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U. S. Nuclear Regulatory Commission
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Washington, DC 20555-0001

10 CFR 50.4

**SUSQUEHANNA STEAM ELECTRIC STATION
ANNUAL RADIOLOGICAL ENVIRONMENTAL
OPERATING REPORT
PLA-7699**

**Docket No. 50-387
50-388**

In accordance with the Susquehanna Steam Electric Station Units 1 and 2 Technical Specification 5.6.2, the Susquehanna Steam Electric Station Annual Radiological Environmental Operating Report is hereby submitted for the calendar year 2017.

Should you have any questions regarding this submittal, please contact Mr. Jason Jennings at (570)-542-3155.

This letter contains no new regulatory commitments.

Sincerely,

A handwritten signature in black ink, appearing to be "B. Berryman", written over a horizontal line.

B. Berryman

Attachment: Susquehanna Steam Electric Station Annual Radiological Environmental Operating Report

Copy:

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Mr. M. Shields, PA DEP/BRP
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Attachment to PLA-7699

**Susquehanna Steam Electric Station Annual
Radiological Environmental Operating Report**

**SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 and 2**

Annual Radiological
Environmental Operating Report

2017

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SUSQUEHANNA STEAM ELECTRIC STATION

Units 1 & 2

2017 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

JANUARY 1 TO DECEMBER 31, 2017

Susquehanna Nuclear, LLC
Berwick, PA
April, 2018

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I. Summary

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

Ecology III was responsible for the collection of environmental samples during 2017. Teledyne Brown Engineering (TBE) was responsible for the analysis of environmental samples during 2017. The results are discussed in this report. Landauer provided the dosimetry services for SSES during 2017.

This Annual Radiological Environmental Operating Report (AREOR) conducted for SSES covers the period January 1, 2017 through December 31, 2017. During that time period, 1574 analyses were performed on 1339 samples.

Of the two man-made radionuclides (tritium [H-3] and cesium-137 [Cs-137]) detected in the environment by the Susquehanna Steam Electric Station (SSES) Radiological Environmental Monitoring Program (REMP), tritium is the only radionuclide attributable to SSES operation. The whole body and organ dose to members of the public attributable to tritium identified in REMP cooling tower blowdown samples was $1.87E-04$ mRem. Tritium was included in the dose calculation because it was identified in the REMP samples of permitted water being discharged to the Susquehanna River. Cs-137 is attributed to fallout from atmospheric nuclear weapons testing. The 2017 average concentration of tritium in the cooling tower blowdown water and the 2017 average cooling tower blowdown flow were used to determine the amount of tritium released. The presumed exposure pathways to the public

from this radionuclide were drinking water taken from the Susquehanna River at Danville, PA and eating fish caught near the SSES discharge to the river. Dose from ground plane deposition (shoreline exposure) is not applicable because tritium does not emit gamma radiation and the beta radiation emitted by tritium is not sufficiently penetrating to reach an individual on the shore.

Based on the above outlined methodology, the total tritium activity released from the SSES to the Susquehanna River in 2017 was 17.0 curies.

The 2017 average dilution factor for the Susquehanna River was 613, based on the annual average river flow of $7.91\text{E}+06$ gpm and the annual average cooling tower blowdown flow of $1.29\text{E}+04$ gpm.

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 respective station Offsite Dose Calculation Manual (ODCM) which are based on the design objectives in 10CFR Part 50, Appendix I, Sections IV.B.2, IV.B.3 and IV.C. The Lower Limit of Detection (LLD) values required by the TRM and SSES ODCM were achieved for the 2017 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 2017 verify the adequacy of the SSES radioactive

effluent control systems.

Samples of air particulates, air iodine, milk, groundwater, drinking water, vegetation, soil, 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.

High sensitivity iodine-131 (I-131) analyses were performed on weekly air samples. 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 concentrations of I-131 and gamma emitting nuclides. 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 detected were consistent with those detected in previous years. No fission or activation products were detected.

Drinking water samples were analyzed for concentrations of tritium, gross beta and gamma emitting nuclides. Tritium and 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.

Soil samples were analyzed for concentrations of gamma emitting nuclides. Naturally occurring isotopes (i.e. K-40, thorium-228 [Th-228], radium-226 [Ra-226] and actinium-228 [Ac-228]), were detected at levels consistent with previous years. Cs-137 was detected at levels consistent with those detected in previous years. Historical and preoperational data consistently indicates that Cs-137 previously detected in the soil is due to residual fallout from atmospheric nuclear weapons testing in the 1970s and early 1980s, and the Chernobyl and Fukushima events, and is not attributable to station operations.

Surface water samples were analyzed for concentrations of tritium and gamma emitting nuclides. Tritium activities detected were consistent with those detected in previous years. Naturally occurring Th-228 was detected in one sample at levels that is consistent with results in previous years. No fission or activation products were detected.

Fish and shoreline sediment samples were analyzed for concentrations of gamma emitting nuclides. Naturally occurring K-40 was detected at levels consistent with those detected in previous years. 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 facility with two boiling-water reactors and generators located just west of the Susquehanna River, approximately 5 miles northeast of Berwick, in Luzerne County, Pennsylvania. 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 total Susquehanna Nuclear, LLC presently owns 2,347 acres of land on both sides of the Susquehanna River. Generally, this land is characterized by open deciduous woodlands interspersed with grasslands.

On the west side of the river, 1,605 (1,670 minus 65 acre Gould Island) acres of land is jointly owned between Susquehanna Nuclear, LLC (90%) and Allegheny Electric Cooperative (10%). The land use on the west side of the river 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 river, Susquehanna Nuclear, LLC owns 100% of the 65-acre Gould Island. On the east side of the river, and across the river from the station, Susquehanna Nuclear, LLC is the 100% owner of 677 acres that are maintained as undeveloped land, natural recreational areas, wildlife areas, and leases to local farmers.

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.

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, 2017, 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 site 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, 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.

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 2017 REMP Atypical Sampling Occurrences

C. Program Changes

There were no program changes in 2017.

Exceptions Table
2017 REMP Atypical Sampling Occurrences

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
JAN	Air	12S1	<p>01/04/17 to 01/11/17 (loss of 0.6 hours) Power outage on 01/11/17. Loss of 0.6 hours as determined by timer box during weekly collection.</p> <p>Non-continuous sampler operation.</p>	<p>CA #17-01 AR 2017-00930 01/11/17: No action required. Air monitor resumed normal operation when power was restored. 01/11/17: Operability verified @ 1115 hours. <i>Ideal sample collected for sample period: 23,100 cf.</i></p>
	Surface Water	6S6	<p>01/10/17 to 01/17/17 (week 3 January composite) Diminished sample flow (1.1 gpm) as discovered during weekly collection.</p>	<p>CA #17-03 CR 2017-01217 01/17/17: Adequate sample volume collected during sample period. Maintenance requested. 01/23/17: Maintenance performed by I&C and sample flow restored to 1.5 gpm. 01/24/17: Operability verified @ 1044 hours. <i>Ideal sample collected for sample periods.</i></p>
FEB	Air	12S1	<p>02/22/17 to 03/02/17 (loss of 24.2 hours) Loss of 12kV power from 02/25/17 @ 1513 to 02/26/17 @ 1523. Loss of 24.2 hours as determined by timer box.</p> <p>Non-continuous sampler operation.</p>	<p>CA #17-05 CR 2017-03995 & CA #17-06 CR 2017-04010 02/27/17: No action required. Air monitor resumed normal operation when power was restored. 02/27/17: Operability verified @ 0845 hours. <i>Ideal sample collected for sample period: 21,300 cf.</i></p>

Exceptions Table (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
MAR	Air	10S3	<p>02/22/17 to 03/02/17 (loss of 0.6 hours) Power outage on 03/02/17. Loss of 0.6 hours as determined by timer box and known restoration time during weekly collection.</p> <p>Non-continuous sampler operation.</p>	<p>CA #17-07 CR 2017-04380 03/02/17: No action required. Air monitor resumed normal operation when power was restored. 03/02/17: Operability verified @ 0950 hours. <i>Ideal sample collected for sample period: 25,000 cf.</i></p>
	Surface Water	6S6	<p>02/28/17 to 03/07/17 (week 1 March composite) Diminished sample flow (0.6 gpm) as discovered during weekly collection.</p>	<p>CA #17-08 CR 2017-04898 03/07/17: Adequate sample volume collected during sample period. Maintenance requested. 03/09/17: Maintenance performed by I&C and sample flow restored to 1.5 gpm. 03/13/17: Operability verified @ 1203 hours. <i>Ideal sample collected for sample periods.</i></p>
	Air	10S3	<p>03/08/17 to 03/16/17 (loss of 0.5 hours) Power outage date and time unknown. Loss of 0.5 hours as determined by timer box during weekly collection.</p> <p>Non-continuous sampler operation.</p>	<p>CA #17-09 CR 2017-05816 03/16/17: No action required. Air monitor resumed normal operation when power was restored. 03/16/17: Operability verified @ 1205 hours. <i>Ideal sample collected for sample period: 26,300 cf.</i></p>

Exceptions Table (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
APR	Air	12S1	<p>03/29/17 to 04/05/17 (loss of 54.1 hours) 12kV power removed from service for repairs, causing REMP air sampler to be out of service. Outage began on 04/03/17 @ 0807 and ended on 04/05/17 @ 1415</p> <p>Non-continuous sampler operation.</p>	<p>CA #17-10 AR 2017-07587 04/05/17: No action required. Air monitor resumed normal operation when power was restored. 04/06/17: Operability verified @ 0827 hours. <i>Ideal sample collected for sample period: 15,200 cf.</i></p>
	Surface Water	6S6	<p>04/04/17 to 04/11/17 (week 2 April composite) Diminished sample flow (1.0 gpm) as discovered during weekly collection.</p>	<p>CA #17-11 CR 2017-08273 04/11/17: Adequate sample volume collected during sample period. 04/12/17: PM performed by I&C. Restored sample flow to 1.5 gpm. 04/18/17: Operability verified @ 1117 hours. <i>Ideal sample collected for sample period.</i></p>
	Surface Water	6S6	<p>04/11/17 to 04/18/17 (week 3 April composite) ACS out of service for approximately 1 hour for routine maintenance by I&C.</p>	<p>CA #17-12 CR 2017-08319 04/12/17: CR generated by I&C. No corrective action required since this was routine maintenance. PM date will be noted on sample collection form. 04/18/17: Operability verified @ 1117 hours <i>Ideal sample collected for sample period.</i></p>

Exceptions Table (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
APR (cont.)	Surface Water	6S6	04/18/17 to 04/25/17 (week 4 April composite) Diminished sample flow (1.0 gpm) as discovered during weekly collection.	CA #17-13 CR 2017-08997 04/25/17: Adequate sample volume collected during sample period. 04/26/17: PM performed by I&C. Restored sample flow to 1.5 gpm. 05/02/17: Operability verified @ 1200 hours. <i>Ideal sample collected for sample period.</i>
	Air	8G1	04/19/17 to 04/26/17 (loss of 1.9 hours) Power outage date and time unknown. Loss of 1.9 hours as determined by timer box during weekly collection. Non-continuous sampler operation.	CA #17-14 CR 2017-09194 04/26/17: No action required. Air monitor resumed normal operation when power was restored. 04/26/17: Operability verified @ 1504 hours. <i>Ideal sample collected for sample period: 22,000 cf.</i> TRM requirements were met since second control location (6G1) was operational during sample period.
MAY	Precip.	12S1	03/29/17 to 05/03/17 (week 5, 2 nd Q composite) Compromised 2 nd quarter composite from week 1 to week 5 for 12S1. Week 5 of 10S3 precipitation was placed in 12S1's composite container.	CA #17-15 CR 2017-09719 05/04/17: A review of "Focus on Five" human performance tools was conducted with all sample collectors. All water composite and field collection containers will be color coded. 05/26/17: Painting of all precipitation buckets and containers completed.

Exceptions Table (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
MAY (cont.)	Surface Water	6S6	05/02/17 to 05/09/17 (week 2 May composite) Diminished sample flow (0.5 gpm) as discovered during weekly collection.	CA #17-16 CR 2017-09887 05/09/17: Adequate sample volume collected during sample period. 05/10/17: PM performed by I&C. Restored sample flow to 1.5 gpm. 05/16/17: Operability verified @ 1045 hours. <i>Ideal sample collected for sample period.</i>
	Surface Water	2S7	05/16/17 to 05/23/17 (week 4 May composite) Insufficient sample volume (<1 gallon) collected for week 4 May composite. ACS was operational at time of sample collection.	CA #17-17 CR 2017-10666 05/23/17: Sample line was flushed of very turbid water and debris. Grab sample collected from flow line @ 1323 hours. 05/23/17: Equipment restored to service @ 1000 hours. 05/30/17: Operability verified @ 0854 hours. <i>Grab sample collected for sample period.</i>
JUN	Surface Water	2S7	06/05/17 to 06/09/17 & 06/13/17 (weeks 1 & 2 June composite) CTBD secured daily from 06/05/17 to 06/09/17, and again on 06/13/17, for planned completion of Blowdown Line Sparger Inspection. No effect on continuous sampler operation.	CA #17-18 CR 2017-11259 & 2017-11732 06/05/17: No corrective action required. Sampler resumed normal operation when blowdown was restored daily. 06/13/17: Operability verified @ 1000 hours. <i>Ideal sample collected for sample periods.</i>

Exceptions Table (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
JUN (cont.)	Surface Water	6S6	<p>05/30/17 to 06/06/17 (week 1 June composite) No sample flow to ACS as discovered during weekly collection, possibly due to a blocked sample line.</p> <p>06/06/17 to 06/13/17 – Week 2 June composite Delayed start date of 06/07/17 @ 0845 hours.</p>	<p>CA #17-19 CR 2017-11378 06/06/17: Adequate sample volume collected during sample period. Grab sample collected at alternate location 5S9 to meet TRM requirements. Composite sample for week 1 June to be used in monthly composite. Requested maintenance (WO# 2093363). 06/07/17: Sample flow restored @ 0845 hours. Operability verified @ 1227 hours. <i>Grab sample collected for sample period.</i></p>
	Surface Water	6S6	<p>06/20/17 to 06/27/17 (week 4 June composite) ACS out of service for approximately 1 hour for routine maintenance by I&C.</p>	<p>CA #17-20 CR 2017-12100 06/20/17: CR generated by I&C. No corrective action required since this was routine maintenance. PM date will be noted on sample collection form. 06/27/17: Operability verified @ 1110 hours <i>Ideal sample collected for sample period.</i></p>
JUL	Surface Water	6S6	<p>07/03/17 to 07/11/17 (week 2 July composite) Diminished sample flow (0.5 gpm) as discovered during weekly collection.</p>	<p>CA #17-22 CR 2017-13090 07/11/17: Adequate sample volume collected during sample period. 07/12/17: PM performed by I&C. Restored sample flow to 1.5 gpm. 07/18/17: Operability verified @ 0954 hours. <i>Ideal sample collected for sample period.</i></p>

Exceptions Table (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
JUL (cont.)	Air	3S2 & 9B1	<p>07/12/17 to 07/19/17 (loss of 5 hours) Power outages on 07/14/17 due to line failure on Route 11. Loss of 5 hours as determined by timer boxes during weekly collection. Non-continuous sampler operation.</p>	<p>CA #17-23 CR 2017-13240 07/15/17: No action required. Air monitors resumed normal operation when power was restored. 07/19/17: Operability verified @ 0754 hours for 3S2 and @ 1405 hours for 9B1. <i>Ideal samples collected for sample period: 19,500 cf. - 3S2 20,100 cf. - 9B1</i></p>
AUG	DLR	9B1	<p>3rd Quarter Environmental DLR was found damaged and laying on the ground. Damaged property occurred as a result of road ground clearing maintenance along Route 11.</p>	<p>CA #17-24 CR 2017-15599 & AR 2017-15619 09/05/17: New post and 2 spare 3rd Q DLRs were installed. <i>Adequate number of DLRs collected from other monitoring locations. CR & AR for tracking and trending of occurrence only, it is not counted as an atypical sample for the Environmental Lab's REMP program.</i></p>
SEP	Surface Water	6S6	<p>09/12/17 to 09/19/17 (week 3 Sep composite) No sample flow to ACS as discovered by I&C during monthly preventative maintenance on 09/19/17 @ 0719, due to a blocked sample line.</p>	<p>CA #17-25 CR 2017-16464 09/19/17: Adequate sample volume collected during sample period. Grab sample collected at location 6S6 to meet TRM requirements. Composite sample for week 3 Sep to be used in monthly composite. 09/19/17: Sample flow restored @ 1016 hours. Operability verified @ 1100 hours. <i>Grab sample collected for sample period.</i></p>

Exceptions Table (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
SFP (cont.)	Air	8G1	<p>09/13/17 to 09/20/17 (loss of 1.6 hours) Power outage on 09/20/17 from 0945 to 1456, but was turned on for 54 minutes between 1119 and 1456 due to PPL performing maintenance on lights in vicinity of air monitor. Loss of 1.6 hours as determined by timer box during weekly collection. Delayed start for week of 09/20/17 to 09/27/17. Non-continuous sampler operation.</p>	<p>CA #17-26 CR 2017-16594 09/20/17: No action required. Air monitor resumed normal operation when power was restored @ 1456 while sample collector was present. 09/20/17: Operability verified @ 1458 hours. <i>Ideal sample collected for sample periods: 21,200 cf (09/20/17) and 20,900 cf (09/27/17).</i> TRM requirements were met since second control location (6G1) was operational during sample period.</p>
			NOV	Air
Air	10S3	<p>11/21/17 to 11/29/17 Flow rate upon arrival was 1.9 cfm, below the procedural range of 2.0-2.4 cfm. This was most likely due to change in air temperature from previous sampling period. Continuous sampling during sample period.</p>		

Exceptions Table (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
DFC	Air	12S1	<p>12/20/17 to 12/27/17 (momentary loss of 12kV power) Momentary loss of power on 12/25/17. No loss of sampling time as determined by timer box during weekly collection.</p> <p>Non-continuous sampler operation.</p>	<p>CA #17-29 CR 2017-21240 12/25/17: No action required. Air monitor resumed normal operation when power was restored. 12/26/17: Operability verified @ 0905 hours. Ideal sample collected for sample period: 21,700 cf.</p>
	Air	10S3	<p>12/20/17 to 12/27/17 (loss of 40 hours) Power outage date and time unknown. Loss of 40 hours as determined by timer box during weekly collection. Pump malfunction- upon arrival pump was providing an inadequate flow rate of 1.3 cfm. Non-continuous sampler operation.</p>	<p>CA #17-30 CR 2017-21289 12/27/17: Air monitor resumed operation when power was restored. Pump was replaced and air flow verification was performed. 12/27/17: Operability verified @ 1049 hours. Atypically low sample collected for sample period: 14,800 cf.</p>
	Air	3S2 & 9B1	<p>12/20/17 to 12/27/17 (loss of 0.2 hours) Power outage dates and times unknown. Loss of 0.2 hours as determined by timer boxes during weekly collection. Non-continuous sampler operation.</p>	<p>CA #17-31 CR 2017-21296 12/27/17: No action required. Air monitors resumed normal operation when power was restored. 12/27/17: Operability verified @ 0907 hours for 3S2 and @ 1056 hours for 9B1. Ideal samples collected for sample period: 22,200 cf.- 3S2 23,300 cf.- 9B1</p>

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

Teledyne Brown Engineering

For the TBE laboratory, 168 out of 173 analyses performed met the specified acceptance criteria. Five analyses did not meet the specified acceptance criteria for the following reasons and were addressed through the TBE Corrective Action Program.

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.

1. Two nuclides in the ERA April 2017 water sample were evaluated as Not Acceptable. (NCR 17-09)
 - a. The Zn-65 result of 39.3 pCi/L, exceeded the lower acceptance limit of 47.2. The known value was unusually low for this study. The sample was run in duplicate on two different detectors. The results of each were 39.3 ± 18.2 pCi/L (46% error and lower efficiency) and 59.3 ± 8.23 pCi/L (13.9% error and higher efficiency). The result from the 2nd detector would have been well within the acceptable range (47.2 – 65.9) and 110.2% of the known value of 53.8 pCi/L.
 - b. The Sr-89 result of 40.7 pCi/L exceeded the lower acceptance limit of 53.8. All associated QC and recoveries were reviewed and no apparent cause could be determined for the failure. The prior three cross-check results were from 99 – 115% of the known values and the one that followed this sample (November, 2017) was 114% of the known value.
2. The DOE MAPEP August 2017 air particulate U-238 result of 0.115 ± 0.025 Bq/sample was higher than the known value of 0.087 ± 0.002 with a ratio of 1.32, therefore the upper ratio of 1.30 (acceptable with warning) was exceeded. TBE's result with error easily overlaps with the acceptable range. MAPEP does not evaluate results with any associated error. Also, the spike level for this sample was very low (2.35 pCi) compared to TBE's normal LCS of 6 pCi. TBE considers this result as passing. (NCR 17-15)
3. The Analytics September 2017 soil Cr-51 result was evaluated as Not Acceptable (Ratio of TBE to known result at 0.65). The

reported value was 0.230 ± 0.144 pCi/g and the known value was 0.355 ± 0.00592 pCi/g. The sample was counted overnight for 14 hours, however the Cr-51 was spiked at a very low level and had a counting error of 65%. Cr-51 has a 27-day half-life, making low-level quantification even more difficult. The error does not appear to have been taken into consideration for this result. If it had been evaluated with the error, the highest result would have been 105% of the reference value, which is acceptable. Also, the known value is significantly lower than TBE's typical MDC for this nuclide in a soil matrix and would typically not be reported to clients (unless specified). The results of all of the previous cross-checks have been in the acceptable (80 – 120%) range. TBE will evaluate further upon completion of the next ICP sample. (NCR 17-16)

4. The ERA November 2017 water Sr-90 sample was evaluated as Not Acceptable. TBE's result of 27.1 pCi/L exceeded the lower acceptance range (30.8 – 48.0 pCi/L). After reviewing the associated QC data for this sample, it was determined that although the spike recovery for Sr-90 was within our laboratory guidelines (70% -130%), both the spike result and our ERA result were biased low. The original cross-check sample was completely consumed and we were unable to reanalyze before submitting the result. We have modified our preparation process to avoid this situation for future cross-check samples. We also have enhanced LIMS programming to force a LCSD when a workgroup includes cross-check samples (as opposed to running a DUP). (NCR 17-19)

The Inter-Laboratory Comparison Program provides evidence of “in control” counting systems and methods, and that the laboratories are producing accurate and reliable data.

In addition, Susquehanna Nuclear’s REMP Laboratory Spike Program provided independently procured Analytics spiked samples as part of Susquehanna Nuclear’s Quality Control Spike Program.

The criteria for the acceptability of the spiked analysis results were established by Susquehanna Nuclear and are based on criteria originally developed by the NRC. The criteria are based on an empirical relationship that combines prior experience and accuracy needs. As the resolution of the measurement process improves, the criteria for determining acceptability become tighter.

Conversely, as the resolution of the process decreases, the criteria for determining acceptability become wider.

IV. Results and Discussion

The analytical results of the 2017 REMP samples are divided into categories based on exposure pathways: atmospheric, direct radiation, terrestrial, and aquatic. The analytical results for the 2017 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 two control locations (6G1 and 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 3 to 23 E-3 pCi/m³ with an average concentration of 12 E-3 pCi/m³, and in 106 of 106 of the control location samples at concentrations ranging from 5 to 22 E-3 pCi/m³ with an average of 11 E-3 pCi/m³. The maximum preoperational level detected was 102 E-3 pCi/m³ with an average concentration of 62 E-3 pCi/m³. (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 32 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 70 E-3 to

153 E-3 pCi/m³ with an average concentration of 109 E-3 pCi/m³, and in the eight control location composites ranging in concentration from 86 to 141 E-3 pCi/m³ with an average concentration of 109 E-3 pCi/m³.

The maximum preoperational level detected was 85 E-3 pCi/m³ with an average concentration of 74 E-3 pCi/m³. (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, 12E1, 12S1, 13S6, 9B1, and 10S3) and two control locations (6G1 and 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 with a pair of optically stimulated luminescent dosimeters (OSLD) composed of aluminum oxide crystals supplied and processed by Landauer. Packets containing OSLDs for quarterly exposure were placed in the owner-controlled area and around the site at various distances and in each land-based meteorological sector. Emphasis was placed on

special interest areas such as population centers, nearby residences, and schools.

A total of 57 locations were monitored for direct radiation during 2017, including 32 site boundary locations, 14 outer distant locations, six special interest locations and five control locations.

The average dose rate for the 208 indicator dosimeters was 16.5 milliroentgen per standard quarter. The average control dose rate for the 20 control dosimeters was 14.7 milliroentgen per standard quarter. The preoperational average for the quarterly direct radiation readings was 17.6 milliroentgen per standard quarter. The results of the direct radiation measurements for 2017 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, vegetation and soil samples.

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 no 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 63 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 2017 are plotted.

Gamma Spectrometry

Naturally occurring K-40 was detected in all 63 samples with concentrations for the 42 indicator location samples ranging from 1,091 to 1,595 pCi/L with an average concentration of 1,323 pCi/L, and the 21 control location sample concentrations ranging from 1,170 to 1,672 pCi/L with an average concentration of 1,366 pCi/L. The maximum preoperational level detected was 1,500 pCi/L with an average concentration of 1,358 pCi/L.

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 14 indicator locations (2S2, 4S4, 6S10, 11S2, 1S3, 4S8, 4S9, 8S4, 7S10, 13S7, 2S8, 6S11A, 6S12 and 7S11) and one control location, (12F3). Each sample was analyzed for H-3 and gamma emitters.

Tritium

Tritium activity was detected above the minimum detectable concentration in four of the 56 indicator location samples with concentrations ranging from 140 to 209 pCi/L with an average concentration of 179 pCi/L. No H-3 was detected in any of the four control location 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 2017 are plotted.

Gamma Spectrometry

Naturally occurring K-40 was detected in two of the 56 indicator samples at a concentration of 117 pCi/L. No K-40 was detected in the control location samples. Preoperational data is not available for comparison. (Table C-6, Appendix C)

Naturally occurring Th-228 was not detected in any of the indicator or control location samples. Preoperational data is not available for comparison. (Table C-6, Appendix C)

All other gamma emitters were less than the LLD.

3. Drinking Water

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

Gross Beta

Gross beta activity was detected in six of the 12 drinking water samples. Sample concentrations ranged from 2 to 4 pCi/L with an average concentration of 3 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 2017 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 four indicator locations (3S3, 12F7, 11D1, and 11S6) and one control location (8G1) were collected throughout the growing season. All samples (vegetable and broadleaf) were analyzed for gamma emitters and included soy beans, potatoes, field corn, pumpkin, kale, swiss chard and collards.

Gamma Spectrometry

Naturally occurring Be-7, attributed to cosmic ray activity in the atmosphere, was detected in 17 of the 32 indicator location samples with concentrations ranging from 387 to 1,215 pCi/kg wet with an average concentration of 703 pCi/kg wet, and in 7 of the control location samples with concentrations ranging from 336 to 963 pCi/kg wet with an average concentration of 537 pCi/kg wet. Preoperational data is not available for comparison.

Naturally occurring K-40 was detected in all 32 indicator location samples with concentrations ranging from 2,658 to 13,540 pCi/kg wet with an average concentration of 5,017 pCi/kg wet, and in all 14 control location samples with concentrations ranging from 2,744 to 6,308 pCi/kg wet with an average concentration of 4,603 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.

5. Soil

Soil samples were collected annually from two indicator locations (12S1 and 10S3) and one control location (8G1). Each sample was analyzed for gamma emitters.

Gamma Spectrometry

Naturally occurring K-40 was detected in all four indicator location samples at concentrations ranging from 9,623 to 13,320 pCi/kg dry with an average concentration of 11,336 pCi/kg dry, and in both of the control location samples at concentrations ranging from 8,166 to 9,559 pCi/kg dry with an average concentration of 8,863 pCi/kg dry. The maximum preoperational level detected was 11,000 pCi/kg dry with an

average concentration of 9,800 pCi/kg dry.

Cesium-137 was detected in one of the four indicator location samples at a concentration of 129 pCi/kg dry. Cesium-137 was detected in one of the two control location samples with a concentration of 122 pCi/kg dry. The maximum preoperational level detected was 1,200 pCi/kg dry with an average concentration of 700 pCi/kg dry.

Naturally occurring Ra-226 was detected in two of the indicator location samples at concentrations ranging from 2,724 to 4,274 pCi/kg dry with an average concentration of 3,498 pCi/kg dry, and was detected in one of the two control location samples with a concentration of 2,221 pCi/kg dry. The maximum preoperational level detected was 1,300 pCi/kg dry with an average concentration of 1,100 pCi/kg dry.

Naturally occurring Ac-228 was detected in three of the four indicator location samples at concentrations ranging from 840 to 919 pCi/kg dry with an average concentration of 885 pCi/kg dry, and in all of the control location samples at concentrations ranging from 890 to 1,174 pCi/kg dry with an average concentration of 1,032 pCi/kg dry. Preoperational data is not available for comparison.

Naturally occurring Th-232 was detected in all of the four indicator location samples at concentrations ranging from 682 to 1,064 pCi/kg dry and an average concentration of 910 pCi/kg dry, and in all of the control location samples at concentrations ranging from 722 to 1,117 pCi/kg dry with an average concentration of 919 pCi/kg dry. The maximum preoperational level detected was 1,300 pCi/kg dry with an average

concentration of 1,100 pCi/kg dry. (Table C–10, 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 six indicator locations (6S5, 2S7, LTAW, 4S7, 5S12, 5S9 and 7S12) and one control location (6S6). Each sample was analyzed for H-3 and gamma emitters.

Tritium

Tritium activity was detected in 10 of 42 indicator location samples with concentrations ranging from 207 to 2,070 pCi/L with an average concentration of 620 pCi/L. The range of H-3 levels in surface water are biased high due to inclusion of samples from the cooling tower blowdown line (CTBD; location 2S7). Routine station operation includes infrequent batch releases of slightly radioactive water which are discharged into the CTBD. When the H-3 concentration from CTBD samples is averaged with those obtained from Susquehanna River downstream monitoring locations, the result is an overall indicator location average that is higher than the actual average H-3 levels of the downstream river water. No radioactivity attributable to station operations was identified above analysis detection levels in any samples from the Susquehanna River in 2017. Tritium was not detected in any of the control location samples. The maximum preoperational level detected was 319

pCi/L, with an average concentration of 140 pCi/L. (Table C-11, Appendix C) Figure C-6 – Tritium Activity in Surface Water, results from 1972 to 2017 are plotted.

Gamma Spectrometry

Naturally occurring K-40 was not detected in any of the indicator or control location samples. Preoperational data is not available for comparison.

Naturally occurring Th-228 was detected in 1 of the control location samples with a concentration of 4 pCi/L.

Preoperational data is not available for comparison. (Table C-11, Appendix C)

Iodine-131

Iodine-131 was not detected in any of the indicator or control samples. The maximum preoperational level detected was 0.43 pCi/L, with an average concentration of 0.33 pCi/L. (Table C-11, 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 2017 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 3,207 to 5,499 pCi/kg wet with an average concentration of 4,062 pCi/kg wet, and in all control location samples at concentrations ranging from 2,649 to 4,298 pCi/kg wet with an average concentration of 3,669 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-12, 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 7,204 to 10,320 pCi/kg dry with an average concentration of 9,160 pCi/kg dry, and in all of the control location samples with concentrations ranging from 11,480 to 19,550 pCi/kg dry with an average concentration of 15,515 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 detected in one of the two control location samples with a concentration of 114 pCi/kg dry. The maximum

preoperational level detected was 210 pCi/kg dry with an average concentration of 110 pCi/kg dry.

Naturally occurring Ra-226 was detected in one of the indicator location samples at concentrations with a concentration of 1,887 pCi/kg dry. Naturally occurring Ra-226 was not detected in any of the control 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 468 to 911 pCi/kg dry with an average concentration of 771 pCi/kg dry, and in both of the control location samples at concentrations ranging from 984 to 1,004 pCi/kg dry with an average concentration of 994 pCi/kg dry. Preoperational data is not available for comparison. (Table C-13, Appendix C)

Naturally occurring Th-228 was detected in all of the four indicator location samples at concentrations ranging from 587 to 901 pCi/kg dry with an average concentration of 781 pCi/kg dry, and in both of the control location samples at concentrations ranging from 883 and 1,196 pCi/kg dry with an average concentration of 1,040 pCi/kg dry. The maximum preoperational level detected was 3,200 pCi/kg dry with an average concentration of 1,300 pCi/kg dry.

All other gamma emitters were less than the LLD.

E. Land Use Census

SYNOPSIS OF 2017 LAND USE CENSUS

Ecology III, Inc. conducted a Land Use Census during the 2017 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 m² (approximately 500 ft²) 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 Sept, 2017 miles	Nearest Garden Sept, 2017 miles	Nearest Dairy Farm Sept, 2017 miles
1	N	1.3	3.2	>5.0
2	NNE	1.0	2.3 ^{a,c,e}	>5.0
3	NE	0.9	2.7	>5.0
4	ENE	2.1	2.4 ^{a,b,c}	>5.0
5	E	1.4	4.3	4.5 ^d
6	ESE	0.5	3.1	>5.0
7	SE	0.5	0.6	>5.0
8	SSE	0.6	2.9	>5.0
9	S	1.0	3.5	>5.0
10	SSW	0.9	1.3	>5.0
11	SW	1.5	1.9	>5.0
12	WSW	1.3	1.3	1.7 ^d
13	W	1.2	2.0	5.0
14	WNW	1.1	1.3	>5.0
15	NW	0.8	2.3 ^{a,c}	>5.0
16	NNW	0.6	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

The 2017 Land Use Census results are summarized in the above table.

V. Annotations to Previous AREOR

There are no annotations to the previous AREOR.

VI. Conclusions

The Radiological Environmental Monitoring Program for SSES was conducted during 2017 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

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- [12] United States Nuclear Regulatory Commission. "An Acceptable Radiological Environmental Monitoring Program." Radiological Assessment Branch Technical Position. November 1979, Revision 1. USNRC, Washington, DC.
- [13] Susquehanna Nuclear, "Engineering Study, EC-ENVR-1012 (Revision 2, February 2013)", Interpretation of Environmental Direct Radiation Results.
- [14] Susquehanna Nuclear, Tritium Release REMP Calculation (RETDAS) V.3.6.6) – March 2017.
- [15] NCRP Report No. 160, "Ionizing Radiation Exposure of the Population of the United States", (2009).

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, 2016 to January 01, 2018

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSIS PERFORMED (1)	LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS		LOCATION WITH HIGHEST MEAN		CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS	
			MEAN (3) RANGE	DISTANCE AND DIRECTION	NAME	MEAN (3) RANGE			
Air Particulates (E-3 pCi/m ³)	GR-B	424	10	1.195E+01 (318/318) (3.150E+00 - 2.250E+01)	0.4 MILES WSW	12S1	1.243E+01 (53/53) (3.510E+00 - 1.990E+01)	1.121E+01 (106/106) (4.650E+00 - 2.230E+01)	0
	GAMMA BE-7	32	N/A	1.088E+02 (24/24) (7.037E+01 - 1.533E+02)	0.6 MILES SSW	10S3	1.148E+02 (4/4) (7.664E+01 - 1.461E+02)	1.091E+02 (8/8) (8.550E+01 - 1.410E+02)	0
	K-40	32	N/A	1.416E+00 (24/24) (-1.335E+01 - 1.325E+01)	0.4 MILES WSW	12S1	4.837E+00 (4/4) (-3.805E+00 - 1.219E+01)	3.034E-02 (8/8) (-1.209E+01 - 1.089E+01)	0
	CS-134	32	50	2.715E-01 (24/24) (-5.641E-01 - 1.439E+00)	4.7 MILES WSW	12E1	7.624E-01 (4/4) (8.625E-02 - 1.439E+00)	5.537E-01 (8/8) (1.910E-01 - 1.212E+00)	0
Charcoal (E-3 pCi/m ³)	CS-137	32	60	9.123E-02 (24/24) (-5.647E-01 - 7.591E-01)	13.5 MILES ESE	6G1	4.697E-01 (4/4) (-1.312E-02 - 1.041E+00)	1.111E-01 (8/8) (-4.738E-01 - 1.041E+00)	0
	GAMMA I-131	424	70	1.410E-01 (318/318) (-1.054E+01 - 1.198E+01)	0.4 MILES W	13S6	5.567E-01 (53/53) (-8.650E+00 - 1.090E+01)	-5.770E-01 (106/106) (-1.058E+01 - 9.392E+00)	0
Ambient Radiation (mR/std. qtr.)	OSLD	228	N/A	1.647E+01 (208/208) (9.632E+00 - 4.057E+01)	0.2 MILES S	9S2	3.297E+01 (4/4) (2.876E+01 - 4.057E+01)	1.467E+01 (20/20) (1.111E+01 - 1.999E+01)	0
	I-131	63	1	-4.607E-03 (42/42) (-4.240E-01 - 4.570E-01)	14 MILES SSW	10G1	3.820E-02 (2/21) (-2.760E-01 - 4.640E-01)	3.820E-02 (21/21) (-2.760E-01 - 4.640E-01)	0
Milk (pCi/Liter)	GAMMA K-40	63	N/A	1.323E+03 (42/42) (1.091E+03 - 1.595E+03)	14 MILES SSW	10G1	1.366E+03 (2/21) (1.170E+03 - 1.672E+03)	1.366E+03 (21/21) (1.170E+03 - 1.672E+03)	0
	CS-134	63	15	-1.620E+00 (42/42) (-1.224E+01 - 4.520E+00)	5.0 MILES W	13E3	-9.101E-01 (2/21) (-1.224E+01 - 4.520E+00)	-1.414E+00 (21/21) (-8.172E+00 - 4.939E+00)	0

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Reporting Period: December 28, 2016 to January 01, 2018

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSIS PERFORMED (1)	LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS		LOCATION WITH HIGHEST MEAN		CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS		
			MEAN (3) RANGE	DISTANCE AND DIRECTION	NAME	MEAN (3) RANGE				
Milk (cont'd) (pCi/Liter)	CS-137	63	18	4.004E-01 (-4.062E+00 - 7.954E+00)	(42/42)	13E3 5.0 MILES W	7.709E-01 (-4.062E+00 - 4.625E+00)	3.386E-01 (-3.916E+00 - 5.633E+00)	(21/21)	0
	BA-140	63	60	-1.279E+00 (-2.599E+01 - 2.387E+01)	(42/42)	10G1 14 MILES SSW	2.375E+00 (-1.037E+01 - 1.658E+01)	2.375E+00 (-1.037E+01 - 1.658E+01)	(21/21)	0
	LA-140	63	15	-5.287E-01 (-6.704E+00 - 5.153E+00)	(42/42)	5E2 4.5 MILES E	2.768E-01 (-4.288E+00 - 5.153E+00)	-1.018E-01 (-4.889E+00 - 4.970E+00)	(21/21)	0
Ground Water (pCi/Liter)	TH-228	63	N/A	1.185E+00 (-1.480E+01 - 1.951E+01)	(42/42)	13E3 5.0 MILES W	3.146E+00 (-7.449E+00 - 1.951E+01)	1.129E+00 (-1.004E+01 - 1.127E+01)	(21/21)	0
	H-3	60	2000	6.093E+01 (-3.120E+01 - 2.090E+02)	(56/56)	4S8 0.1 MILES ENE	1.382E+02 (8.880E+01 - 2.020E+02)	6.083E+01 (2.500E+01 - 1.130E+02)	(4/4)	0
	GAMMA K-40	60 60	N/A	1.991E+01 (-8.931E+01 - 1.548E+02)	(56/56)	4S9 0.3 MILES E	7.199E+01 (1.456E+01 - 1.548E+02)	-2.038E+01 (-7.228E+01 - 3.562E+01)	(4/4)	0
Milk (cont'd) (pCi/Liter)	MN-54	60	15	-4.363E-01 (-6.126E+00 - 4.151E+00)	(56/56)	12F3 5.2 MILES WSW	1.715E+00 (1.082E+00 - 2.572E+00)	1.715E+00 (1.082E+00 - 2.572E+00)	(4/4)	0
	CO-58	60	15	-6.320E-01 (-5.341E+00 - 4.297E+00)	(56/56)	2S2 0.9 MILES NNE	9.962E-01 (-1.406E+00 - 2.337E+00)	-4.384E+00 (-7.922E+00 - -1.593E+00)	(4/4)	0
	FE-59	60	30	1.658E+00 (-9.994E+00 - 1.768E+01)	(56/56)	6S11A 0.4 MILES ESE	8.042E+00 (1.150E+00 - 1.768E+01)	-1.034E+00 (-3.666E+00 - 2.494E+00)	(4/4)	0
CO-60	60	15	2.983E-01 (-3.770E+00 - 4.221E+00)	(56/56)	7S10 0.3 MILES SE	1.504E+00 (-8.413E-01 - 2.494E+00)	4.234E-01 (-8.558E-01 - 2.770E+00)	(4/4)	0	

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Reporting Period: December 28, 2016 to January 01, 2018

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSIS PERFORMED (1)	LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS		LOCATION WITH HIGHEST MEAN		CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS		
			MEAN (3) RANGE	DISTANCE AND DIRECTION	NAME	MEAN (3) RANGE				
Ground Water (cont'd) (pCi/Liter)	ZN-65	60	30	-2.436E+00 (56/56) (-2.438E+01 - 9.995E+00)	0.1 MILES N	1S3	2.801E+00 (-4.689E+00 - 9.066E+00)	(4/4)	1.354E+00 (4/4) (-4.890E+00 - 7.811E+00)	0
	NB-95	60	15	1.037E+00 (56/56) (-5.985E+00 - 1.299E+01)	5.2 MILES WSW	12F3	5.109E+00 (2.229E+00 - 8.037E+00)	(4/4)	5.109E+00 (4/4) (2.229E+00 - 8.037E+00)	0
	ZR-95	60	30	3.777E-01 (56/56) (-6.524E+00 - 7.702E+00)	0.4 MILES SW	11S2	3.741E+00 (-6.942E-01 - 7.702E+00)	(4/4)	9.640E-01 (4/4) (-2.838E+00 - 7.306E+00)	0
	I-131	60	15	1.385E+00 (56/56) (-5.631E+00 - 8.314E+00)	0.9 MILES NNE	2S2	4.103E+00 (1.610E+00 - 8.314E+00)	(4/4)	7.890E-01 (4/4) (-3.647E+00 - 6.402E+00)	0
CS-134	60	15	2.936E-01 (56/56) (-7.856E+00 - 8.906E+00)	0.4 MILES ESE	6S10	3.340E+00 (3.857E-01 - 8.906E+00)	(4/4)	(4/4)	8.297E-01 (4/4) (-7.794E-01 - 2.598E+00)	0
BA-140	60	60	2.337E+00 (56/56) (-3.224E+01 - 2.236E+01)	0.4 MILES SW	11S2	5.652E+00 (-2.950E-02 - 9.881E+00)	(4/4)	(4/4)	-1.047E+00 (4/4) (-4.872E+00 - 2.411E+00)	0
TH-228	60	N/A	1.134E-01 (56/56) (-1.511E+01 - 1.066E+01)	0.1 MILES ENE	4S8	3.578E+00 (-5.512E+00 - 1.047E+01)	(4/4)	(4/4)	4.175E-01 (4/4) (-7.471E+00 - 9.537E+00)	0
H-3	12	2000	5.449E+00 (12/12) (-4.890E+01 - 9.800E+01)	26 MILES WSW	12H2	5.449E+00 (-4.890E+01 - 9.800E+01)	(12/12)	(12/12)	0.00E+00	0

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			MEAN (3) RANGE	DISTANCE AND DIRECTION	NAME	MEAN (3) RANGE		
Drinking Water (cont'd) (pCi/Liter)	GAMMA	12						
	K-40	12	N/A	2.977E+00 (12/12) (-2.527E+01 - 3.581E+01)	26 MILES WSW	12H2	2.977E+00 (-2.527E+01 - 3.581E+01)	0
	MN-54	12	15	-4.160E-01 (12/12) (-1.531E+00 - 3.237E-01)	26 MILES WSW	12H2	-4.160E-01 (-1.531E+00 - 3.237E-01)	0
	CO-58	12	15	-1.161E-01 (12/12) (-7.061E-01 - 8.841E-01)	26 MILES WSW	12H2	-1.161E-01 (-7.061E-01 - 8.841E-01)	0
	FE-59	12	30	2.901E-01 (12/12) (-2.968E+00 - 3.245E+00)	26 MILES WSW	12H2	2.901E-01 (-2.968E+00 - 3.245E+00)	0
	CO-60	12	15	3.038E-01 (12/12) (-4.675E-01 - 1.248E+00)	26 MILES WSW	12H2	3.038E-01 (-4.675E-01 - 1.248E+00)	0
	ZN-65	12	30	-1.033E+00 (12/12) (-3.835E+00 - 8.242E-01)	26 MILES WSW	12H2	-1.033E+00 (-3.835E+00 - 8.242E-01)	0
	NB-95	12	15	3.131E-01 (12/12) (-2.334E-01 - 9.987E-01)	26 MILES WSW	12H2	3.131E-01 (-2.334E-01 - 9.987E-01)	0
	ZR-95	12	30	4.462E-02 (12/12) (-2.311E+00 - 1.257E+00)	26 MILES WSW	12H2	4.462E-02 (-2.311E+00 - 1.257E+00)	0
	I-131	12	15	-9.668E-01 (12/12) (-6.069E+00 - 5.280E+00)	26 MILES WSW	12H2	-9.668E-01 (-6.069E+00 - 5.280E+00)	0
	CS-134	12	15	-1.608E+00 (12/12) (-4.372E+00 - 8.179E-01)	26 MILES WSW	12H2	-1.608E+00 (-4.372E+00 - 8.179E-01)	0

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			MEAN (3) RANGE	DISTANCE AND DIRECTION	NAME	MEAN (3) RANGE			
Drinking Water (cont'd) (pCi/Liter)	CS-137	12	18	1.258E-02 (-7.414E-01 - 1.209E+00) (12/12)	26 MILES WSW	12H2	1.258E-02 (-7.414E-01 - 1.209E+00) (12/12)	0.00E+00	0
	BA-140	12	60	2.483E+00 (-5.140E+00 - 9.268E+00) (12/12)	26 MILES WSW	12H2	2.483E+00 (-5.140E+00 - 9.268E+00) (12/12)	0.00E+00	0
	LA-140	12	15	9.423E-01 (-4.716E+00 - 1.988E+00) (12/12)	26 MILES WSW	12H2	9.423E-01 (-4.716E+00 - 1.988E+00) (12/12)	0.00E+00	0
Food/Garden Crops (pCi/kg wet)	GAMMA BE-7	46	N/A	4.214E+02 (-1.908E+02 - 1.215E+03) (32/32)	0.5 MILES SW	11S6	5.507E+02 (8.609E+01 - 1.215E+03) (14/14)	3.943E+02 (6.311E+01 - 9.629E+02) (14/14)	0
	K-40	46	N/A	5.017E+03 (2.658E+03 - 1.354E+04) (32/32)	3.3 MILES SW	11D1	6.549E+03 (2.658E+03 - 1.354E+04) (3/3)	4.603E+03 (2.744E+03 - 6.308E+03) (14/14)	0
	MN-54	46	N/A	4.772E-01 (-1.544E+01 - 1.873E+01) (32/32)	8.3 MILES WSW	12F7	1.873E+01 (1.873E+01) (1/1)	-3.280E+00 (-2.446E+01 - 1.610E+01) (14/14)	0
	CO-58	46	N/A	1.580E+00 (-1.985E+01 - 2.125E+01) (32/32)	8.3 MILES WSW	12F7	6.452E+00 (6.452E+00) (1/1)	-2.293E+00 (-1.822E+01 - 8.621E+00) (14/14)	0
	FE-59	46	N/A	4.097E-01 (-2.786E+01 - 4.012E+01) (32/32)	8.3 MILES WSW	12F7	2.196E+01 (2.196E+01) (1/1)	4.188E+00 (-4.584E+01 - 4.273E+01) (14/14)	0
	CO-60	46	N/A	2.805E+00 (-1.330E+01 - 3.904E+01) (32/32)	3.3 MILES SW	11D1	1.138E+01 (8.120E+00 - 1.345E+01) (3/3)	3.130E+00 (-1.087E+01 - 1.972E+01) (14/14)	0
ZN-65	46	N/A	1.420E+01 (-9.632E+01 - 3.540E+01) (32/32)	8.3 MILES WSW	12F7	1.208E+01 (1.208E+01) (1/1)	-1.281E+01 (-6.477E+01 - 4.697E+01) (14/14)	0	

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			MEAN (3) RANGE	DISTANCE AND DIRECTION	NAME	MEAN (3) RANGE		
Food/Garden Crops (cont'd) NB-95 (pCi/kg wet)	46	N/A	4.366E+00 (32/32) (-1.009E+01 - 2.030E+01)	0.9 MILES NE	3S3	7.043E+00 (-8.764E+00 - 1.859E+01)	1.303E+00 (14/14) (-1.121E+01 - 1.349E+01)	0
ZR-95	46	N/A	1.876E+00 (32/32) (-3.750E+01 - 3.439E+01)	8.3 MILES WSW	12F7	1.739E+01 (1.739E+01)	1.230E+00 (14/14) (-2.043E+01 - 2.356E+01)	0
I-131	46	60	4.549E-01 (32/32) (-2.630E+01 - 2.915E+01)	12 MILES SSE	8G1	1.986E+00 (-2.067E+01 - 2.180E+01)	1.986E+00 (14/14) (-2.067E+01 - 2.180E+01)	0
CS-134	46	60	-1.416E+00 (32/32) (-2.247E+01 - 3.292E+01)	0.5 MILES SW	11S6	3.041E+00 (-1.366E+01 - 3.292E+01)	1.046E+00 (14/14) (-2.197E+01 - 4.954E+01)	0
CS-137	46	80	-2.862E+00 (32/32) (-1.686E+01 - 7.985E+00)	12 MILES SSE	8G1	-1.251E+00 (-1.731E+01 - 2.355E+01)	-1.251E+00 (14/14) (-1.731E+01 - 2.355E+01)	0
BA-140	46	N/A	2.759E+00 (32/32) (-1.196E+02 - 8.139E+01)	0.9 MILES NE	3S3	1.405E+01 (-5.235E+01 - 8.139E+01)	-1.686E+00 (14/14) (-4.751E+01 - 5.065E+01)	0
LA-140	46	N/A	-1.943E+00 (32/32) (-2.158E+01 - 2.174E+01)	0.9 MILES NE	3S3	9.805E-01 (-2.158E+01 - 2.174E+01)	-3.169E+00 (14/14) (-1.547E+01 - 1.878E+01)	0
AC-228	46	N/A	6.435E+00 (32/32) (-3.616E+01 - 9.020E+01)	0.9 MILES NE	3S3	1.328E+01 (-3.105E+01 - 6.956E+01)	3.796E+00 (14/14) (-3.336E+01 - 2.343E+01)	0
TH-228	46	N/A	-1.946E+00 (32/32) (-3.867E+01 - 6.502E+01)	8.3 MILES WSW	12F7	6.502E+01 (6.502E+01)	4.187E+00 (14/14) (-2.593E+01 - 2.813E+01)	0
Soil (pCi/kg dry) GAMMA K-40	6	N/A	1.134E+04 (4/4) (9.623E+03 - 1.332E+04)	0.4 MILES WSW	12S1	1.194E+04 (1.055E+04 - 1.332E+04)	8.863E+03 (2/2) (8.166E+03 - 9.559E+03)	0
CS-134	6	150	-5.731E+00 (4/4) (-3.795E+01 - 1.175E+01)	0.4 MILES WSW	12S1	1.638E+00 (-3.160E+00 - 6.435E+00)	-1.917E+01 (2/2) (-2.894E+01 - -9.403E+00)	0

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			MEAN (3) RANGE	DISTANCE AND DIRECTION	NAME	MEAN (3) RANGE		
Soil (cont'd) (pCi/kg dry)	CS-137	6	180	7.923E+01 (4/4) (2.858E+01 - 1.290E+02)	12 MILES SSE	8G1	1.226E+02 (2/2) (1.218E+02 - 1.234E+02)	0
	RA-226	6	N/A	2.506E+03 (4/4) (1.363E+03 - 4.272E+03)	0.4 MILES WSW	12S1	2.089E+03 (2/2) (1.956E+03 - 2.221E+03)	0
	AC-228	6	N/A	8.232E+02 (4/4) (6.365E+02 - 9.186E+02)	12 MILES SSE	8G1	1.032E+03 (2/2) (8.898E+02 - 1.174E+03)	0
Surface Water (pCi/Liter)	TH-228	6	N/A	9.104E+02 (4/4) (6.821E+02 - 1.064E+03)	0.4 MILES WSW	12S1	9.193E+02 (2/2) (7.215E+02 - 1.117E+03)	0
	H-3	56	2000	1.912E+02 (42/42) (-7.270E+01 - 2.070E+03)	0.1 MILES NNE	2S7	1.526E+01 (14/14) (-6.410E+01 - 6.970E+01)	0
GAMMA K-40	MN-54	56	N/A	-9.579E-01 (42/42) (-8.097E+01 - 8.060E+01)	0.4 MILES E	5S12	3.836E+00 (4/4) (-1.809E+01 - 5.088E+01)	0
CO-58	FE-59	56	15	-3.249E-01 (42/42) (-5.608E+00 - 2.304E+00)	0.1 MILES NNE	2S7	-6.570E-02 (13/13) (-7.457E-01 - 7.202E-01)	0
CO-60	CO-58	56	15	-2.827E-01 (42/42) (-3.269E+00 - 1.804E+00)	0.7 MILES NE-ESE	LTAW	-4.659E-02 (4/4) (-1.004E+00 - 1.139E+00)	0
CO-60	CO-58	56	30	6.752E-01 (42/42) (-1.055E+01 - 8.066E+00)	0.8 MILES E	5S9	1.859E+00 (1/1) (-1.036E+00 - 5.645E+00)	0
CO-60	CO-58	56	15	6.793E-01 (42/42) (-1.610E+00 - 4.401E+00)	0.4 MILES E	5S12	1.132E-01 (4/4) (-9.640E-01 - 7.473E-01)	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, 2016 to January 01, 2018

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSIS PERFORMED (1)	LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS		LOCATION WITH HIGHEST MEAN		CONTROL LOCATION		NUMBER OF NONROUTINE REPORTED MEASUREMENTS		
			MEAN (3) RANGE	DISTANCE AND DIRECTION	MEAN (3) RANGE	NAME	MEAN (3) RANGE	MEAN (3) RANGE			
Surface Water (cont'd) (pCi/Liter)	ZN-65	56	30	-3.123E+00 (-1.667E+01 - 6.889E+00)	(42/42)	5S12 0.4 MILES E	6.138E-01 (-3.676E+00 - 6.889E+00)	(4/4)	-2.566E+00 (-8.232E+00 - 7.090E-01)	(14/14)	0
	NB-95	56	15	5.118E-01 (-3.083E+00 - 5.636E+00)	(42/42)	7S12 0.3 MILES SE	1.718E+00 (2.378E-01 - 5.636E+00)	(4/4)	5.133E-01 (-7.015E-01 - 1.934E+00)	(14/14)	0
	ZR-95	56	30	4.696E-01 (-5.244E+00 - 5.940E+00)	(42/42)	LTAW 0.7 MILES NE-ESE	3.856E+00 (2.146E+00 - 5.460E+00)	(4/4)	-5.613E-01 (-2.198E+00 - 1.155E+00)	(14/14)	0
	I-131	56	15	1.066E+00 (-5.299E+00 - 1.221E+01)	(42/42)	5S12 0.4 MILES E	2.666E+00 (-1.627E-02 - 5.980E+00)	(4/4)	-3.391E-01 (-6.797E+00 - 5.787E+00)	(14/14)	0
	CS-134	56	15	-9.125E-01 (-5.380E+00 - 5.002E+00)	(42/42)	7S12 0.3 MILES SE	5.111E-01 (-4.306E+00 - 5.002E+00)	(4/4)	-1.769E+00 (-7.790E+00 - 9.296E-01)	(14/14)	0
	CS-137	56	18	3.110E-02 (-3.146E+00 - 6.820E+00)	(42/42)	4S7 0.4 MILES ENE	1.046E+00 (-2.134E+00 - 6.820E+00)	(4/4)	7.761E-02 (-1.307E+00 - 1.369E+00)	(14/14)	0
	BA-140	56	60	-6.633E-01 (-1.243E+01 - 1.051E+01)	(42/42)	5S9 0.8 MILES E	5.793E+00 (5.793E+00)	(1/1)	1.334E+00 (-9.345E+00 - 1.311E+01)	(14/14)	0
	LA-140	56	15	-2.500E-01 (-6.505E+00 - 7.344E+00)	(42/42)	2S7 0.1 MILES NNE	5.231E-01 (-2.926E+00 - 4.452E+00)	(13/13)	3.226E-01 (-3.715E+00 - 4.096E+00)	(14/14)	0
	TH-228	56	N/A	1.933E+00 (-6.053E+00 - 1.093E+01)	(42/42)	7S12 0.3 MILES SE	5.842E+00 (2.703E+00 - 7.598E+00)	(4/4)	1.109E+00 (-1.703E+00 - 3.614E+00)	(14/14)	0
Fish (pCi/kg wet)	GAMMA K-40	14	N/A	4.062E+03 (3.207E+03 - 5.499E+03)	(8/8)	IND 0.9-1.4 MILES ESE	4.245E+03 (3.207E+03 - 5.499E+03)	(6/6)	3.669E+03 (2.649E+03 - 4.298E+03)	(6/6)	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, 2016 to January 01, 2018

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSIS PERFORMED (1)	LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS		LOCATION WITH HIGHEST MEAN		CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
			MEAN (3) RANGE	DISTANCE AND DIRECTION	NAME	MEAN (3) RANGE		
Fish (cont'd) (pCi/kg wet)								
MN-54	14	130	-1.076E+01 (-2.522E+01 - -3.750E+00)	30 MILES NNE	2H	1.371E+01 (-1.537E+00 - 2.205E+01)	1.371E+01 (-1.537E+00 - 2.205E+01)	0
CO-58	14	130	-1.219E+00 (-1.770E+01 - 3.834E+01)	0.9-1.4 MILES ESE	IND	2.750E-01 (-1.770E+01 - 3.834E+01)	-5.734E+00 (-1.838E+01 - 1.598E+01)	0
FE-59	14	260	2.376E+01 (-5.295E+01 - 7.135E+01)	0.7 MILES NE-ESE	LTAW	3.174E+01 (-7.880E+00 - 7.135E+01)	-5.368E+00 (-3.850E+01 - 4.668E+01)	0
CO-60	14	130	3.707E+00 (-2.390E+01 - 2.101E+01)	0.7 MILES NE-ESE	LTAW	1.596E+01 (1.091E+01 - 2.101E+01)	9.556E+00 (5.903E+00 - 1.417E+01)	0
ZN-65	14	260	-4.677E+01 (-1.252E+02 - 2.806E+01)	30 MILES NNE	2H	-1.898E+01 (-4.915E+01 - 4.833E+01)	-1.898E+01 (-4.915E+01 - 4.833E+01)	0
CS-134	14	130	-2.183E+01 (-8.099E+01 - 1.689E+01)	0.9-1.4 MILES-ESE	IND	-7.173E+00 (-3.532E+01 - 1.689E+01)	-1.503E+01 (-4.996E+01 - 2.565E+00)	0
CS-137	14	150	1.036E+01 (-1.825E+01 - 3.553E+01)	0.7 MILES NE-ESE	LTAW	1.565E+01 (-4.221E+00 - 3.553E+01)	4.094E+00 (-7.219E+00 - 1.848E+01)	0
GAMMA K-40	6	N/A	9.160E+03 (7.204E+03 - 1.032E+04)	1.6 MILES NNE	2B	1.552E+04 (1.148E+04 - 1.955E+04)	1.552E+04 (1.148E+04 - 1.955E+04)	0
CS-134	6	150	6.843E+01 (7.487E+00 - 2.340E+02)	6.9 MILES WSW	12F	1.207E+02 (7.487E+00 - 2.340E+02)	-5.710E+00 (-5.006E+01 - 3.864E+01)	0
CS-137	6	180	1.986E+01 (3.780E+00 - 3.799E+01)	1.6 MILES NNE	2B	6.926E+01 (2.441E+01 - 1.141E+02)	6.926E+01 (2.441E+01 - 1.141E+02)	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, 2016 to January 01, 2018

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSIS PERFORMED (1)	LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS		LOCATION WITH HIGHEST MEAN		CONTROL LOCATION		NUMBER OF NONROUTINE REPORTED MEASUREMENTS
			MEAN (3) RANGE	DISTANCE AND DIRECTION	NAME	MEAN (3) RANGE	MEAN (3) RANGE	MEAN (3) RANGE	
Sediment (cont'd) (pCi/kg dry)	RA-226	6	N/A	1.561E+03 (9.950E+02 - 1.887E+03)	1.6 MILES NNE	2B	1.866E+03 (1.483E+03 - 2.248E+03)	1.866E+03 (1.483E+03 - 2.248E+03)	0
	AC-228	6	N/A	7.708E+02 (4.677E+02 - 9.113E+02)	1.6 MILES NNE	2B	9.939E+02 (9.837E+02 - 1.004E+03)	9.939E+02 (9.837E+02 - 1.004E+03)	0
	TH-228	6	N/A	7.809E+02 (5.869E+02 - 9.008E+02)	1.6 MILES NNE	2B	1.040E+03 (8.834E+02 - 1.196E+03)	1.040E+03 (8.834E+02 - 1.196E+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 available measure results. 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).

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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 DEG.	LONGITUDINAL DEG.	SAMPLE TYPE
LESS THAN ONE MILE FROM THE SSES				
2S7	0.1 mi.NNE	41.093540	-76.144773	Surface water
5S9	0.8 mi.E;	41.093292	-76.130472	Surface water
5S12	0.4 mi.E;	41.092540	-76.138704	Surface water
7S12	0.3 mi.SE;	41.088507	-76.143270	Surface water
6S5	0.9 mi.ESE;	41.084639	-76.130642	Surface water
6S6 **	0.8 mi.ESE;	41.088115	-76.131637	Surface water
LTAW	0.7 mi.NE-ESE;	41.098356	-76.135401	Surface water
4S7	0.4 mi.ENE;	41.094418	-76.138236	Surface water
LTAW	0.7 mi.NE-ESE;	41.098356	-76.135401	Fish
10S3	0.6 mi. SSW;	41.085264	-76.152128	Air, Soil
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
12S1	0.4 mi.WSW;	41.088436	-76.154314	Soil
2S8	0.1 mi.NNE;	41.094991	-76.144207	Ground water
2S2	0.9 mi.NNE;	41.102243	-76.136702	Ground water
4S4	0.5 mi.ENE;	41.095471	-76.138798	Ground water
6S10	0.4 mi.ESE;	41.090511	-76.137802	Ground water
6S11A	0.4 mi.ESE;	41.083448	-76.133412	Ground water
6S11B	0.4 mi.ESE;	41.083448	-76.133411	Ground water
6S12	0.8 mi.ESE;	41.083411	-76.116935	Ground water
7S11	0.3 mi.SE;	41.083527	-76.133513	Ground water
11S2	0.4 mi.SW;	41.088816	-76.152793	Ground water
1S3	0.1 mi N;	41.093640	-76.146076	Ground water

** Control Location

TABLE B-1 (cont'd)
SAMPLING LOCATIONS

STATION CODE	STATION LOCATION	LATITUDINAL DEG.	LONGITUDINAL DEG.	SAMPLE TYPE
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
3S2	0.5 mi.NE;	41.095716	-76.140207	Precipitation
12S1	0.4 mi.WSW;	41.088436	-76.154314	Precipitation
11S6	0.5 mi.SW;	41.085305	-76.152022	Broadleaf
3S3	0.9 mi.NE;	41.101856	-76.133090	Broadleaf
5S10	0.7 mi.E;	41.0.93899	-76.132814	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
FROM ONE TO FIVE MILES FROM THE SSES				
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, Precipitation
12E1	4.7 mi.WSW;	41.072418	-76.230554	Air
5E2	4.5 mi.E;	41.085184	-76.061099	Milk
8C1	2.9 mi.SSE;	41.054518	-76.129027	Broadleaf
10B5	1.3 mi.SSW;	41.075404	-76.157422	Broadleaf
13E3	5.0 mi.W;	41.100259	-76.241102	Milk
11D1	3.3 mi.SW;	41.055212	-76.186797	Food Products
11D2	3.5 mi.SW;	41.054827	-76.205081	Food products

** Control Location

TABLE B-1 (cont'd)
SAMPLING LOCATIONS

STATION CODE	STATION LOCATION	LATITUDINAL DEG.	LONGITUDINAL DEG.	SAMPLE TYPE
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
6G1 **	13.5 mi.ESE;	41.018989	-75.906515	Air
8G1 **	12 mi.SSE;	40.928886	-76.055092	Air, Precipitation, Soil, Broadleaf
10G1 **	14 mi.SSW;	40.934847	-76.284449	Milk
12F3 **	5.2 mi.WSW;	41.054491	-76.232176	Ground water
12F7	8.3 mi.WSW;	41.036689	-76.286776	Food Products
11F2	5.5 mi.SW;	41.045741	-76.242128	Food products
15G1 **	11.4 mi.NW;	41.188578	-76.324598	Broadleaf
OSLD LOCATIONS				
LESS THAN ONE MILE FROM THE SSES				
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

* Special Interest Area (other than controls)

** Control Location

TABLE B-1 (cont'd)
SAMPLING LOCATIONS

STATION CODE	STATION LOCATION LESS THAN ONE MILE FROM THE SSES	LATITUDINAL		LONGITUDINAL		SAMPLE TYPE
		DEG.	DEG.	DEG.	DEG.	
7S7	0.4 mi. SE;	41.08745	-76.142033	OSLD		OSLD
8S2	0.2 mi. SSE;	41.08907	-76.14437	OSLD		OSLD
9S2	0.2 mi. S;	41.08952	-76.14322	OSLD		OSLD
10S1	0.4 mi. SSW;	41.08663	-76.150082	OSLD		OSLD
10S2	0.2 mi. SSW;	41.08894	-76.147881	OSLD		OSLD
11S7	0.4 mi. SWN;	41.08832	-76.15297	OSLD		OSLD
12S1	0.4 mi. WSW;	41.0887	-76.154112	OSLD		OSLD
12S3	0.4 mi. WSW;	41.08968	-76.153192	OSLD		OSLD
13S2	0.4 mi. W;	41.09198	-76.153166	OSLD		OSLD
13S5	0.4 mi. W;	41.09179	-76.153167	OSLD		OSLD
13S6	0.4 mi. W;	41.09177	-76.154073	OSLD		OSLD
14S5	0.5 mi. WNW;	41.09503	-76.153787	OSLD		OSLD
15S5	0.4 mi. NW;	41.09576	-76.15103	OSLD		OSLD
16S1	0.3 mi. NNW;	41.09611	-76.147388	OSLD		OSLD
16S2	0.3 mi. NNW;	41.09599	-76.148922	OSLD		OSLD
6A4 *	0.6 mi. ESE;	41.08791	-76.136795	OSLD		OSLD
8A3	0.9 mi. SSE;	41.07982	-76.1139078	OSLD		OSLD
15A3 *	0.9 mi. NW;	41.10003	-76.1585	OSLD		OSLD
16A2 *	0.8 mi. NNW;	41.1025	-76.151595	OSLD		OSLD
FROM ONE to FIVE MILES FROM THE SSES						
12S7	1.1 mi. WSW;	41.08621	-76.165914	OSLD		OSLD
8B2 *	1.4 mi. SSE;	41.07483	-76.130724	OSLD		OSLD
9B1	1.3 mi. S;	41.07356	-76.147874	OSLD		OSLD
10B3 *	1.7 mi. SSW;	41.07064	-76.156646	OSLD		OSLD
1D5	4.0 mi. N;	41.14936	-76.144346	OSLD		OSLD
8D3	4.0 mi. SSE;	41.03824	-76.121683	OSLD		OSLD

* Special Interest Area (other than controls)

TABLE B-1 (cont'd)
SAMPLING LOCATIONS

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

* Special Interest Area (other than controls)

** Control Location

TABLE B-2

SUSQUEHANNA STEAM ELECTRIC STATION RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Sample Medium	Analysis	Sampling Method	Collection Procedure Number	Analytical Procedure Number
Ambient Radiation	Dosimeter	Quarterly	SSES, HP-TP-205	Landauer Procedure L313, Inlight Dosimeter Analysis
Air	Gross Beta	Weekly	Applied Ecoscience, Appendix 2	TBE-2008 Gross Alpha and/or Gross Beta Activity in Various Matrices.
Air	I-131	Weekly	Applied Ecoscience, Appendix 2	TBE-2012 Radioiodine in Various Matrices
Air	Gamma	Quarterly	Applied Ecoscience, Appendix 2	TBE-2007 Gamma Emitting Radioisotope Analysis
Drinking Water	Gross Beta	Monthly	Applied Ecoscience, Appendix 5	TBE-2008 Gross Alpha and/or Gross Beta Activity in Various Matrices.
Surface & Drinking Water	Tritium	Monthly (LTAW, 4S7, 5S12 and 7S12 Quarterly)	Applied Ecoscience, Appendix 3, 4, 5, 6, & 7	TBE-2010 Tritium and Carbon-14 Analysis by Liquid Scintillation.
Surface & Drinking Water	Gamma	Monthly (LTAW, 4S7, 5S12 and 7S12 Quarterly)	Applied Ecoscience, Appendix 3, 4, 5, 6, & 7	TBE-2007 Gamma Emitting Radioisotope Analysis.
Ground Water	Tritium	Quarterly	Applied Ecoscience, Appendix 8	TBE-2010 Tritium and Carbon-14 Analysis by Liquid Scintillation
Ground Water	Gamma	Quarterly	Applied Ecoscience, Appendix 8	TBE-2007 Gamma Emitting Radioisotope Analysis

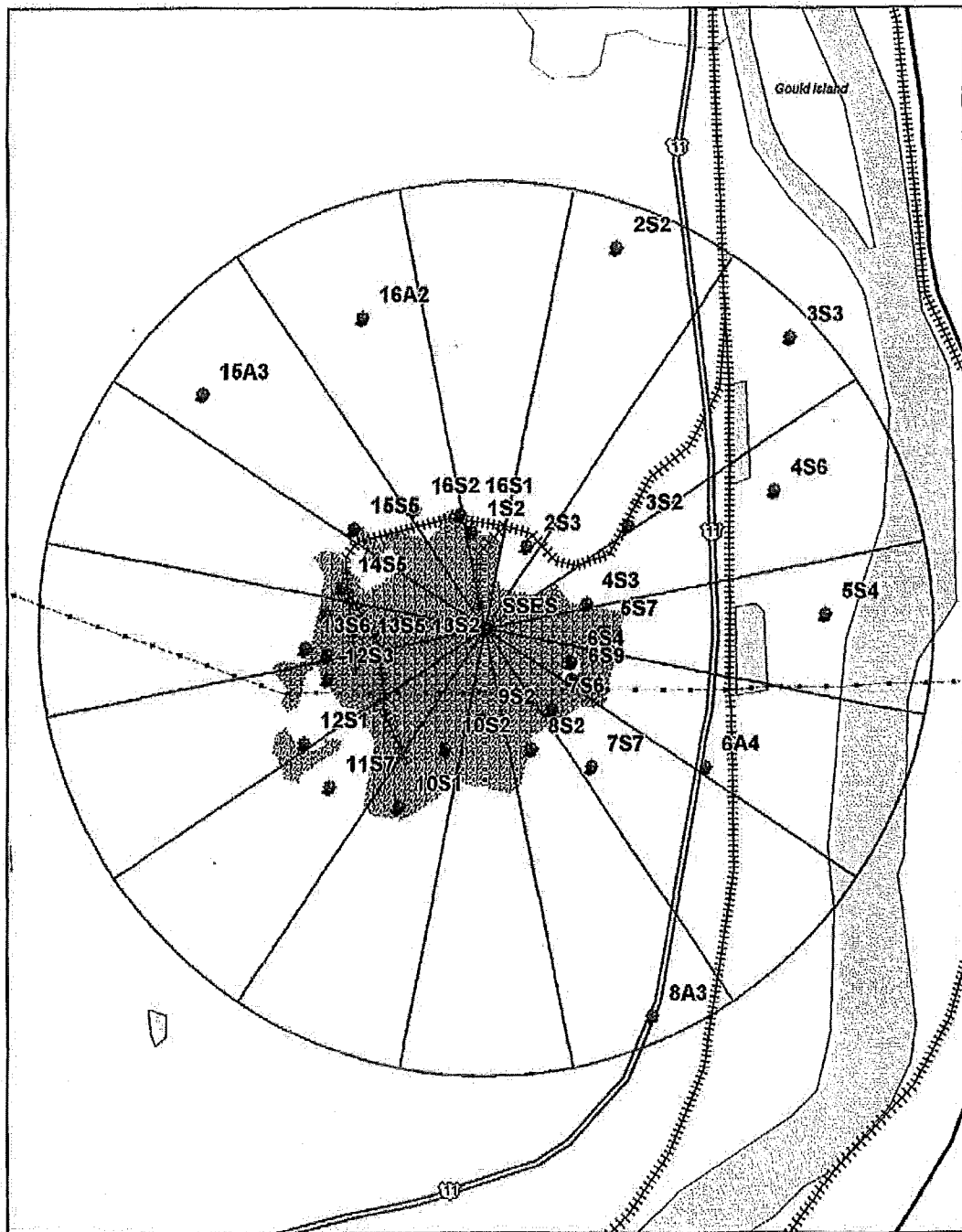
TABLE B-2 (cont'd)

SUSQUEHANNA STEAM ELECTRIC STATION RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

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

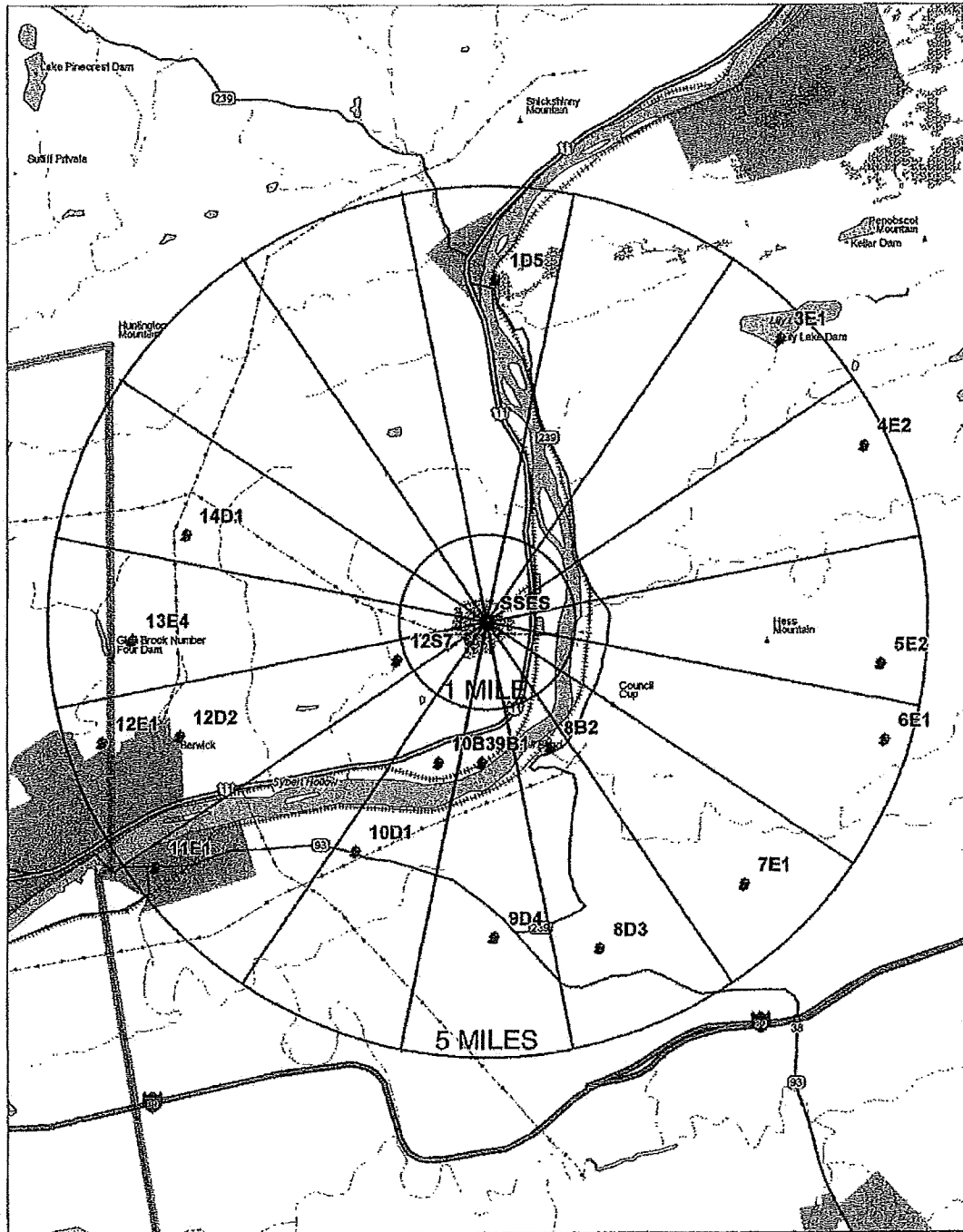
MAP B-1

Direct Radiation Monitoring Locations Within One Mile



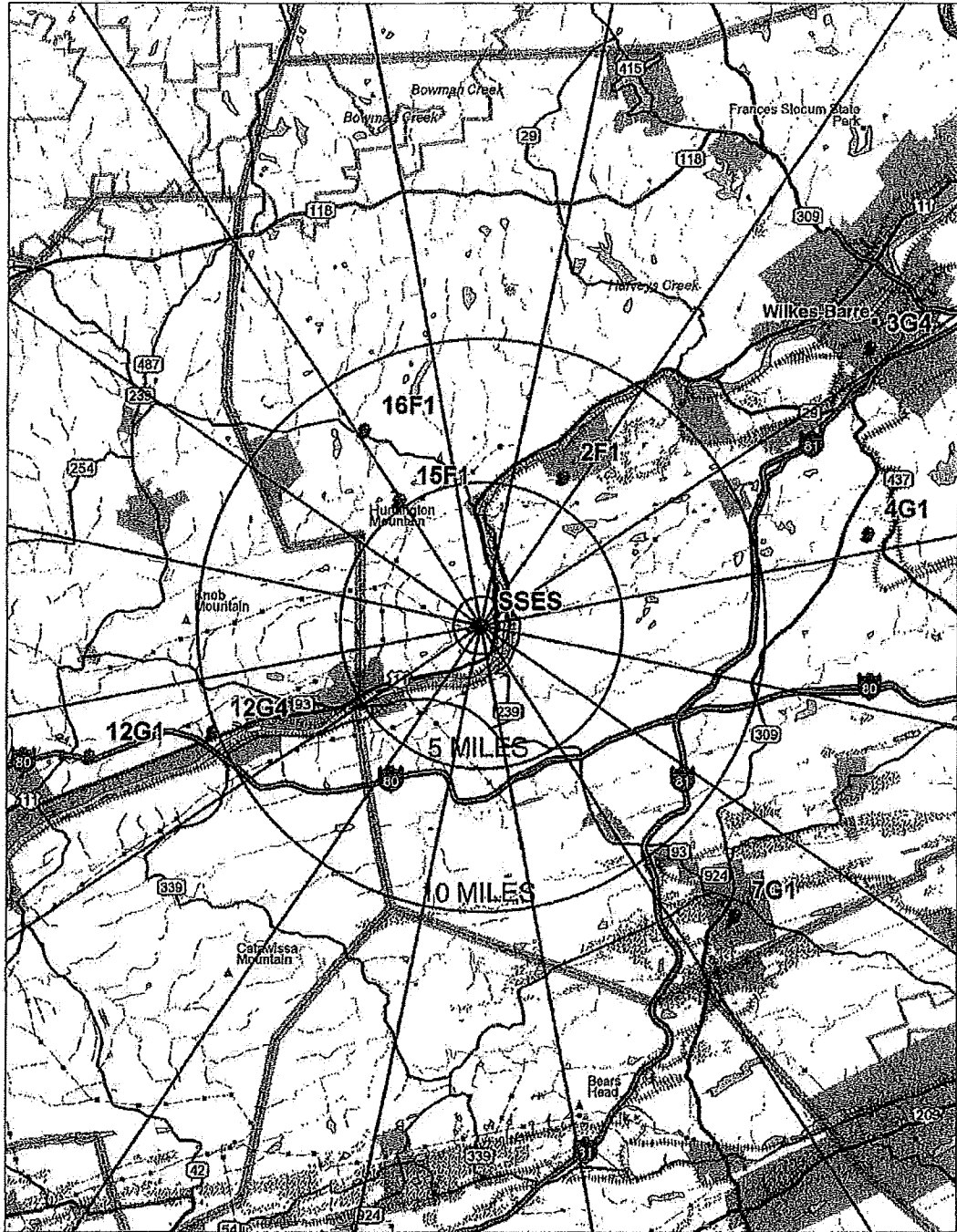
MAP B-2

Direct Radiation Monitoring Locations From One to Five Miles



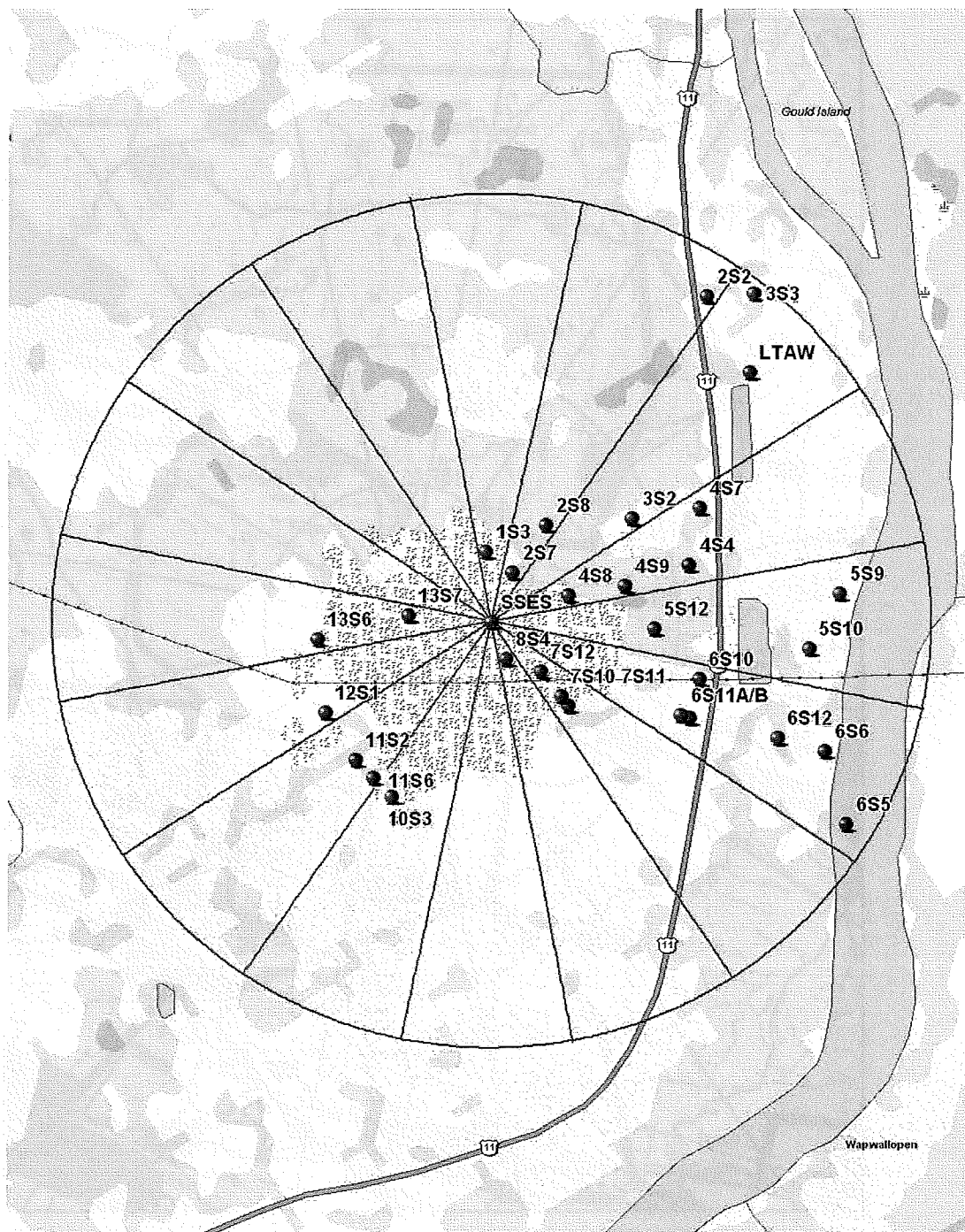
MAP B-3

Direct Radiation Monitoring Locations Greater Than Five Miles



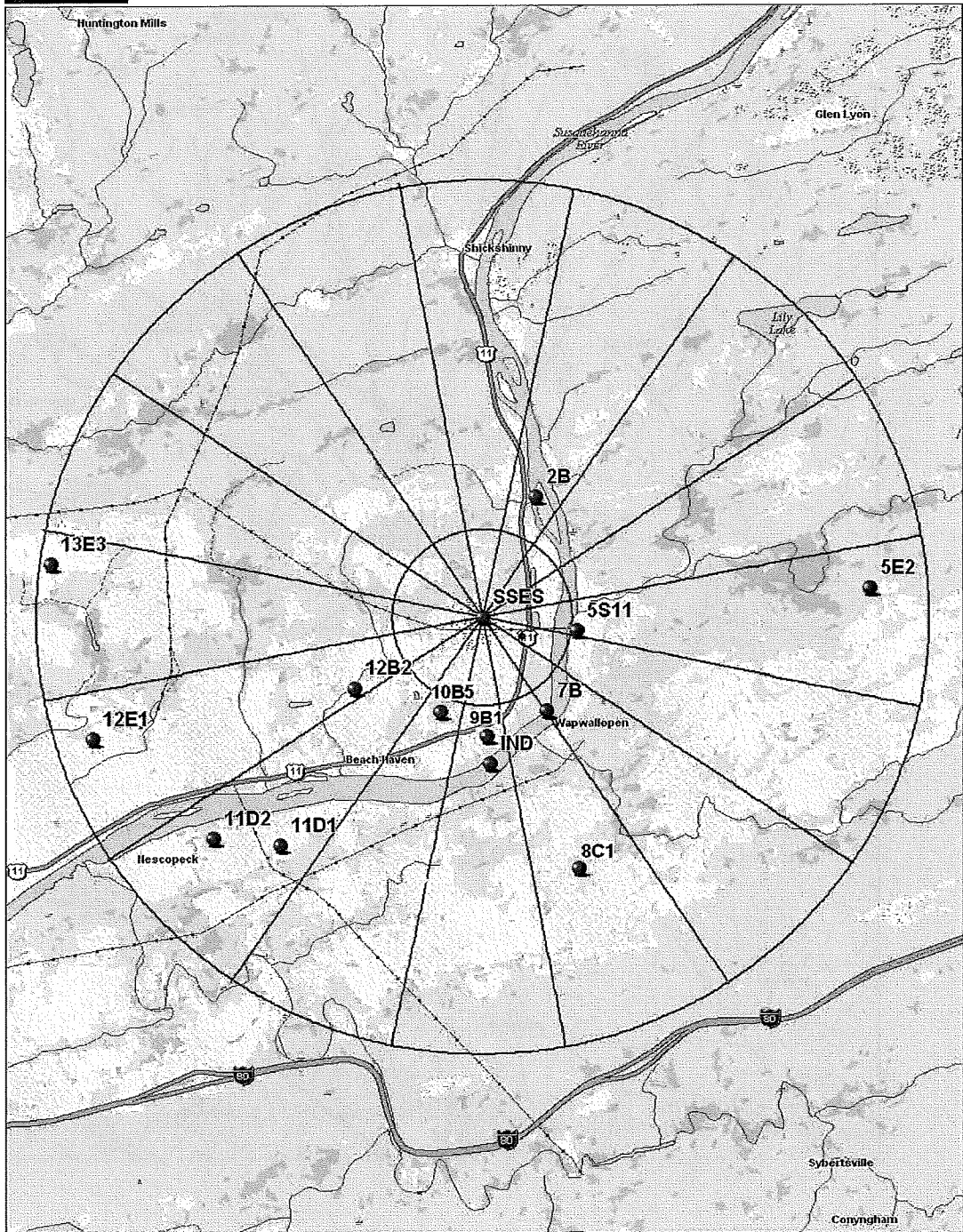
MAP B-4

Environmental Sampling Locations Within One Mile



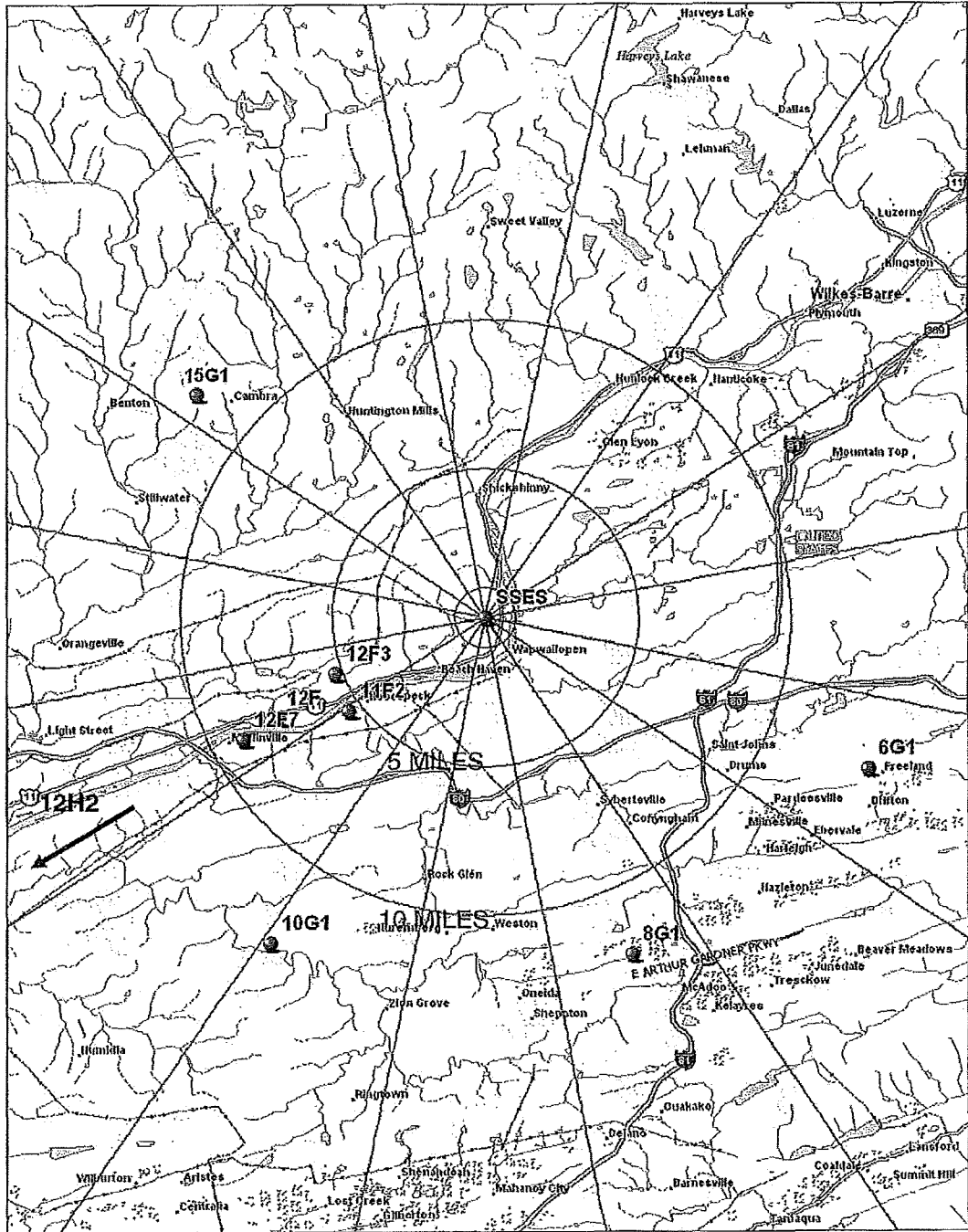
MAP B-5

Environmental Sampling Locations From One to Five Miles



MAP B-6

Environmental Sampling Locations Greater Than Five Miles



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APPENDIX C

DATA TABLES

TABLE C-1

**GROSS BETA ANALYSES OF AIR PARTICULATE FILTERS
SUSQUEHANNA STEAM ELECTRIC STATION, 2017**

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

COLLECTION PERIOD	3S2	6G1	8G1	12E1	12S1	13S6
12/28/16 - 01/04/17	6 \pm 2	6 \pm 2	6 \pm 2	8 \pm 2	8 \pm 2	5 \pm 2
01/04/17 - 01/11/17	11 \pm 2	9 \pm 2	8 \pm 2	10 \pm 2	10 \pm 2	10 \pm 2
01/11/17 - 01/18/17	14 \pm 2	13 \pm 2	11 \pm 2	14 \pm 2	15 \pm 2	11 \pm 2
01/18/17 - 01/25/17	8 \pm 2	6 \pm 2	5 \pm 2	6 \pm 2	8 \pm 2	8 \pm 2
01/25/17 - 02/01/17	9 \pm 2	7 \pm 2	9 \pm 2	8 \pm 2	9 \pm 2	9 \pm 2
02/01/17 - 02/08/17	13 \pm 2	14 \pm 2	13 \pm 2	16 \pm 2	16 \pm 2	13 \pm 2
02/08/17 - 02/15/17	8 \pm 2	11 \pm 2	10 \pm 2	11 \pm 2	11 \pm 2	11 \pm 2
02/15/17 - 02/22/17	10 \pm 2	10 \pm 2	12 \pm 2	11 \pm 2	15 \pm 2	13 \pm 2
02/22/17 - 03/02/17	12 \pm 2	9 \pm 2	11 \pm 2	13 \pm 2	14 \pm 2	12 \pm 2
03/02/17 - 03/08/17	11 \pm 2	12 \pm 2	12 \pm 2	12 \pm 2	15 \pm 2	14 \pm 2
03/08/17 - 03/16/17	8 \pm 2	9 \pm 2	9 \pm 2	9 \pm 2	9 \pm 2	10 \pm 2
03/16/17 - 03/22/17	13 \pm 2	14 \pm 3	12 \pm 2	14 \pm 2	15 \pm 3	14 \pm 2
03/22/17 - 03/29/17	12 \pm 2	9 \pm 2	9 \pm 2	11 \pm 2	14 \pm 2	10 \pm 2
03/29/17 - 04/05/17	7 \pm 2	8 \pm 2	9 \pm 2	7 \pm 2	8 \pm 2	9 \pm 2
04/05/17 - 04/12/17	8 \pm 2	8 \pm 2	9 \pm 2	8 \pm 2	12 \pm 2	9 \pm 2
04/12/17 - 04/19/17	9 \pm 2	9 \pm 2	10 \pm 2	10 \pm 2	13 \pm 2	11 \pm 2
04/19/17 - 04/26/17	5 \pm 2	6 \pm 2	7 \pm 2	6 \pm 2	6 \pm 2	5 \pm 2
04/26/17 - 05/03/17	10 \pm 2	9 \pm 2	9 \pm 2	9 \pm 2	12 \pm 2	10 \pm 2
05/03/17 - 05/10/17	7 \pm 2	8 \pm 2	7 \pm 2	7 \pm 2	7 \pm 2	7 \pm 2
05/10/17 - 05/17/17	3 \pm 2	6 \pm 2	5 \pm 2	6 \pm 2	4 \pm 2	6 \pm 2
05/17/17 - 05/24/17	13 \pm 2	12 \pm 2	11 \pm 2	14 \pm 2	13 \pm 2	15 \pm 2
05/24/17 - 05/31/17	4 \pm 2	6 \pm 2	5 \pm 2	5 \pm 2	5 \pm 2	5 \pm 2
05/31/17 - 06/07/17	10 \pm 2	11 \pm 2	11 \pm 2	11 \pm 2	10 \pm 2	10 \pm 2
06/07/17 - 06/14/17	13 \pm 2	14 \pm 2	13 \pm 2	14 \pm 2	12 \pm 2	12 \pm 2
06/14/17 - 06/21/17	10 \pm 2	9 \pm 2	9 \pm 2	10 \pm 2	12 \pm 2	11 \pm 2
06/21/17 - 06/28/17	16 \pm 3	10 \pm 2	12 \pm 2	14 \pm 2	14 \pm 2	12 \pm 2
06/28/17 - 07/05/17	15 \pm 2	13 \pm 2	13 \pm 2	15 \pm 2	13 \pm 2	12 \pm 2
07/05/17 - 07/12/17	15 \pm 2	12 \pm 2	12 \pm 2	14 \pm 2	15 \pm 2	12 \pm 2
07/12/17 - 07/19/17	16 \pm 3	17 \pm 3	17 \pm 3	19 \pm 3	19 \pm 3	17 \pm 3
07/19/17 - 07/26/17	14 \pm 2	14 \pm 2	14 \pm 2	14 \pm 2	12 \pm 2	14 \pm 2
07/26/17 - 08/02/17	12 \pm 2	14 \pm 2	11 \pm 2	13 \pm 2	14 \pm 2	11 \pm 2
08/02/17 - 08/09/17	13 \pm 2	15 \pm 2	14 \pm 2	15 \pm 2	13 \pm 2	13 \pm 2
08/09/17 - 08/16/17	16 \pm 3	14 \pm 2	17 \pm 2	17 \pm 2	15 \pm 2	15 \pm 2
08/16/17 - 08/23/17	19 \pm 3	18 \pm 3	20 \pm 3	18 \pm 3	19 \pm 3	17 \pm 3
08/23/17 - 08/30/17	8 \pm 2	8 \pm 2	8 \pm 2	8 \pm 2	8 \pm 2	6 \pm 2
08/30/17 - 09/06/17	15 \pm 2	13 \pm 2	15 \pm 2	13 \pm 2	16 \pm 2	17 \pm 2
09/06/17 - 09/13/17	10 \pm 2	9 \pm 2	10 \pm 2	10 \pm 2	11 \pm 2	9 \pm 2
09/13/17 - 09/20/17	15 \pm 2	14 \pm 2	12 \pm 2	11 \pm 2	13 \pm 2	14 \pm 2
09/20/17 - 09/27/17	21 \pm 3	21 \pm 3	22 \pm 3	23 \pm 3	20 \pm 3	20 \pm 3
09/27/17 - 10/04/17	13 \pm 2	11 \pm 2	10 \pm 2	13 \pm 2	11 \pm 2	10 \pm 2
10/04/17 - 10/11/17	15 \pm 2	13 \pm 2	13 \pm 2	14 \pm 2	15 \pm 2	13 \pm 2
10/11/17 - 10/18/17	14 \pm 2	11 \pm 2	10 \pm 2	13 \pm 2	14 \pm 2	12 \pm 2
10/18/17 - 10/25/17	19 \pm 3	15 \pm 2	17 \pm 2	19 \pm 3	19 \pm 3	17 \pm 2
10/25/17 - 11/01/17	10 \pm 2	12 \pm 2	8 \pm 2	10 \pm 2	10 \pm 2	10 \pm 2
11/01/17 - 11/08/17	11 \pm 2	11 \pm 2	13 \pm 2	13 \pm 2	11 \pm 2	13 \pm 2
11/08/17 - 11/15/17	13 \pm 2	11 \pm 2	10 \pm 2	13 \pm 2	15 \pm 2	12 \pm 2
11/15/17 - 11/21/17	11 \pm 3	9 \pm 2	9 \pm 2	9 \pm 2	9 \pm 2	11 \pm 2
11/21/17 - 11/29/17	14 \pm 2	14 \pm 2	14 \pm 2	14 \pm 2	15 \pm 2	13 \pm 2
11/29/17 - 12/06/17	16 \pm 2	12 \pm 2	15 \pm 2	17 \pm 2	15 \pm 2	16 \pm 2
12/06/17 - 12/13/17	14 \pm 2	14 \pm 2	11 \pm 2	15 \pm 2	15 \pm 2	16 \pm 2
12/13/17 - 12/20/17	13 \pm 2	12 \pm 2	12 \pm 2	14 \pm 2	13 \pm 2	12 \pm 2
12/20/17 - 12/27/17	10 \pm 2	9 \pm 2	10 \pm 2	11 \pm 2	12 \pm 2	9 \pm 2
12/27/17 - 01/03/18	12 \pm 2	12 \pm 2	12 \pm 2	14 \pm 2	13 \pm 2	11 \pm 2
AVERAGE	12 \pm 7	11 \pm 6	11 \pm 7	12 \pm 7	12 \pm 7	12 \pm 7

TABLE C-1

**GROSS BETA ANALYSES OF AIR PARTICULATE FILTERS
SUSQUEHANNA STEAM ELECTRIC STATION, 2017**

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

COLLECTION PERIOD	9B1	10S3
12/28/16 - 01/04/17	7 \pm 2	6 \pm 2
01/04/17 - 01/11/17	12 \pm 2	13 \pm 2
01/11/17 - 01/18/17	13 \pm 2	13 \pm 2
01/18/17 - 01/25/17	8 \pm 2	8 \pm 2
01/25/17 - 02/01/17	8 \pm 2	9 \pm 2
02/01/17 - 02/08/17	15 \pm 2	15 \pm 2
02/08/17 - 02/15/17	11 \pm 2	11 \pm 2
02/15/17 - 02/22/17	11 \pm 2	12 \pm 2
02/22/17 - 03/02/17	13 \pm 2	13 \pm 2
03/02/17 - 03/08/17	13 \pm 2	13 \pm 2
03/08/17 - 03/16/17	9 \pm 2	10 \pm 2
03/16/17 - 03/22/17	14 \pm 2	16 \pm 3
03/22/17 - 03/29/17	11 \pm 2	12 \pm 2
03/29/17 - 04/05/17	8 \pm 2	8 \pm 2
04/05/17 - 04/12/17	12 \pm 2	10 \pm 2
04/12/17 - 04/19/17	8 \pm 2	10 \pm 2
04/19/17 - 04/26/17	5 \pm 2	6 \pm 2
04/26/17 - 05/03/17	10 \pm 2	9 \pm 2
05/03/17 - 05/10/17	7 \pm 2	8 \pm 2
05/10/17 - 05/17/17	5 \pm 2	3 \pm 2
05/17/17 - 05/24/17	13 \pm 2	14 \pm 2
05/24/17 - 05/31/17	5 \pm 2	6 \pm 2
05/31/17 - 06/07/17	11 \pm 2	12 \pm 2
06/07/17 - 06/14/17	12 \pm 2	12 \pm 2
06/14/17 - 06/21/17	9 \pm 2	10 \pm 2
06/21/17 - 06/28/17	14 \pm 2	14 \pm 2
06/28/17 - 07/05/17	12 \pm 2	14 \pm 2
07/05/17 - 07/12/17	14 \pm 2	13 \pm 2
07/12/17 - 07/19/17	18 \pm 3	18 \pm 3
07/19/17 - 07/26/17	14 \pm 2	14 \pm 2
07/26/17 - 08/02/17	11 \pm 2	13 \pm 2
08/02/17 - 08/09/17	14 \pm 2	15 \pm 2
08/09/17 - 08/16/17	16 \pm 3	18 \pm 3
08/16/17 - 08/23/17	20 \pm 3	17 \pm 3
08/23/17 - 08/30/17	11 \pm 2	10 \pm 2
08/30/17 - 09/06/17	16 \pm 2	14 \pm 2
09/06/17 - 09/13/17	10 \pm 2	10 \pm 2
09/13/17 - 09/20/17	13 \pm 2	13 \pm 2
09/20/17 - 09/27/17	19 \pm 3	18 \pm 3
09/27/17 - 10/04/17	12 \pm 2	12 \pm 2
10/04/17 - 10/11/17	14 \pm 2	15 \pm 2
10/11/17 - 10/18/17	11 \pm 2	12 \pm 2
10/18/17 - 10/25/17	18 \pm 3	20 \pm 3
10/25/17 - 11/01/17	10 \pm 2	10 \pm 2
11/01/17 - 11/08/17	12 \pm 2	13 \pm 2
11/08/17 - 11/15/17	12 \pm 2	12 \pm 2
11/15/17 - 11/21/17	9 \pm 2	11 \pm 3
11/21/17 - 11/29/17	16 \pm 2	15 \pm 2
11/29/17 - 12/06/17	15 \pm 2	15 \pm 2
12/06/17 - 12/13/17	15 \pm 2	14 \pm 2
12/13/17 - 12/20/17	14 \pm 2	14 \pm 2
12/20/17 - 12/27/17	12 \pm 2	11 \pm 3
12/27/17 - 01/03/18	14 \pm 2	14 \pm 2
AVERAGE	12 \pm 7	12 \pm 7

**TABLE C-2 GAMMA SPECTROSCOPIC ANALYSES OF COMPOSITED AIR PARTICULATE FILTERS
SUSQUEHANNA STEAM ELECTRIC STATION, 2017**

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

SITE	COLLECTION PERIOD	Be-7	K-40	Cs-134	Cs-137
6G1	12/28/16 - 03/29/17	99 \pm 27	< 21	< 2	< 2
	03/29/17 - 06/28/17	127 \pm 21	< 18	< 1	< 1
	06/28/17 - 10/04/17	120 \pm 31	< 28	< 2	< 2
	10/04/17 - 01/03/18	91 \pm 16	< 10	< 1	< 1
	AVERAGE	109 \pm 33	-	-	-
8G1	12/28/16 - 03/29/17	86 \pm 18	< 10	< 1	< 1
	03/29/17 - 06/28/17	113 \pm 20	< 16	< 1	< 1
	06/28/17 - 10/04/17	141 \pm 27	< 23	< 1	< 1
	10/04/17 - 01/03/18	96 \pm 21	< 23	< 1	< 1
	AVERAGE	109 \pm 49	-	-	-
3S2	12/28/16 - 03/29/17	125 \pm 25	< 17	< 1	< 1
	03/29/17 - 06/28/17	128 \pm 22	< 19	< 1	< 1
	06/28/17 - 10/04/17	103 \pm 18	< 9	< 1	< 1
	10/04/17 - 01/03/18	78 \pm 14	< 15	< 1	< 1
	AVERAGE	108 \pm 46	-	-	-
12E1	12/28/16 - 03/29/17	93 \pm 23	< 22	< 1	< 1
	03/29/17 - 06/28/17	153 \pm 23	< 22	< 1	< 1
	06/28/17 - 10/04/17	105 \pm 19	< 19	< 1	< 1
	10/04/17 - 01/03/18	93 \pm 21	< 24	< 2	< 2
	AVERAGE	111 \pm 57	-	-	-
12S1	12/28/16 - 03/29/17	122 \pm 37	< 35	< 2	< 1
	03/29/17 - 06/28/17	144 \pm 24	< 16	< 1	< 1
	06/28/17 - 10/04/17	94 \pm 27	< 29	< 2	< 2
	10/04/17 - 01/03/18	85 \pm 16	< 19	< 1	< 1
	AVERAGE	111 \pm 53	-	-	-
13S6	12/28/16 - 03/29/17	126 \pm 29	< 19	< 1	< 1
	03/29/17 - 06/28/17	124 \pm 20	< 16	< 1	< 1
	06/28/17 - 10/04/17	92 \pm 30	< 31	< 2	< 2
	10/04/17 - 01/03/18	87 \pm 21	< 23	< 1	< 2
	AVERAGE	107 \pm 41	-	-	-
10S3	12/28/16 - 03/29/17	129 \pm 23	< 9	< 1	< 1
	03/29/17 - 06/28/17	108 \pm 20	< 16	< 1	< 1
	06/28/17 - 10/04/17	146 \pm 25	< 26	< 1	< 1
	10/04/17 - 01/03/18	77 \pm 19	< 22	< 1	< 1
	AVERAGE	115 \pm 60	-	-	-
9B1	12/28/16 - 03/29/17	70 \pm 30	< 20	< 1	< 1
	03/29/17 - 06/28/17	109 \pm 24	< 24	< 1	< 2
	06/28/17 - 10/04/17	132 \pm 19	< 19	< 1	< 1
	10/04/17 - 01/03/18	90 \pm 15	< 18	< 1	< 1
	AVERAGE	100 \pm 52	-	-	-

TABLE C-3

**IODINE-131 ANALYSES OF AIR IODINE SAMPLES
SUSQUEHANNA STEAM ELECTRIC STATION, 2017**

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

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

TABLE C-3

**IODINE-131 ANALYSES OF AIR IODINE SAMPLES
SUSQUEHANNA STEAM ELECTRIC STATION, 2017**

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

COLLECTION PERIOD	9B1	10S3
12/28/16 - 01/04/17	< 8	< 8
01/04/17 - 01/11/17	< 15	< 14
01/11/17 - 01/18/17	< 6	< 13
01/18/17 - 01/25/17	< 13	< 17
01/25/17 - 02/01/17	< 3	< 8
02/01/17 - 02/08/17	< 8	< 9
02/08/17 - 02/15/17	< 19	< 18
02/15/17 - 02/22/17	< 19	< 18
02/22/17 - 03/02/17	< 16	< 15
03/02/17 - 03/08/17	< 18	< 18
03/08/17 - 03/16/17	< 12	< 16
03/16/17 - 03/22/17	< 12	< 11
03/22/17 - 03/29/17	< 6	< 18
03/29/17 - 04/05/17	< 11	< 12
04/05/17 - 04/12/17	< 11	< 6
04/12/17 - 04/19/17	< 11	< 18
04/19/17 - 04/26/17	< 11	< 14
04/26/17 - 05/03/17	< 17	< 14
05/03/17 - 05/10/17	< 12	< 11
05/10/17 - 05/17/17	< 19	< 17
05/17/17 - 05/24/17	< 15	< 14
05/24/17 - 05/31/17	< 19	< 16
05/31/17 - 06/07/17	< 9	< 7
06/07/17 - 06/14/17	< 8	< 12
06/14/17 - 06/21/17	< 20	< 18
06/21/17 - 06/28/17	< 9	< 4
06/28/17 - 07/05/17	< 15	< 17
07/05/17 - 07/12/17	< 14	< 19
07/12/17 - 07/19/17	< 10	< 11
07/19/17 - 07/26/17	< 15	< 19
07/26/17 - 08/02/17	< 5	< 16
08/02/17 - 08/09/17	< 17	< 17
08/09/17 - 08/16/17	< 16	< 17
08/16/17 - 08/23/17	< 16	< 16
08/23/17 - 08/30/17	< 15	< 19
08/30/17 - 09/06/17	< 9	< 11
09/06/17 - 09/13/17	< 11	< 13
09/13/17 - 09/20/17	< 8	< 12
09/20/17 - 09/27/17	< 9	< 9
09/27/17 - 10/04/17	< 17	< 19
10/04/17 - 10/11/17	< 12	< 18
10/11/17 - 10/18/17	< 10	< 17
10/18/17 - 10/25/17	< 9	< 12
10/25/17 - 11/01/17	< 8	< 10
11/01/17 - 11/08/17	< 10	< 12
11/08/17 - 11/15/17	< 6	< 10
11/15/17 - 11/21/17	< 14	< 18
11/21/17 - 11/29/17	< 16	< 15
11/29/17 - 12/06/17	< 6	< 5
12/06/17 - 12/13/17	< 9	< 19
12/13/17 - 12/20/17	< 5	< 10
12/20/17 - 12/27/17	< 8	< 19
12/27/17 - 01/03/18	< 7	< 13
AVERAGE	-	-

**TABLE C-4 ENVIRONMENTAL OPTICALLY STIMULATED LUMINESCENCE DOSIMETRY RESULTS
SUSQUEHANNA STEAM ELECTRIC STATION, 2017**

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

LOCATION	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
	1/12/2017 to 4/12/2017	4/12/2017 to 7/12/2017	7/12/2017 to 10/12/2017	10/12/2017 to 1/12/2018
ONSITE				
1S2	18.0 ± 1.6	18.0 ± 2.2	24.0 ± 1.2	17.9 ± 3.4
2S2	12.2 ± 1.6	13.2 ± 1.5	16.7 ± 0.2	12.2 ± 0.6
2S3	16.7 ± 0.1	18.3 ± 1.0	22.7 ± 1.1	16.1 ± 1.2
3S2	11.6 ± 0.0	14.2 ± 0.5	17.5 ± 0.2	12.5 ± 1.7
3S3	11.1 ± 0.2	14.8 ± 3.8	14.8 ± 0.8	10.6 ± 0.1
4S3	17.6 ± 2.2	22.1 ± 0.9	23.6 ± 0.4	15.1 ± 0.3
4S6	11.8 ± 0.2	13.6 ± 0.6	17.0 ± 1.0	10.5 ± 0.8
5S4	9.94 ± 1.0	12.9 ± 1.3	14.4 ± 1.1	10.0 ± 0.7
5S7	11.7 ± 1.4	15.1 ± 1.4	18.3 ± 0.8	13.4 ± 0.8
6S4	18.5 ± 0.3	22.7 ± 0.4	26.6 ± 1.1	19.2 ± 1.2
6S9	17.1 ± 1.1	21.2 ± 0.6	24.9 ± 1.3	18.9 ± 0.9
7S6	16.9 ± 0.4	18.5 ± 0.4	22.5 ± 0.1	17.1 ± 0.8
7S7	10.0 ± 1.6	12.5 ± 0.4	15.6 ± 2.5	12.2 ± 0.9
8S2	17.7 ± 1.6	21.7 ± 0.6	21.0 ± 4.2	25.3 ± 0.4
9S2	29.6 ± 1.9	33.0 ± 1.0	40.6 ± 3.2	28.8 ± 1.0
10S1	11.4 ± 0.2	13.4 ± 0.8	15.9 ± 0.9	12.2 ± 0.6
10S2	23.4 ± 0.5	25.7 ± 0.2	35.6 ± 0.3	25.0 ± 0.3
11S7	16.3 ± 4.9	13.7 ± 1.1	18.0 ± 2.9	12.6 ± 0.4
12S1	14.3 ± 0.4	15.7 ± 0.9	18.7 ± 0.2	13.4 ± 1.8
12S3	15.5 ± 0.7	18.9 ± 2.1	22.3 ± 0.0	15.1 ± 0.3
12S7	11.6 ± 0.2	12.7 ± 1.7	15.9 ± 1.1	12.2 ± 0.6
13S2	21.9 ± 1.9	25.3 ± 0.6	30.2 ± 3.5	21.3 ± 1.1
13S5	23.0 ± 1.9	25.6 ± 0.5	31.5 ± 2.2	21.2 ± 0.8
13S6	17.3 ± 0.1	18.9 ± 1.2	18.9 ± 3.7	15.3 ± 0.6
14S5	15.4 ± 0.1	17.6 ± 0.1	21.5 ± 1.6	15.6 ± 0.4
15S5	13.9 ± 1.1	15.6 ± 0.9	18.9 ± 0.5	14.4 ± 0.5
16S1	16.9 ± 1.5	20.6 ± 0.9	24.2 ± 1.5	17.5 ± 1.4
16S2	15.1 ± 0.4	19.0 ± 0.1	22.1 ± 0.8	14.9 ± 1.6

See the comments at the end of this table.

**TABLE C-4 ENVIRONMENTAL OPTICALLY STIMULATED LUMINESCENCE DOSIMETRY RESULTS
SUSQUEHANNA STEAM ELECTRIC STATION, 2017**

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

LOCATION	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
	1/12/2017 to 4/12/2017	4/12/2017 to 7/12/2017	7/12/2017 to 10/12/2017	10/12/2017 to 1/12/2018
0-1 MILE OFFSITE				
6A4	14.5 ± 1.7	15.4 ± 1.0	18.2 ± 0.4	13.7 ± 0.1
8A3	10.8 ± 0.9	12.0 ± 1.8	15.4 ± 1.1	11.3 ± 0.6
15A3	10.2 ± 1.2	12.2 ± 0.6	15.0 ± 0.5	11.1 ± 1.5
16A2	10.6 ± 1.5	12.0 ± 0.5	15.5 ± 1.5	10.6 ± 0.8
1-2 MILES OFFSITE				
8B2	11.8 ± 2.5	13.3 ± 1.1	15.3 ± 0.1	11.2 ± 0.6
9B1	15.4 ± 1.9	17.1 ± 0.3	22.1 ± 0.1	16.6 ± 0.9
10B3	13.1 ± 0.6	12.6 ± 0.4	15.2 ± 0.1	11.4 ± 0.9
2-4 MILES OFFSITE				
1D5	14.2 ± 1.1	13.5 ± 0.6	18.0 ± 0.6	13.0 ± 0.1
8D3	14.4 ± 2.9	14.7 ± 0.6	17.8 ± 0.1	13.8 ± 0.8
9D4	15.8 ± 1.6	14.6 ± 0.5	17.1 ± 0.1	14.6 ± 1.0
10D1	13.0 ± 0.6	14.3 ± 0.5	17.0 ± 0.5	12.8 ± 1.2
12D2	15.4 ± 0.3	16.8 ± 0.1	20.4 ± 1.1	14.5 ± 0.3
14D1	12.0 ± 0.7	14.6 ± 0.3	17.1 ± 1.6	12.0 ± 0.1
4-5 MILES OFFSITE				
3E1	13.1 ± 1.7	12.0 ± 0.3	13.6 ± 1.2	11.4 ± 0.4
4E2	14.8 ± 2.1	16.6 ± 0.7	19.2 ± 1.7	14.1 ± 0.6
5E2	13.0 ± 0.4	13.9 ± 0.1	17.3 ± 1.0	13.4 ± 2.0
6E1	14.7 ± 1.1	17.7 ± 2.6	19.7 ± 0.3	15.1 ± 0.1
7E1	15.0 ± 0.4	16.5 ± 1.8	19.7 ± 2.3	13.7 ± 0.9
11E1	9.6 ± 0.6	10.1 ± 0.6	12.3 ± 1.3	10.2 ± 1.4
12E1	11.5 ± 0.3	13.4 ± 0.7	14.6 ± 2.6	11.7 ± 0.9
13E4	13.5 ± 0.6	17.5 ± 0.5	22.1 ± 0.2	15.8 ± 1.6

See the comments at the end of this table.

**TABLE C-4 ENVIRONMENTAL OPTICALLY STIMULATED LUMINESCENCE DOSIMETRY RESULTS
SUSQUEHANNA STEAM ELECTRIC STATION, 2017**

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

<u>LOCATION</u>	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
	1/12/2017 to 4/12/2017	4/12/2017 to 7/12/2017	7/12/2017 to 10/12/2017	10/12/2017 to 1/12/2018
5-10 MILES OFFSITE				
2F1	13.3 \pm 0.1	13.8 \pm 0.8	14.4 \pm 0.5	12.5 \pm 0.5
15F1	13.6 \pm 0.1	16.8 \pm 1.7	20.3 \pm 0.4	15.4 \pm 0.8
16F1	14.8 \pm 0.4	17.5 \pm 1.2	20.1 \pm 1.9	15.9 \pm 0.2
10-20 MILES OFFSITE				
3G4	14.5 \pm 0.4	16.2 \pm 0.6	17.9 \pm 0.2	13.7 \pm 1.8
4G1	14.6 \pm 1.0	16.8 \pm 0.6	20.0 \pm 2.3	14.7 \pm 1.4
7G1	13.9 \pm 1.0	15.6 \pm 0.8	17.5 \pm 2.6	11.6 \pm 0.8
12G1	13.8 \pm 2.8	12.8 \pm 1.5	14.9 \pm 0.6	11.1 \pm 0.3
12G4	12.1 \pm 0.9	13.4 \pm 0.1	16.9 \pm 0.4	11.5 \pm 1.3

See the comments at the end of this table.

LOCATION

INDICATOR
Average (5)

14.7 \pm 7.5

16.6 \pm 8.7

19.8 \pm 10.9

14.7 \pm 7.9

CONTROL

Average (5)

13.8 \pm 2.0

15.0 \pm 3.5

17.4 \pm 3.7

12.5 \pm 3.2

COMMENTS

- (1) Individual monitor location results are normally the average of the elemental doses of four elements from the two dosimeters assigned to each monitoring location.
- (2) A standard (std.) quarter (qtr.) is considered to be 91.25 days. Results obtained for monitoring periods of other durations are normalized by multiplying them by 91.25/x, where x is the actual duration in days of the period.
- (3) Uncertainties for individual monitoring location results are two standard deviations of the elemental doses of four elements from the two dosimeters assigned to each monitoring location, representing the variability between the elemental doses of each of the four dosimeter elements.
- (4) No measurement could be made at this location because the dosimeters were lost, stolen, or damaged. Refer to Section III, Program Description.
- (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, 2017**
Results in pCi/Liter \pm 2 sigma

SITE	COLLECTION DATE	I-131	<-----GAMMA EMITTERS----->					
			K-40	Cs-134	Cs-137	Ba-140	La-140	Th-228
10G1	01/03/17	< 0.5	1411 \pm 164	< 9	< 10	< 37	< 9	< 18
	02/06/17	< 0.4	1294 \pm 200	< 7	< 7	< 33	< 8	< 15
	03/06/17	< 0.5	1353 \pm 159	< 7	< 7	< 25	< 7	< 14
	04/03/17	< 0.3	1344 \pm 179	< 8	< 10	< 31	< 11	< 16
	04/17/17	< 0.4	1235 \pm 184	< 9	< 10	< 30	< 9	< 17
	05/01/17	< 0.5	1474 \pm 164	< 7	< 7	< 25	< 7	< 14
	05/15/17	< 0.7	1250 \pm 160	< 5	< 8	< 24	< 7	< 15
	05/30/17	< 0.5	1386 \pm 187	< 7	< 8	< 28	< 8	< 16
	06/12/17	< 0.4	1360 \pm 173	< 7	< 8	< 26	< 7	< 13
	06/26/17	< 0.5	1170 \pm 153	< 7	< 7	< 24	< 7	< 13
	07/11/17	< 0.6	1390 \pm 174	< 10	< 9	< 47	< 14	< 18
	07/24/17	< 0.9	1426 \pm 163	< 5	< 6	< 23	< 8	< 12
	08/07/17	< 0.5	1391 \pm 222	< 8	< 11	< 35	< 10	< 17
	08/21/17	< 0.6	1242 \pm 153	< 7	< 7	< 29	< 10	< 14
	09/05/17	< 0.4	1225 \pm 151	< 10	< 10	< 50	< 12	< 19
	09/18/17	< 0.3	1212 \pm 185	< 7	< 8	< 50	< 12	< 17
	10/02/17	< 0.5	1672 \pm 155	< 5	< 5	< 31	< 10	< 11
	10/16/17	< 1.0	1458 \pm 191	< 8	< 8	< 30	< 8	< 16
	10/30/17	< 0.2	1556 \pm 201	< 9	< 10	< 40	< 11	< 18
	11/13/17	< 0.4	1446 \pm 205	< 7	< 8	< 34	< 10	< 17
12/11/17	< 0.5	1388 \pm 182	< 6	< 9	< 23	< 10	< 16	
	AVERAGE	-	1366 \pm 244	-	-	-	-	-
13E3	01/04/17	< 0.6	1349 \pm 214	< 8	< 11	< 37	< 10	< 16
	02/07/17	< 0.3	1453 \pm 172	< 7	< 9	< 26	< 9	< 13
	03/06/17	< 0.4	1350 \pm 200	< 8	< 10	< 31	< 10	< 15
	04/03/17	< 0.4	1595 \pm 221	< 13	< 15	< 56	< 13	< 23
	04/17/17	< 0.6	1375 \pm 213	< 9	< 8	< 26	< 4	< 18
	05/01/17	< 0.7	1329 \pm 215	< 8	< 9	< 26	< 7	< 17
	05/15/17	< 0.7	1421 \pm 142	< 5	< 7	< 22	< 6	< 10
	05/30/17	< 0.5	1250 \pm 182	< 7	< 9	< 26	< 7	< 15
	06/12/17	< 0.4	1409 \pm 200	< 9	< 8	< 34	< 7	< 17
	06/26/17	< 0.4	1317 \pm 167	< 11	< 11	< 37	< 10	< 20
	07/11/17	< 0.5	1326 \pm 165	< 5	< 7	< 29	< 10	< 14
	07/24/17	< 0.6	1508 \pm 185	< 12	< 12	< 39	< 11	< 19
	08/07/17	< 0.5	1404 \pm 173	< 7	< 7	< 29	< 4	< 17
	08/21/17	< 0.3	1245 \pm 186	< 8	< 9	< 32	< 9	< 16
	09/05/17	< 0.4	1386 \pm 147	< 9	< 9	< 38	< 15	< 16
	09/18/17	< 0.5	1279 \pm 163	< 7	< 8	< 40	< 10	< 12
	10/02/17	< 0.4	1290 \pm 128	< 5	< 5	< 26	< 7	< 8
	10/16/17	< 0.6	1138 \pm 157	< 5	< 6	< 25	< 5	< 11
	10/30/17	< 0.3	1404 \pm 217	< 8	< 7	< 33	< 10	< 17
	11/13/17	< 0.5	1236 \pm 171	< 6	< 6	< 27	< 8	< 14
12/11/17	< 1.0	1311 \pm 182	< 6	< 8	< 27	< 6	< 13	
	AVERAGE	-	1351 \pm 202	-	-	-	-	-

TABLE C-5

**IODINE-131 AND GAMMA SPECTROSCOPIC ANALYSES OF MILK
SUSQUEHANNA STEAM ELECTRIC STATION, 2017**

Results in pCi/Liter \pm 2 sigma

SITE	COLLECTION DATE	I-131	<-----GAMMA EMITTERS----->					
			K-40	Cs-134	Cs-137	Ba-140	La-140	Th-228
5E2	01/03/17	< 0.7	1250 \pm 146	< 6	< 6	< 23	< 5	< 11
	02/06/17	< 0.3	1233 \pm 190	< 8	< 9	< 31	< 11	< 17
	03/06/17	< 0.5	1383 \pm 165	< 6	< 6	< 24	< 7	< 12
	04/03/17	< 0.5	1316 \pm 173	< 7	< 8	< 25	< 6	< 15
	04/17/17	< 0.4	1330 \pm 205	< 7	< 8	< 30	< 7	< 15
	05/01/17	< 0.5	1351 \pm 156	< 6	< 8	< 26	< 9	< 14
	05/15/17	< 0.8	1291 \pm 165	< 6	< 7	< 26	< 8	< 14
	05/30/17	< 0.5	1429 \pm 212	< 8	< 10	< 29	< 7	< 15
	06/12/17	< 0.6	1246 \pm 163	< 8	< 9	< 29	< 11	< 17
	06/26/17	< 0.5	1261 \pm 179	< 11	< 12	< 29	< 13	< 17
	07/11/17	< 0.5	1274 \pm 201	< 8	< 8	< 44	< 15	< 14
	07/24/17	< 0.9	1091 \pm 234	< 9	< 10	< 37	< 12	< 15
	08/07/17	< 0.6	1180 \pm 202	< 9	< 10	< 32	< 9	< 17
	08/21/17	< 0.4	1141 \pm 167	< 7	< 6	< 20	< 6	< 12
	09/05/17	< 0.3	1454 \pm 189	< 6	< 7	< 34	< 8	< 13
	09/18/17	< 0.4	1304 \pm 150	< 5	< 7	< 32	< 13	< 11
	10/02/17	< 0.7	1453 \pm 136	< 5	< 6	< 23	< 5	< 11
	10/16/17	< 0.6	1401 \pm 181	< 7	< 8	< 26	< 10	< 15
	10/30/17	< 0.2	1291 \pm 193	< 8	< 7	< 29	< 8	< 14
	11/13/17	< 0.6	1225 \pm 194	< 8	< 9	< 31	< 14	< 17
12/11/17	< 0.3	1266 \pm 177	< 7	< 10	< 31	< 11	< 13	
	AVERAGE	-	1294 \pm 193	-	-	-	-	-

**TABLE C-6 TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF GROUNDWATER
SUSQUEHANNA STEAM ELECTRIC STATION, 2017**

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
12F3	02/02/17	< 148	< 80	< 9	< 7	< 19	< 7	< 13	< 10	< 13	< 12	< 7	< 7	< 31	< 13	< 16
	05/22/17	< 139	< 111	< 6	< 17	< 13	< 7	< 13	< 7	< 11	< 8	< 6	< 7	< 26	< 8	< 13
	07/31/17	< 141	< 146	< 7	< 16	< 12	< 8	< 14	< 7	< 7	< 6	< 6	< 6	< 23	< 8	< 13
	10/26/17	< 131	< 52	< 6	< 15	< 13	< 8	< 10	< 8	< 6	< 6	< 6	< 7	< 25	< 9	< 11
AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2S2	02/02/17	< 146	< 147	< 8	< 9	< 21	< 8	< 13	< 10	< 14	< 13	< 8	< 9	< 29	< 12	< 15
	05/22/17	< 134	< 41	< 6	< 11	< 12	< 5	< 12	< 6	< 9	< 7	< 5	< 6	< 19	< 8	< 9
	07/31/17	< 141	< 64	< 7	< 18	< 15	< 9	< 15	< 8	< 11	< 11	< 5	< 7	< 29	< 10	< 14
	10/26/17	< 131	< 103	< 5	< 16	< 13	< 6	< 13	< 6	< 12	< 9	< 5	< 7	< 24	< 9	< 12
AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2S8	02/17/17	< 133	< 138	< 5	< 8	< 17	< 8	< 16	< 7	< 12	< 14	< 6	< 7	< 40	< 12	< 14
	05/22/17	< 145	< 112	< 6	< 19	< 15	< 6	< 15	< 8	< 13	< 15	< 6	< 8	< 31	< 12	< 11
	08/05/17	< 141	< 126	< 8	< 20	< 17	< 8	< 17	< 11	< 15	< 13	< 8	< 9	< 33	< 12	< 20
	11/03/17	< 137	< 128	< 7	< 24	< 17	< 10	< 17	< 9	< 14	< 13	< 8	< 9	< 38	< 15	< 16
AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4S4	02/02/17	< 146	< 139	< 6	< 6	< 19	< 4	< 14	< 8	< 12	< 10	< 7	< 7	< 31	< 12	< 15
	05/22/17	< 136	< 82	< 5	< 11	< 7	< 5	< 7	< 5	< 8	< 6	< 4	< 4	< 20	< 6	< 9
	07/31/17	< 139	< 131	< 8	< 19	< 18	< 8	< 18	< 8	< 17	< 11	< 11	< 9	< 35	< 9	< 20
	10/26/17	< 130	< 107	< 5	< 16	< 12	< 6	< 12	< 5	< 9	< 7	< 6	< 5	< 21	< 7	< 10
AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6S10	02/02/17	< 146	< 176	< 9	< 12	< 28	< 11	< 24	< 13	< 20	< 14	< 9	< 11	< 40	< 14	< 19
	05/22/17	< 138	< 41	< 4	< 5	< 14	< 5	< 10	< 6	< 9	< 6	< 5	< 5	< 20	< 7	< 10
	07/31/17	< 143	< 123	< 9	< 7	< 19	< 9	< 18	< 7	< 12	< 10	< 9	< 8	< 30	< 12	< 17
	10/26/17	< 129	< 67	< 6	< 5	< 15	< 7	< 14	< 8	< 10	< 9	< 7	< 6	< 24	< 10	< 12
AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

**TABLE C-6 TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF GROUNDWATER
SUSQUEHANNA STEAM ELECTRIC STATION, 2017**

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
11S2	02/02/17	< 146	< 67	< 8	< 6	< 19	< 9	< 20	< 9	< 11	< 11	< 7	< 8	< 31	< 6	< 16
	05/22/17	< 137	< 138	< 8	< 7	< 18	< 7	< 16	< 7	< 15	< 8	< 7	< 7	< 29	< 11	< 11
	07/13/17	< 141	< 125	< 8	< 7	< 14	< 10	< 14	< 5	< 10	< 7	< 7	< 6	< 25	< 8	< 14
	10/26/17	< 130	< 158	< 7	< 6	< 14	< 7	< 11	< 7	< 14	< 10	< 7	< 6	< 29	< 10	< 15
AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13S7	01/26/17	< 127	< 126	< 6	< 4	< 24	< 7	< 14	< 8	< 13	< 14	< 7	< 6	< 38	< 11	< 14
	05/09/17	< 142	< 62	< 6	< 6	< 18	< 7	< 15	< 7	< 12	< 11	< 6	< 7	< 29	< 10	< 14
	08/01/17	< 140	79 ± 46	< 5	< 5	< 14	< 5	< 11	< 6	< 9	< 10	< 5	< 6	< 27	< 8	< 11
	11/04/17	< 134	< 51	< 7	< 7	< 19	< 8	< 15	< 8	< 13	< 13	< 7	< 7	< 29	< 11	< 16
AVERAGE	-	79 ± 0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1S3	01/27/17	209 ± 99	< 94	< 5	< 5	< 17	< 4	< 14	< 6	< 9	< 10	< 5	< 5	< 28	< 9	< 13
	05/09/17	< 144	< 76	< 5	< 5	< 16	< 6	< 13	< 6	< 10	< 7	< 6	< 6	< 21	< 9	< 13
	08/01/17	164 ± 91	< 77	< 7	< 8	< 17	< 8	< 18	< 7	< 14	< 14	< 8	< 8	< 37	< 10	< 15
	11/04/17	< 133	< 80	< 8	< 9	< 22	< 10	< 18	< 9	< 19	< 12	< 11	< 9	< 42	< 9	< 15
AVERAGE	187 ± 64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4S8	01/26/17	< 149	< 63	< 7	< 6	< 21	< 6	< 16	< 7	< 12	< 14	< 6	< 7	< 28	< 10	< 11
	05/09/17	202 ± 95	< 188	< 10	< 10	< 26	< 11	< 22	< 14	< 15	< 14	< 9	< 10	< 38	< 14	< 19
	08/01/17	< 141	< 166	< 6	< 8	< 19	< 7	< 13	< 6	< 14	< 12	< 6	< 8	< 33	< 13	< 14
	11/04/17	140 ± 87	< 80	< 8	< 8	< 17	< 6	< 14	< 10	< 12	< 12	< 6	< 9	< 35	< 11	< 17
AVERAGE	171 ± 88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4S9	02/14/17	< 148	155 ± 94	< 9	< 8	< 24	< 8	< 19	< 8	< 14	< 13	< 6	< 7	< 31	< 12	< 15
	04/24/17	< 144	< 62	< 6	< 7	< 18	< 7	< 16	< 8	< 12	< 15	< 7	< 9	< 39	< 11	< 15
	07/24/17	< 139	< 55	< 8	< 8	< 16	< 5	< 15	< 6	< 15	< 14	< 8	< 7	< 39	< 14	< 17
	11/13/17	< 145	< 62	< 6	< 6	< 20	< 7	< 12	< 7	< 12	< 14	< 6	< 7	< 30	< 11	< 15
AVERAGE	-	155 ± 0	-	-	-	-	-	-	-	-	-	-	-	-	-	-

**TABLE C-6 TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF GROUNDWATER
SUSQUEHANNA STEAM ELECTRIC STATION, 2017**

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
6S11A	02/23/17	< 134	< 169	< 8	< 6	< 29	< 8	< 19	< 8	< 15	< 11	< 9	< 8	< 32	< 12	< 16
	05/25/17	< 145	< 195	< 8	< 8	< 24	< 9	< 16	< 9	< 14	< 15	< 7	< 8	< 42	< 10	< 14
	08/03/17	< 137	< 80	< 8	< 8	< 20	< 8	< 19	< 9	< 15	< 13	< 9	< 8	< 37	< 10	< 17
	11/17/17	< 149	< 88	< 8	< 11	< 27	< 12	< 23	< 9	< 18	< 15	< 9	< 11	< 41	< 14	< 21
AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6S12	02/21/17	< 132	< 128	< 7	< 7	< 19	< 8	< 14	< 9	< 11	< 12	< 8	< 7	< 33	< 13	< 12
	05/04/17	< 140	< 48	< 5	< 5	< 15	< 6	< 12	< 6	< 10	< 15	< 6	< 7	< 33	< 8	< 12
	07/27/17	< 139	< 81	< 9	< 10	< 22	< 12	< 19	< 10	< 14	< 12	< 8	< 11	< 33	< 11	< 17
	11/17/17	< 148	< 97	< 8	< 6	< 19	< 7	< 11	< 8	< 11	< 11	< 7	< 8	< 29	< 9	< 15
AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7S10	02/08/17	< 149	< 48	< 4	< 5	< 13	< 5	< 11	< 6	< 10	< 15	< 5	< 6	< 34	< 9	< 9
	05/03/17	< 144	< 50	< 5	< 6	< 14	< 5	< 11	< 6	< 8	< 12	< 5	< 5	< 34	< 10	< 10
	07/25/17	< 138	< 74	< 7	< 8	< 17	< 8	< 14	< 6	< 12	< 10	< 7	< 7	< 31	< 15	< 14
	10/30/17	< 134	< 41	< 6	< 7	< 19	< 7	< 12	< 6	< 12	< 14	< 6	< 7	< 32	< 9	< 12
AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7S11	02/08/17	< 147	< 38	< 4	< 4	< 14	< 3	< 8	< 4	< 8	< 13	< 4	< 4	< 29	< 7	< 9
	05/03/17	< 140	< 57	< 5	< 5	< 17	< 5	< 10	< 5	< 9	< 15	< 5	< 7	< 31	< 7	< 10
	07/25/17	< 141	< 135	< 9	< 8	< 23	< 8	< 20	< 9	< 16	< 15	< 9	< 9	< 40	< 12	< 17
	10/30/17	< 130	< 84	< 4	< 5	< 13	< 5	< 10	< 6	< 6	< 12	< 4	< 6	< 27	< 11	< 10
AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8S4	01/27/17	< 148	< 71	< 7	< 7	< 19	< 4	< 15	< 8	< 12	< 13	< 7	< 7	< 31	< 13	< 16
	05/08/17	< 148	< 50	< 4	< 6	< 16	< 8	< 12	< 6	< 13	< 8	< 6	< 6	< 26	< 5	< 11
	08/02/17	< 146	< 77	< 7	< 7	< 18	< 6	< 13	< 8	< 10	< 13	< 6	< 8	< 30	< 12	< 15
	11/04/17	< 137	< 123	< 6	< 6	< 15	< 6	< 12	< 7	< 8	< 10	< 5	< 5	< 31	< 7	< 13
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, 2017**

Results in pCi/Liter \pm 2 sigma

SITE	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Precip Sites 3S2, 12S1, 8G1 (offsite, controls)	62*	49	40	38	82	63	51	39	45	32
Precip Sites 1 and 2 (onsite, East of Station Reactor Bldgs)	370	230*	193	216	242	182	142	250	206	251
Precipitation Sites 3 and 4 (onsite, West of Station Reactor Bldgs)	414	404*	350	233	169	151	231	258	197	383
1S3 - MW-1 (43')	248	150	252	131	164	197	115	169	175	130
4S8 - MW-2 (45')	292	154	190	173	137	202	187	138	154	138
4S9 - MW-3 (94')	127	54	150	64	80	135	94	180	125	55
8S4 - MW-4 (111')	172	66	105	68	81	109	60	162	145	91
7S10 - MW-5 (36')	171	69	96	-6	74	106	68	70	73	51
13S7 - MW-6 (16')	142	134	143	34	80	111	71	79	111	107
2S8 - MW-7 (85')	Not installed	Not installed	Not installed	22	54	72	70	70	74	56
6S11A - MW-8A (14')	177	82	165	58	15	72	103	110	63	38
6S11B - MW-8B (19')	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
7S11 - MW-10 (132')	3	-27	-9	1	-1	23	29	55	13	1
12F3 - Groundwater Control	26	-53	-2	5	-6	45	-26	20	41	61
LTAW - Surface Water	179	104	110	132	132	145	27	73	89	77

* Revised values to reflect full scope of precipitation data.

**TABLE C-8 GROSS BETA, TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF DRINKING WATER
SUSQUEHANNA STEAM ELECTRIC STATION, 2017**

Results in pCi/Liter ± 2 sigma

SITE	COLLECTION PERIOD		-----GAMMA EMITTERS----->														
	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	12/27/16	- 01/23/17	< 1.7	< 147	< 22	< 1	< 2	< 4	< 1	< 3	< 2	< 3	< 6	< 1	< 1	< 12	< 4
12H2	01/23/17	- 02/27/17	< 1.8	< 140	< 36	< 2	< 2	< 8	< 2	< 4	< 3	< 4	< 12	< 2	< 2	< 21	< 7
12H2	02/27/17	- 03/28/17	2.0 ± 1.3	< 148	< 17	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 12	< 2	< 2	< 21	< 6
12H2	03/28/17	- 04/25/17	2.0 ± 1.2	< 146	< 15	< 2	< 2	< 6	< 2	< 4	< 2	< 3	< 11	< 2	< 2	< 20	< 6
12H2	04/25/17	- 05/30/17	< 1.7	< 145	< 8	< 1	< 1	< 3	< 1	< 2	< 1	< 2	< 15	< 1	< 1	< 18	< 6
12H2	05/30/17	- 06/27/17	2.4 ± 1.3	< 141	< 22	< 1	< 1	< 5	< 1	< 2	< 2	< 3	< 14	< 1	< 1	< 19	< 6
12H2	06/27/17	- 07/25/17	< 2.1	< 142	< 32	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 10	< 2	< 2	< 17	< 6
12H2	07/25/17	- 08/29/17	2.9 ± 1.4	< 134	< 39	< 2	< 2	< 6	< 2	< 3	< 2	< 3	< 13	< 1	< 2	< 21	< 6
12H2	08/29/17	- 09/26/17	3.7 ± 1.5	< 124	< 24	< 1	< 2	< 5	< 1	< 3	< 2	< 3	< 14	< 1	< 1	< 20	< 6
12H2	09/26/17	- 10/24/17	< 2.3	< 136	< 36	< 2	< 3	< 10	< 3	< 6	< 3	< 5	< 12	< 3	< 3	< 23	< 8
12H2	10/24/17	- 11/28/17	< 1.8	< 148	< 41	< 2	< 2	< 7	< 2	< 4	< 2	< 4	< 13	< 2	< 2	< 24	< 7
12H2	11/28/17	- 12/26/17	2.9 ± 1.4	< 146	< 37	< 2	< 2	< 7	< 2	< 4	< 2	< 4	< 14	< 2	< 2	< 25	< 8
	AVERAGE		2.7 ± 1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE C-9 **GAMMA SPECTROSCOPIC ANALYSES OF FOOD PRODUCTS (FRUITS AND VEGETABLES)**
SUSQUEHANNA STEAM ELECTRIC STATION, 2017

Results in pCi/kg (wet) ± 2 sigma

SITE	COLLECTION									
	DATE	Be-7	K-40	I-131	Cs-134	Cs-137	Ac-228	Th-228		
8G1	07/13/17	< 327	3028 ± 580	< 38	< 29	< 37	< 125	< 62		
	07/13/17	< 317	4092 ± 814	< 44	< 29	< 33	< 165	< 64		
	07/13/17	< 298	2744 ± 591	< 44	< 36	< 32	< 119	< 47		
	08/22/17	< 336	5125 ± 474	< 44	< 35	< 30	< 108	< 53		
	08/22/17	< 311	5020 ± 684	< 56	< 33	< 41	< 155	< 60		
	08/22/17	< 391	4228 ± 767	< 54	< 33	< 33	< 147	< 69		
	09/11/17	532 ± 130	6068 ± 383	< 23	< 13	< 15	< 48	< 25		
	09/11/17	504 ± 173	6302 ± 511	< 40	< 21	< 23	< 91	< 40		
	09/11/17	361 ± 151	3391 ± 354	< 27	< 16	< 18	< 63	< 25		
	10/17/17	510 ± 252	5042 ± 672	< 49	< 24	< 24	< 125	< 47		
	10/17/17	336 ± 218	6308 ± 679	< 46	< 26	< 27	< 118	< 51		
	10/17/17	963 ± 237	3484 ± 538	< 37	< 25	< 26	< 100	< 49		
	11/14/17	553 ± 291	6064 ± 798	< 40	< 25	< 29	< 131	< 61		
	11/14/17	< 291	3544 ± 698	< 38	< 29	< 34	< 130	< 65		
AVERAGE	537 ± 412	4603 ± 2536	-	-	-	-	-	-		
11D1	11/10/17	< 215	2658 ± 514	< 46	< 25	< 28	< 106	< 52		
	11/30/17	< 165	3448 ± 591	< 35	< 27	< 27	< 113	< 44		
	11/30/17	< 256	13540 ± 1183	< 43	< 35	< 34	< 165	< 51		
	AVERAGE	-	6549 ± 12135	-	-	-	-	-		
11S6	07/13/17	< 190	3445 ± 463	< 27	< 18	< 19	< 89	< 32		
	07/13/17	< 282	4176 ± 662	< 51	< 31	< 38	< 149	< 60		
	07/13/17	< 316	3404 ± 511	< 45	< 38	< 33	< 135	< 63		
	08/22/17	462 ± 288	2947 ± 625	< 47	< 27	< 28	< 122	< 58		
	08/22/17	555 ± 254	3896 ± 515	< 47	< 26	< 31	< 107	< 49		
	08/22/17	1204 ± 333	4160 ± 514	< 51	< 35	< 31	< 132	< 58		
	09/11/17	587 ± 210	4294 ± 560	< 43	< 26	< 24	< 111	< 46		
	09/11/17	1215 ± 276	7971 ± 769	< 56	< 26	< 33	< 133	< 53		
	09/11/17	1131 ± 163	5099 ± 333	< 37	< 22	< 22	< 80	< 38		
	10/17/17	387 ± 200	4241 ± 506	< 31	< 19	< 21	< 80	< 38		
	10/17/17	415 ± 225	6077 ± 530	< 32	< 19	< 19	< 75	< 39		
	10/17/17	714 ± 272	5364 ± 526	< 52	< 35	< 36	< 138	< 63		
	11/14/17	570 ± 318	6219 ± 769	< 41	< 39	< 39	< 138	< 71		
	11/14/17	< 233	4896 ± 729	< 35	< 24	< 17	< 94	< 40		
AVERAGE	724 ± 662	4728 ± 2686	-	-	-	-	-			

TABLE C-9

GAMMA SPECTROSCOPIC ANALYSES OF FOOD PRODUCTS (FRUITS AND VEGETABLES)
 SUSQUEHANNA STEAM ELECTRIC STATION, 2017

Results in pCi/kg (wet) ± 2 sigma

SITE	COLLECTION		K-40	I-131	Cs-134	Cs-137	Ac-228	Th-228
	DATE	DATE						
12F7	10/9/2017		5874 ± 848	< 38	< 32	< 31	< 124	< 64
	AVERAGE	-	5874 ± 0	-	-	-	-	-
3S3	7/13/2017	< 342	3583 ± 539	< 49	< 34	< 37	< 143	< 55
	7/13/2017	< 263	4559 ± 619	< 38	< 28	< 32	< 125	< 59
	7/13/2017	< 261	3441 ± 685	< 40	< 22	< 25	< 131	< 52
	8/22/2017	< 378	3460 ± 623	< 49	< 33	< 29	< 146	< 49
	8/22/2017	< 320	5530 ± 675	< 51	< 34	< 36	< 112	< 62
	8/22/2017	532 ± 235	3786 ± 640	< 45	< 31	< 28	< 124	< 55
	9/11/2017	< 260	3547 ± 593	< 47	< 25	< 28	< 124	< 52
	9/11/2017	763 ± 284	7309 ± 677	< 45	< 30	< 28	< 95	< 46
	9/11/2017	567 ± 237	4502 ± 636	< 51	< 32	< 28	< 119	< 56
	10/17/2017	< 294	3672 ± 582	< 46	< 26	< 33	< 100	< 43
	10/17/2017	522 ± 312	7048 ± 781	< 42	< 24	< 32	< 110	< 50
	10/17/2017	828 ± 233	6133 ± 705	< 34	< 21	< 24	< 99	< 44
	11/14/2017	696 ± 377	6737 ± 893	< 42	< 33	< 35	< 119	< 61
11/14/2017	797 ± 399	5519 ± 861	< 49	< 40	< 45	< 145	< 78	
	AVERAGE	672 ± 261	4916 ± 2876	-	-	-	-	-

**TABLE C-10 GAMMA SPECTROSCOPIC ANALYSES OF SOIL
SUSQUEHANNA STEAM ELECTRIC STATION, 2017**

Results in pCi/kg (dry) ± 2 sigma

SITE	COLLECTION		K-40	Cs-134	Cs-137	Ra-226	Ac-228	Th-228
	DATE							
8G1	09/13/17		8166 ± 2056	< 104	< 178	< 2319	1174 ± 520	1117 ± 202
	09/13/17		9559 ± 1488	< 58	122 ± 80	2221 ± 1226	890 ± 270	722 ± 105
	AVERAGE		8863 ± 1970	-	122 ± 0	2221 ± 0	1032 ± 402	919 ± 559
12S1	09/13/17		10550 ± 1385	< 54	129 ± 64	< 1322	919 ± 258	938 ± 120
	09/13/17		13320 ± 1772	< 81	< 111	4272 ± 1732	897 ± 305	957 ± 151
	AVERAGE		11935 ± 3917	-	129 ± 0	4272 ± 0	908 ± 30	948 ± 27
10S3	09/13/17		9623 ± 1909	< 106	< 152	2724 ± 1628	< 346	682 ± 141
	09/13/17		11850 ± 1808	< 64	< 109	< 1935	840 ± 366	1064 ± 130
	AVERAGE		10737 ± 3149	-	-	2724 ± 0	840 ± 0	873 ± 540

TABLE C-11

TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF SURFACE WATER
SUSQUEHANNA STEAM ELECTRIC STATION, 2017

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	12/27/16 - 01/24/17	< 150	< 31	< 2	< 2	< 6	< 2	< 2	< 4	< 4	< 2	< 4	< 7	< 2	< 2	< 14	< 5	< 3
	01/24/17 - 02/28/17	< 142	< 46	< 2	< 2	< 7	< 2	< 2	< 4	< 4	< 3	< 4	< 12	< 2	< 2	< 21	< 7	< 5
	02/28/17 - 03/28/17	< 148	< 32	< 2	< 2	< 7	< 2	< 2	< 4	< 4	< 2	< 4	< 11	< 2	< 2	< 20	< 7	< 4
	03/28/17 - 04/25/17	< 147	< 22	< 1	< 2	< 5	< 1	< 1	< 3	< 3	< 2	< 3	< 9	< 1	< 1	< 16	< 5	< 3
	04/25/17 - 05/30/17	< 148	< 18	< 2	< 2	< 7	< 2	< 2	< 4	< 4	< 2	< 4	< 15	< 2	< 2	< 24	< 8	< 3
	05/23/17 - 05/23/17	< 145	< 39	< 4	< 5	< 16	< 4	< 4	< 10	< 10	< 5	< 8	< 15	< 4	< 5	< 31	< 11	< 9
	05/30/17 - 06/27/17	< 140	< 38	< 2	< 2	< 5	< 2	< 3	< 3	< 3	< 2	< 3	< 12	< 2	< 2	< 21	< 6	< 3
	06/27/17 - 07/25/17	< 143	< 15	< 2	< 2	< 6	< 2	< 2	< 3	< 3	< 2	< 4	< 10	< 2	< 2	< 18	< 5	< 3
	07/25/17 - 08/29/17	< 139	< 32	< 2	< 2	< 6	< 2	< 2	< 3	< 3	< 2	< 3	< 14	< 2	< 2	< 22	< 7	< 3
	08/29/17 - 09/26/17	< 128	< 23	< 1	< 1	< 5	< 1	< 1	< 3	< 3	< 2	< 3	< 11	< 1	< 1	< 16	< 6	4 ± 2
	09/19/17 - 09/19/17	< 128	< 33	< 2	< 2	< 7	< 2	< 2	< 4	< 4	< 2	< 3	< 8	< 2	< 2	< 16	< 6	< 3
09/26/17 - 10/24/17	< 140	< 27	< 3	< 3	< 8	< 2	< 2	< 5	< 5	< 3	< 5	< 11	< 3	< 3	< 21	< 7	< 5	
10/24/17 - 11/28/17	< 139	< 40	< 2	< 2	< 7	< 2	< 2	< 4	< 4	< 3	< 4	< 12	< 2	< 2	< 21	< 7	< 4	
11/28/17 - 12/26/17	< 147	< 34	< 2	< 2	< 7	< 2	< 2	< 5	< 5	< 2	< 4	< 13	< 2	< 2	< 20	< 8	< 4	
AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4 ± 0
5S9	06/06/17 - 06/06/17	< 141	< 17	< 1	< 1	< 4	< 1	< 1	< 2	< 2	< 1	< 2	< 14	< 1	< 1	< 18	< 5	< 2
AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2S7	12/27/16 - 01/24/17	< 147	< 32	< 2	< 2	< 5	< 2	< 2	< 3	< 3	< 2	< 3	< 7	< 2	< 2	< 14	< 4	< 3
	01/24/17 - 02/28/17	393 ± 104	< 56	< 2	< 3	< 8	< 2	< 2	< 5	< 5	< 3	< 5	< 12	< 2	< 3	< 23	< 7	< 5
	02/28/17 - 03/28/17	957 ± 133	< 38	< 2	< 2	< 6	< 2	< 2	< 4	< 4	< 2	< 4	< 12	< 2	< 2	< 21	< 7	< 4
	03/28/17 - 04/25/17	511 ± 114	< 33	< 2	< 2	< 6	< 2	< 3	< 3	< 2	< 2	< 3	< 11	< 2	< 2	< 19	< 6	< 3
	04/25/17 - 05/30/17	400 ± 113	< 18	< 2	< 2	< 7	< 2	< 4	< 4	< 2	< 2	< 4	< 15	< 2	< 2	< 23	< 7	< 4
	05/23/17 - 05/23/17	< 146	< 40	< 4	< 4	< 10	< 3	< 3	< 7	< 7	< 4	< 7	< 13	< 4	< 3	< 24	< 9	< 7
	05/30/17 - 06/27/17	< 145	< 18	< 2	< 2	< 7	< 2	< 4	< 4	< 4	< 2	< 4	< 15	< 2	< 2	< 23	< 8	< 3
	06/27/17 - 07/25/17	2070 ± 216	< 21	< 2	< 2	< 7	< 2	< 2	< 4	< 4	< 2	< 4	< 13	< 2	< 2	< 23	< 8	< 4
	07/25/17 - 08/29/17	771 ± 118	< 14	< 1	< 2	< 5	< 1	< 3	< 3	< 3	< 2	< 3	< 11	< 1	< 1	< 17	< 6	< 2
	08/29/17 - 09/26/17	354 ± 94	< 16	< 2	< 2	< 6	< 2	< 3	< 3	< 3	< 2	< 4	< 13	< 2	< 2	< 21	< 7	< 3
	09/26/17 - 10/24/17	< 149	< 59	< 3	< 3	< 10	< 3	< 3	< 6	< 6	< 4	< 6	< 12	< 3	< 3	< 26	< 9	< 6
10/24/17 - 11/28/17	291 ± 108	< 47	< 2	< 2	< 7	< 2	< 2	< 4	< 4	< 3	< 4	< 12	< 2	< 2	< 21	< 7	< 4	
11/28/17 - 12/26/17	207 ± 99	< 20	< 2	< 2	< 8	< 2	< 2	< 4	< 4	< 3	< 4	< 15	< 2	< 2	< 24	< 7	< 4	
AVERAGE	662 ± 1159	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6S5	01/03/17 - 01/24/17	< 128	< 30	< 2	< 2	< 5	< 2	< 3	< 3	< 2	< 3	< 6	< 2	< 2	< 2	< 12	< 4	< 3
	01/30/17 - 02/28/17	< 141	< 51	< 3	< 3	< 8	< 2	< 6	< 6	< 3	< 5	< 12	< 3	< 3	< 22	< 6	< 6	
	03/07/17 - 03/28/17	< 150	< 22	< 2	< 3	< 8	< 2	< 5	< 5	< 3	< 5	< 10	< 2	< 2	< 19	< 8	< 4	
	04/04/17 - 04/25/17	< 150	< 19	< 2	< 2	< 6	< 2	< 4	< 4	< 2	< 4	< 10	< 2	< 2	< 18	< 6	< 6	
	05/02/17 - 05/30/17	< 147	< 37	< 2	< 2	< 7	< 2	< 5	< 5	< 3	< 3	< 15	< 3	< 2	< 24	< 6	< 6	

TABLE C-11

TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF SURFACE WATER
SUSQUEHANNA STEAM ELECTRIC STATION, 2017

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
6S5 (cont'd)	06/06/17 - 06/27/17	< 140	< 18	< 2	< 2	< 7	< 2	< 5	< 3	< 5	< 3	< 5	< 2	< 24	< 7	< 5
	07/03/17 - 07/25/17	< 146	< 22	< 3	< 8	< 3	< 5	< 3	< 3	< 5	< 3	< 5	< 2	< 21	< 7	< 4
	08/01/17 - 08/29/17	< 136	< 19	< 2	< 7	< 2	< 4	< 3	< 4	< 4	< 3	< 4	< 2	< 22	< 7	< 4
	09/05/17 - 09/26/17	< 126	< 17	< 2	< 6	< 2	< 3	< 2	< 2	< 4	< 2	< 4	< 2	< 18	< 6	< 4
	10/03/17 - 10/24/17	< 136	< 31	< 3	< 4	< 3	< 7	< 4	< 4	< 6	< 10	< 4	< 3	< 23	< 8	< 6
	10/31/17 - 11/28/17	< 136	< 39	< 2	< 3	< 8	< 3	< 5	< 3	< 5	< 12	< 2	< 2	< 20	< 6	< 5
	12/05/17 - 12/26/17	< 148	< 41	< 2	< 2	< 8	< 2	< 5	< 3	< 4	< 11	< 2	< 2	< 20	< 7	< 4
AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4S7	02/06/17 - 02/06/17	< 145	< 154	< 6	< 6	< 20	< 7	< 12	< 7	< 11	< 7	< 6	< 26	< 8	< 9	
	04/27/17 - 04/27/17	< 147	< 116	< 6	< 6	< 15	< 8	< 15	< 7	< 10	< 7	< 8	< 30	< 15	< 12	
	07/27/17 - 07/27/17	< 142	< 173	< 8	< 10	< 22	< 9	< 12	< 9	< 18	< 14	< 8	< 43	< 10	< 15	
	10/26/17 - 10/26/17	246 ± 90	< 87	< 4	< 3	< 10	< 4	< 8	< 3	< 6	< 5	< 4	< 18	< 5	< 7	
AVERAGE	246 ± 0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
LTAW	02/06/17 - 02/06/17	< 145	< 116	< 5	< 5	< 13	< 5	< 9	< 4	< 8	< 6	< 5	< 18	< 4	< 10	
	04/27/17 - 04/27/17	< 145	< 134	< 6	< 6	< 15	< 6	< 10	< 6	< 13	< 9	< 6	< 26	< 8	< 10	
	07/27/17 - 07/27/17	< 142	< 137	< 9	< 7	< 7	< 5	< 16	< 8	< 15	< 13	< 8	< 30	< 11	< 14	
	10/26/17 - 10/26/17	< 132	< 104	< 4	< 5	< 11	< 5	< 10	< 5	< 9	< 8	< 4	< 24	< 6	< 11	
AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
5S12	02/06/17 - 02/06/17	< 147	< 84	< 5	< 5	< 19	< 7	< 12	< 6	< 9	< 6	< 6	< 21	< 7	< 10	
	04/27/17 - 04/27/17	< 149	< 62	< 7	< 6	< 20	< 9	< 16	< 8	< 11	< 13	< 8	< 34	< 14	< 16	
	07/27/17 - 07/27/17	< 141	< 65	< 7	< 8	< 21	< 8	< 17	< 7	< 15	< 14	< 9	< 39	< 11	< 16	
	10/26/17 - 10/26/17	< 133	< 37	< 4	< 4	< 10	< 5	< 11	< 4	< 8	< 7	< 4	< 23	< 7	< 8	
AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
7S12	02/06/17 - 02/06/17	< 146	< 101	< 5	< 5	< 15	< 6	< 12	< 5	< 10	< 7	< 4	< 6	< 24	< 11	
	04/27/17 - 04/27/17	< 149	< 83	< 9	< 9	< 22	< 8	< 18	< 10	< 15	< 14	< 7	< 40	< 11	< 14	
	07/27/17 - 07/27/17	< 142	< 133	< 5	< 5	< 15	< 6	< 11	< 6	< 10	< 10	< 5	< 23	< 9	< 10	
	10/26/17 - 10/26/17	< 134	< 49	< 4	< 4	< 12	< 5	< 9	< 5	< 8	< 7	< 5	< 21	< 6	< 8	
AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

TABLE C-12

GAMMA SPECTROSCOPIC ANALYSIS OF FISH
SUSQUEHANNA STEAM ELECTRIC STATION, 2017

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										
Small Mouth Bass	05/24/17	3261 ± 913	< 53	< 52	< 152	< 40	< 93	< 50	< 65	
Channel Catfish	05/24/17	2649 ± 657	< 41	< 43	< 101	< 46	< 95	< 40	< 46	
Shorthead Redhorse	05/24/17	4164 ± 1114	< 77	< 66	< 218	< 79	< 165	< 66	< 70	
Small Mouth Bass	10/20/17	4298 ± 1070	< 57	< 34	< 81	< 55	< 118	< 39	< 53	
Walleye	10/20/17	3792 ± 1300	< 90	< 87	< 222	< 79	< 156	< 77	< 79	
Quillback	10/20/17	3848 ± 1226	< 54	< 57	< 184	< 80	< 111	< 70	< 61	
AVERAGE		3669 ± 1231	-	-	-	-	-	-	-	-
IND										
Shorthead Redhorse	05/23/17	3590 ± 767	< 38	< 27	< 119	< 35	< 81	< 46	< 46	
Channel Catfish	05/23/17	3207 ± 1049	< 75	< 80	< 191	< 73	< 163	< 66	< 86	
Small Mouth Bass	05/23/17	4041 ± 906	< 48	< 48	< 159	< 41	< 84	< 49	< 50	
Quillback	10/19/17	5499 ± 1226	< 35	< 62	< 200	< 73	< 147	< 53	< 65	
Small Mouth Bass	10/19/17	4359 ± 920	< 42	< 50	< 121	< 30	< 119	< 49	< 52	
Walleye	10/19/17	4772 ± 1036	< 53	< 71	< 186	< 56	< 129	< 62	< 54	
AVERAGE		4245 ± 1652	-	-	-	-	-	-	-	-
LTAW										
Small Mouth Bass	10/21/17	3701 ± 857	< 48	< 38	< 131	< 47	< 93	< 50	< 42	
Rainbow Trout	10/21/17	3330 ± 895	< 51	< 49	< 176	< 48	< 101	< 60	< 65	
AVERAGE		3516 ± 525	-	-	-	-	-	-	-	-

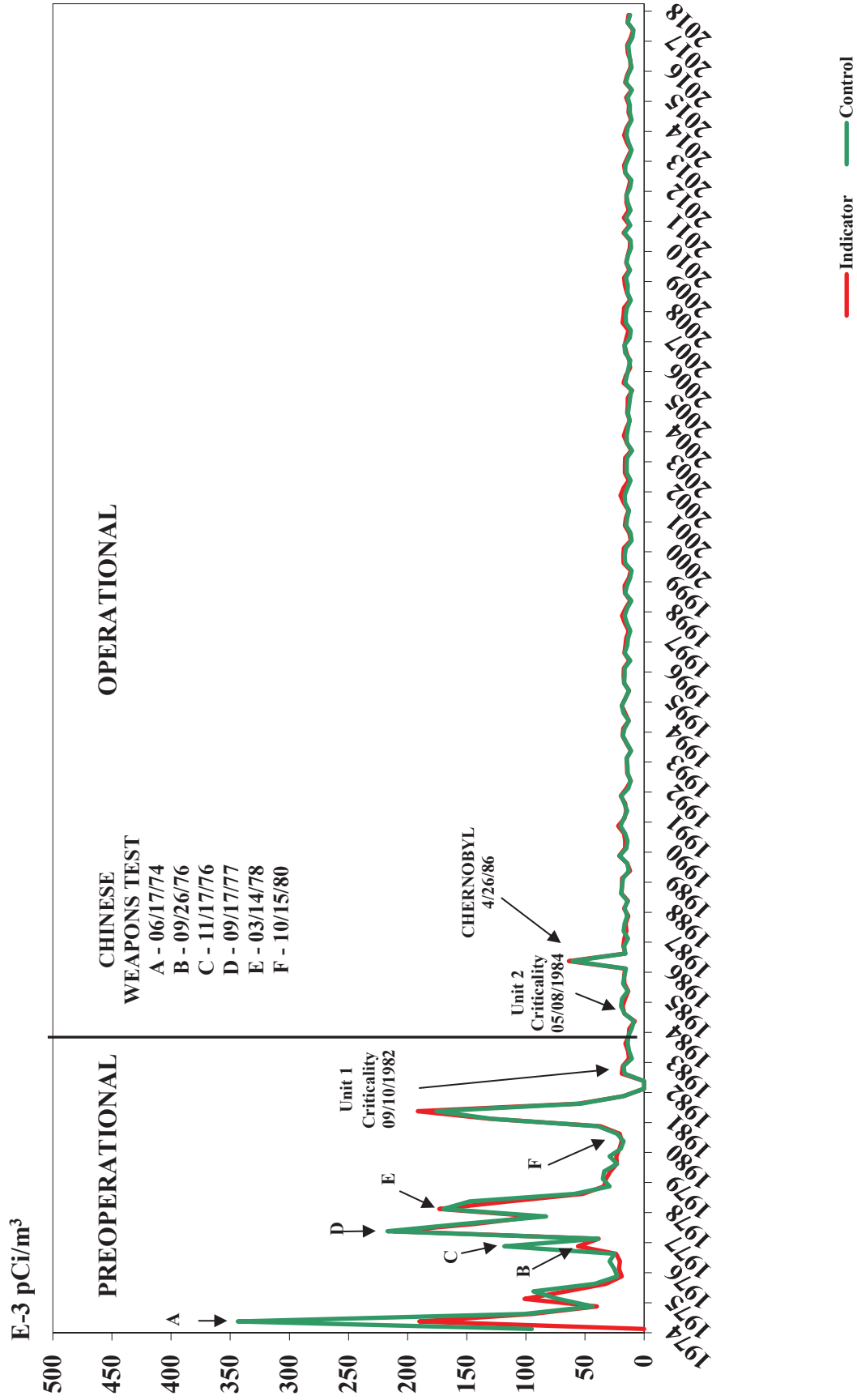
TABLE C-13

**GAMMA SPECTROSCOPIC ANALYSES OF SHORELINE SEDIMENT
SUSQUEHANNA STEAM ELECTRIC STATION, 2017**

Results in pCi/kg (dry) \pm 2 sigma

SITE	COLLECTION		K-40	Cs-134	Cs-137	Ra-226	Ac-228	Th-228
	DATE							
2B	05/01/17		11480 \pm 1668	< 76	114 \pm 58	< 1702	984 \pm 306	883 \pm 172
	10/19/17		19550 \pm 2302	< 87	< 100	< 1785	1004 \pm 384	1196 \pm 143
	AVERAGE		15515 \pm 11413	-	114 \pm 0	-	994 \pm 29	1040 \pm 442
7B	05/01/17		9435 \pm 1215	< 47	< 67	1887 \pm 1114	911 \pm 243	821 \pm 91.4
	10/19/17		9681 \pm 1544	< 93	< 111	< 2063	902 \pm 349	815 \pm 224
	AVERAGE		9558 \pm 348	-	-	1887 \pm 0	906 \pm 14	818 \pm 9
12F	05/01/17		7204 \pm 1209	< 61	< 74	< 1488	803 \pm 290	587 \pm 130
	10/19/17		10320 \pm 1108	< 111	< 81	< 1869	468 \pm 290	901 \pm 142
	AVERAGE		8762 \pm 4407	-	-	-	635 \pm 474	744 \pm 444

FIGURE C-1 - GROSS BETA ACTIVITY IN AIR PARTICULATES



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

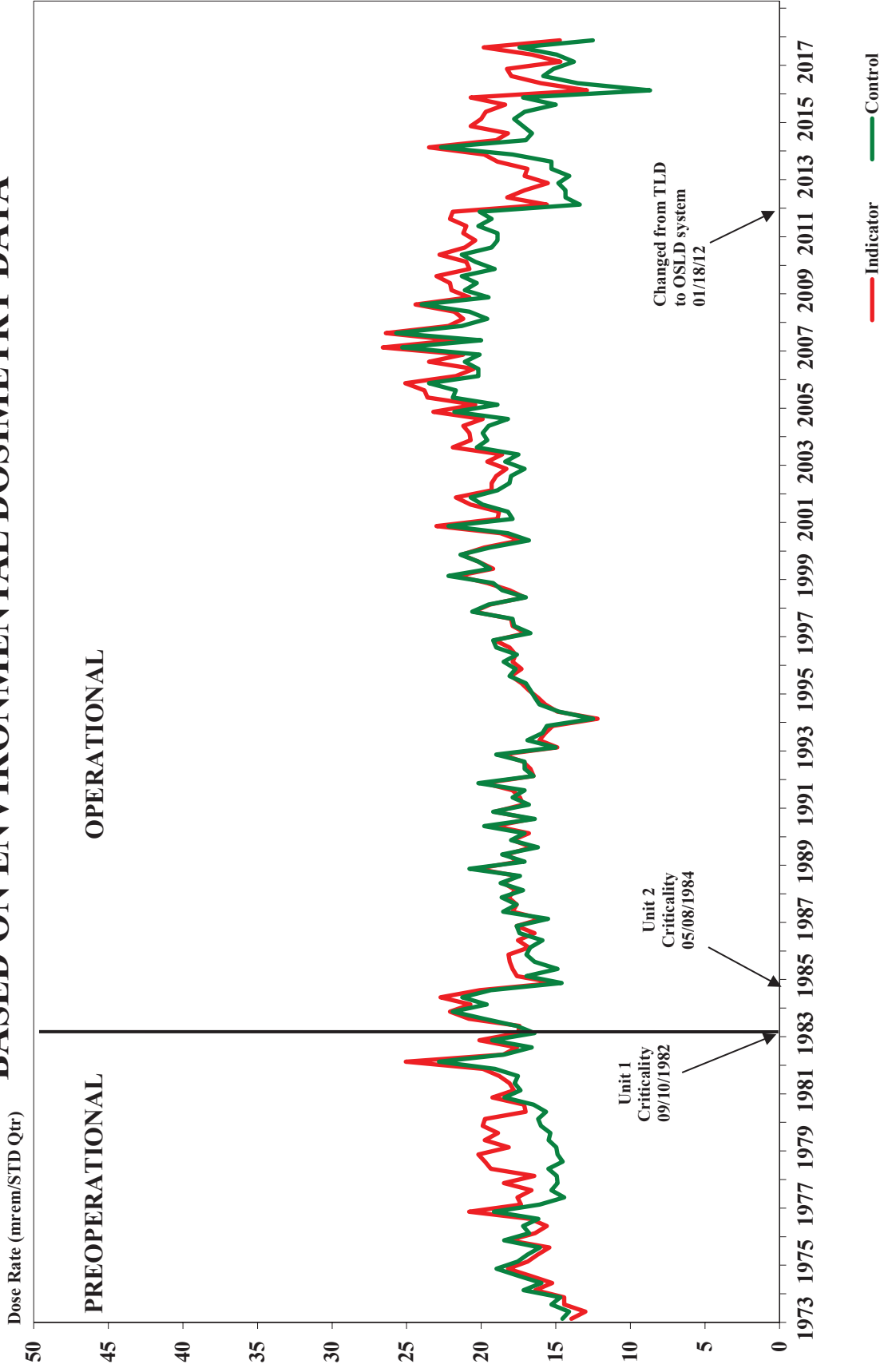


FIGURE C-3 - IODINE-131 ACTIVITY IN MILK

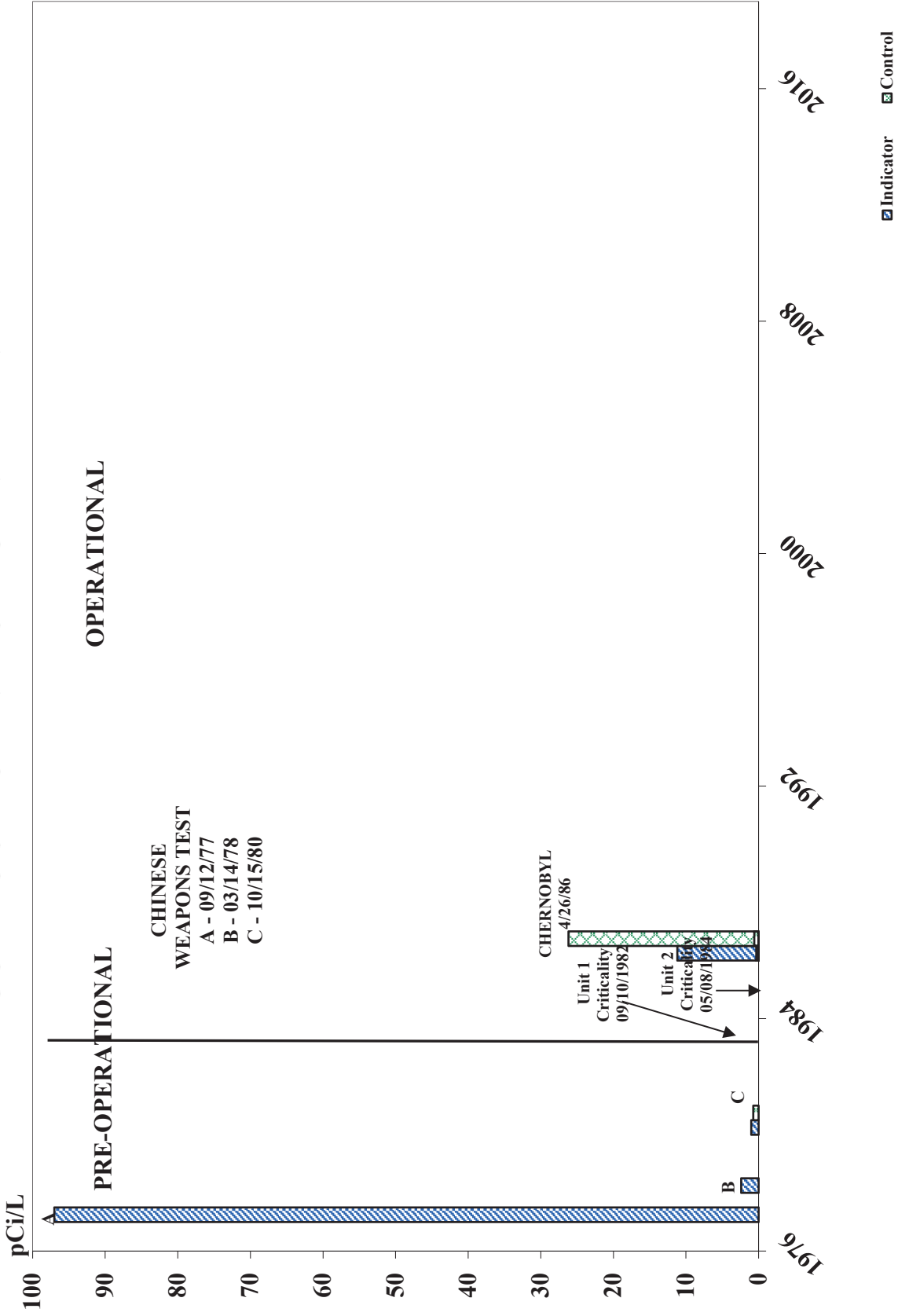


FIGURE C-4 - ANNUAL AVERAGE TRITIUM ACTIVITY IN PRECIPITATION AND SURFACE WATER VERSUS GROUND WATER

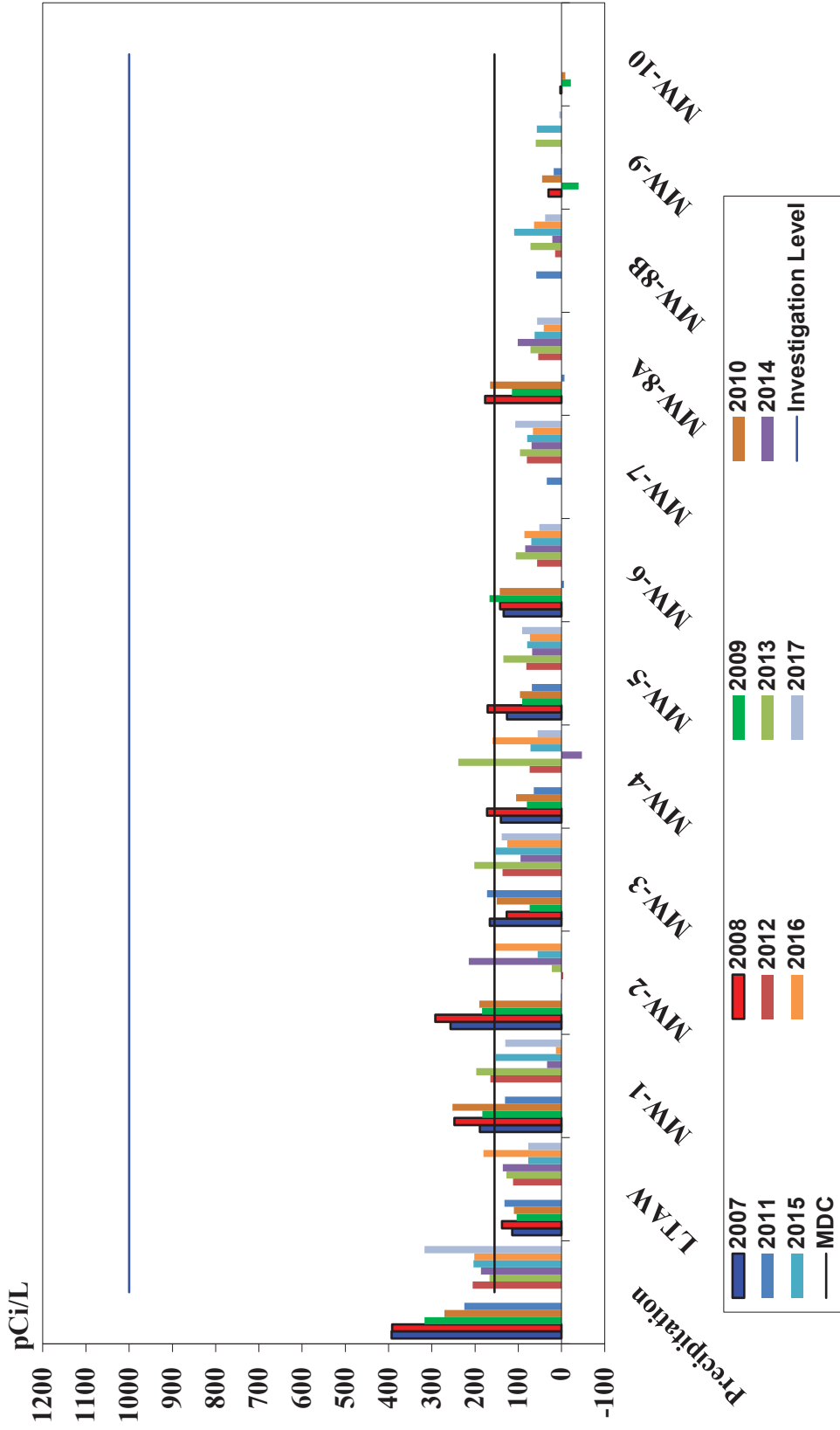


FIGURE C-5 - GROSS BETA ACTIVITY IN DRINKING WATER

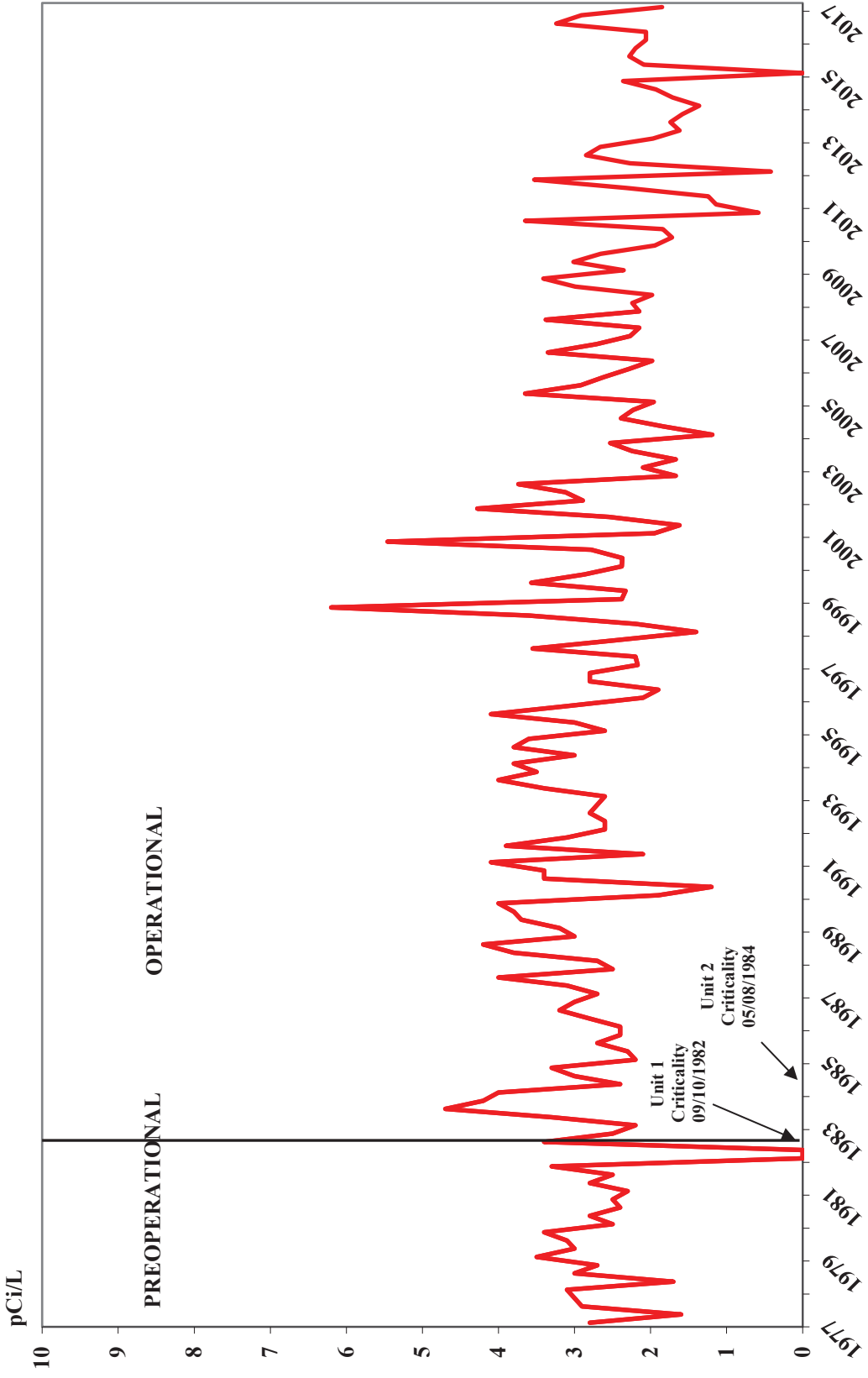
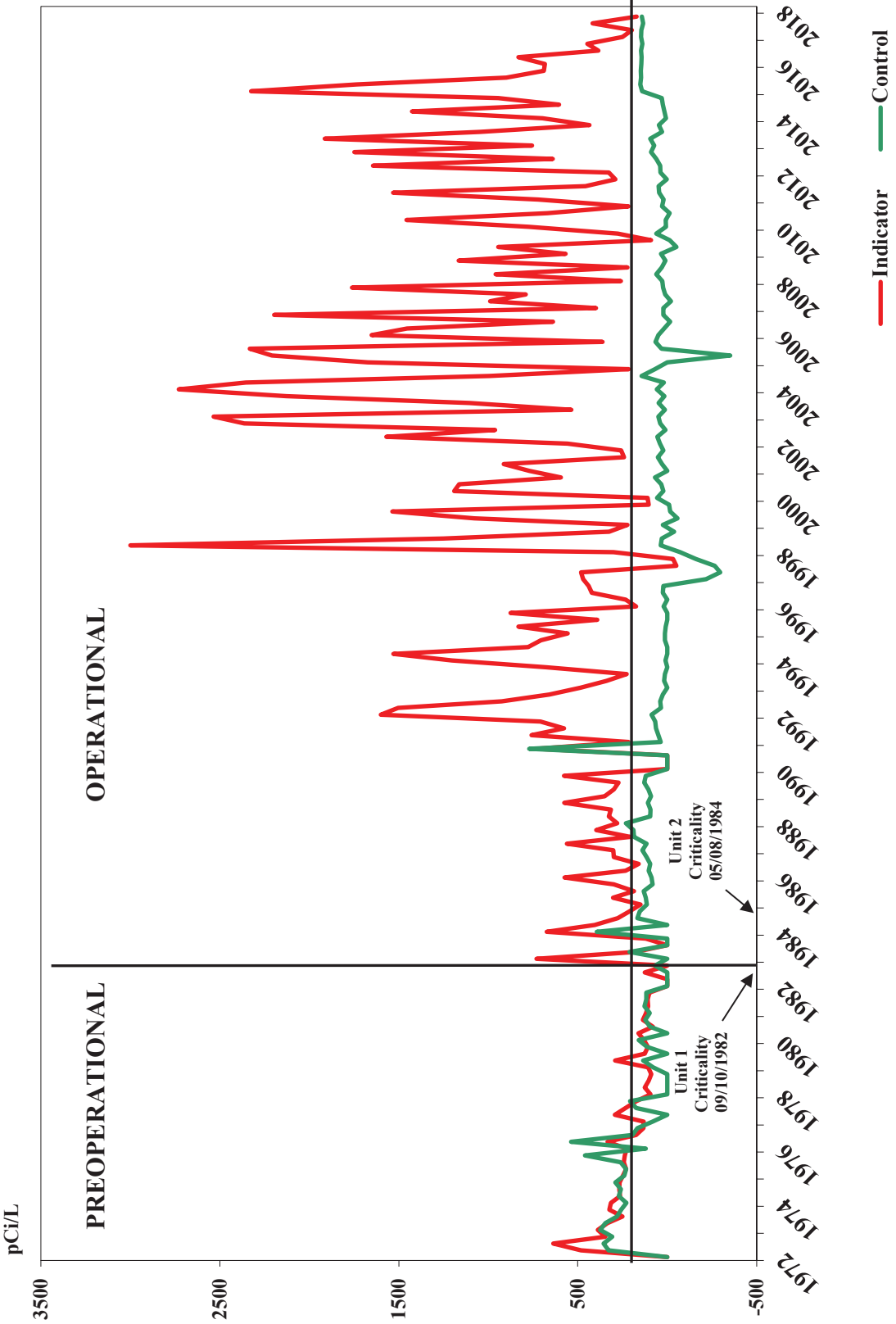


FIGURE C-6 - TRITIUM ACTIVITY IN SURFACE WATER



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APPENDIX D

SUMMARY OF RESULTS FROM ANALYTICS, ENVIRONMENTAL RESOURCE ASSOCIATES (ERA), DEPARTMENT OF ENERGY (DOE) – MIXED ANALYTE PERFORMANCE EVALUATION PROGRAM (MAPEP), AND PPL REMP LABORATORY QUALITY CONTROL SPIKE PROGRAM

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)			
June 2017	E11844	Milk	Sr-89	pCi/L	81.3	92.6	0.88	A			
			Sr-90	pCi/L	12.1	13.5	0.90	A			
June 2017	E11846	Milk	Ce-141	pCi/L	142	151	0.94	A			
			Co-58	pCi/L	147	155	0.95	A			
			Co-60	pCi/L	185	191	0.97	A			
			Cr-51	pCi/L	321	315	1.02	A			
			Cs-134	pCi/L	168	188	0.89	A			
			Cs-137	pCi/L	148	150	0.99	A			
			Fe-59	pCi/L	116	115	1.01	A			
			I-131	pCi/L	102	93.6	1.09	A			
			Mn-54	pCi/L	168	172	0.98	A			
			Zn-65	pCi/L	195	204	0.96	A			
			June 2017	E11847	Charcoal	I-131	pCi	87.9	84.8	1.04	A
			June 2017	E11845	AP	Sr-89	pCi	70.8	79.1	0.90	A
Sr-90	pCi	9.10				11.5	0.79	W			
June 2017	E11848	AP	Ce-141	pCi	112	116	0.96	A			
			Co-58	pCi	119	119	1.00	A			
			Co-60	pCi	171	146	1.17	A			
			Cr-51	pCi	270	241	1.12	A			
			Cs-134	pCi	152	144	1.05	A			
			Cs-137	pCi	114	115	0.99	A			
			Fe-59	pCi	94.1	88.3	1.07	A			
			Mn-54	pCi	139	132	1.06	A			
June 2017	E11849	Water	Fe-55	pCi/L	1840	1890	0.97	A			
July 2017	E11901	AP	GR-A	pCi	50.1	44.2	1.13	A			
			GR-B	pCi	218	233	0.93	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 2017	E11914	Milk	Sr-89	pCi/L	84.3	82.7	1.02	A		
			Sr-90	pCi/L	12.6	12.1	1.04	A		
	E11915	Milk	Ce-141	pCi/L	93.9	87.0	1.08	A		
			Co-58	pCi/L	115	117	0.98	A		
			Co-60	pCi/L	265	262	1.01	A		
			Cr-51	pCi/L	273	217	1.26	W		
			Cs-134	pCi/L	186	201	0.93	A		
			Cs-137	pCi/L	175	172	1.02	A		
			Fe-59	pCi/L	137	125	1.09	A		
			I-131	pCi/L	78.0	71.0	1.10	A		
			Mn-54	pCi/L	128	123	1.04	A		
			Zn-65	pCi/L	206	184	1.12	A		
			E11916	Charcoal	I-131	pCi	71.9	64.4	1.12	A
			E11917	AP	Ce-141	pCi	80.1	86.3	0.93	A
Co-58	pCi	110			116	0.95	A			
Co-60	pCi	277			260	1.07	A			
Cr-51	pCi	275			215	1.28	W			
Cs-134	pCi	192			199	0.96	A			
Cs-137	pCi	165			170	0.97	A			
Fe-59	pCi	122			124	0.98	A			
Mn-54	pCi	120			122	0.99	A			
Zn-65	pCi	175			183	0.96	A			
E11918	Water	Fe-55	pCi/L	1630	1630	1.00	A			
E11919	Soil	Ce-141	pCi/g	0.136	0.142	0.96	A			
		Co-58	pCi/g	0.179	0.191	0.94	A			
		Co-60	pCi/g	0.405	0.429	0.94	A			
		Cr-51	pCi/g	0.230	0.355	0.65	N ⁽¹⁾			
		Cs-134	pCi/g	0.272	0.328	0.83	A			
		Cs-137	pCi/g	0.336	0.356	0.94	A			
		Fe-59	pCi/g	0.210	0.205	1.02	A			
		Mn-54	pCi/g	0.210	0.201	1.05	A			
Zn-65	pCi/g	0.301	0.301	1.00	A					

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

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

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

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

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

(1) See NCR 17-16

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 2017	17-MaS36	Soil	Ni-63	Bq/kg	-5.512		(1)	A
			Sr-90	Bq/kg	571	624	437 - 811	A
	17-MaW36	Water	Am-241	Bq/L	0.693	0.846	0.592 - 1.100	A
			Ni-63	Bq/L	13.4	12.2	8.5 - 15.9	A
			Pu-238	Bq/L	0.7217	0.703	0.492 - 0.914	A
			Pu-239/240	Bq/L	0.9277	0.934	0.654 - 1.214	A
	17-RdF36	AP	U-234/233	Bq/sample	0.0911	0.104	0.073 - 0.135	A
			U-238	Bq/sample	0.0967	0.107	0.075 - 0.139	A
	17-RdV36	Vegetation	Cs-134	Bq/sample	6.44	6.95	4.87 - 9.04	A
			Cs-137	Bq/sample	4.61	4.60	3.22 - 5.98	A
			Co-57	Bq/sample	-0.0229		(1)	A
			Co-60	Bq/sample	8.52	8.75	6.13 - 11.38	A
			Mn-54	Bq/sample	3.30	3.28	2.30 - 4.26	A
			Sr-90	Bq/sample	1.30	1.75	1.23 - 2.28	W
Zn-65			Bq/sample	5.45	5.39	3.77 - 7.01	A	
August 2017	17-MaS37	Soil	Ni-63	Bq/kg	1130	1220	854 - 1586	A
			Sr-90	Bq/kg	296	289	202 - 376	A
	17-MaW37	Water	Am-241	Bq/L	0.838	0.892	0.624 - 1.160	A
			Ni-63	Bq/L	-0.096		(1)	A
			Pu-238	Bq/L	0.572	0.603	0.422 - 0.784	A
			Pu-239/240	Bq/L	0.863	0.781	0.547 - 1.015	A
	17-RdF37	AP	U-234/233	Bq/sample	0.103	0.084	0.059 - 0.109	W
			U-238	Bq/sample	0.115	0.087	0.061 - 0.113	N ⁽²⁾
	17-RdV37	Vegetation	Cs-134	Bq/sample	2.34	2.32	1.62 - 3.02	A
			Cs-137	Bq/sample	0.05		(1)	A
			Co-57	Bq/sample	3.32	2.8	2.0 - 3.6	A
			Co-60	Bq/sample	2.09	2.07	1.45 - 2.69	A
			Mn-54	Bq/sample	2.90	2.62	1.83 - 3.41	A
			Sr-90	Bq/sample	1.17	1.23	0.86 - 1.60	A
Zn-65	Bq/sample	6.07	5.37	3.76 - 6.98	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) See NCR 17-15

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 2017	MRAD-26	AP	GR-A	pCi/sample	76.3	85.5	28.6 - 133	A
April 2017	RAD-109	Water	Ba-133	pCi/L	49.2	49.7	40.8 - 55.1	A
			Cs-134	pCi/L	83.2	90.1	74.0 - 99.1	A
			Cs-137	pCi/L	202	206	185 - 228	A
			Co-60	pCi/L	51.2	54.7	49.2 - 62.7	A
			Zn-65	pCi/L	39.3	53.8	47.2 - 65.9	N ⁽¹⁾
			GR-A	pCi/L	53.6	75.0	39.5 - 92.3	A
			GR-B	pCi/L	42.7	38.5	25.5 - 46.0	A
			U-Nat	pCi/L	50.1	55.6	45.2 - 61.7	A
			H-3	pCi/L	7080	6850	5920 - 7540	A
			Sr-89	pCi/L	40.7	66.2	53.8 - 74.3	N ⁽¹⁾
			Sr-90	pCi/L	26.9	26.7	19.3 - 31.1	A
			I-131	pCi/L	26.7	29.9	24.9 - 34.9	A
September 2017	MRAD-27	AP	GR-A	pCi/sample	40.9	50.1	16.8 - 77.8	A
		AP	GR-B	pCi/sample	58.0	61.8	39.1 - 90.1	A
October 2017	RAD-111	Water	Ba-133	pCi/L	71.3	73.7	61.7 - 81.1	A
			Cs-134	pCi/L	43.0	53.0	42.8 - 58.3	A
			Cs-137	pCi/L	48.2	52.9	47.6 - 61.1	A
			Co-60	pCi/L	69.0	69.5	62.6 - 78.9	A
			Zn-65	pCi/L	335	348	313 - 406	A
			GR-A	pCi/L	32.5	35.6	18.3 - 45.8	A
			GR-B	pCi/L	24.3	25.6	16.0 - 33.6	A
			U-Nat	pCi/L	36.6	37.0	30.0 - 40.9	A
			H-3	pCi/L	6270	6250	5390 - 6880	A
November 2017	111317O	Water	Sr-89	pCi/L	57.1	50.0	39.4 - 57.5	A
			Sr-90	pCi/L	27.1	41.8	30.8 - 48.0	N ⁽²⁾

(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 17-09

(2) See NCR 17-19

TABLE D-4 SUSQUEHANNA REMP LABORATORY SPIKE PROGRAM
ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM - 2017
QUALITY CONTROL SPIKE PROGRAM
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES (TBE)
(PAGE 1 OF 4)

Month/Year	Identification Number	Matrix	Nuclide	Units	Analytics Calculated Results (a)	TBE Results (a)	TBE/Analytics Ratio
September 2017	E11962	Soil	Ce-141	pCi/kg	142 ± 5	148 ± 22	1.04
			Cr-51	pCi/kg	355 ± 12	329 ± 126	0.93
			Cs-134	pCi/kg	328 ± 11	295 ± 13	0.90
			Cs-137	pCi/kg	281 ± 9	361 ± 15	1.28
			Co-58	pCi/kg	191 ± 6	181 ± 16	0.95
			Mn-54	pCi/kg	201 ± 7	215 ± 15	1.07
			Fe-59	pCi/kg	205 ± 7	243 ± 26	1.18
			Zn-65	pCi/kg	301 ± 10	293 ± 28	0.97
			Co-60	pCi/kg	429 ± 14	400 ± 14	0.93
March 2017	E11798	Milk	I-131	pCi/L	71.9 ± 2	75.4 ± 3	1.05
			Ce-141	pCi/L	257 ± 9	233 ± 11	0.91
			Cr-51	pCi/L	515 ± 17	475 ± 47	0.92
			Cs-134	pCi/L	213 ± 7	181 ± 6	0.85
			Cs-137	pCi/L	248 ± 8	232 ± 8	0.93
			Co-58	pCi/L	266 ± 9	240 ± 10	0.90
			Mn-54	pCi/L	292 ± 10	281 ± 9	0.96
			Fe-59	pCi/L	229 ± 8	240 ± 11	1.05
			Zn-65	pCi/L	354 ± 12	350 ± 18	0.99
Co-60	pCi/L	325 ± 11	310 ± 7	0.95			
June 2017	E11850	Milk	I-131	pCi/L	98.3 ± 3	102 ± 3	1.04
			Ce-141	pCi/L	252 ± 8	230 ± 9	0.91
			Cr-51	pCi/L	524 ± 18	525 ± 55	1.00
			Cs-134	pCi/L	313 ± 10	269 ± 6	0.86
			Cs-137	pCi/L	250 ± 8	234 ± 9	0.94
			Co-58	pCi/L	259 ± 9	239 ± 9	0.92
			Mn-54	pCi/L	286 ± 10	277 ± 9	0.97
			Fe-59	pCi/L	192 ± 6	197 ± 12	1.02
			Zn-65	pCi/L	339 ± 1	324 ± 16	0.96
Co-60	pCi/L	318 ± 11	307 ± 7	0.96			
September 2017	E11958	Milk	I-131	pCi/L	57.5 ± 2	76 ± 3	1.32
			Ce-141	pCi/L	108 ± 4	103 ± 13	0.96
			Cr-51	pCi/L	270 ± 9	233 ± 65	0.86
			Cs-134	pCi/L	250 ± 8	218 ± 5	0.87
			Cs-137	pCi/L	214 ± 7	207 ± 8	0.96
			Co-58	pCi/L	146 ± 5	143 ± 8	0.98
			Mn-54	pCi/L	153 ± 5	148 ± 8	0.97
			Fe-59	pCi/L	156 ± 5	167 ± 14	1.07
			Zn-65	pCi/L	229 ± 8	231 ± 17	1.01
Co-60	pCi/L	326 ± 11	317 ± 7	0.97			

**TABLE D-4 SUSQUEHANNA REMP LABORATORY SPIKE PROGRAM
ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM - 2017
QUALITY CONTROL SPIKE PROGRAM
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES (TBE)
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Month/Year	Identification Number	Matrix	Nuclide	Units	Analytics Calculated Results (a)	TBE Results (a)	TBE/Analytics Ratio
December 2017	E12046	Milk	I-131	pCi/L	55.1 ± 2	67 ± 6	1.21
			Ce-141	pCi/L	96.1 ± 3	105 ± 9	1.09
			Cr-51	pCi/L	237 ± 8	248 ± 66	1.05
			Cs-134	pCi/L	122 ± 4	124 ± 6	1.02
			Cs-137	pCi/L	138 ± 5	160 ± 11	1.16
			Co-58	pCi/L	87.8 ± 3	90 ± 10	1.02
			Mn-54	pCi/L	157 ± 5	163 ± 11	1.04
			Fe-59	pCi/L	111 ± 4	129 ± 15	1.16
			Zn-65	pCi/L	206 ± 7	229 ± 21	1.11
			Co-60	pCi/L	169 ± 6	182 ± 8	1.07
March 2017	E11799	AP Filter	Ce-141	pCi/L	98.2 ± 3	92 ± 13	0.94
			Cr-51	pCi/L	196 ± 7	219 ± 85	1.12
			Cs-134	pCi/L	81.2 ± 3	80 ± 7	0.99
			Cs-137	pCi/L	94.7 ± 3	98 ± 13	1.04
			Co-58	pCi/L	101 ± 4	91 ± 11	0.90
			Mn-54	pCi/L	111 ± 4	112 ± 12	1.01
			Fe-59	pCi/L	87.2 ± 3	83 ± 18	0.96
			Zn-65	pCi/L	135 ± 5	138 ± 20	1.02
			Co-60	pCi/L	124 ± 4	136 ± 9	1.10
			March 2017	E11800	AP Filter	Ce-141	pCi
Cr-51	pCi	211 ± 7				182 ± 68	0.86
Cs-134	pCi	87.1 ± 3				84 ± 7	0.96
Cs-137	pCi	102 ± 4				105 ± 12	1.03
Co-58	pCi	109 ± 4				101 ± 13	0.93
Mn-54	pCi	119 ± 4				124 ± 13	1.04
Fe-59	pCi	93.6 ± 3				101 ± 21	1.08
Zn-65	pCi	145 ± 5				127 ± 25	0.88
Co-60	pCi	133 ± 5				162 ± 11	1.22
March 2017	E11801	AP Filter				Ce-141	pCi
			Cr-51	pCi	202 ± 7	234 ± 67	1.16
			Cs-134	pCi	83.6 ± 3	82 ± 8	0.98
			Cs-137	pCi	97.5 ± 3	102 ± 15	1.04
			Co-58	pCi	104 ± 4	101 ± 13	0.97
			Mn-54	pCi	115 ± 4	122 ± 12	1.06
			Fe-59	pCi	89.8 ± 3	100 ± 18	1.11
			Zn-65	pCi	139 ± 5	135 ± 23	0.97
			Co-60	pCi	127 ± 4	164 ± 10	1.29

**TABLE D-4 SUSQUEHANNA REMP LABORATORY SPIKE PROGRAM
ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM - 2017
QUALITY CONTROL SPIKE PROGRAM
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES (TBE)
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Month/Year	Identification		Nuclide	Units	Analytics	TBE	TBE/Analytics
	Number	Matrix			Calculated Results (a)	Results (a)	Ratio
June 2017	E11851	AP Filter	Ce-141	pCi	120 ± 4	117 ± 15	0.98
			Cr-51	pCi	249 ± 9	259 ± 82	1.04
			Cs-134	pCi	149 ± 5	151 ± 8	1.01
			Cs-137	pCi	119 ± 4	117 ± 13	0.98
			Co-58	pCi	123 ± 4	121 ± 13	0.99
			Mn-54	pCi	136 ± 5	129 ± 15	0.95
			Fe-59	pCi	91.0 ± 3	92 ± 17	1.01
			Zn-65	pCi	161 ± 6	153 ± 26	0.95
			Co-60	pCi	151 ± 5	174 ± 10	1.15
June 2017	E11852	AP Filter	Ce-141	pCi	120 ± 4	121 ± 12	1.01
			Cr-51	pCi	250 ± 9	240 ± 75	0.96
			Cs-134	pCi	149 ± 5	155 ± 9	1.04
			Cs-137	pCi	119 ± 4	125 ± 12	1.05
			Co-58	pCi	123 ± 4	122 ± 14	0.99
			Mn-54	pCi	136 ± 5	132 ± 16	0.97
			Fe-59	pCi	91.3 ± 3	89 ± 19	0.97
			Zn-65	pCi	161 ± 6	160 ± 24	1.00
			Co-60	pCi	151 ± 5	175 ± 11	1.16
June 2017	E11853	AP Filter	Ce-141	pCi	119 ± 4	129 ± 14	1.09
			Cr-51	pCi	247 ± 9	225 ± 97	0.91
			Cs-134	pCi	148 ± 5	149 ± 9	1.00
			Cs-137	pCi	118 ± 4	130 ± 14	1.10
			Co-58	pCi	122 ± 4	118 ± 13	0.96
			Mn-54	pCi	135 ± 5	142 ± 14	1.05
			Fe-59	pCi	90.5 ± 3	83 ± 17	0.91
			Zn-65	pCi	160 ± 6	153 ± 25	0.95
			Co-60	pCi	150 ± 5	175 ± 11	1.16
December 2017	E12047A	AP Filter	Ce-141	pCi	61.8 ± 2	52 ± 13	0.84
			Cr-51	pCi	152 ± 5	147 ± 69	0.97
			Cs-134	pCi	78.4 ± 3	85 ± 12	1.09
			Cs-137	pCi	88.8 ± 3	92 ± 12	1.04
			Co-58	pCi	56.5 ± 2	55 ± 11	0.98
			Mn-54	pCi	101 ± 4	102 ± 12	1.01
			Fe-59	pCi	71.2 ± 2	61 ± 19	0.86
			Zn-65	pCi	133 ± 5	137 ± 27	1.03
			Co-60	pCi	109 ± 4	141 ± 11	1.29

**TABLE D-4 SUSQUEHANNA REMP LABORATORY SPIKE PROGRAM
ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM - 2017
QUALITY CONTROL SPIKE PROGRAM
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES (TBE)
(PAGE 4 OF 4)**

Month/Year	Identification Number	Matrix	Nuclide	Units	Analytics Calculated Results (a)	TBE Results (a)	TBE/Analytics Ratio
December 2017	E12048A	AP Filter	Ce-141	pCi	102 ± 3	94 ± 12	0.92
			Cr-51	pCi	251 ± 9	199 ± 79	0.79
			Cs-134	pCi	129 ± 5	132 ± 9	1.02
			Cs-137	pCi	146 ± 5	158 ± 15	1.08
			Co-58	pCi	93.1 ± 3	88 ± 13	0.94
			Mn-54	pCi	166 ± 6	161 ± 15	0.97
			Fe-59	pCi	117 ± 4	119 ± 21	1.01
			Zn-65	pCi	219 ± 8	192 ± 27	0.87
			Co-60	pCi	179 ± 6	204 ± 11	1.14
December 2017	E12049A	AP Filter	Ce-141	pCi	75.2 ± 3	64 ± 10	0.85
			Cr-51	pCi	185 ± 6	226 ± 85	1.22
			Cs-134	pCi	95.5 ± 3	101 ± 13	1.05
			Cs-137	pCi	108 ± 4	108 ± 11	1.00
			Co-58	pCi	68.8 ± 2	70 ± 13	1.02
			Mn-54	pCi	123 ± 4	129 ± 14	1.04
			Fe-59	pCi	86.8 ± 3	78 ± 19	0.89
			Zn-65	pCi	162 ± 6	160 ± 21	0.99
			Co-60	pCi	132 ± 5	160 ± 11	1.21
March 2017	E11805	Water	H-3	pCi/L	4900 ± 163	4480 ± 398	0.91
June 2017	E11854	Water	H-3	pCi/L	4790 ± 160	4900 ± 539	1.02
September 2017	E11963	Water	H-3	pCi/L	2820 ± 94	2770 ± 262	0.98
December 2017	E12053	Water	H-3	pCi/L	4710 ± 157	4420 ± 397	0.94
March 2017	E11802	Charcoal	I-131	pCi	94.4 ± 3	97 ± 3	1.02
March 2017	E11803	Charcoal	I-131	pCi	95.0 ± 3	97 ± 3	1.02
March 2017	E11804	Charcoal	I-131	pCi	95.1 ± 3	93 ± 3	0.97
September 2017	E11959	Charcoal	I-131	pCi	64.9 ± 2	67 ± 8	1.04
September 2017	E11960	Charcoal	I-131	pCi	87.1 ± 3	88 ± 9	1.01
September 2017	E11961	Charcoal	I-131	pCi	74.9 ± 3	77 ± 21	1.03
December 2017	E12050	Charcoal	I-131	pCi	64 ± 2	65 ± 4	1.02
December 2017	E12051	Charcoal	I-131	pCi	38 ± 1	41 ± 3	1.06
December 2017	E12052	Charcoal	I-131	pCi	57 ± 2	58 ± 3	1.01

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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	2010	2011	2012	2013	2014	2015	2016	2017
Air Particulate & Charcoal	3S2	SSES Backup Met. Tower	99.9	99.3	98.9	99.9	100	99	100	99.9
	12S1	West Building	99.9	100	99.9	99.9	100	100	100	99.1
	13S6	Former Laydown Area, West of Confers Lane	100	99.7	99.1	99.9	100	97	100	100
	12E1	Berwick Hospital	100	100	99.9	100.0	100	10	99.1	100
	6G1	Freeland Substation	100	100	99.9	99.9	100	90*	100	100
	8G1	PPL System Facilities Center, Humboldt Industrial Park	99.7	100	99.8	99.9	100	100	100	99.2
Drinking Water	10S3	E of Confers Lane, S of Towers Club	-	-	-	-	-	-	100	99.5
	9B1	Transmission Line, E of Route 11	-	-	-	-	-	-	100	99.9
Surface Water	12H2	Danville Water Company	100	100	100	100.0	100	100	100	100
	2S7	Cooling Tower Blowdown Discharge Line	98.0	99.1	98.1	98.1	69**	100	99.1	100
	6S6	River Water Intake Line	100	95.5	93.4	93.2	93	98	99.7	99.9

* Planned power outage by Electric Utilities

** Auto-Composite sampler problems, March through June. New Auto-Composite sampler installed in July.