100	99.9	99.9	99.9	99.9	99.9	100.0
	12E1	Berwick Hospital	100.0	100	98	99.1	100	100	100	100.0	100	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	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	100
	10S3	E of Confers Lane, S of Towers Club	-	-	-	100	99.5	99.9	99.2	98.9	99.9	99.7	99.9
	9B1	Transmission Line, E of Route 11	-	-	-	100	99.9	99.9	99.9	100.0	99.9	99.9	99.9
Drinking Water	12H2	Danville Water Company	100.0	100	100	100	100	100	98.1	100.0	100	100.0	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	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	94.0

* 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.