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APR 15 2019

U. S. Nuclear Regulatory Commission
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10 CFR 50.4

SUSQUEHANNA STEAM ELECTRIC STATION
ANNUAL RADIOLOGICAL ENVIRONMENTAL
OPERATING REPORT **Docket No. 50-387**
PLA-7769 **50-388**

In accordance with the Susquehanna Steam Electric Station (SSES) Units 1 and 2 Technical Specification 5.6.2, the SSES Annual Radiological Environmental Operating Report is hereby submitted for the 2018 calendar year.

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

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

Kevin Cimorelli

Attachment: 2018 Annual Radiological Environmental Operating Report

Copy: NRC Region I
Ms. T. E. Hood, NRC Project Manager
Ms. J. Tobin, NRC Project Manager
Ms. L. H. Micewski, NRC Sr. Resident Inspector
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Attachment to PLA-7769

2018 Annual Radiological Environmental Operating Report

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 and 2

Annual Radiological
Environmental Operating Report

2018

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SUSQUEHANNA STEAM ELECTRIC STATION

Units 1 & 2

2018 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

JANUARY 1 TO DECEMBER 31, 2018

Susquehanna Nuclear, LLC
Berwick, PA
April, 2019

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I. Summary

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

Applied Ecoscience, Inc. was responsible for the collection of environmental samples during 2018. Teledyne Brown Engineering (TBE) was responsible for the analysis of environmental samples during 2018. The results are discussed in this report**.** Landauer provided the dosimetry services for SSES during 2018.

This Annual Radiological Environmental Operating Report (AREOR) conducted for SSES covers the period January 1, 2018 through December 31, 2018. During that time period, 1444 analyses were performed on 1234 samples.

Tritium (H-3) is the only man-made radionuclide detected in the environment by the Susquehanna Steam Electric Station (SSES) Radiological Environmental Monitoring Program (REMP) that is attributable to station operations. The whole body and organ dose to members of the public attributable to tritium identified in REMP cooling tower blowdown samples was 3.17E-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. The 2018 average concentration of tritium in the cooling tower blowdown water and the 2018 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 2018 was 35.3 curies.

The 2018 average dilution factor for the Susquehanna River was 1,036, based on the annual average river flow of 1.14E+07 gpm and the annual average cooling tower blowdown flow of 1.10E+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 2018 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 2018 verify the adequacy of the SSES radioactive effluent control systems.

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

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

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 and naturally occurring thorium-228 (Th-228) were detected at levels consistent with those detected in previous years. No fission or activation products were detected.

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

products were detected.

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

Soil sample collection was discontinued in 2018. 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 K-40 and Th-228 was detected in several samples at levels that are 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. Naturally occurring Ra-226, Ac-228 and Th-228 were detected in shoreline sediment at levels consistent with results in previous years. No fission or activation products were detected in fish or sediment samples.

II. The Radiological Environmental Monitoring Program

The Susquehanna Steam Electric Station (SSES) is a nuclear electrical generating 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, 2018, 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

Surface water auto-composite sampler at station 6S6 was removed from service for approximately 1 hour on the following dates for routine maintenance (sample line cleaning): May 21, 2018; June 18, 2018; September 17, 2018; December 17, 2018. The auto-composite sampler was successfully returned to service following the routine maintenance work on each of the dates referenced above.

See Exceptions Table 2018 REMP Atypical Sampling Occurrences

B. Program Changes

The program changes for 2018 are as follows. Changes were part of REMP program consolidation efforts by Talen Energy.

Soil collection from all stations was discontinued in 2018.

Precipitation collection from stations 3S2, 12S1, 8G1, and 10S3 was discontinued as of May 30th 2018.

Air particulate and Charcoal collection from station 6G1 was discontinued as of May 30th 2018.

Groundwater collection from stations 12F3, 2S2, 4S4, 6S10, and 11S2 was discontinued as of May 30th 2018.

Surface water collection from stations 4S7, LTAW, 5S12, and 7S12 was discontinued as of May 30th 2018.

Exceptions Table

2018 REMP Atypical Sampling Occurrences

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
JAN	Air	10S3	12/27/17 to 01/03/18 Flow rate upon arrival was 1.6 cfm, below the procedural range of 2.0-2.4 cfm. This was due to a loose fitting on the pump. Continuous sampling during sample period.	CA #18-01 CR 2018-00148 01/03/18: Loose fitting was tightened, and air flow restored to 2.2 cfm. 01/03/18: Operability verified @ 0925 hours. *Ideal sample collected for sample period: 20,100 cf.*
	Air	10S3	01/03/18 to 01/10/18 (loss of 0.2 hours) Power outage date and time unknown. Loss of 0.2 hours as determined by timer box during weekly collection. Non-continuous sampler operation.	CA #18-03 CR 2018-01082 01/10/18: No action required. Air monitor resumed normal operation when power was restored. 01/10/18: Operability verified @ 0919 hours. *Ideal sample collected for sample period: 22,500 cf.*
	Surface Water	2S7	01/09/18 to 01/15/18 (week 3 January composite) ACS automatically shut off on 01/14/18 @ approximately 0300 hours when the float weight was tripped. Greater than normal volume of water collected for week, possibly due to air bubbles in the sample line.	CA #18-04 CR 2018-01333 01/15/18: Sample line tubing was cleared of air. Sampler was calibrated to within procedural range. 01/15/18: Operability verified @ 1344 hours. *Ideal sample collected for sample period.*

Exceptions Table (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
JAN (cont.)	Surface Water	2S7	01/23/18 to 01/30/18 (week 1 February composite) ACS sample line presumably blocked with sediment and will not draw liquid. Calibration/volume verification not possible due to lack of water in line.	CA #18-05 CR 2018-02015 01/30/18: Grab samples collected at 2S7 and 6S6 for comparative analysis. 02/01/18: FIN unsuccessful in clearing sample line. Sample line switched to Chemistry's side of sampling station. Delayed start for week 2 February composite. 02/01/18: Operability verified @ 1354 hours. *Ideal sample collected for sample period.*
FEB	Air	10S3	01/31/18 to 02/06/18 (loss of 0.8 hours) Power outage date and time unknown. Loss of 0.8 hours as determined by timer box during weekly collection. Non-continuous sampler operation.	CA #18-06 CR 2018-02429 02/06/18: No action required. Air monitor resumed normal operation when power was restored. 02/06/18: Operability verified @ 0856 hours. *Ideal sample collected for sample period: 19,600 cf.*
	Surface Water	6S6	02/13/18 to 02/20/18 (week 4 February composite) ACS out of service for approximately 1 hour for routine maintenance by I&C.	CA #18-07 CR 2018-02986 02/20/18: CR generated by I&C. No corrective action required since this was routine maintenance. PM date will be noted on sample collection form. 02/20/18: Operability verified @ 1132 hours *Ideal sample collected for sample period.*

Exceptions Table (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
FEB (cont.)	Air	3S2	02/14/18 to 02/21/18 Timer box #6 failed to advance past 1.0 for sample period. Timer box malfunction did not affect normal sample collection. Continuous sampling during sample period.	CA #18-08 CR 2018-03069 02/21/18: Timer box #6 was replaced with timer box #2. 02/21/18: Operability verified @ 0829 hours. *Ideal sample collected for sample period: 21,200 cf.*
MAR	Air	12S1	02/28/18 to 03/06/18 (loss of 13.3 hours) 12kV Power outage occurred @ 2200 hours on 03/01/18. Loss of 13.3 hours as determined by timer box. Non-continuous sampler operation.	CA #18-09 CR 2018-03535 03/02/18: No action required. Air monitor resumed normal operation when power was restored. 03/02/18: Operability verified @ 1158 hours. *Ideal sample collected for sample period: 16,400 cf.*
	Air	12S1	03/06/18 to 03/14/18 (loss of 9.0 hours) 12kV Power outage due to scheduled repair work (RLW02158245) occurred on 03/10/18. Loss of 9.0 hours as determined by timer box. Non-continuous sampler operation.	CA #18-10 CR 2018-03856 03/10/18: No action required. Air monitor resumed normal operation when power was restored. 03/12/18: Operability verified @ 0920 hours. *Ideal sample collected for sample period: 22,700 cf.*

Exceptions Table (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
MAR (cont.)	Air	13S6 & 13S6Q	03/06/18 to 03/14/18 (loss of 4.5 hours) Power outage date and time unknown. Loss of 4.5 hours as determined by timer boxes during weekly collection. Non-continuous sampler operation.	CA #18-11 CR 2018-04011 03/14/18: No action required. Air monitors resumed normal operation when power was restored. 03/14/18: Operability verified @ 0802 hours for 13S6 and 13S6Q. *Ideal samples collected for sample period:* *24,800 cf.- 13S6* *25,100 cf.- 13S6Q*
APR	Air	9B1	03/28/18 to 04/04/18 Air flow verification failure due to defective coupler on air sampler. Defective coupler allowed a small amount of air to bypass the sample head. Air flow verification of <0.1 cf/30 seconds unachievable. Continuous sampling during sample period.	CA #18-12 CR 2018-05238 04/05/18: All four O-rings and one (quick connect) coupler were replaced. Equipment restored to service and air flow verification successfully performed. 04/05/18: Operability verified @ 1530 hours. *Ideal sample collected for sample period:* *22,600 cf.*
MAY	Air	12S1	04/25/18 to 05/02/18 Flow rate upon arrival was 1.8 cfm, below the procedural range of 2.0-2.4 cfm. Procedural range unachievable with pump settings at maximum due to pump malfunction. Continuous sampling during sample period.	CA #18-13 CR 2018-07291 05/02/18: Pump was replaced, and air flow verification was performed. 05/02/18: Operability verified @ 0931 hours. *Ideal sample collected for sample period:* *17,000 cf.*

Exceptions Table (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
MAY (cont.)	Air	12S1	05/09/18 to 05/16/18 (momentary loss of 12kV power) Momentary loss of power on 05/15/18. No loss of sampling time as determined by timer box during weekly collection. Non-continuous sampler operation.	CA #18-14 CR 2018-07883 05/15/18: No action required. Air monitor resumed normal operation when power was restored. 05/16/18: Operability verified @ 0839 hours. *Ideal sample collected for sample period: 21,900 cf.*
	Air	10S3	05/09/18 to 05/16/18 (loss of 3.9 hours) Power outage date and time unknown. Loss of 3.9 hours as determined by timer box during weekly collection. Non-continuous sampler operation.	CA #18-15 CR 2018-07949 05/16/18: No action required. Air monitor resumed normal operation when power was restored. 05/16/18: Operability verified @ 0852 hours. *Ideal sample collected for sample period: 21,300 cf.*
	Air	3S2	05/23/18 to 05/30/18 Timer box failed to advance past 0.1 for sample period. Due to placement and pump vibration, the power toggle was bumped to the “off” position. Timer box malfunction did not affect normal sample collection. Continuous sampling during sample period.	CA #18-16 CR 2018-08622 05/30/18: Timer box was placed away from pump and was monitored. 05/30/18: Operability verified @ 0749 hours. *Ideal sample collected for sample period: 21,700 cf.*

Exceptions Table (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
MAY (cont.)	Surface Water	2S7	05/30/18 (week 1 June composite) CTBD secured on 05/30/18 for clean out of MH-PD-07. No effect on continuous sampler operation.	CA #18-17 OP 142-001 05/30/18: No corrective action required. Sampler maintained normal operation while blowdown was secured. 05/30/18: Operability verified @ 0912 hours. *Ideal sample collected for sample periods.*
JUN	Surface Water	6S6	06/05/18 to 06/12/18 (week 2 June composite) Diminished sample flow (<0.1 gpm) at ACS as discovered during weekly collection.	CA #18-18 CR 2018-09248 06/12/18: Adequate sample volume collected during sample period. Maintenance requested. 06/18/18: Maintenance performed by I&C and sample flow restored to 1.5 gpm. 06/19/18: Operability verified @ 0843 hours. *Ideal sample collected for sample periods.*
	Air	12S1	06/13/18 to 06/20/18 (momentary loss of 12kV power) Momentary loss of power on 06/14/18. No loss of sampling time as determined by timer box. Non-continuous sampler operation.	CA #18-19 CR 2018-09406 06/14/18: No action required. Air monitor resumed normal operation when power was restored. 06/14/18: Operability verified @ 1512 hours. *Ideal sample collected for sample period: 21,700 cf.*

Exceptions Table (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
JUN (cont.)	Air	12S1	06/20/18 to 06/27/18 Timer box failed to advance for sample period due to reset button being stuck in depressed state. Continuous sampling during sample period.	CA #18-20 CR 2018-09862 06/27/18: Timer box reset button was fixed and monitored to ensure it was advancing. 06/27/18: Operability verified @ 0903 hours. *Ideal sample collected for sample period: 21,600 cf.*
	Air	12S1	06/27/18 to 07/03/18 (loss of 2.3 hours) 12kV Power outage occurred @ 1023 hours on 06/27/18. Loss of 2.3 hours as determined by timer box. Non-continuous sampler operation.	CA #18-21 CR 2018-09859 06/27/18: No action required. Air monitor resumed normal operation when power was restored. 06/27/18: Operability verified @ 1334 hours. *Ideal sample collected for sample period: 17,900 cf.*
JUL	Air	3S2	06/27/18 to 07/03/18 Timer box #2 failed to advance past 1.8 for sample period. Continuous sampling during sample period.	CA #18-22 CR 2018-10132 07/03/18: Timer box #2 replaced with timer box #6. 07/03/18: Operability verified @ 0900 hours. *Ideal sample collected for sample period: 18,500 cf.*
	Air	12S1	07/11/18 to 07/18/18 (momentary loss of 12kV power) Momentary loss of power on 07/15/18 @ 0715 hours and 0809 hours. Non-continuous sampler operation.	CA #18-23 CR 2018-10553 07/15/18: No action required. Air monitor resumed normal operation when power was restored. 07/17/18: Operability verified @ 0900 hours. *Ideal sample collected for sample period: 23,300 cf.*

Exceptions Table (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
JUL (cont.)	Air	12S1	07/11/18 to 07/18/18 On 07/17/18 timer box #9 was found to be running in reverse while performing operability verification following a momentary loss of 12 kV power on 07/15/18. Non-continuous sampler operation during sample period due to momentary loss of 12 kV power on 07/15/18 (CA #18-23, CR 2018-10553).	CA #18-24 CR 2018-10688 07/17/18: Timer box #9 replaced with timer box #5. 07/17/18: Operability verified @ 0943 hours. *Ideal sample collected for sample period: 23,300 cf.*
	Air	12S1	07/18/18 to 07/25/18 (momentary loss of 12kV power) Momentary loss of power on 07/23/18 @ 1300 hours. No loss of sampling time as determined by timer box. Non-continuous sampler operation.	CA #18-25 CR 2018-10930 07/23/18: No action required. Air monitor resumed normal operation when power was restored. 07/24/18: Operability verified @ 0925 hours. *Ideal sample collected for sample period: 23,800 cf.*
	Air	10S3	07/18/18 to 07/25/18 Flow rate upon arrival was 1.0 cfm, below the procedural range of 2.0-2.4 cfm. This was due to a loose fitting on the pump. Continuous sampling during sample period.	CA #18-26 CR 2018-11048 07/25/18: Loose fitting was tightened, and air flow restored to 2.2 cfm. 07/25/18: Operability verified @ 0825 hours. *Ideal sample collected for sample period: 16,400 cf.*

Exceptions Table (continued)

Date	Sample Type	Location Code(s)	Sample Period Reason for Occurrence(s)	Corrective Action
JUL (cont.)	Air	12S1	07/25/18 to 08/01/18 (loss of 0.2 hours) 12kV Power outage occurred on 07/25/18. Loss of 0.2 hours as determined by timer box. Non-continuous sampler operation.	CA #18-27 CR 2018-11066 07/25/18: No action required. Air monitor resumed normal operation when power was restored. 07/26/18: Operability verified @ 0820 hours. *Ideal sample collected for sample period: 23,700 cf.*
AUG	Air	3S2, 13S6, 9B1	07/25/18 to 08/01/18 Power outage dates and times unknown. Loss of 2.5 hours at 3S2 and 9B1, and loss of 2.7 hours at 13S6, as determined by timer boxes during weekly collection. Non-continuous sampler operation.	CA #18-28 CR 2018-11422 08/01/18: No action required. Air monitors resumed normal operation when power was restored. 08/01/18: Operability verified @ 0801 hours for 3S2, @ 0814 hours for 13S6, and @ 1118 hours for 9B1. *Ideal samples collected for sample period:* *22,500 cf.- 3S2* *22,200 cf.- 13S6* *22,600 cf.- 9B1*
NOV	Air	8G1	10/31/18 to 11/07/18 (loss of 1.1 hours) Power outage date and time unknown. Loss of 1.1 hours as determined by timer box during weekly collection. Non-continuous sampler operation.	CA #18-29 CR 2018-15506 11/07/18: No action required. Air monitor resumed normal operation when power was restored. 11/07/18: Operability verified @ 1038 hours. *Ideal sample collected for sample period: 22,800 cf.*

D. Quality Assurance Program

Teledyne Brown Engineering

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

E. Summary of Results – Inter-Laboratory Comparison Program

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

1. Analytics Evaluation Criteria

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

2. ERA Evaluation Criteria

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

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

3. DOE Evaluation Criteria

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

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

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

Teledyne Brown Engineering

For the TBE laboratory, 164 out of 172 analyses performed met the specified acceptance criteria. Six analyses did not meet the specified acceptance criteria for the following reasons and were addressed through the TBE Corrective Action Program.

1. TBE was unable to report the February 2018 DOE MAPEP vegetation Sr-90 result due to QC failure and limited sample amount. (NCR 18-09)

2. The Analytics September 2018 milk Fe-59 result was evaluated as Not Acceptable (Ratio of TBE to known result at 133%). The reported value was 158 ± 17.6 pCi/L and the known value was 119 ± 19.9 pCi/L. No cause for the failure could be determined. TBE has passed 24 of the previous 27 milk cross-check results since 2012. This sample was run in duplicate on a different detector with comparable results (162 +/- 16 pCi/L). NOTE: TBE's 4th Qtr. result passed at 105%. (NCR 18-20)

3. The Analytics September milk I-131 result was evaluated as Not Acceptable (Ratio of TBE to known result at 143%). Due to a personnel change in the gamma prep lab, the sample was not prepped/counted in a timely manner such as to accommodate the I-131 8-day half-life. Analysts have been made aware of the urgency for this analysis and it will be monitored more closely by QA. NOTE: TBE's 4th Qtr. result passed at 101% (NCR 18-24)

4. The Analytics September soil Cr-51 result was evaluated as Not Acceptable (Ratio of TBE to known result at 131%). As with #3 above, the sample was not prepped/counted in a timely manner such as to accommodate the Cr-51 27-day half-life. The same corrective action applies here as in #3. (NCR 18-21)

5. The MAPEP November vegetation Sr-90 result of 0.338 Bq/sample was evaluated as Not Acceptable (Lower acceptable range was 0.554 Bq/sample). It appears that there has been incomplete dissolution of Sr-90 due to the composition of the MAPEP vegetation "matrix". To resolve this issue, the TBE-2018 procedure has been modified to add

H2O2 to assist in breaking down the organic material that comprises this “matrix”. This corrective action will be monitored closely by QA. (NCR 18-25).

6. The ERA November 2018 water Sr-90 sample was evaluated as Not Acceptable. TBE’s initial reported result of 36.8 pCi/L exceeded the upper acceptance range (22.9 – 36.4 pCi/L). After reviewing the data for this sample, it was discovered that there was a typographical error at the time the results were entered at the ERA website. The correct result in LIMS of 36.2 should have been submitted instead. This result is within ERA’s acceptance limits. In addition to the typo error, ERA’s very stringent upper acceptance limit of 116% is not a reflection of TBE’s ability to successfully perform this analysis. (NCR 18-23)

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

IV. Results and Discussion

The analytical results of the 2018 REMP samples are divided into categories based on exposure pathways: atmospheric, direct radiation, terrestrial, and aquatic. The analytical results for the 2018 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). Station 6G1 was discontinued after May 3th 2018. 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 312 of 312 of the indicator location samples at concentrations ranging from 5 to 23 E-3 pCi/m^3 with an average concentration of 12 E-3 pCi/m^3, and in 73 of 73 of the control location samples at concentrations ranging from 4 to 24 E-3 pCi/m^3 with an average of 12 E-3 pCi/m^3. The maximum preoperational level detected was 102 E-3 pCi/m^3 with an average concentration of 62 E-3 pCi/m^3. (Table C–1, Appendix C); Historical levels of gross beta are shown in Figure C-1. Results for gross beta analysis from 1974 to current year are plotted.

Gamma Spectrometry

Gamma spectrometry was performed on each of the 30 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 58 E-3 to 161 E-3 pCi/m^3 with an average concentration of 97 E-3 pCi/m^3, and in the six control location composites ranging in concentration from 90 to 108 E-3 pCi/m^3 with an average concentration of 97 E-3 pCi/m^3.

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

All other gamma emitters were less than the LLD.

2. Air Iodine

Filtered air iodine samples were collected weekly at six indicator locations (3S2, 9B1, 10S3, 12E1, 12S1, and 13S6) and two control locations (6G1 and 8G1). Station 6G1 was discontinued after May 3th 2018. 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 2018, including 32 site boundary locations, 14 outer distant locations, six special interest locations and five control locations.

The indicator locations annual average dose rate was 16.3 milliroentgen per standard quarter. The annual average dose rate for the control locations was 14.4 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 2018 confirmed that the radiation levels in the vicinity of the SSES were similar to previous years. (Table C–4, Appendix C); Figure C-2 – Ambient Radiation Levels Based on Environmental Dosimetry Data from 1973 to current year are plotted as quarterly averages.

C. Terrestrial

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

1. Milk

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

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

Iodine-131

Iodine-131 was not detected above minimum detectable concentration in any of the 60 samples analyzed. Preoperational data is not available for comparison. (Table C-5, Appendix C); Figure C-3 – Iodine-131 Activity in Milk results from 1976 to 2018 are plotted.

Gamma Spectrometry

Naturally occurring K-40 was detected in all 60 samples with concentrations for the 40 indicator location samples ranging from 1,055 to 1,623 pCi/L with an average concentration of 1,268 pCi/L, and the 20 control location sample concentrations ranging from 1,055 to 1,458 pCi/L with an average concentration of 1,277 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).Stations 12F3, 2S2, 4S4, 6S10, and 11S2 were discontinued after May 30th 2018. Each sample was analyzed for H-3 and gamma emitters.

Tritium

Tritium activity was detected above the minimum detectable concentration in 11 of the 48 indicator location samples with concentrations ranging from 147 to 354 pCi/L with an average concentration of 200 pCi/L. No H-3 was detected in the control

location sample. 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 2018 are plotted.

Gamma Spectrometry

Naturally occurring K-40 was not detected in any of the indicator or control samples. Preoperational data is not available for comparison. (Table C-6, Appendix C)

Naturally occurring Th-228 was detected in one of the 48 indicator samples at a concentration of 9 pCi/L. 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 four of the 12 drinking water samples. Sample concentrations ranged from 2 to 3 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 2018 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 (fruit, vegetable, and broadleaf) were analyzed for gamma emitters and included soy beans, 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 23 of the 34 indicator location samples with concentrations ranging from 313 to 1,038 pCi/kg wet with an average concentration of 581 pCi/kg wet, and in 11 of the control location samples with concentrations ranging from 246 to 850 pCi/kg wet with an average concentration of 540 pCi/kg wet. Preoperational data is not available for comparison.

Naturally occurring K-40 was detected in all 34 indicator location samples with concentrations ranging from 1,688 to 16,720 pCi/kg wet with an average concentration of 4,355 pCi/kg wet, and in all 15 control location samples with concentrations ranging from 2,599 to 4,927 pCi/kg wet with an average concentration of 3,815 pCi/kg wet. The maximum preoperational level detected was 4,800 pCi/kg wet with an average concentration of 2,140 pCi/kg wet.

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

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

All other gamma emitters were less than the LLD.

D. Aquatic

Aquatic samples include surface water, fish and sediment samples.

1. Surface Water

Surface water samples were collected routinely at six indicator locations (6S5, 2S7, LTAW, 4S7, 5S12, 5S9 and 7S12) and one control location (6S6). Stations 4S7, LTAW, 5S12, and 7S12 were discontinued after May 30th 2018. Samples were not collected at station 5S9 in 2018. Each sample was analyzed for H-3 and gamma emitters.

Tritium

Tritium activity was detected in 16 of 33 indicator location samples with concentrations ranging from 169 to 6,170 pCi/L with an average concentration of 1,217 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 2018. 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-10, Appendix C) Figure C-6 – Tritium Activity in Surface Water, results from 1972 to 2018 are plotted.

Gamma Spectrometry

Naturally occurring K-40 was detected in two of the indicator location samples with concentrations ranging from 45 pCi/L to 101 pCi/L with an average concentration of 73 pCi/L and one control location sample with a concentration of 47 pCi/L. Preoperational data is not available for comparison.

Naturally occurring Th-228 was detected in two indicator location samples with concentrations ranging from 5.6 pCi/L to

5.8 pCi/L with an average concentration of 5.7 pCi/L, and was detected in one of the control location samples with a concentration of 12 pCi/L. Preoperational data is not available for comparison. (Table C-10, 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-10, Appendix C)

All other gamma emitters were less than the LLD.

2. Fish

Edible species of fish were collected in the spring and fall of 2018 at two indicator locations (IND [Susquehanna River] and LTAW (only collected in the fall)) and one control location (2H [Susquehanna River]). Each sample was analyzed for gamma emitters.

Gamma Spectrometry

Naturally occurring K-40 was detected in all indicator location samples at concentrations ranging from 2,666 to 5,034 pCi/kg wet with an average concentration of 3,597 pCi/kg wet, and in all control location samples at concentrations ranging from 2,913 to 4,598 pCi/kg wet with an average concentration of 3,517 pCi/kg wet. The maximum preoperational level detected was 3,600 pCi/kg dry with an average concentration of 3,871 pCi/kg dry. (Table C–11, Appendix C)

All other gamma emitters were less than the LLD

3. Shoreline Sediment

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

Gamma Spectroscopy

Naturally occurring K-40 was detected in all four of the indicator location samples at concentrations ranging from 7,160 to 10,320 pCi/kg dry with an average concentration of 8,323 pCi/kg dry, and in all of the control location samples with concentrations ranging from 10,830 to 14,350 pCi/kg dry with an average concentration of 12,590 pCi/kg dry. The maximum preoperational level detected was 11,000 pCi/kg dry with an average concentration of 8,500 pCi/kg dry.

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

Naturally occurring Ra-226 was detected in three of the indicator location samples with concentrations ranging from 1,524 pCi/kg to 2,800 pCi/kg a concentration of 2,003 pCi/kg dry, and one control location sample with a concentration of 1,547 pCi/kg. 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 605 to 1,024

pCi/kg dry with an average concentration of 835 pCi/kg dry, and in both of the control location samples at concentrations ranging from 912 to 1,184 pCi/kg dry with an average concentration of 1,048 pCi/kg dry. Preoperational data is not available for comparison. (Table C-12, Appendix C)

Naturally occurring Th-228 was detected in all of the four indicator location samples at concentrations ranging from 776 to 965 pCi/kg dry with an average concentration of 863 pCi/kg dry, and in both of the control location samples at concentrations ranging from 956 and 1,429 pCi/kg dry with an average concentration of 1,193 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 2018 LAND USE CENSUS

Applied Ecoscience, Inc. conducted a Land Use Census during the 2018 growing season around SSES to comply with the ODCM. The purpose of the survey was to document the nearest milk animal, residence and garden greater than 50 m^2 (approximately 500 ft^2) producing broad leaf vegetation within a distance of 8 km (approximately 5 miles) in each of the 16 meteorological sectors surrounding the SSES.

Distance in Miles from the SUSQUEHANNA NUCLEAR Reactor Buildings				
Meteorological Sector		Nearest Residence Sept, 2018 miles	Nearest Garden Sept, 2018 miles	Nearest Dairy Farm Sept, 2018 miles
1	N	1.3	3.2	>5.0
2	NNE	1.0	2.3 [a,b,c,e]	>5.0
3	NE	0.9	2.7	>5.0
4	ENE	2.1	2.4 [a,c,f]	>5.0
5	E	1.4	4.9	4.5 [d]
6	ESE	0.5	3.1	>5.0
7	SE	0.6	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 [a,c]	>5.0 [d]
11	SW	1.5	1.9	>5.0
12	WSW	1.3	1.3	1.7 [d]
13	W	1.2	3.2	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
f Rabbits raised for consumption at this location.

The 2018 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 2018 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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[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, 2017 to January 01, 2019

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSIS PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN (3) RANGE		CONTROL LOCATION MEAN (3) RANGE		NUMBER OF NONROUTINE REPORTED MEASURMENTS (4)
Air Particulates	GR-B	385	10	1.202E+01 (312/312)	12E1	1.256E+01	(52/52)	1.167E+01	(73/73)	0
(E-3 pCi/m^3)				(4.600E+00 - 2.300E+01)	4.7 MILES WSW	(4.680E+00 - 2.250E+01)		(4.490E+00 - 2.400E+01)		
	GAMMA	30								
	BE-7	30	N/A	9.717E+01 (24/24)	9B1	1.055E+02	(4/4)	9.673E+01	(6/6)	0
				(5.845E+01 - 1.611E+02)	1.3 MILES SSW	(6.403E+01 - 1.315E+02)		(8.995E+01 - 1.079E+02)		
	K-40	30	N/A	1.287E+00 (24/24)	9B1	8.983E+00	(4/4)	-1.553E+00	(6/6)	0
				(-1.192E+01 - 1.145E+01)	1.3 MILES SSW	(3.822E+00 - 1.145E+01)		(-1.098E+01 - 6.878E+00)		
	CS-134	30	50	2.923E-01 (24/24)	3S2	4.285E-01	(4/4)	-2.613E-01	(6/6)	0
				(-1.188E+00 - 1.044E+00)	0.5 MILES NE	(-9.589E-02 - 1.044E+00)		(-7.604E-01 - 5.060E-01)		
	CS-137	30	60	1.249E-01 (24/24)	12E1	2.268E-01	(4/4)	-2.010E-01	(6/6)	0
				(-6.628E-01 - 6.448E-01)	4.7 MILES WSW	(-5.574E-02 - 5.511E-01)		(-5.804E-01 - 1.354E-01)		
Charcoal	GAMMA	385								
(E-3 pCi/m^3)	I-131	385	70	-4.568E-02 (312/312)	3S2	2.686E-01	(52/52)	-7.010E-01	(73/73)	0
				(-9.475E+00 - 7.800E+00)	0.5 MILES NE	(-9.292E+00 - 7.570E+00)		(-9.482E+00 - 6.876E+00)		
Ambient Radiation	OSLD	227	N/A	1.632E+01 (208/208)	9S2	3.267E+01	(4/4)	1.437E+01	(19/19)	0
(mR/std. qtr.)				(7.717E+00 - 3.509E+01)	0.2 MILES S	(2.634E+01 - 3.509E+01)		(1.049E+01 - 1.820E+01)		
Milk	I-131	60	1	-1.055E-01 (40/40)	10G1	-7.297E-02	(20/20)	-7.297E-02	(20/20)	0
(pCi/Liter)				(-9.780E-01 - 3.590E-01)	14 MILES SSW	(-4.510E-01 - 1.870E-01)		(-4.510E-01 - 1.870E-01)		
	GAMMA	60								
	K-40	60	N/A	1.268E+03 (40/40)	10G1	1.277E+03	(20/20)	1.277E+03	(20/20)	0
				(1.055E+03 - 1.623E+03)	14 MILES SSW	(1.055E+03 - 1.458E+03)		(1.055E+03 - 1.458E+03)		
	CS-134	60	15	-1.382E+00 (40/40)	13E3	-1.141E+00	(20/20)	-2.522E+00	(20/20)	0
				(-1.143E+01 - 4.901E+00)	5.0 MILES W	(-9.320E+00 - 3.501E+00)		(-8.041E+00 - 3.629E+00)		

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Reporting Period: December 28, 2017 to January 01, 2019

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Milk (cont'd) (pCi/Liter)	CS-137	60	18	6.255E-01 (40/40) (-4.459E+00 - 9.184E+00)	5E2 4.5 MILES E	9.618E-01 (-3.355E+00 - 5.406E+00)	(20/20)	5.447E-01 (20/20) (-3.411E+00 - 5.147E+00)	0
	BA-140	60	60	-7.073E-01 (40/40) (-1.937E+01 - 1.622E+01)	13E3 5.0 MILES W	2.166E+00 (-1.244E+01 - 1.622E+01)	(20/20)	-9.601E-01 (20/20) (-2.115E+01 - 1.810E+01)	0
	LA-140	60	15	-2.935E-03 (40/40) (-7.808E+00 - 9.135E+00)	5E2 4.5 MILES E	8.134E-01 (-3.851E+00 - 9.135E+00)	(20/20)	1.551E-01 (20/20) (-4.260E+00 - 5.553E+00)	0
	TH-228	60	N/A	5.549E-01 (40/40) (-1.083E+01 - 7.394E+00)	5E2 4.5 MILES E	1.256E+00 (-7.198E+00 - 7.053E+00)	(20/20)	1.941E-01 (20/20) (-1.092E+01 - 1.658E+01)	0
Ground Water (pCi/Liter)	H-3	50	2000	9.431E+01 (48/48) (-3.630E+01 - 3.540E+02)	1S3 0.1 MILES N	2.178E+02 (1.360E+02 - 3.540E+02)	(4/4)	8.185E+01 (2/2) (7.740E+01 - 8.630E+01)	0
	GAMMA	50							
	K-40	50	N/A	2.720E+00 (48/48) (-8.691E+01 - 6.754E+01)	4S8 0.1 MILES ENE	2.470E+01 (-3.416E+01 - 6.754E+01)	(4/4)	-8.606E+00 (2/2) (-1.593E+01 - -1.281E+00)	0
	MN-54	50	15	-6.542E-01 (48/48) (-8.122E+00 - 2.792E+00)	7S10 0.3 MILES SE	7.614E-01 (-7.994E-01 - 2.497E+00)	(4/4)	3.344E-01 (2/2) (-2.339E-01 - 9.027E-01)	0
	CO-58	50	15	-5.217E-01 (48/48) (-5.521E+00 - 2.651E+00)	6S10 0.4 MILES ESE	1.012E+00 (9.705E-01 - 1.054E+00)	(2/2)	-5.037E-01 (2/2) (-7.648E-01 - -2.425E-01)	0
	FE-59	50	30	3.626E-01 (48/48) (-1.176E+01 - 1.497E+01)	4S9 0.3 MILES ENE	4.621E+00 (-1.817E+00 - 1.497E+01)	(4/4)	9.365E-01 (2/2) (-2.840E-01 - 2.157E+00)	0
	CO-60	50	15	5.891E-01 (48/48) (-4.156E+00 - 5.657E+00)	4S4 0.5 MILES ENE	3.852E+00 (2.047E+00 - 5.657E+00)	(2/2)	6.749E-01 (2/2) (-7.112E-03 - 1.357E+00)	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, 2017 to January 01, 2019

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSIS PERFORMED (1)	LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN (3) RANGE	CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASURMENTS (4)
Ground Water (cont'd) (pCi/Liter)	ZN-65 50	30	-3.005E+00 (48/48) (-2.447E+01 - 7.517E+00)	2S8	1.161E+00 (4/4) (-2.974E+00 - 7.517E+00)	-3.115E+00 (2/2) (-4.430E+00 - -1.800E+00)	0
	NB-95 50	15	1.252E+00 (48/48) (-7.108E+00 - 1.300E+01)	2S8	5.645E+00 (4/4) (2.184E+00 - 1.189E+01)	3.571E+00 (2/2) (1.643E-01 - 6.978E+00)	0
	ZR-95 50	30	-1.294E-01 (48/48) (-6.888E+00 - 6.467E+00)	4S4 0.5 MILES ENE	4.429E+00 (2/2) (2.627E+00 - 6.230E+00)	2.220E+00 (2/2) (1.022E+00 - 3.417E+00)	0
	I-131 50	15	-2.183E-01 (48/48) (-5.428E+00 - 7.161E+00)	13S7 0.2 MILES W	2.256E+00 (4/4) (-1.064E+00 - 7.161E+00)	-5.720E-01 (2/2) (-1.930E+00 - 7.860E-01)	0
	CS-134 50	15	-7.348E-01 (48/48) (-6.565E+00 - 6.949E+00)	2S8	1.597E+00 (4/4) (-2.212E+00 - 6.949E+00)	1.157E+00 (2/2) (5.294E-01 - 1.784E+00)	0
	CS-137 50	18	-6.578E-01 (48/48) (-5.735E+00 - 3.740E+00)	7S11	1.960E+00 (4/4) (1.182E+00 - 3.449E+00)	-3.257E+00 (2/2) (-6.390E+00 - -1.240E-01)	0
	BA-140 50	60	-1.363E+00 (48/48) (-2.626E+01 - 1.723E+01)	4S4 0.5 MILES ENE	8.252E+00 (2/2) (1.893E+00 - 1.461E+01)	4.441E+00 (2/2) (2.426E+00 - 6.456E+00)	0
	LA-140 50	15	-2.142E-01 (48/48) (-6.066E+00 - 8.363E+00)	4S4 0.5 MILES ENE	2.816E+00 (2/2) (1.385E+00 - 4.247E+00)	-1.647E+00 (2/2) (-2.046E+00 - -1.247E+00)	0
	TH-228 50	N/A	4.919E-01 (48/48) (-2.105E+01 - 1.554E+01)	11S2 0.4 MILES SW	7.179E+00 (2/2) (7.164E+00 - 7.194E+00)	3.380E+00 (2/2) (1.975E+00 - 4.784E+00)	0
Drinking Water (pCi/Liter)	GR-B 12	4	1.493E+00 (12/12) (-2.210E-01 - 3.320E+00)	12H2 26 MILES WSW	1.493E+00 (12/12) (-2.210E-01 - 3.320E+00)	.000E+00	0
	H-3 12	2000	6.120E+01 (12/12) (-1.640E+01 - 1.410E+02)	12H2 26 MILES WSW	6.120E+01 (12/12) (-1.640E+01 - 1.410E+02)	.000E+00	0

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NAME OF FACILITY: SUSQUEHANNA STEAM ELECTRIC STATION
LOCATION OF FACILITY: LUZERNE COUNTY, PENNSYLVANIA

Reporting Period: December 28, 2017 to January 01, 2019

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSIS PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN (3) RANGE	CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASURMENTS (4)
Drinking Water (cont'd)	GAMMA	12						
(pCi/Liter)	K-40	12	N/A	5.744E+00 (12/12) (-1.705E+01 - 2.533E+01)	12H2 26 MILES WSW	5.744E+00 (12/12) (-1.705E+01 - 2.533E+01)	.000E+00	0
	MN-54	12	15	-1.352E-01 (12/12) (-9.694E-01 - 1.394E+00)	12H2 26 MILES WSW	-1.352E-01 (12/12) (-9.694E-01 - 1.394E+00)	.000E+00	0
	CO-58	12	15	-3.226E-01 (12/12) (-1.386E+00 - 6.350E-01)	12H2 26 MILES WSW	-3.226E-01 (12/12) (-1.386E+00 - 6.350E-01)	.000E+00	0
	FE-59	12	30	1.386E+00 (12/12) (-1.437E+00 - 3.170E+00)	12H2 26 MILES WSW	1.386E+00 (12/12) (-1.437E+00 - 3.170E+00)	.000E+00	0
	CO-60	12	15	8.358E-01 (12/12) (-1.953E-01 - 2.044E+00)	12H2 26 MILES WSW	8.358E-01 (12/12) (-1.953E-01 - 2.044E+00)	.000E+00	0
	ZN-65	12	30	-2.156E+00 (12/12) (-4.949E+00 - -5.172E-02)	12H2 26 MILES WSW	-2.156E+00 (12/12) (-4.949E+00 - -5.172E-02)	.000E+00	0
	NB-95	12	15	8.353E-01 (12/12) (1.403E-01 - 2.851E+00)	12H2 26 MILES WSW	8.353E-01 (12/12) (1.403E-01 - 2.851E+00)	.000E+00	0
	ZR-95	12	30	3.198E-02 (12/12) (-1.829E+00 - 9.189E-01)	12H2 26 MILES WSW	3.198E-02 (12/12) (-1.829E+00 - 9.189E-01)	.000E+00	0
	I-131	12	15	-1.124E+00 (12/12) (-7.265E+00 - 5.808E+00)	12H2 26 MILES WSW	-1.124E+00 (12/12) (-7.265E+00 - 5.808E+00)	.000E+00	0
	CS-134	12	15	-5.774E-01 (12/12) (-4.875E+00 - 1.981E+00)	12H2 26 MILES WSW	-5.774E-01 (12/12) (-4.875E+00 - 1.981E+00)	.000E+00	0

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Reporting Period: December 28, 2017 to January 01, 2019

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSIS PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN (3) RANGE		CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASURMENTS (4)
Drinking Water (cont'd) (pCi/Liter)	CS-137	12	18	-2.346E-01 (12/12) (-1.041E+00 - 9.905E-01)	12H2 26 MILES WSW	-2.346E-01 (-1.041E+00 - 9.905E-01)	(12/12)	.000E+00	0
	BA-140	12	60	-4.225E-01 (12/12) (-8.566E+00 - 7.367E+00)	12H2 26 MILES WSW	-4.225E-01 (-8.566E+00 - 7.367E+00)	(12/12)	.000E+00	0
	LA-140	12	15	-1.624E-01 (12/12) (-4.702E+00 - 5.896E+00)	12H2 26 MILES WSW	-1.624E-01 (-4.702E+00 - 5.896E+00)	(12/12)	.000E+00	0
Food/Garden Crops (pCi/kg wet)	GAMMA	49							
	BE-7	49	N/A	4.429E+02 (34/34) (-6.537E+01 - 1.038E+03)	11S6 0.5 MILES SW	5.252E+02 (6.367E+01 - 1.038E+03)	(15/15)	4.375E+02 (15/15) (2.411E+01 - 8.497E+02)	0
	K-40	49	N/A	4.355E+03 (34/34) (1.688E+03 - 1.672E+04)	11D1 3.3 MILES SW	7.369E+03 (1.688E+03 - 1.672E+04)	(3/3)	3.815E+03 (15/15) (2.599E+03 - 4.927E+03)	0
	MN-54	49	N/A	2.293E+00 (34/34) (-8.966E+00 - 1.514E+01)	12F7 8.3 MILES WSW	3.774E+00 (3.774E+00)	(1/1)	-1.877E+00 (15/15) (-1.674E+01 - 9.911E+00)	0
	CO-58	49	N/A	-1.420E+00 (34/34) (-1.554E+01 - 8.786E+00)	11S6 0.5 MILES SW	6.612E-01 (-6.675E+00 - 7.400E+00)	(15/15)	-1.386E+00 (15/15) (-1.840E+01 - 1.148E+01)	0
	FE-59	49	N/A	-2.839E+00 (34/34) (-6.522E+01 - 4.750E+01)	12F7 8.3 MILES WSW	2.287E+01 (2.287E+01)	(1/1)	4.330E+00 (15/15) (-2.334E+01 - 4.061E+01)	0
	CO-60	49	N/A	1.964E+00 (34/34) (-1.059E+01 - 1.531E+01)	11D1 3.3 MILES SW	4.858E+00 (-8.475E+00 - 1.166E+01)	(3/3)	1.462E+00 (15/15) (-1.052E+01 - 1.865E+01)	0
	ZN-65	49	N/A	-1.647E+01 (34/34) (-3.965E+01 - 1.609E+01)	11S6 0.5 MILES SW	-1.233E+01 (-3.880E+01 - 1.609E+01)	(15/15)	-1.435E+01 (15/15) (-4.234E+01 - 3.317E+01)	0

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MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSIS PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE		LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN (3) RANGE		CONTROL LOCATION MEAN (3) RANGE		NUMBER OF NONROUTINE REPORTED MEASURMENTS (4)
Food/Garden Crops (cont'd) (pCi/kg wet)	NB-95	49	N/A	2.322E+00 (-1.312E+01 - 1.603E+01)	(34/34)	11D1 3.3 MILES SW	9.372E+00 (2.665E+00 - 1.479E+01)	(3/3)	-1.004E+00 (-1.489E+01 - 1.395E+01)	(15/15)	0
	ZR-95	49	N/A	1.227E+00 (-1.885E+01 - 1.931E+01)	(34/34)	12F7 8.3 MILES WSW	1.439E+01 (1.439E+01)	(1/1)	1.571E+00 (-2.573E+01 - 2.038E+01)	(15/15)	0
	I-131	49	60	-5.852E-01 (-2.303E+01 - 2.742E+01)	(34/34)	11S6 0.5 MILES SW	1.483E+00 (-1.547E+01 - 2.742E+01)	(15/15)	-2.953E-01 (-2.710E+01 - 2.024E+01)	(15/15)	0
	CS-134	49	60	-5.875E+00 (-3.573E+01 - 2.277E+01)	(34/34)	12F7 8.3 MILES WSW	4.634E+00 (4.634E+00)	(1/1)	-2.020E+00 (-1.448E+01 - 3.668E+01)	(15/15)	0
	CS-137	49	80	1.169E+00 (-1.067E+01 - 1.465E+01)	(34/34)	12F7 8.3 MILES WSW	5.471E+00 (5.471E+00)	(1/1)	2.384E+00 (-7.459E+00 - 1.917E+01)	(15/15)	0
	BA-140	49	N/A	4.286E+00 (-4.523E+01 - 7.972E+01)	(34/34)	12F7 8.3 MILES WSW	7.479E+01 (7.479E+01)	(1/1)	7.165E+00 (-6.188E+01 - 6.115E+01)	(15/15)	0
	LA-140	49	N/A	-1.729E+00 (-2.133E+01 - 1.483E+01)	(34/34)	12F7 8.3 MILES WSW	8.278E+00 (8.278E+00)	(1/1)	-1.598E-01 (-1.913E+01 - 2.445E+01)	(15/15)	0
	AC-228	49	N/A	1.998E+00 (-4.865E+01 - 8.463E+01)	(34/34)	11D1 3.3 MILES SW	5.580E+01 (3.785E+01 - 8.463E+01)	(3/3)	3.494E+00 (-5.636E+01 - 5.234E+01)	(15/15)	0
	TH-228	49	N/A	3.679E+00 (-2.757E+01 - 6.547E+01)	(34/34)	11D1 3.3 MILES SW	8.529E+00 (-6.513E+00 - 2.633E+01)	(3/3)	-5.979E+00 (-2.524E+01 - 1.297E+01)	(15/15)	0

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MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSIS PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN (3) RANGE		CONTROL LOCATION MEAN (3) RANGE		NUMBER OF NONROUTINE REPORTED MEASURMENTS (4)
Surface Water (pCi/Liter)	H-3	46	2000	6.617E+02 (33/33) (-1.900E+01 - 6.170E+03)	2S7 0.1 MILES NNE	1.501E+03 (1.350E+02 - 6.170E+03)	(13/13)	5.688E+01 (-3.470E+01 - 1.230E+02)	(13/13)	0
	GAMMA	46								
	K-40	46	N/A	2.840E+00 (33/33) (-1.138E+02 - 1.008E+02)	LTAW 0.7 MILES NE	5.772E+01 (1.463E+01 - 1.008E+02)	(2/2)	-1.063E+01 (-1.611E+02 - 4.680E+01)	(13/13)	0
	MN-54	46	15	3.246E-02 (33/33) (-2.044E+00 - 2.661E+00)	2S7 0.1 MILES NNE	3.862E-01 (-8.110E-01 - 1.448E+00)	(13/13)	-1.856E-01 (-1.809E+00 - 1.040E+00)	(13/13)	0
	CO-58	46	15	-2.622E-01 (33/33) (-4.348E+00 - 1.155E+00)	7S12 0.3 MILES SE	3.404E-01 (1.534E-01 - 5.274E-01)	(2/2)	-2.530E-01 (-1.538E+00 - 7.882E-01)	(13/13)	0
	FE-59	46	30	9.063E-01 (33/33) (-4.165E+00 - 1.210E+01)	4S7 0.4 MILES ENE	8.290E+00 (4.480E+00 - 1.210E+01)	(2/2)	2.386E-01 (-2.734E+00 - 3.225E+00)	(13/13)	0
	CO-60	46	15	4.710E-01 (33/33) (-2.090E+00 - 1.501E+00)	LTAW 0.7 MILES NE	1.097E+00 (8.236E-01 - 1.370E+00)	(2/2)	5.243E-01 (-6.191E-01 - 1.461E+00)	(13/13)	0
	ZN-65	46	30	-1.431E+00 (33/33) (-1.032E+01 - 5.775E+00)	5S12 0.4 MILES E	1.344E+00 (-3.087E+00 - 5.775E+00)	(2/2)	-2.446E+00 (-5.173E+00 - -4.381E-02)	(13/13)	0
	NB-95	46	15	3.281E-01 (33/33) (-1.864E+00 - 2.986E+00)	7S12 0.3 MILES SE	2.135E+00 (1.633E+00 - 2.636E+00)	(2/2)	5.375E-01 (-5.906E-01 - 1.886E+00)	(13/13)	0
	ZR-95	46	30	9.105E-03 (33/33) (-4.492E+00 - 8.268E+00)	7S12 0.3 MILES SE	4.766E+00 (1.264E+00 - 8.268E+00)	(2/2)	1.316E-01 (-1.011E+00 - 1.767E+00)	(13/13)	0
	I-131	46	15	4.466E-01 (33/33) (-5.021E+00 - 7.821E+00)	5S12 0.4 MILES E	1.961E+00 (1.288E+00 - 2.634E+00)	(2/2)	2.001E-01 (-6.769E+00 - 1.004E+01)	(13/13)	0

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MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSIS PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN (3) RANGE		CONTROL LOCATION MEAN (3) RANGE		NUMBER OF NONROUTINE REPORTED MEASURMENTS (4)
Surface Water (cont'd) (pCi/Liter)	CS-134	46	15	-5.181E-01 (33/33) (-4.965E+00 - 2.457E+00)	5S12 0.4 MILES E	7.386E-01 (3.832E-01 - 1.094E+00)	(2/2)	-1.155E+00 (-3.627E+00 - 5.297E-01)	(13/13)	0
	CS-137	46	18	-1.861E-01 (33/33) (-1.949E+00 - 1.427E+00)	5S12 0.4 MILES E	9.282E-01 (4.294E-01 - 1.427E+00)	(2/2)	-1.827E-01 (-1.432E+00 - 6.841E-01)	(13/13)	0
	BA-140	46	60	-1.680E-01 (33/33) (-1.405E+01 - 1.648E+01)	7S12 0.3 MILES SE	3.341E+00 (-9.798E+00 - 1.648E+01)	(2/2)	9.303E-01 (-1.176E+01 - 1.565E+01)	(13/13)	0
	LA-140	46	15	-1.058E-01 (33/33) (-4.917E+00 - 5.430E+00)	5S12 0.4 MILES E	2.133E+00 (-1.164E+00 - 5.430E+00)	(2/2)	-1.476E+00 (-5.809E+00 - 2.790E+00)	(13/13)	0
	TH-228	46	N/A	5.809E-02 (33/33) (-7.898E+00 - 6.555E+00)	6S6 0.8 MILES ESE	9.781E-01 (-3.632E+00 - 1.199E+01)	(13/13)	9.781E-01 (-3.632E+00 - 1.199E+01)	(13/13)	0
Fish (pCi/kg wet)	GAMMA	14								
	K-40	14	N/A	3.597E+03 (8/8) (2.666E+03 - 5.034E+03)	LTAW 0.7 MILES NE	3.954E+03 (3.911E+03 - 3.996E+03)	(2/2)	3.517E+03 (2.913E+03 - 4.598E+03)	(6/6)	0
	MN-54	14	130	9.567E+00 (8/8) (-1.285E+01 - 2.918E+01)	LTAW 0.7 MILES NE	1.030E+01 (8.435E+00 - 1.216E+01)	(2/2)	8.021E+00 (-1.171E+01 - 3.363E+01)	(6/6)	0
	CO-58	14	130	-1.800E+01 (8/8) (-4.791E+01 - 6.103E+00)	IND 0.9-1.4 MILES ESE	-8.228E+00 (-3.649E+01 - 6.103E+00)	(6/6)	-8.255E+00 (-5.256E+01 - 4.438E+01)	(6/6)	0
	FE-59	14	260	-2.162E+01 (8/8) (-1.006E+02 - 5.599E+01)	2H 30 MILES NNE	-8.013E+00 (-9.866E+01 - 1.442E+02)	(6/6)	-8.013E+00 (-9.866E+01 - 1.442E+02)	(6/6)	0
	CO-60	14	130	-8.805E+00 (8/8) (-4.541E+01 - 2.389E+01)	2H 30 MILES NNE	-9.345E-01 (-2.854E+01 - 4.128E+01)	(6/6)	-9.345E-01 (-2.854E+01 - 4.128E+01)	(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, 2017 to January 01, 2019

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSIS PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN (3) RANGE	CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASURMENTS (4)
Fish (cont'd)	ZN-65	14	260	-4.219E+01 (8/8)	LTAW	-2.473E+01 (2/2)	-4.415E+01 (6/6)	0
(pCi/kg wet)				(-1.002E+02 - 4.228E+01)	0.7 MILES NE	(-8.039E+01 - 3.094E+01)	(-6.566E+01 - -9.410E+00)	
	CS-134	14	130	-2.136E+01 (8/8)	LTAW	5.345E-01 (2/2)	-3.161E+01 (6/6)	0
				(-7.832E+01 - 1.582E+01)	0.7 MILES NE	(-6.943E+00 - 8.012E+00)	(-6.360E+01 - -6.567E+00)	
	CS-137	14	150	1.094E+00 (8/8)	IND	6.517E+00 (6/6)	3.592E+00 (6/6)	
				(-3.277E+01 - 3.311E+01)	0.9-1.4 MILES ESE	(-6.778E+00 - 3.311E+01)	(-1.703E+01 - 2.624E+01)	0
Sediment	GAMMA	6						
(pCi/kg dry)	K-40	6	N/A	8.323E+03 (4/4)	2B	1.259E+04 (2/2)	1.259E+04 (2/2)	0
				(7.160E+03 - 1.032E+04)	1.6 MILES NNE	(1.083E+04 - 1.435E+04)	(1.083E+04 - 1.435E+04)	
	CS-134	6	150	3.159E+00 (4/4)	7B	4.225E+00 (2/2)	-7.880E+00 (2/2)	0
				(-1.176E+01 - 2.021E+01)	1.2 MILES SE	(-1.176E+01 - 2.021E+01)	(-3.191E+01 - 1.615E+01)	
	CS-137	6	180	2.873E+01 (4/4)	7B	4.546E+01 (2/2)	1.644E+01 (2/2)	0
				(1.025E+01 - 5.042E+01)	1.2 MILES SE	(4.050E+01 - 5.042E+01)	(9.317E+00 - 2.357E+01)	
	RA-226	6	N/A	1.587E+03 (4/4)	7B	2.243E+03 (2/2)	1.614E+03 (2/2)	
				(3.371E+02 - 2.800E+03)	1.2 MILES SE	(1.686E+03 - 2.800E+03)	(1.547E+03 - 1.681E+03)	0
	AC-228	6	N/A	8.346E+02 (4/4)	2B	1.048E+03 (2/2)	1.048E+03 (2/2)	
				(6.048E+02 - 1.024E+03)	1.6 MILES NNE	(9.121E+02 - 1.184E+03)	(9.121E+02 - 1.184E+03)	0
	TH-228	6	N/A	8.634E+02 (4/4)	2B	1.193E+03 (2/2)	1.193E+03 (2/2)	
				(7.761E+02 - 9.653E+02)	1.6 MILES NNE	(9.564E+02 - 1.429E+03)	(9.564E+02 - 1.429E+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 Requirments (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	LONGITUDINAL	SAMPLE TYPE
LESS THAN ONE MILE FROM THE SSES		DEG.	DEG.	
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
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
2S8	0.1 mi.NNE;	41.094991	-76..044207	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	LONGITUDINAL	SAMPLE TYPE
LESS THAN ONE MILE FROM THE SSES		DEG.	DEG.	
4S8	0.1 mi.ENE;	41.092306	-76.144283	Ground water
4S9	0.3 mi.E;	41.093369	-76.141644	Ground water
8S4	0.1 mi.SSE;	41.091424	-76.145531	Ground water
7S10	0.3 mi.SE;	41.089736	-76.142783	Ground water
13S7	0.2 mi.W;	41.091236	-76.149647	Ground water
11S6	0.5 mi.SW;	41.085305	-76.152022	Broadleaf
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
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	LONGITUDINAL	SAMPLE TYPE
GREATER THAN FIVE MILES FROM THE SSES		DEG.	DEG.	
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, 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

** Control Location

TABLE B-1 (cont'd)

SAMPLING LOCATIONS

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

* Special Interest Area (other than controls)

TABLE B-1 (cont'd)

SAMPLING LOCATIONS

STATION CODE	STATION LOCATION	LATITUDINAL	LONGITUDINAL	SAMPLE TYPE
FROM ONE to FIVE MILES FROM THE SSES		DEG.	DEG.	
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

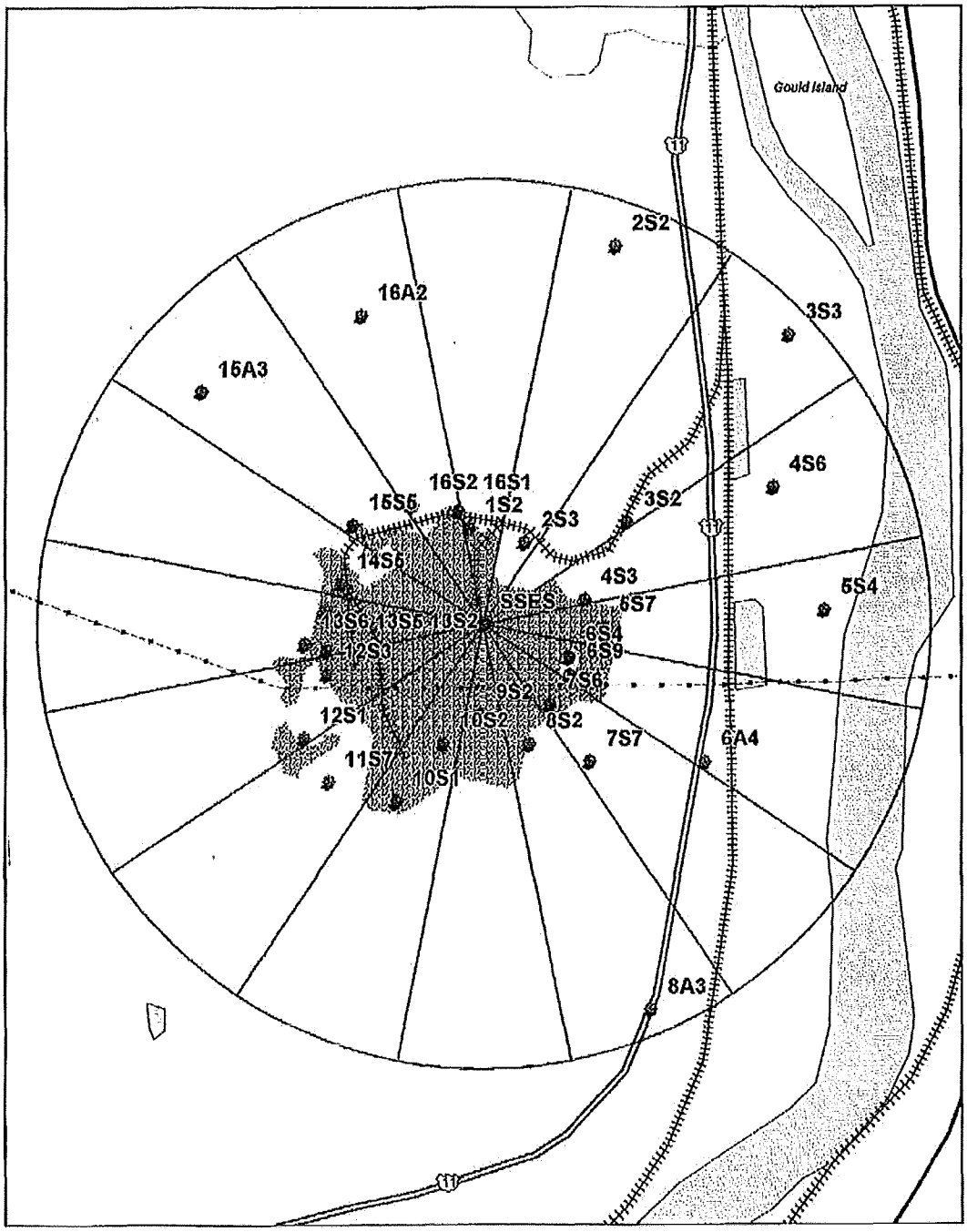
TABLE B-2 (cont'd)

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

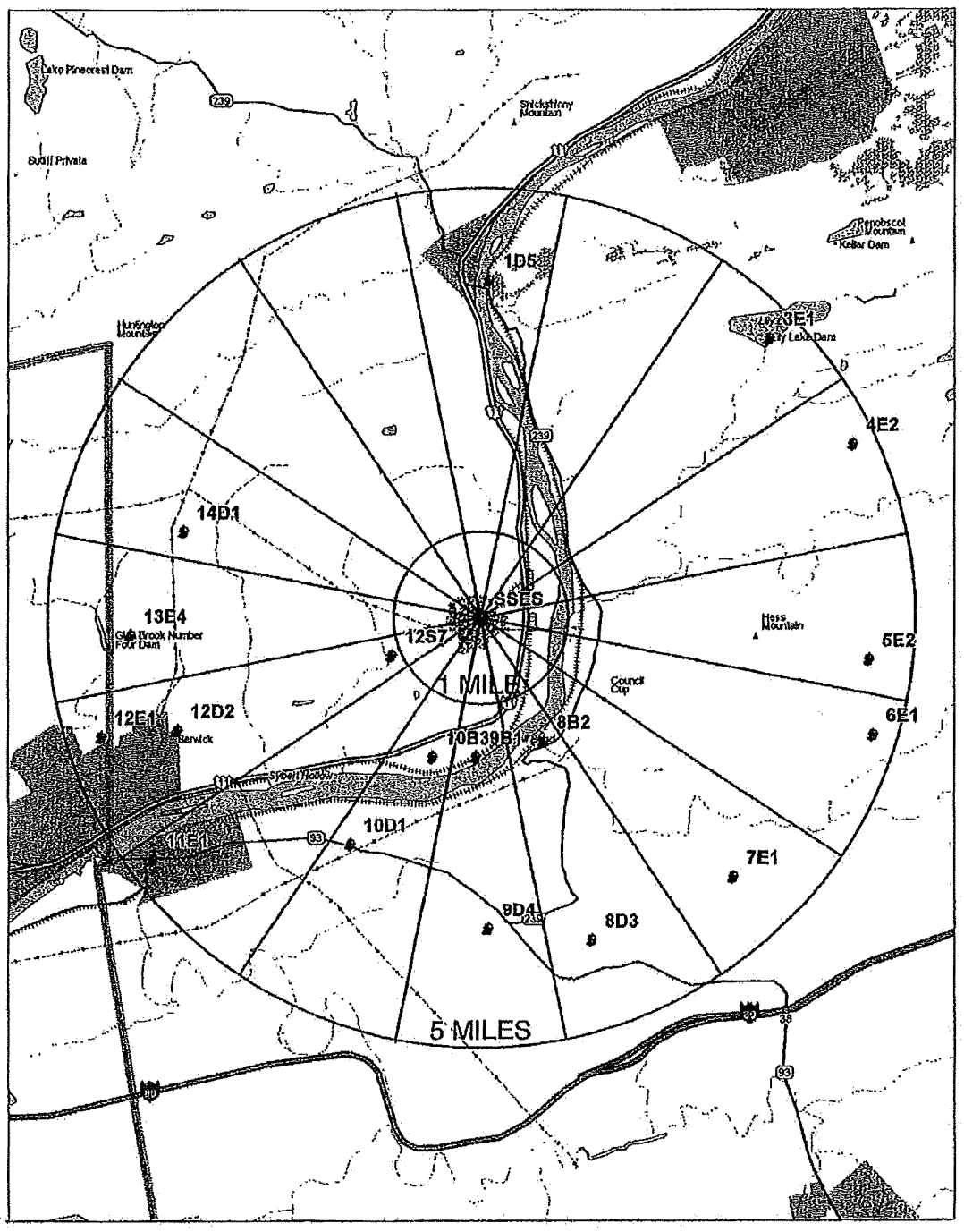
MAP B-1

Direct Radiation Monitoring Locations Within One Mile



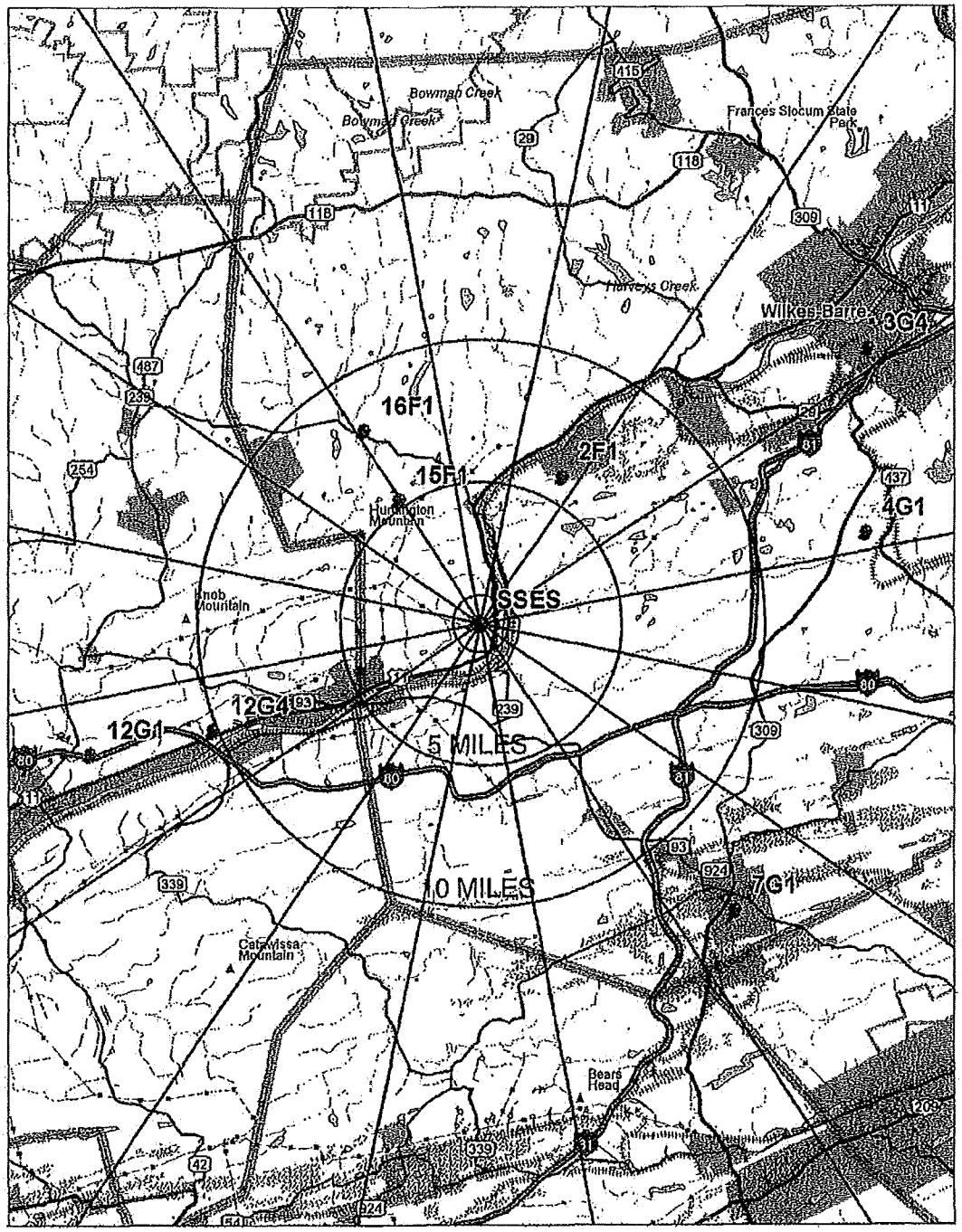
MAP B-2

Direct Radiation Monitoring Locations From One to Five Miles



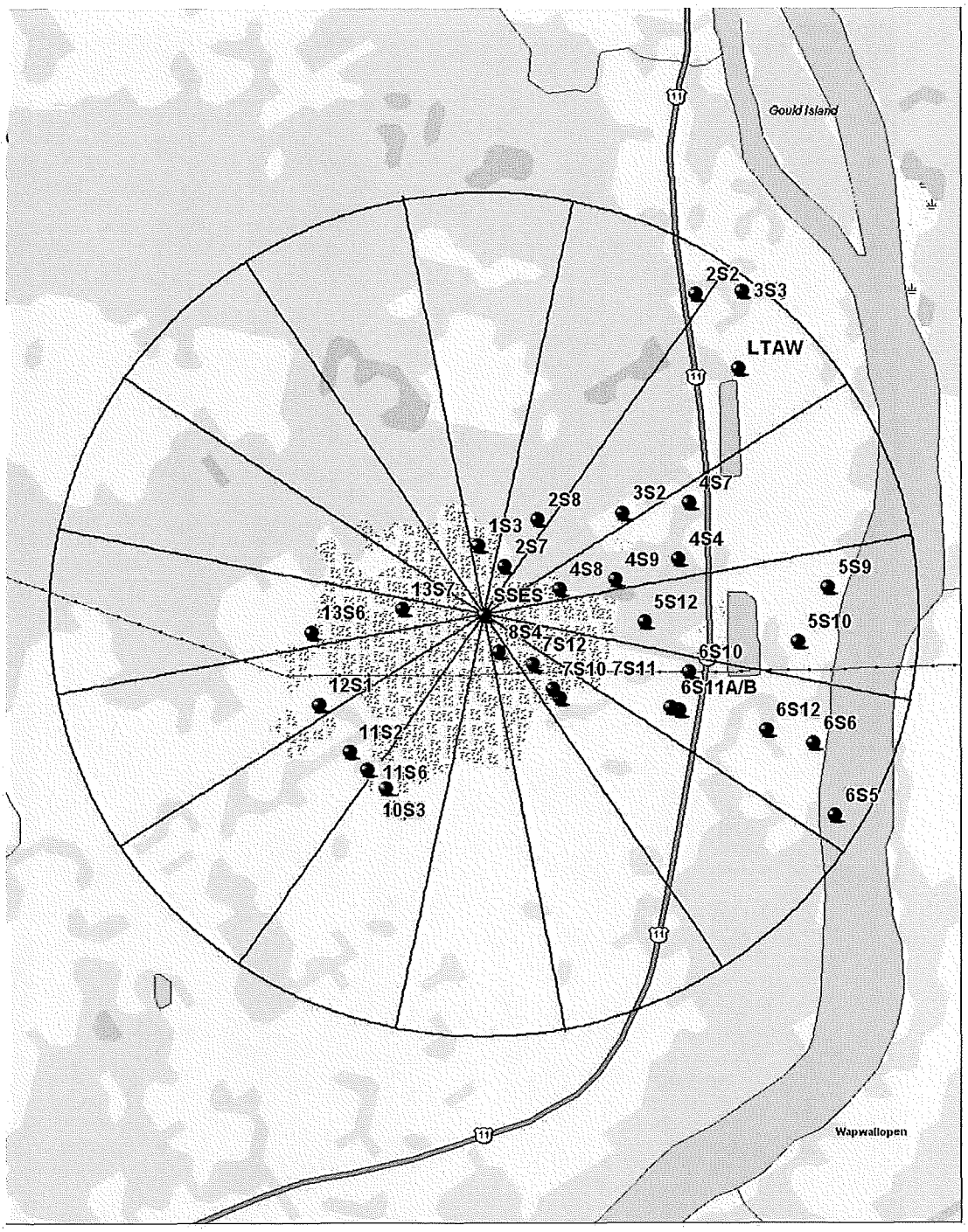
MAP B-3

Direct Radiation Monitoring Locations Greater Than Five Miles



MAP B-4

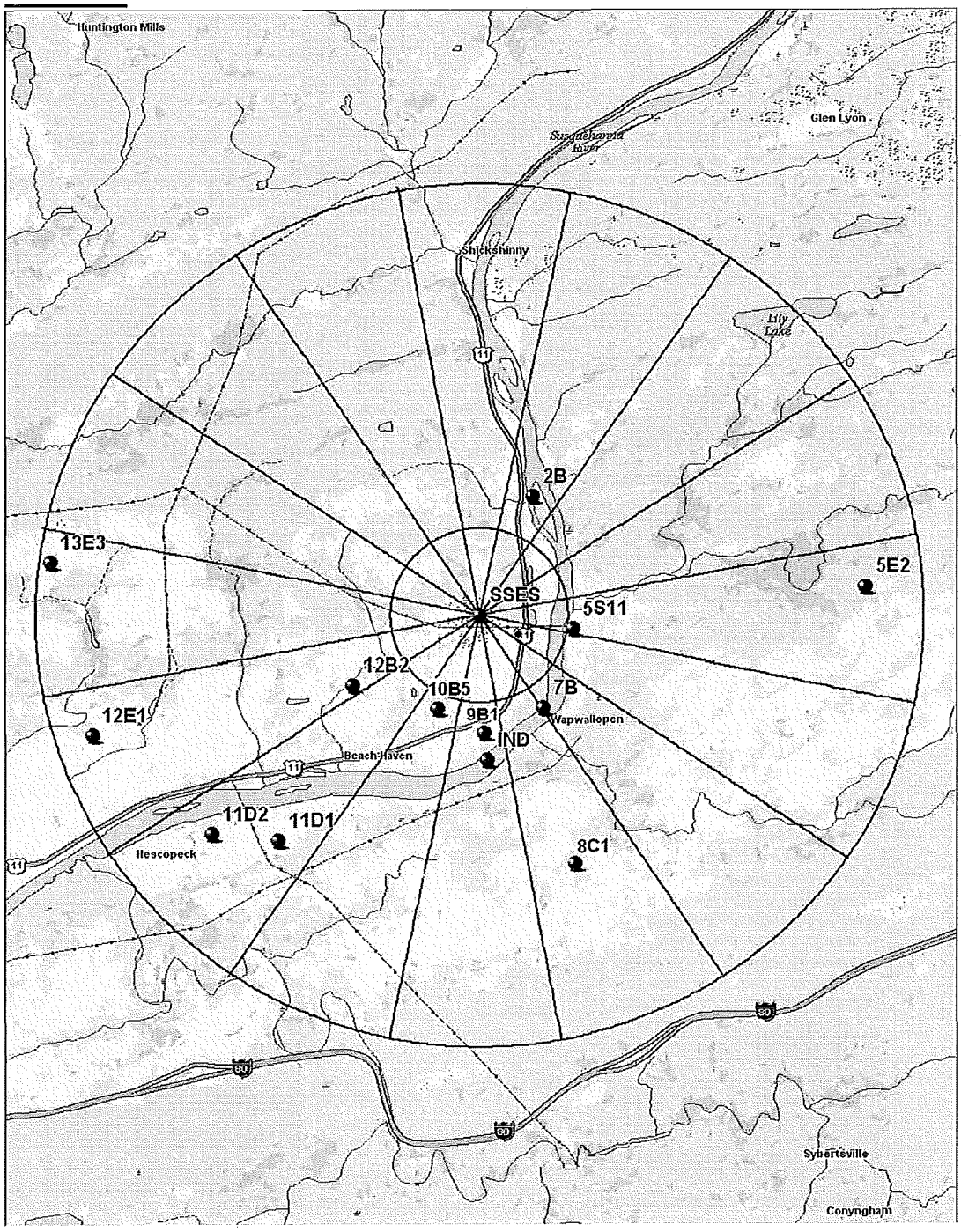
Environmental Sampling Locations Within One Mile



MAP B-5

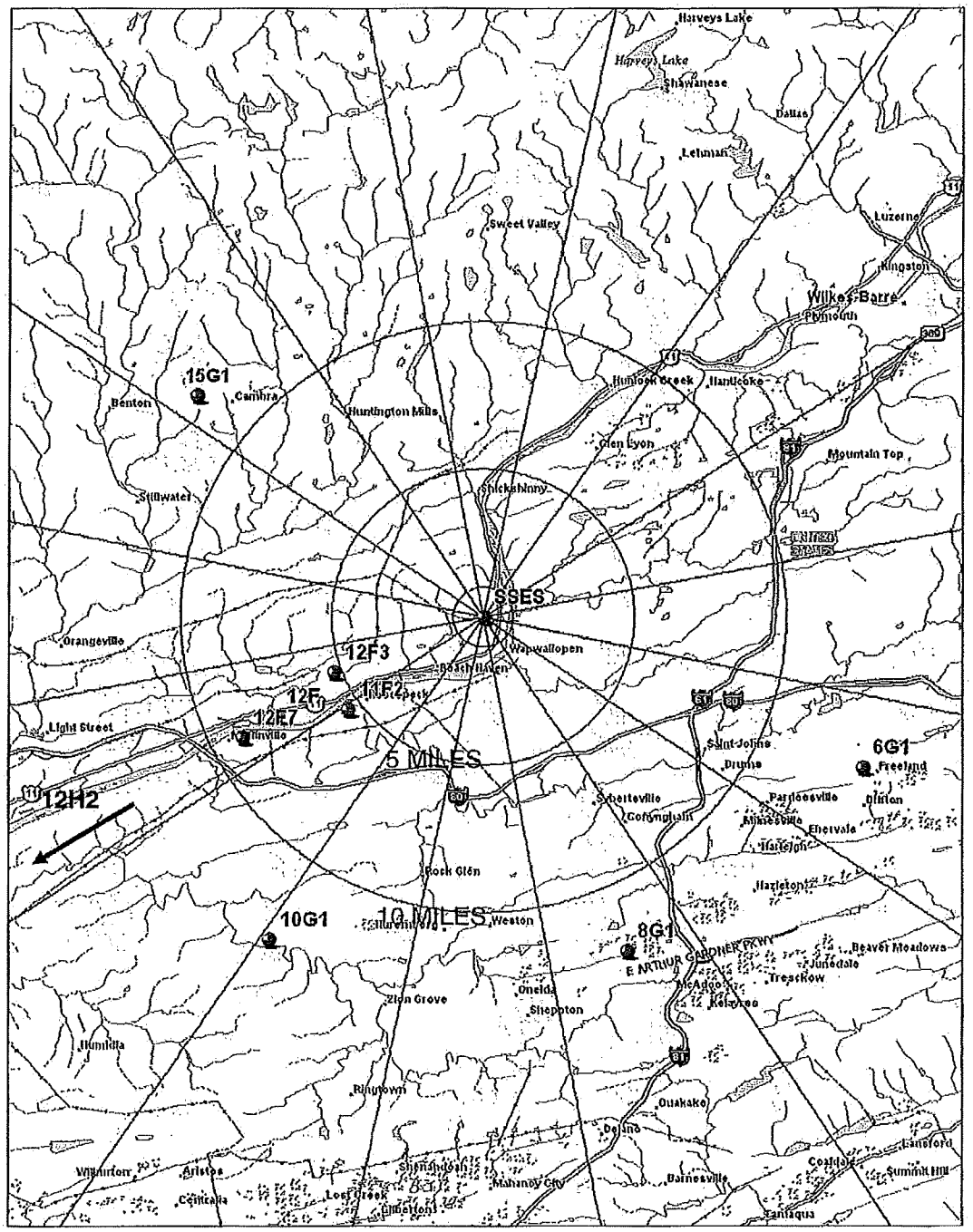
Environmental Sampling Locations

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, 2018

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

COLLECTION PERIOD	3S2	*6G1	8G1	12E1	12S1	13S6
01/03/18 - 01/10/18	11 ± 2	12 ± 2	12 ± 2	13 ± 2	13 ± 2	11 ± 2
01/10/18 - 01/16/18	13 ± 3	13 ± 3	13 ± 3	11 ± 3	12 ± 3	13 ± 3
01/16/18 - 01/24/18	18 ± 2	15 ± 2	15 ± 2	16 ± 2	16 ± 2	18 ± 2
01/24/18 - 01/31/18	9 ± 2	11 ± 2	9 ± 2	12 ± 2	13 ± 2	9 ± 2
01/31/18 - 02/06/18	11 ± 2	12 ± 2	11 ± 2	10 ± 2	12 ± 2	11 ± 2
02/06/18 - 02/14/18	12 ± 2	11 ± 2	11 ± 2	14 ± 2	13 ± 2	12 ± 2
02/14/18 - 02/21/18	12 ± 2	12 ± 2	11 ± 2	15 ± 2	14 ± 2	16 ± 2
02/21/18 - 02/28/18	8 ± 2	9 ± 2	10 ± 2	8 ± 2	9 ± 2	7 ± 2
02/28/18 - 03/06/18	11 ± 2	13 ± 2	13 ± 2	14 ± 2	14 ± 3	13 ± 2
03/06/18 - 03/14/18	7 ± 2	4 ± 1	5 ± 1	5 ± 1	6 ± 2	6 ± 2
03/14/18 - 03/20/18	14 ± 3	14 ± 2	14 ± 3	14 ± 3	14 ± 3	15 ± 3
03/20/18 - 03/28/18	9 ± 2	9 ± 2	10 ± 2	9 ± 2	9 ± 2	11 ± 2
03/28/18 - 04/04/18	9 ± 2	8 ± 2	10 ± 2	11 ± 2	9 ± 2	10 ± 2
04/04/18 - 04/11/18	11 ± 2	11 ± 2	11 ± 2	12 ± 2	11 ± 2	12 ± 2
04/11/18 - 04/18/18	9 ± 2	10 ± 2	10 ± 2	12 ± 2	10 ± 2	10 ± 2
04/18/18 - 04/25/18	12 ± 2	10 ± 2	14 ± 2	13 ± 2	12 ± 2	9 ± 2
04/25/18 - 05/02/18	12 ± 2	14 ± 2	14 ± 2	12 ± 2	12 ± 3	12 ± 2
05/02/18 - 05/09/18	14 ± 2	13 ± 2	13 ± 2	13 ± 2	15 ± 2	13 ± 2
05/09/18 - 05/16/18	12 ± 2	11 ± 2	15 ± 2	15 ± 2	13 ± 2	13 ± 2
05/16/18 - 05/23/18	7 ± 2	7 ± 2	8 ± 2	7 ± 2	10 ± 2	7 ± 2
05/23/18 - 05/30/18	14 ± 2	17 ± 2	14 ± 2	14 ± 2	15 ± 2	13 ± 2
05/30/18 - 06/06/18	8 ± 2		7 ± 2	6 ± 2	7 ± 2	6 ± 2
06/06/18 - 06/13/18	11 ± 2		15 ± 2	12 ± 2	12 ± 2	13 ± 2
06/13/18 - 06/20/18	11 ± 2		9 ± 2	10 ± 2	11 ± 2	11 ± 2
06/20/18 - 06/27/18	10 ± 2		11 ± 2	10 ± 2	10 ± 2	10 ± 2
06/27/18 - 07/03/18	17 ± 3		14 ± 2	16 ± 3	16 ± 3	16 ± 3
07/03/18 - 07/11/18	16 ± 2		15 ± 2	15 ± 2	14 ± 2	16 ± 2
07/11/18 - 07/18/18	14 ± 2		15 ± 2	17 ± 2	15 ± 2	17 ± 2
07/18/18 - 07/25/18	7 ± 2		7 ± 2	9 ± 2	6 ± 2	8 ± 2
07/25/18 - 08/01/18	13 ± 2		11 ± 2	11 ± 2	11 ± 2	15 ± 2
08/01/18 - 08/08/18	18 ± 2		23 ± 3	22 ± 3	20 ± 2	18 ± 2
08/08/18 - 08/15/18	14 ± 2		11 ± 2	14 ± 2	13 ± 2	12 ± 2
08/15/18 - 08/22/18	13 ± 2		14 ± 2	14 ± 2	14 ± 2	13 ± 2
08/22/18 - 08/29/18	22 ± 3		24 ± 3	23 ± 3	22 ± 3	22 ± 3
08/29/18 - 09/05/18	11 ± 2		11 ± 2	12 ± 2	10 ± 2	11 ± 2
09/05/18 - 09/12/18	9 ± 2		10 ± 2	11 ± 2	12 ± 2	12 ± 2
09/12/18 - 09/19/18	8 ± 2		7 ± 2	9 ± 2	7 ± 2	9 ± 2
09/19/18 - 09/26/18	8 ± 2		9 ± 2	11 ± 2	8 ± 2	11 ± 2
09/26/18 - 10/03/18	12 ± 2		15 ± 2	17 ± 2	13 ± 2	14 ± 2
10/03/18 - 10/10/18	16 ± 2		13 ± 2	14 ± 2	12 ± 2	15 ± 2
10/10/18 - 10/17/18	9 ± 2		11 ± 2	10 ± 2	9 ± 2	10 ± 2
10/17/18 - 10/24/18	9 ± 2		12 ± 2	11 ± 2	8 ± 2	11 ± 2
10/24/18 - 10/31/18	6 ± 2		7 ± 2	9 ± 2	8 ± 2	8 ± 2
10/31/18 - 11/07/18	12 ± 2		10 ± 2	15 ± 2	12 ± 2	11 ± 2
11/07/18 - 11/14/18	12 ± 2		10 ± 2	12 ± 2	11 ± 2	11 ± 2
11/14/18 - 11/20/18	11 ± 2		13 ± 2	13 ± 2	12 ± 2	11 ± 2
11/20/18 - 11/28/18	13 ± 2		12 ± 2	14 ± 2	11 ± 2	10 ± 2
11/28/18 - 12/05/18	9 ± 2		10 ± 2	9 ± 2	9 ± 2	9 ± 2
12/05/18 - 12/12/18	15 ± 2		13 ± 2	18 ± 2	17 ± 2	15 ± 2
12/12/18 - 12/19/18	16 ± 2		14 ± 2	19 ± 3	16 ± 2	18 ± 2
12/19/18 - 12/26/18	11 ± 2		11 ± 2	12 ± 2	11 ± 2	12 ± 2
12/26/18 - 01/02/19	11 ± 2		11 ± 2	12 ± 2	11 ± 2	12 ± 2
AVERAGE	12 ± 6	11 ± 6	12 ± 7	13 ± 7	12 ± 6	12 ± 6

*Station 6G1 is discontinued as of 5/30/18.

TABLE C-1 **GROSS BETA ANALYSES OF AIR PARTICULATE FILTERS**
SUSQUEHANNA STEAM ELECTRIC STATION, 2018

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

COLLECTION PERIOD	9B1	10S3
01/03/18 - 01/10/18	13 ± 2	13 ± 2
01/10/18 - 01/16/18	13 ± 3	12 ± 2
01/16/18 - 01/24/18	20 ± 2	16 ± 2
01/24/18 - 01/31/18	10 ± 2	11 ± 2
01/31/18 - 02/06/18	10 ± 2	10 ± 2
02/06/18 - 02/14/18	13 ± 2	12 ± 2
02/14/18 - 02/21/18	12 ± 2	13 ± 2
02/21/18 - 02/28/18	9 ± 2	8 ± 2
02/28/18 - 03/06/18	14 ± 2	14 ± 2
03/06/18 - 03/14/18	5 ± 1	6 ± 2
03/14/18 - 03/20/18	14 ± 3	16 ± 3
03/20/18 - 03/28/18	13 ± 2	9 ± 2
03/28/18 - 04/04/18	8 ± 2	10 ± 2
04/04/18 - 04/11/18	7 ± 2	12 ± 2
04/11/18 - 04/18/18	10 ± 2	10 ± 2
04/18/18 - 04/25/18	13 ± 2	11 ± 2
04/25/18 - 05/02/18	11 ± 2	11 ± 2
05/02/18 - 05/09/18	14 ± 2	15 ± 2
05/09/18 - 05/16/18	11 ± 2	13 ± 2
05/16/18 - 05/23/18	7 ± 2	7 ± 2
05/23/18 - 05/30/18	17 ± 2	15 ± 2
05/30/18 - 06/06/18	7 ± 2	8 ± 2
06/06/18 - 06/13/18	12 ± 2	14 ± 2
06/13/18 - 06/20/18	11 ± 2	9 ± 2
06/20/18 - 06/27/18	11 ± 2	11 ± 2
06/27/18 - 07/03/18	17 ± 3	15 ± 2
07/03/18 - 07/11/18	13 ± 2	15 ± 2
07/11/18 - 07/18/18	15 ± 2	15 ± 2
07/18/18 - 07/25/18	7 ± 2	9 ± 2
07/25/18 - 08/01/18	13 ± 2	11 ± 2
08/01/18 - 08/08/18	21 ± 3	19 ± 2
08/08/18 - 08/15/18	11 ± 2	12 ± 2
08/15/18 - 08/22/18	15 ± 2	12 ± 2
08/22/18 - 08/29/18	23 ± 3	21 ± 3
08/29/18 - 09/05/18	12 ± 2	11 ± 2
09/05/18 - 09/12/18	10 ± 2	13 ± 2
09/12/18 - 09/19/18	7 ± 2	8 ± 2
09/19/18 - 09/26/18	9 ± 2	10 ± 2
09/26/18 - 10/03/18	13 ± 2	16 ± 2
10/03/18 - 10/10/18	13 ± 2	14 ± 2
10/10/18 - 10/17/18	9 ± 2	10 ± 2
10/17/18 - 10/24/18	9 ± 2	8 ± 2
10/24/18 - 10/31/18	8 ± 2	9 ± 2
10/31/18 - 11/07/18	12 ± 2	12 ± 2
11/07/18 - 11/14/18	10 ± 2	13 ± 2
11/14/18 - 11/20/18	11 ± 2	11 ± 2
11/20/18 - 11/28/18	12 ± 2	13 ± 2
11/28/18 - 12/05/18	9 ± 2	10 ± 2
12/05/18 - 12/12/18	18 ± 2	18 ± 2
12/12/18 - 12/19/18	15 ± 2	15 ± 2
12/19/18 - 12/26/18	12 ± 2	12 ± 2
12/26/18 - 01/02/19	12 ± 2	11 ± 2
AVERAGE	12 ± 7	12 ± 6

TABLE C-2 GAMMA SPECTROSCOPIC ANALYSES OF COMPOSITED AIR PARTICULATE FILTERS SUSQUEHANNA STEAM ELECTRIC STATION, 2018

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

SITE	COLLECTION PERIOD	Be-7	K-40	Cs-134	Cs-137
*6G1	01/03/18 - 04/04/18	108 ± 23	< 19	< 1	< 1
	04/04/18 - 05/30/18	92 ± 39	< 25	< 1	< 1
	AVERAGE	100 ± 22	-	-	-
8G1	01/03/18 - 04/04/18	94 ± 17	< 13	< 1	< 1
	04/04/18 - 07/03/18	90 ± 23	< 24	< 1	< 1
	07/03/18 - 10/03/18	106 ± 24	< 16	< 2	< 1
	10/03/18 - 01/02/19	90 ± 17	< 18	< 1	< 1
	AVERAGE	95 ± 15	-	-	-
3S2	01/03/18 - 04/04/18	73 ± 16	< 14	< 1	< 1
	04/04/18 - 07/03/18	114 ± 26	< 25	< 2	< 2
	07/03/18 - 10/03/18	81 ± 20	< 12	< 1	< 1
	10/03/18 - 01/02/19	70 ± 14	< 18	< 1	< 1
	AVERAGE	85 ± 41	-	-	-
12E1	01/03/18 - 04/04/18	83 ± 17	< 15	< 1	< 1
	04/04/18 - 07/03/18	127 ± 24	< 20	< 1	< 1
	07/03/18 - 10/03/18	107 ± 23	< 20	< 1	< 1
	10/03/18 - 01/02/19	75 ± 16	< 22	< 1	< 1
	AVERAGE	98 ± 48	-	-	-
12S1	01/03/18 - 04/04/18	80 ± 19	< 17	< 1	< 1
	04/04/18 - 07/03/18	123 ± 21	< 21	< 1	< 1
	07/03/18 - 10/03/18	108 ± 29	< 30	< 2	< 2
	10/03/18 - 01/02/19	58 ± 13	< 18	< 1	< 1
	AVERAGE	92 ± 57	-	-	-
13S6	01/03/18 - 04/04/18	89 ± 22	< 20	< 1	< 1
	04/04/18 - 07/03/18	161 ± 29	< 23	< 1	< 1
	07/03/18 - 10/03/18	89 ± 21	< 19	< 1	< 1
	10/03/18 - 01/02/19	63 ± 18	< 15	< 1	< 1
	AVERAGE	101 ± 84	-	-	-
10S3	01/03/18 - 04/04/18	86 ± 30	< 22	< 2	< 1
	04/04/18 - 07/03/18	139 ± 22	< 19	< 1	< 1
	07/03/18 - 10/03/18	108 ± 26	< 23	< 2	< 1
	10/03/18 - 01/02/19	76 ± 16	< 11	< 1	< 1
	AVERAGE	102 ± 56	-	-	-
9B1	01/03/18 - 04/04/18	114 ± 24	< 34	< 1	< 2
	04/04/18 - 07/03/18	132 ± 24	< 23	< 1	< 1
	07/03/18 - 10/03/18	113 ± 22	< 28	< 2	< 1
	10/03/18 - 01/02/19	64 ± 17	< 16	< 1	< 1
	AVERAGE	105 ± 58	-	-	-

*Station was discontinued as of 05/30/18.

TABLE C-3 **IODINE-131 ANALYSES OF AIR IODINE SAMPLES**
SUSQUEHANNA STEAM ELECTRIC STATION, 2018

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

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

*Station 6G1 is discontinued as of 5/30/18.

TABLE C-3 **IODINE-131 ANALYSES OF AIR IODINE SAMPLES**
SUSQUEHANNA STEAM ELECTRIC STATION, 2018

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

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

TABLE C-4 ENVIRONMENTAL OPTICALLY STIMULATED LUMINESCENCE DOSIMETRY RESULTS SUSQUEHANNA STEAM ELECTRIC STATION, 2018

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

LOCATION	First Quarter 1/10/2018 to 3/22/2018	Second Quarter 3/22/2018 to 7/5/2018	Third Quarter 7/5/2018 to 10/9/2018	Fourth Quarter 10/9/2018 to 1/11/2019
ONSITE				
1S2	20.9 ± 1.5	15.4 ± 0.1	23.6 ± 3.9	22.0 ± 0.8
2S2	14.5 ± 0.6	12.8 ± 1.8	14.6 ± 1.1	14.6 ± 0.1
2S3	17.4 ± 0.6	14.9 ± 0.7	19.4 ± 0.4	20.3 ± 2.6
3S2	13.0 ± 0.3	12.8 ± 1.8	15.2 ± 1.1	14.6 ± 1.4
3S3	11.6 ± 0.5	10.1 ± 0.1	13.6 ± 0.3	14.3 ± 0.6
4S3	16.9 ± 1.9	16.7 ± 0.0	20.2 ± 1.0	20.3 ± 1.5
4S6	13.9 ± 0.2	12.7 ± 0.6	13.7 ± 0.0	15.0 ± 0.0
5S4	10.7 ± 0.6	10.7 ± 0.6	11.5 ± 0.3	13.3 ± 1.5
5S7	14.1 ± 1.8	13.7 ± 0.8	16.3 ± 0.1	18.0 ± 0.4
6S4	24.2 ± 4.1	19.3 ± 1.5	22.8 ± 2.6	23.7 ± 1.8
6S9	20.6 ± 0.5	16.7 ± 0.7	22.9 ± 1.9	21.9 ± 0.9
7S6	18.8 ± 2.8	18.2 ± 2.4	20.2 ± 1.5	21.6 ± 0.8
7S7	12.2 ± 0.0	11.3 ± 0.2	12.5 ± 0.7	13.2 ± 0.3
8S2	19.0 ± 1.6	16.5 ± 0.2	22.4 ± 0.6	22.0 ± 1.1
9S2	35.1 ± 0.4	26.3 ± 1.7	34.8 ± 0.3	34.4 ± 5.7
10S1	13.3 ± 1.7	11.4 ± 0.8	13.9 ± 0.8	14.9 ± 0.1
10S2	31.7 ± 1.5	24.8 ± 1.5	29.4 ± 0.9	29.6 ± 0.8
11S7	13.4 ± 0.5	12.2 ± 0.6	13.8 ± 1.1	14.4 ± 1.9
12S1	15.8 ± 1.6	13.2 ± 0.6	16.9 ± 0.8	16.6 ± 0.3
12S3	17.0 ± 3.0	17.8 ± 0.2	17.9 ± 0.1	17.7 ± 3.0
12S7	13.0 ± 0.5	12.4 ± 0.1	13.9 ± 1.3	14.8 ± 2.4
13S2	24.9 ± 2.3	21.2 ± 2.1	26.5 ± 4.0	22.3 ± 3.4
13S5	24.0 ± 1.5	19.2 ± 0.6	30.6 ± 3.5	25.4 ± 3.6
13S6	18.1 ± 0.1	16.0 ± 0.8	20.2 ± 0.8	21.0 ± 0.8
14S5	17.3 ± 0.3	17.1 ± 0.9	19.6 ± 0.2	20.0 ± 1.9
15S5	16.3 ± 1.3	13.7 ± 0.1	17.8 ± 3.4	16.6 ± 2.3
16S1	19.0 ± 0.3	14.9 ± 1.3	20.2 ± 1.1	19.4 ± 0.4
16S2	18.4 ± 0.6	15.7 ± 1.4	19.9 ± 1.1	20.9 ± 1.6

See the comments at the end of this table.

TABLE C-4 ENVIRONMENTAL OPTICALLY STIMULATED LUMINESCENCE DOSIMETRY RESULTS SUSQUEHANNA STEAM ELECTRIC STATION, 2018

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

LOCATION	First Quarter 1/10/2018 to 3/22/2018	Second Quarter 3/22/2018 to 7/5/2018	Third Quarter 7/5/2018 to 10/9/2018	Fourth Quarter 10/9/2018 to 1/11/2019
0-1 MILE OFFSITE				
6A4	16.8 ± 1.5	13.5 ± 1.5	16.1 ± 1.0	19.3 ± 0.2
8A3	11.0 ± 0.3	10.9 ± 0.0	13.0 ± 0.7	15.5 ± 0.5
15A3	11.2 ± 0.4	11.8 ± 0.5	13.8 ± 0.3	13.4 ± 0.2
16A2	10.9 ± 1.0	9.8 ± 0.4	13.2 ± 1.0	13.0 ± 0.8
1-2 MILES OFFSITE				
8B2	11.3 ± 2.0	11.7 ± 1.1	14.6 ± 2.4	13.7 ± 1.2
9B1	16.8 ± 0.8	15.6 ± 0.2	18.3 ± 0.3	17.2 ± 0.1
10B3	12.0 ± 0.7	10.8 ± 0.6	13.9 ± 0.1	13.0 ± 1.2
3-4 MILES OFFSITE				
1D5	14.0 ± 0.2	14.1 ± 1.0	16.2 ± 0.8	16.0 ± 0.5
8D3	12.2 ± 1.3	13.0 ± 0.4	15.4 ± 1.0	13.3 ± 0.1
9D4	12.5 ± 0.9	13.3 ± 1.0	15.7 ± 0.7	15.6 ± 0.8
10D1	13.6 ± 0.0	13.7 ± 2.2	15.8 ± 0.1	14.2 ± 1.4
12D2	16.8 ± 0.0	15.7 ± 0.4	21.3 ± 1.8	17.8 ± 0.5
14D1	12.4 ± 0.1	14.3 ± 0.2	16.0 ± 0.3	16.8 ± 0.2
4-5 MILES OFFSITE				
3E1	9.8 ± 1.1	9.9 ± 0.2	11.8 ± 0.9	11.4 ± 1.4
4E2	13.2 ± 0.3	14.4 ± 0.7	14.3 ± 0.8	14.8 ± 0.5
5E2	12.1 ± 0.1	12.4 ± 1.0	16.5 ± 2.1	14.6 ± 2.1
6E1	14.3 ± 0.9	15.0 ± 0.3	16.6 ± 0.7	17.0 ± 1.1
7E1	13.5 ± 0.2	13.5 ± 0.3	16.5 ± 1.0	15.7 ± 0.6
11E1	9.7 ± 0.6	9.6 ± 0.0	12.8 ± 1.7	7.7 ± 4.0
12E1	11.9 ± 1.0	11.0 ± 1.1	12.9 ± 1.3	14.9 ± 1.6
13E4	17.2 ± 0.2	15.3 ± 0.4	17.9 ± 0.2	18.1 ± 0.7

See the comments at the end of this table.

TABLE C-4 ENVIRONMENTAL OPTICALLY STIMULATED LUMINESCENCE DOSIMETRY RESULTS SUSQUEHANNA STEAM ELECTRIC STATION, 2018

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

LOCATION	First Quarter 1/10/2018 to 3/22/2018	Second Quarter 3/22/2018 to 7/5/2018	Third Quarter 7/5/2018 to 10/9/2018	Fourth Quarter 10/9/2018 to 1/11/2019
5-10 MILES OFFSITE				
2F1	14.1 ± 0.7	12.2 ± 0.3	14.4 ± 0.3	14.7 ± 0.3
15F1	14.5 ± 0.8	14.5 ± 0.1	16.7 ± 1.6	17.4 ± 1.9
16F1	17.1 ± 2.0	14.3 ± 0.8	17.6 ± 0.0	18.6 ± 0.7
10-20 MILES OFFSITE				
3G4	15.2 ± 0.4	14.0 ± 0.7	16.3 ± 0.2	16.4 ± 0.4
4G1	15.7 ± 1.5	14.7 ± 0.6	18.2 ± 1.7	17.5 ± 0.1
7G1	12.9 ± 1.2	12.1 ± 0.3	15.8 ± 0.3	15.2 ± 0.4
12G1	11.4 ± 0.3	10.5 ± 0.5	14.2 ± 0.1	13.3 ± 0.6
12G4	12.7 ± 0.1	11.4 ± 0.7	14.5 ± 0.1	12.9 ± 2.1

See the comments at the end of this table.

LOCATION				
INDICATOR				
Average (5)	15.8 ± 10.1	14.4 ± 6.9	17.6 ± 9.7	17.4 ± 9.1
CONTROL				
Average (5)	13.6 ± 3.7	12.5 ± 3.5	15.8 ± 3.2	15.1 ± 4.0

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. of the Annual Radiological Environmental Operating Report for an explanation of program exceptions to REMP.

(5) Uncertainties associated with quarterly indicator and control averages are two standard deviations, representing the variability between the results of the individual monitoring locations.

TABLE C-5 IODINE-131 AND GAMMA SPECTROSCOPIC ANALYSES OF MILK SUSQUEHANNA STEAM ELECTRIC STATION, 2018

Results in pCi/Liter ± 2 sigma

SITE	COLLECTION DATE	I-131	<----------GAMMA EMITTERS----------> K-40	Cs-134	Cs-137	Ba-140	La-140	Th-228
10G1	01/08/18	< 0.8	1421 ± 163	< 6	< 7	< 23	< 7	< 14
	02/05/18	< 0.5	1458 ± 154	< 8	< 9	< 28	< 8	< 16
	03/05/18	< 0.4	1330 ± 223	< 11	< 12	< 41	< 11	< 18
	04/09/18	< 0.4	1055 ± 206	< 8	< 8	< 31	< 11	< 15
	04/23/18	< 0.6	1231 ± 181	< 6	< 8	< 29	< 6	< 15
	05/07/18	< 0.5	1239 ± 161	< 7	< 6	< 33	< 10	< 14
	05/21/18	< 0.5	1313 ± 181	< 6	< 7	< 29	< 7	< 14
	06/04/18	< 0.5	1230 ± 188	< 8	< 9	< 37	< 15	< 14
	06/18/18	< 0.4	1224 ± 183	< 6	< 9	< 28	< 14	< 15
	07/02/18	< 0.4	1189 ± 156	< 6	< 6	< 29	< 9	< 13
	07/16/18	< 0.5	1359 ± 190	< 8	< 9	< 35	< 12	< 16
	07/30/18	< 0.5	1368 ± 180	< 7	< 7	< 29	< 7	< 11
	08/13/18	< 0.7	1329 ± 151	< 6	< 7	< 38	< 10	< 13
	08/27/18	< 0.3	1201 ± 189	< 7	< 9	< 31	< 10	< 15
	09/10/18	< 0.8	1228 ± 187	< 7	< 8	< 38	< 14	< 15
	09/24/18	< 0.7	1181 ± 169	< 8	< 8	< 39	< 13	< 13
	10/08/18	< 0.7	1331 ± 176	< 6	< 9	< 39	< 12	< 14
	10/22/18	< 0.6	1296 ± 114	< 5	< 5	< 22	< 6	< 8
	11/05/18	< 0.4	1444 ± 202	< 8	< 7	< 37	< 10	< 18
	12/10/18	< 0.5	1118 ± 209	< 7	< 8	< 44	< 14	< 15
	AVERAGE	-	1277 ± 213	-	-	-	-	-
13E3	01/08/18	< 0.5	1623 ± 212	< 7	< 9	< 31	< 9	< 19
	02/05/18	< 0.6	1192 ± 181	< 6	< 7	< 29	< 8	< 15
	03/05/18	< 0.5	1372 ± 184	< 7	< 8	< 28	< 7	< 15
	04/09/18	< 0.5	1223 ± 174	< 8	< 11	< 26	< 11	< 16
	04/23/18	< 0.4	1102 ± 169	< 8	< 8	< 31	< 10	< 14
	05/07/18	< 0.3	1055 ± 124	< 5	< 6	< 31	< 8	< 11
	05/21/18	< 0.2	1297 ± 124	< 6	< 6	< 23	< 6	< 11
	06/04/18	< 0.5	1291 ± 205	< 8	< 9	< 41	< 12	< 16
	06/18/18	< 0.4	1215 ± 169	< 9	< 7	< 31	< 12	< 16
	07/02/18	< 0.6	1184 ± 133	< 5	< 6	< 21	< 6	< 11
	07/16/18	< 0.7	1298 ± 176	< 8	< 10	< 32	< 6	< 17
	07/30/18	< 0.6	1292 ± 186	< 8	< 8	< 32	< 9	< 16
	08/13/18	< 0.4	1217 ± 188	< 7	< 9	< 38	< 10	< 16
	08/27/18	< 0.3	1305 ± 239	< 7	< 8	< 31	< 6	< 17
	09/10/18	< 0.7	1530 ± 212	< 8	< 8	< 41	< 12	< 15
	09/24/18	< 0.5	1256 ± 163	< 8	< 9	< 40	< 15	< 16
	10/08/18	< 0.6	1249 ± 175	< 7	< 9	< 44	< 13	< 16
	10/22/18	< 0.7	1263 ± 125	< 5	< 5	< 25	< 8	< 8
	11/05/18	< 0.5	1308 ± 199	< 9	< 10	< 48	< 13	< 16
	12/10/18	< 0.8	1170 ± 210	< 8	< 7	< 47	< 10	< 15
	AVERAGE	-	1272 ± 257	-	-	-	-	-

TABLE C-5 IODINE-131 AND GAMMA SPECTROSCOPIC ANALYSES OF MILK SUSQUEHANNA STEAM ELECTRIC STATION, 2018

Results in pCi/Liter ± 2 sigma

SITE	COLLECTION DATE	I-131	<----------GAMMA EMITTERS---------->					
			K-40	Cs-134	Cs-137	Ba-140	La-140	Th-228
5E2	01/08/18	< 0.7	1274 ± 171	< 6	< 8	< 22	< 7	< 14
	02/05/18	< 0.4	1228 ± 172	< 8	< 10	< 32	< 6	< 14
	03/05/18	< 0.5	1303 ± 221	< 9	< 8	< 30	< 11	< 18
	04/09/18	< 0.3	1310 ± 160	< 6	< 9	< 31	< 10	< 15
	04/23/18	< 0.3	1284 ± 140	< 5	< 6	< 25	< 6	< 13
	05/07/18	< 0.5	1179 ± 143	< 6	< 6	< 33	< 9	< 11
	05/21/18	< 0.3	1213 ± 148	< 5	< 7	< 25	< 7	< 13
	06/04/18	< 0.5	1235 ± 148	< 6	< 6	< 28	< 5	< 13
	06/18/18	< 0.4	1202 ± 194	< 7	< 8	< 31	< 10	< 15
	07/02/18	< 0.4	1279 ± 164	< 6	< 8	< 24	< 8	< 13
	07/16/18	< 0.7	1411 ± 206	< 8	< 9	< 36	< 11	< 17
	07/30/18	< 0.5	1284 ± 202	< 8	< 8	< 31	< 12	< 18
	08/13/18	< 0.6	1210 ± 165	< 6	< 8	< 41	< 7	< 14
	08/27/18	< 0.4	1349 ± 171	< 7	< 8	< 32	< 9	< 16
	09/10/18	< 0.7	1308 ± 169	< 7	< 9	< 38	< 12	< 15
	09/24/18	< 0.6	1388 ± 164	< 6	< 7	< 34	< 9	< 15
	10/08/18	< 0.5	1248 ± 162	< 6	< 6	< 30	< 15	< 13
	10/22/18	< 0.7	1273 ± 130	< 4	< 6	< 22	< 8	< 10
	11/05/18	< 0.5	1205 ± 195	< 7	< 9	< 29	< 10	< 13
	12/10/18	< 0.5	1077 ± 171	< 6	< 6	< 31	< 13	< 12
	AVERAGE	-	1263 ± 151	-	-	-	-	-

TABLE C-6 **TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF GROUNDWATER SUSQUEHANNA STEAM ELECTRIC STATION, 2018**

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	01/22/18	< 143	< 106	< 6	< 6	< 13	< 6	< 12	< 8	< 10	< 8	< 7	< 6	< 26	< 7	< 12
	05/03/18	< 132	< 55	< 3	< 3	< 11	< 4	< 6	< 4	< 7	< 11	< 3	< 4	< 23	< 7	< 6
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*2S2	01/22/18	< 143	< 116	< 7	< 8	< 19	< 10	< 14	< 9	< 14	< 8	< 7	< 9	< 27	< 10	< 14
	05/09/18	< 132	< 89	< 5	< 4	< 12	< 5	< 10	< 5	< 9	< 8	< 4	< 4	< 22	< 8	< 9
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2S8	01/22/18	< 140	< 82	< 10	< 10	< 27	< 10	< 24	< 13	< 15	< 13	< 13	< 12	< 34	< 13	< 26
	05/01/18	< 143	< 54	< 3	< 3	< 7	< 3	< 6	< 3	< 5	< 5	< 3	< 3	< 15	< 5	< 5
	08/02/18	< 140	< 62	< 6	< 7	< 17	< 6	< 12	< 7	< 13	< 11	< 6	< 6	< 31	< 9	< 15
	10/31/18	< 148	< 72	< 6	< 6	< 15	< 8	< 13	< 7	< 10	< 10	< 6	< 6	< 29	< 11	< 12
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*4S4	01/22/18	< 141	< 151	< 7	< 7	< 26	< 11	< 18	< 10	< 18	< 10	< 9	< 10	< 37	< 14	< 16
	05/03/18	< 128	< 43	< 4	< 4	< 13	< 4	< 8	< 4	< 8	< 11	< 4	< 4	< 25	< 10	< 7
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*6S10	01/22/18	< 146	< 142	< 5	< 6	< 13	< 6	< 10	< 7	< 10	< 9	< 6	< 7	< 23	< 7	< 11
	05/03/18	< 131	< 36	< 5	< 5	< 11	< 3	< 9	< 5	< 10	< 15	< 4	< 5	< 30	< 11	< 8
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*11S2	01/22/18	< 140	< 112	< 5	< 8	< 22	< 8	< 10	< 6	< 12	< 9	< 6	< 9	< 27	< 10	< 19
	05/03/18	< 131	< 36	< 4	< 4	< 11	< 4	< 8	< 4	< 8	< 13	< 4	< 4	< 28	< 9	< 7
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13S7	01/26/18	151 ± 92	< 124	< 7	< 8	< 24	< 8	< 16	< 8	< 11	< 11	< 8	< 7	< 29	< 11	< 14
	04/30/18	< 145	< 13	< 1	< 1	< 2	< 1	< 2	< 1	< 1	< 2	< 1	< 1	< 5	< 2	< 2
	07/30/18	< 149	< 48	< 4	< 5	< 14	< 4	< 8	< 4	< 8	< 10	< 4	< 3	< 23	< 8	< 9
	10/30/18	< 150	< 56	< 7	< 7	< 18	< 8	< 13	< 6	< 11	< 12	< 6	< 6	< 31	< 11	< 13
	AVERAGE	151 ± 0	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*Station was discontinued as of 05/30/18.

TABLE C-6 TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF GROUNDWATER SUSQUEHANNA STEAM ELECTRIC STATION, 2018

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
1S3	01/26/18	354 ± 103	< 141	< 7	< 7	< 19	< 7	< 14	< 9	< 12	< 11	< 7	< 7	< 36	< 13	< 13
	04/30/18	161 ± 94	< 34	< 3	< 4	< 10	< 4	< 6	< 4	< 6	< 8	< 3	< 3	< 22	< 7	< 7
	07/30/18	220 ± 97	< 104	< 5	< 5	< 15	< 5	< 11	< 6	< 10	< 10	< 5	< 5	< 27	< 8	< 10
	10/30/18	< 150	< 44	< 5	< 6	< 13	< 5	< 12	< 5	< 10	< 8	< 5	< 5	< 24	< 8	< 9
	AVERAGE	245 ± 198	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4S8	01/26/18	280 ± 97	< 153	< 10	< 10	< 23	< 9	< 18	< 10	< 15	< 14	< 9	< 9	< 43	< 15	< 17
	04/30/18	169 ± 97	< 32	< 5	< 6	< 15	< 6	< 9	< 6	< 10	< 12	< 5	< 6	< 24	< 10	< 10
	07/30/18	198 ± 96	< 42	< 5	< 5	< 15	< 5	< 8	< 5	< 8	< 10	< 5	< 6	< 27	< 10	< 11
	10/30/18	< 149	< 48	< 6	< 5	< 14	< 4	< 11	< 6	< 8	< 9	< 5	< 5	< 26	< 8	< 9
	AVERAGE	216 ± 115	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4S9	01/25/18	194 ± 93	< 104	< 5	< 6	< 18	< 7	< 14	< 7	< 12	< 9	< 6	< 7	< 34	< 10	< 12
	04/27/18	< 146	< 24	< 2	< 3	< 7	< 3	< 6	< 3	< 5	< 11	< 3	< 3	< 20	< 7	< 5
	07/27/18	< 148	< 51	< 3	< 3	< 10	< 4	< 6	< 4	< 6	< 9	< 3	< 3	< 20	< 7	< 6
	10/29/18	< 128	< 64	< 6	< 5	< 21	< 6	< 12	< 7	< 10	< 10	< 6	< 5	< 30	< 10	< 11
	AVERAGE	194 ± 0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6S11A	02/01/18	< 145	< 122	< 5	< 6	< 16	< 5	< 13	< 5	< 11	< 10	< 5	< 6	< 28	< 10	< 13
	05/02/18	< 142	< 122	< 6	< 6	< 13	< 6	< 12	< 6	< 11	< 12	< 6	< 5	< 31	< 10	< 13
	08/02/18	< 148	< 136	< 5	< 6	< 18	< 7	< 13	< 7	< 12	< 11	< 7	< 7	< 29	< 13	< 13
	10/31/18	< 127	< 55	< 6	< 5	< 18	< 6	< 12	< 7	< 10	< 9	< 6	< 6	< 24	< 10	< 12
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6S12	02/08/18	< 146	< 61	< 8	< 10	< 25	< 13	< 18	< 9	< 18	< 11	< 9	< 10	< 33	< 9	< 18
	05/01/18	< 147	< 26	< 3	< 3	< 8	< 3	< 5	< 3	< 4	< 6	< 3	< 3	< 14	< 5	9 ± 4
	07/26/18	< 145	< 100	< 4	< 5	< 13	< 4	< 10	< 5	< 8	< 15	< 4	< 4	< 36	< 9	< 7
	10/29/18	< 149	< 120	< 6	< 6	< 20	< 6	< 12	< 7	< 12	< 12	< 5	< 5	< 29	< 11	< 12
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9 ± 0
7S10	01/29/18	176 ± 94	< 161	< 9	< 8	< 17	< 9	< 20	< 11	< 16	< 10	< 9	< 8	< 33	< 13	< 19
	04/27/18	< 145	< 17	< 1	< 1	< 2	< 1	< 1	< 1	< 1	< 2	< 1	< 1	< 5	< 2	< 1
	07/31/18	< 138	< 60	< 6	< 5	< 16	< 7	< 15	< 7	< 10	< 12	< 6	< 6	< 32	< 9	< 12
	11/01/18	< 130	< 154	< 8	< 7	< 15	< 8	< 15	< 8	< 14	< 13	< 7	< 8	< 33	< 15	< 14
	AVERAGE	176 ± 0	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE C-6 TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF GROUNDWATER SUSQUEHANNA STEAM ELECTRIC STATION, 2018

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
7S11	01/29/18	147 ± 91	< 65	< 8	< 9	< 22	< 8	< 18	< 8	< 12	< 11	< 9	< 9	< 31	< 11	< 17
	04/27/18	< 144	< 52	< 3	< 3	< 10	< 3	< 6	< 3	< 6	< 12	< 3	< 3	< 26	< 9	< 6
	07/31/18	< 143	< 109	< 5	< 5	< 14	< 6	< 10	< 4	< 10	< 11	< 5	< 7	< 30	< 11	< 12
	11/01/18	< 149	< 91	< 8	< 6	< 13	< 7	< 18	< 6	< 10	< 9	< 6	< 9	< 29	< 12	< 13
	AVERAGE	147 ± 0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8S4	01/26/18	155 ± 95	< 50	< 7	< 7	< 16	< 4	< 16	< 6	< 9	< 9	< 5	< 8	< 31	< 9	< 12
	04/30/18	< 144	< 47	< 5	< 5	< 14	< 6	< 11	< 6	< 10	< 12	< 4	< 5	< 28	< 9	< 10
	07/30/18	< 148	< 71	< 6	< 5	< 16	< 7	< 13	< 6	< 12	< 12	< 6	< 7	< 34	< 12	< 11
	10/30/18	< 150	< 67	< 5	< 5	< 13	< 4	< 9	< 4	< 8	< 8	< 4	< 4	< 24	< 7	< 9
	AVERAGE	155 ± 0	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE C-7

ANNUAL AVERAGE TRITIUM CONCENTRATION IN PRECIPITATION, MONITORING WELLS AND LAKE TOOK-A-WHILE (LTAW) SURFACE WATER DATA SUSQUEHANNA STEAM ELECTRIC STATION, 2018

Results in pCi/Liter ± 2 sigma

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

* Revised values to reflect full scope of precipitation data.

** Station was discontinued after 5/30/18.

TABLE C-8 **GROSS BETA, TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF DRINKING WATER SUSQUEHANNA STEAM ELECTRIC STATION, 2018**

Results in pCi/Liter ± 2 sigma

	COLLECTION PERIOD				<----------GAMMA EMITTERS---------->												
SITE	START	STOP	Gr-B	H-3	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140
12H2	12/26/17 -	01/23/18	< 2.0	< 143	< 22	< 2	< 3	< 8	< 3	< 4	< 3	< 5	< 9	< 2	< 2	< 20	< 6
12H2	01/23/18 -	02/27/18	< 2.1	< 130	< 14	< 2	< 2	< 6	< 2	< 3	< 2	< 3	< 12	< 2	< 2	< 19	< 6
12H2	02/27/18 -	03/27/18	< 1.8	< 137	< 17	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 11	< 2	< 2	< 19	< 6
12H2	03/27/18 -	04/24/18	< 2.1	< 145	< 13	< 1	< 1	< 5	< 1	< 3	< 2	< 3	< 14	< 1	< 1	< 19	< 5
12H2	04/24/18 -	05/29/18	< 2.1	< 137	< 42	< 2	< 2	< 8	< 2	< 4	< 2	< 4	< 15	< 2	< 2	< 24	< 10
12H2	05/29/18 -	06/26/18	2.4 ± 1.4	< 143	< 29	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 9	< 1	< 2	< 16	< 6
12H2	06/26/18 -	07/24/18	2.8 ± 1.6	< 138	< 13	< 1	< 2	< 5	< 1	< 3	< 2	< 3	< 9	< 1	< 1	< 14	< 5
12H2	07/24/18 -	08/28/18	< 2.0	< 144	< 33	< 2	< 2	< 6	< 2	< 4	< 2	< 3	< 15	< 2	< 2	< 22	< 8
12H2	08/28/18 -	09/25/18	3.3 ± 1.4	< 137	< 38	< 2	< 3	< 7	< 3	< 4	< 3	< 5	< 14	< 2	< 2	< 26	< 8
12H2	09/25/18 -	10/23/18	< 1.9	< 149	< 50	< 3	< 3	< 6	< 3	< 6	< 3	< 5	< 14	< 3	< 3	< 26	< 9
12H2	10/23/18 -	11/27/18	2.2 ± 1.3	< 149	< 15	< 2	< 2	< 5	< 2	< 4	< 2	< 3	< 13	< 2	< 2	< 21	< 7
12H2	11/27/18 -	12/31/18	< 2.0	< 141	< 33	< 2	< 2	< 7	< 2	< 4	< 2	< 3	< 13	< 2	< 2	< 20	< 9
		AVERAGE	2.7 ± 1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE C-9 **GAMMA SPECTROSCOPIC ANALYSES OF FOOD PRODUCTS (FRUITS, VEGETABLES AND BROADLEAF) SUSQUEHANNA STEAM ELECTRIC STATION, 2018**

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	06/25/18	246 ± 106	2599 ± 398	< 22	< 17	< 17	< 58	< 33
	06/25/18	< 151	4503 ± 440	< 22	< 15	< 14	< 71	< 33
	06/25/18	< 198	4927 ± 582	< 24	< 17	< 21	< 71	< 32
	07/23/18	338 ± 198	3974 ± 435	< 26	< 18	< 18	< 72	< 38
	07/23/18	< 317	3910 ± 531	< 44	< 47	< 31	< 142	< 67
	07/23/18	408 ± 201	2975 ± 643	< 35	< 17	< 28	< 79	< 44
	08/27/18	667 ± 346	4926 ± 628	< 56	< 29	< 32	< 127	< 54
	08/27/18	796 ± 185	3551 ± 497	< 47	< 25	< 27	< 111	< 44
	08/27/18	850 ± 253	4630 ± 634	< 36	< 22	< 15	< 99	< 40
	09/17/18	357 ± 145	2787 ± 346	< 31	< 16	< 17	< 81	< 35
	09/17/18	452 ± 196	3684 ± 612	< 45	< 23	< 26	< 111	< 44
	09/17/18	706 ± 190	3504 ± 494	< 42	< 17	< 22	< 78	< 34
	10/15/18	478 ± 212	3314 ± 536	< 48	< 19	< 30	< 82	< 39
	10/15/18	< 239	3927 ± 532	< 49	< 24	< 27	< 85	< 37
	10/15/18	642 ± 216	4007 ± 533	< 50	< 29	< 29	< 108	< 49
	AVERAGE	540 ± 403	3815 ± 1451	-	-	-	-	-
11D1	10/05/18	< 166	1688 ± 361	< 55	< 22	< 23	< 110	< 37
	12/10/18	< 246	3700 ± 533	< 54	< 25	< 28	< 96	< 40
	12/10/18	< 297	16720 ± 1053	< 58	< 35	< 31	< 132	< 55
	AVERAGE	-	7369 ± 16320	-	-	-	-	-
11S6	06/25/18	313 ± 156	2294 ± 436	< 25	< 13	< 21	< 70	< 32
	06/25/18	< 166	5314 ± 542	< 23	< 17	< 20	< 69	< 33
	06/25/18	< 163	4387 ± 467	< 20	< 14	< 20	< 67	< 26
	07/23/18	722 ± 204	3857 ± 553	< 28	< 23	< 23	< 69	< 40
	07/23/18	593 ± 309	4828 ± 573	< 35	< 28	< 27	< 113	< 55
	07/23/18	802 ± 207	4105 ± 475	< 26	< 19	< 23	< 77	< 38
	08/27/18	1038 ± 228	6022 ± 579	< 39	< 23	< 22	< 87	< 41
	08/27/18	782 ± 221	5347 ± 594	< 34	< 14	< 19	< 81	< 35
	08/27/18	< 200	3703 ± 539	< 39	< 19	< 20	< 96	< 39
	09/17/18	410 ± 136	3091 ± 433	< 29	< 14	< 18	< 69	< 32
	09/17/18	762 ± 185	5980 ± 511	< 38	< 18	< 18	< 79	< 34
	09/17/18	733 ± 205	3962 ± 456	< 37	< 21	< 22	< 93	< 39
	10/15/18	414 ± 177	2978 ± 409	< 52	< 22	< 22	< 92	< 40
	10/15/18	< 147	4424 ± 567	< 40	< 17	< 18	< 88	< 33
	10/15/18	422 ± 228	4015 ± 548	< 50	< 20	< 24	< 97	< 38
	AVERAGE	635 ± 445	4287 ± 2153	-	-	-	-	-

TABLE C-9 **GAMMA SPECTROSCOPIC ANALYSES OF FOOD PRODUCTS (FRUITS, VEGETABLES AND BROADLEAF)**
SUSQUEHANNA STEAM ELECTRIC STATION, 2018

Results in pCi/kg (wet) ± 2 sigma

SITE	COLLECTION DATE	Be-7	K-40	I-131	Cs-134	Cs-137	Ac-228	Th-228
12F7	01/10/18	< 198	3004 ± 470	< 29	< 21	< 27	< 90	< 45
	AVERAGE	-	3004 ± 0	-	-	-	-	-
3S3	06/25/18	< 158	2539 ± 392	< 26	< 16	< 21	< 62	< 27
	06/25/18	< 231	4794 ± 581	< 30	< 21	< 26	< 84	< 39
	06/25/18	< 194	3814 ± 442	< 28	< 19	< 23	< 91	< 36
	07/23/18	702 ± 167	3492 ± 485	< 30	< 24	< 23	< 82	< 43
	07/23/18	567 ± 278	4031 ± 578	< 30	< 23	< 27	< 113	< 36
	07/23/18	683 ± 201	4493 ± 503	< 36	< 35	< 32	< 119	< 47
	08/27/18	639 ± 207	4063 ± 490	< 37	< 14	< 20	< 79	< 34
	08/27/18	476 ± 273	5928 ± 678	< 57	< 27	< 27	< 110	< 53
	08/27/18	495 ± 141	4970 ± 507	< 28	< 17	< 18	< 79	< 34
	09/17/18	458 ± 157	2286 ± 417	< 39	< 18	< 23	< 80	< 38
	09/17/18	395 ± 173	4616 ± 552	< 38	< 21	< 25	< 105	< 43
	09/17/18	769 ± 200	3470 ± 492	< 29	< 19	< 19	< 74	< 35
	10/15/18	386 ± 160	3094 ± 431	< 51	< 25	< 27	< 108	< 44
	10/15/18	343 ± 200	3654 ± 543	< 51	< 24	< 24	< 105	< 43
	10/15/18	471 ± 226	3423 ± 554	< 47	< 23	< 26	< 109	< 45
	AVERAGE	532 ± 276	3911 ± 1906	-	-	-	-	-

TABLE C-10 **TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF SURFACE WATER**
SUSQUEHANNA STEAM ELECTRIC STATION, 2018

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	12/26/17 - 01/23/18	< 143	< 22	< 2	< 2	< 6	< 2	< 4	< 3	< 4	< 9	< 2	< 2	< 18	< 5	< 4
	01/23/18 - 02/27/18	< 130	< 30	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 15	< 2	< 2	< 21	< 8	12 ± 3
	01/30/18 - 01/30/18	< 134	< 24	< 1	< 1	< 3	< 1	< 1	< 1	< 2	< 15	< 1	< 1	< 16	< 5	< 2
	02/27/18 - 03/27/18	< 137	< 14	< 1	< 2	< 5	< 2	< 3	< 2	< 3	< 9	< 1	< 2	< 16	< 5	< 3
	03/27/18 - 04/24/18	< 146	47 ± 28	< 1	< 2	< 4	< 1	< 3	< 2	< 3	< 15	< 1	< 1	< 22	< 7	< 3
	04/24/18 - 05/29/18	< 142	< 27	< 1	< 2	< 6	< 2	< 3	< 2	< 3	< 14	< 2	< 2	< 21	< 6	< 4
	05/29/18 - 06/26/18	< 144	< 30	< 1	< 2	< 5	< 2	< 3	< 2	< 3	< 8	< 1	< 1	< 14	< 6	< 2
	06/26/18 - 07/24/18	< 142	< 32	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 10	< 2	< 2	< 17	< 5	< 4
	07/24/18 - 08/28/18	< 150	< 14	< 2	< 2	< 6	< 2	< 3	< 2	< 3	< 14	< 1	< 2	< 22	< 6	< 3
	08/28/18 - 09/25/18	< 148	< 16	< 2	< 2	< 5	< 2	< 3	< 2	< 4	< 12	< 2	< 2	< 20	< 6	< 3
	09/25/18 - 10/23/18	< 130	< 35	< 2	< 2	< 7	< 2	< 4	< 2	< 4	< 14	< 2	< 2	< 23	< 7	< 3
	10/23/18 - 11/27/18	< 149	< 37	< 2	< 2	< 6	< 2	< 3	< 2	< 3	< 13	< 1	< 2	< 19	< 6	< 3
	11/27/18 - 12/31/18	< 139	< 29	< 2	< 2	< 7	< 2	< 3	< 2	< 3	< 13	< 1	< 2	< 21	< 7	< 3
	AVERAGE	-	47 ± 0	-	-	-	-	-	-	-	-	-	-	-	-	12 ± 0
**5S9	- -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2S7	12/26/17 - 01/23/18	344 ± 109	< 23	< 2	< 3	< 7	< 3	< 5	< 3	< 5	< 10	< 2	< 3	< 21	< 7	< 5
	01/23/18 - 02/27/18	438 ± 108	< 18	< 2	< 2	< 7	< 2	< 3	< 2	< 4	< 13	< 1	< 2	< 21	< 9	6 ± 3
	01/30/18 - 01/30/18	< 137	< 19	< 1	< 1	< 3	< 1	< 1	< 1	< 2	< 14	< 1	< 1	< 13	< 5	< 2
	02/27/18 - 03/27/18	1140 ± 176	< 25	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 10	< 1	< 2	< 16	< 5	< 3
	03/27/18 - 04/24/18	6170 ± 674	< 35	< 1	< 2	< 6	< 2	< 3	< 2	< 3	< 14	< 2	< 2	< 22	< 9	< 3
	04/24/18 - 05/29/18	2890 ± 281	< 10	< 1	< 1	< 4	< 1	< 2	< 1	< 2	< 14	< 1	< 1	< 19	< 6	< 2
	05/29/18 - 06/26/18	204 ± 98	< 35	< 1	< 2	< 5	< 2	< 3	< 2	< 3	< 9	< 1	< 2	< 15	< 5	< 3
	06/26/18 - 07/24/18	190 ± 96	< 18	< 2	< 2	< 7	< 2	< 4	< 2	< 4	< 12	< 2	< 2	< 20	< 6	< 4
	07/24/18 - 08/28/18	2890 ± 276	< 13	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 13	< 1	< 1	< 20	< 7	< 2
	08/28/18 - 09/25/18	3950 ± 357	< 9	< 1	< 1	< 3	< 1	< 2	< 1	< 2	< 6	< 1	< 1	< 11	< 3	< 2
	09/25/18 - 10/23/18	592 ± 125	< 38	< 2	< 2	< 8	< 2	< 5	< 2	< 5	< 15	< 2	< 2	< 24	< 8	6 ± 3
	10/23/18 - 11/27/18	221 ± 102	< 32	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 13	< 2	< 2	< 20	< 7	< 3
	11/27/18 - 12/31/18	354 ± 100	< 14	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 15	< 2	< 2	< 22	< 6	< 4
	AVERAGE	1615 ± 3874	-	-	-	-	-	-	-	-	-	-	-	-	-	6 ± 0
6S5	01/02/18 - 01/23/18	< 144	< 55	< 3	< 3	< 9	< 3	< 6	< 3	< 6	< 8	< 3	< 3	< 19	< 6	< 5
	01/30/18 - 02/27/18	< 133	< 40	< 2	< 2	< 6	< 2	< 4	< 3	< 5	< 14	< 2	< 2	< 24	< 8	< 4
	03/06/18 - 03/27/18	< 137	< 21	< 2	< 3	< 7	< 2	< 5	< 3	< 4	< 10	< 2	< 2	< 19	< 6	< 4
	04/03/18 - 04/24/18	< 148	< 16	< 2	< 2	< 6	< 2	< 4	< 2	< 3	< 13	< 2	< 2	< 20	< 6	< 3
	05/01/18 - 05/29/18	< 147	45 ± 26	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 13	< 2	< 2	< 21	< 7	< 3
	06/05/18 - 06/26/18	< 147	< 22	< 1	< 1	< 4	< 1	< 3	< 1	< 3	< 6	< 1	< 1	< 11	< 4	< 2

TABLE C-10 **TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF SURFACE WATER**
SUSQUEHANNA STEAM ELECTRIC STATION, 2018

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	07/02/18 - 07/24/18	< 145	< 14	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 7	< 1	< 2	< 13	< 4	< 3
(cont'd)	07/31/18 - 08/28/18	210 ± 94	< 21	< 2	< 2	< 7	< 2	< 5	< 2	< 4	< 14	< 2	< 2	< 23	< 8	< 4
	09/04/18 - 09/25/18	< 143	< 17	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 9	< 2	< 2	< 17	< 5	< 3
	10/02/18 - 10/23/18	< 150	< 34	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 9	< 2	< 2	< 18	< 6	< 4
	10/30/18 - 11/27/18	< 145	< 31	< 2	< 2	< 7	< 2	< 4	< 2	< 4	< 11	< 2	< 2	< 19	< 6	< 3
	12/04/18 - 12/31/18	< 142	< 24	< 2	< 3	< 10	< 4	< 6	< 3	< 6	< 14	< 3	< 3	< 28	< 11	< 5
	AVERAGE	210 ± 0	45 ± 0	-	-	-	-	-	-	-	-	-	-	-	-	-
*4S7	02/15/18 - 02/15/18	390 ± 100	< 66	< 8	< 7	< 27	< 7	< 15	< 6	< 14	< 12	< 8	< 8	< 39	< 13	< 12
	05/03/18 - 05/03/18	187 ± 87	< 85	< 4	< 4	< 13	< 5	< 10	< 4	< 8	< 10	< 3	< 4	< 27	< 10	< 6
	AVERAGE	289 ± 287	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*LTAW	02/15/18 - 02/15/18	< 149	101 ± 42	< 6	< 7	< 20	< 7	< 14	< 9	< 14	< 15	< 8	< 8	< 39	< 9	< 14
	05/03/18 - 05/03/18	< 143	< 97	< 4	< 4	< 10	< 4	< 7	< 4	< 7	< 13	< 4	< 4	< 32	< 8	< 8
	AVERAGE	-	101 ± 0	-	-	-	-	-	-	-	-	-	-	-	-	-
*5S12	02/15/18 - 02/15/18	< 143	< 141	< 8	< 6	< 19	< 7	< 14	< 7	< 9	< 13	< 5	< 6	< 30	< 14	< 13
	05/03/18 - 05/03/18	< 143	< 43	< 4	< 4	< 10	< 5	< 10	< 5	< 8	< 11	< 4	< 5	< 29	< 8	< 8
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*7S12	02/15/18 - 02/15/18	< 150	< 115	< 6	< 6	< 13	< 7	< 11	< 7	< 13	< 12	< 6	< 6	< 34	< 8	< 12
	05/03/18 - 05/03/18	169 ± 86	< 58	< 4	< 4	< 12	< 3	< 6	< 4	< 7	< 10	< 4	< 4	< 22	< 8	< 8
	AVERAGE	169 ± 0	-	-	-	-	-	-	-	-	-	-	-	-	-	-

* Station was discontinued after 5/30/18.
** No samples taken from station in 2018.

TABLE C-11 **GAMMA SPECTROSCOPIC ANALYSIS OF FISH**
SUSQUEHANNA STEAM ELECTRIC STATION, 2018

Results in pCi/kg (wet) ± 2 sigma

SITE	COLLECTION DATE	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Cs-134	Cs-137
2H									
Channel Catfish	05/10/18	3059 ± 690	< 49	< 32	< 142	< 62	< 94	< 52	< 44
Smallmouth Bass	05/10/18	3387 ± 1208	< 79	< 69	< 162	< 99	< 163	< 77	< 91
Shorthead Redhorse	05/10/18	4598 ± 978	< 53	< 59	< 158	< 41	< 93	< 48	< 58
Walleye	10/19/18	3693 ± 1079	< 78	< 58	< 230	< 54	< 148	< 62	< 63
Shorthead Redhorse	10/19/18	2913 ± 811	< 61	< 59	< 113	< 45	< 116	< 47	< 56
Smallmouth Bass	10/19/18	3453 ± 951	< 67	< 79	< 155	< 61	< 148	< 61	< 65
	AVERAGE	3517 ± 1198	-	-	-	-	-	-	-
IND									
Channel Catfish	05/09/18	3440 ± 877	< 40	< 50	< 171	< 43	< 71	< 45	< 39
Shorthead Redhorse	05/09/18	5034 ± 1033	< 61	< 63	< 168	< 45	< 123	< 61	< 67
Smallmouth Bass	05/09/18	3009 ± 1066	< 62	< 58	< 178	< 62	< 149	< 70	< 67
Smallmouth Bass	10/18/18	2988 ± 812	< 47	< 36	< 119	< 67	< 91	< 49	< 44
Walleye	10/18/18	2666 ± 1286	< 93	< 76	< 215	< 68	< 168	< 84	< 99
Shorthead Redhorse	10/18/18	3730 ± 1008	< 62	< 57	< 203	< 75	< 158	< 58	< 62
	AVERAGE	3478 ± 1698	-	-	-	-	-	-	-
LTAW									
Rainbow Trout	10/19/18	3911 ± 1003	< 87	< 77	< 249	< 65	< 145	< 76	< 91
Largemouth Bass	10/19/18	3996 ± 1128	< 80	< 76	< 220	< 78	< 205	< 80	< 89
	AVERAGE	3954 ± 120	-	-	-	-	-	-	-

TABLE C-12 GAMMA SPECTROSCOPIC ANALYSES OF SHORELINE SEDIMENT SUSQUEHANNA STEAM ELECTRIC STATION, 2018

Results in pCi/kg (dry) ± 2 sigma

SITE	COLLECTION DATE	K-40	Cs-134	Cs-137	Ra-226	Ac-228	Th-228
2B	04/24/18	10830 ± 1157	< 44	< 57	1547 ± 959	912 ± 238	956 ± 89
	10/25/18	14350 ± 2345	< 140	< 151	< 2999	1184 ± 421	1429 ± 238
	AVERAGE	12590 ± 4978	-	-	1547 ± 0	1048 ± 385	1193 ± 668
7B	04/24/18	8009 ± 1007	< 44	< 62	1686 ± 980	796 ± 203	832 ± 87
	10/25/18	10320 ± 1396	< 70	< 91	2800 ± 1269	913 ± 300	965 ± 143
	AVERAGE	9165 ± 3268	-	-	2243 ± 1575	855 ± 166	899 ± 188
12F	04/24/18	7801 ± 781	< 49	< 55	1524 ± 778	605 ± 193	776 ± 67
	10/25/18	7160 ± 1700	< 115	< 108	< 2656	1024 ± 485	880 ± 182
	AVERAGE	7481 ± 907	-	-	1524 ± 0	814 ± 593	828 ± 147

FIGURE C-1 - GROSS BETA ACTIVITY IN AIR PARTICULATES

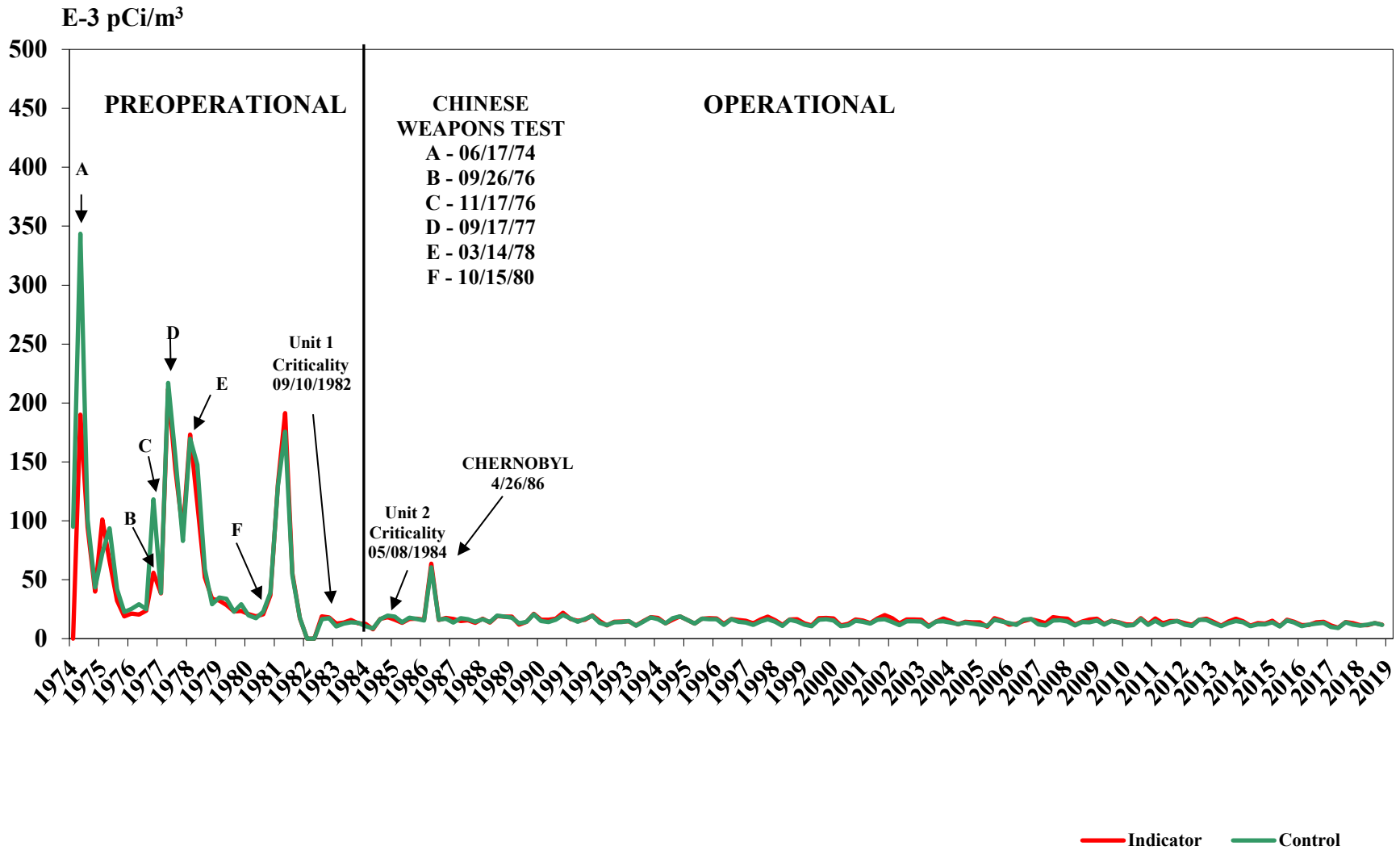


FIGURE C-2 - AMBIENT RADIATION LEVELS BASED ON ENVIRONMENTAL DOSIMETRY DATA

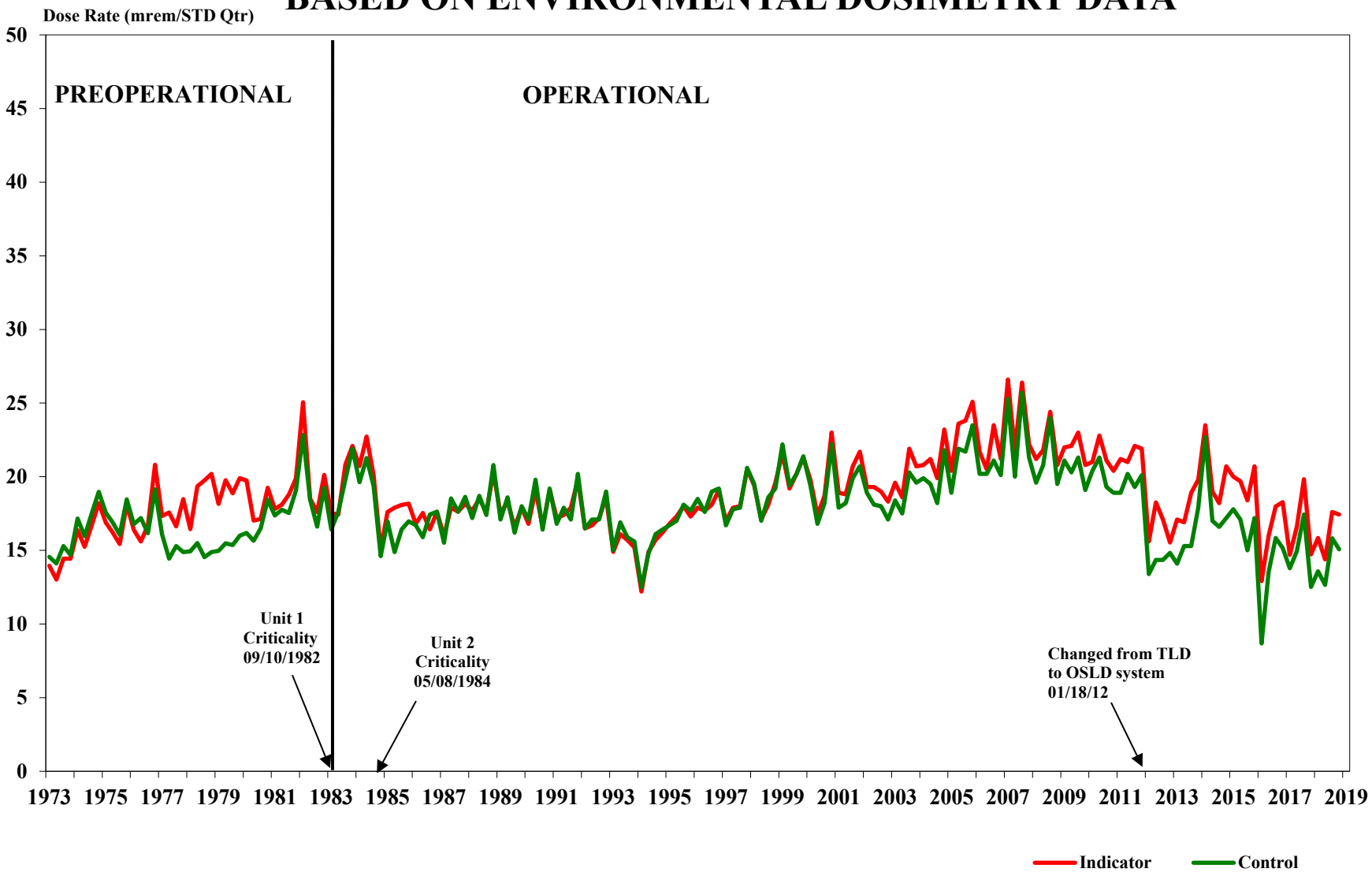


FIGURE C-3 - IODINE-131 ACTIVITY IN MILK

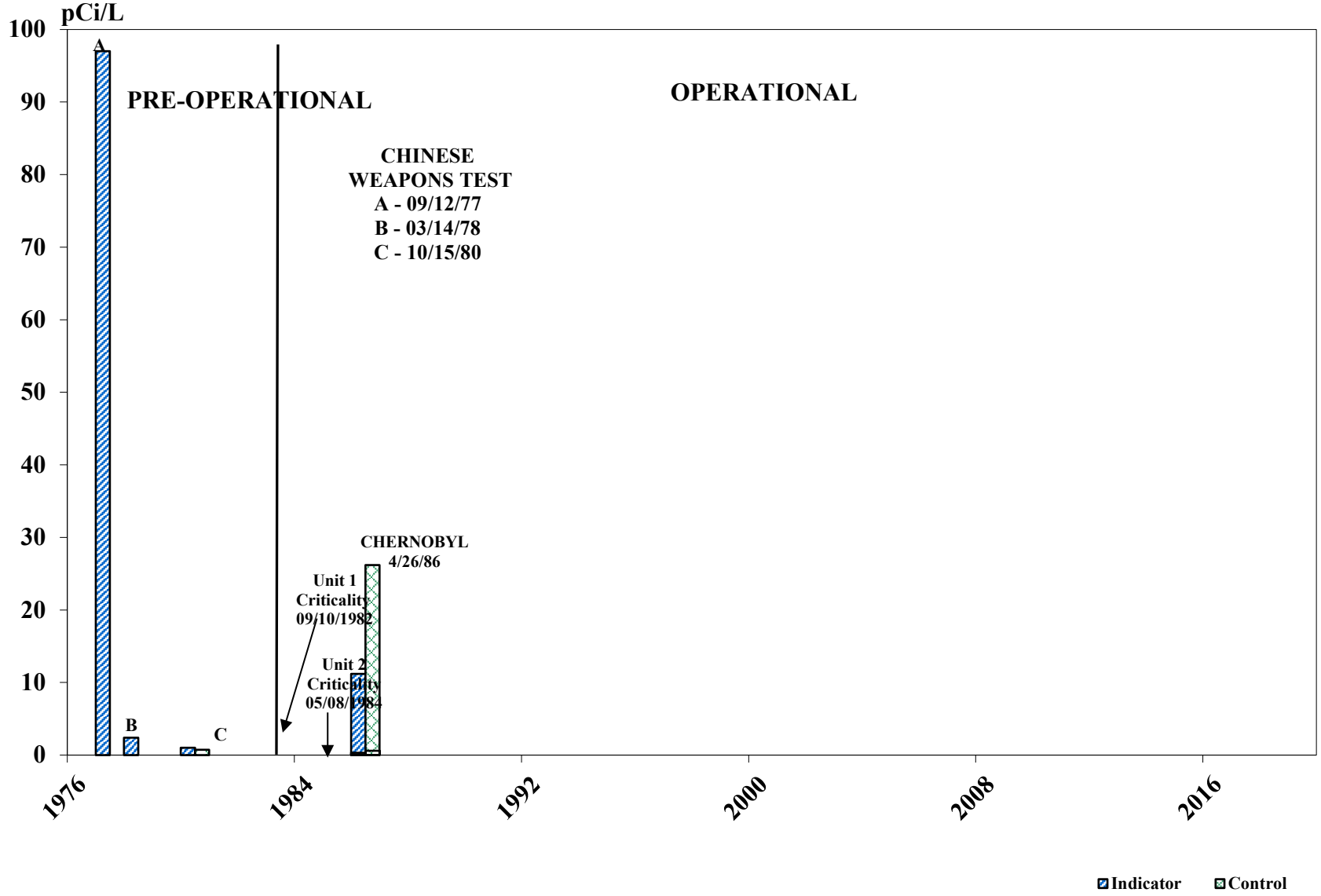


FIGURE C-4 - ANNUAL AVERAGE TRITIUM ACTIVITY IN PRECIPITATION AND SURFACE WATER VERSUS GROUND WATER

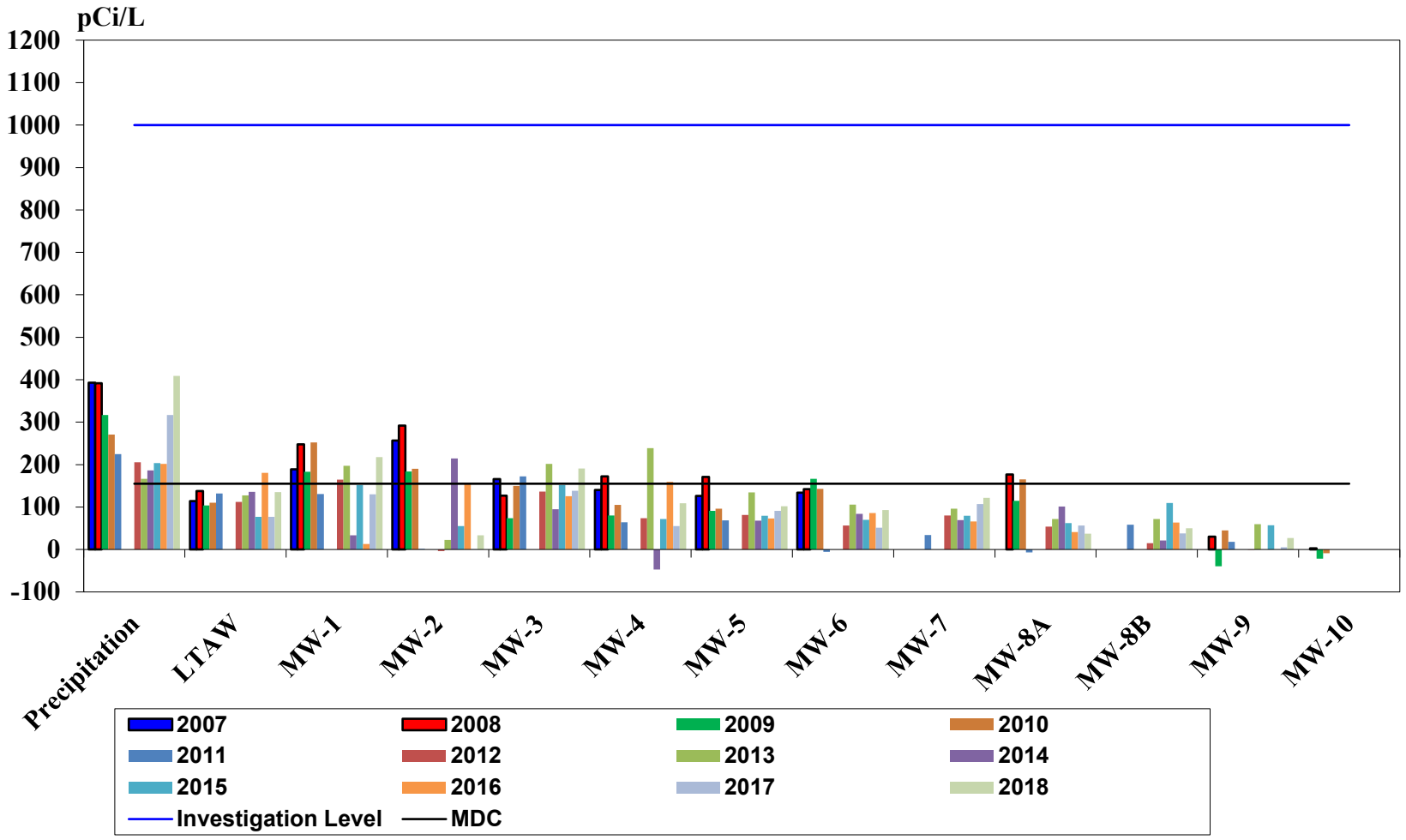


FIGURE C-5 - GROSS BETA ACTIVITY IN DRINKING WATER

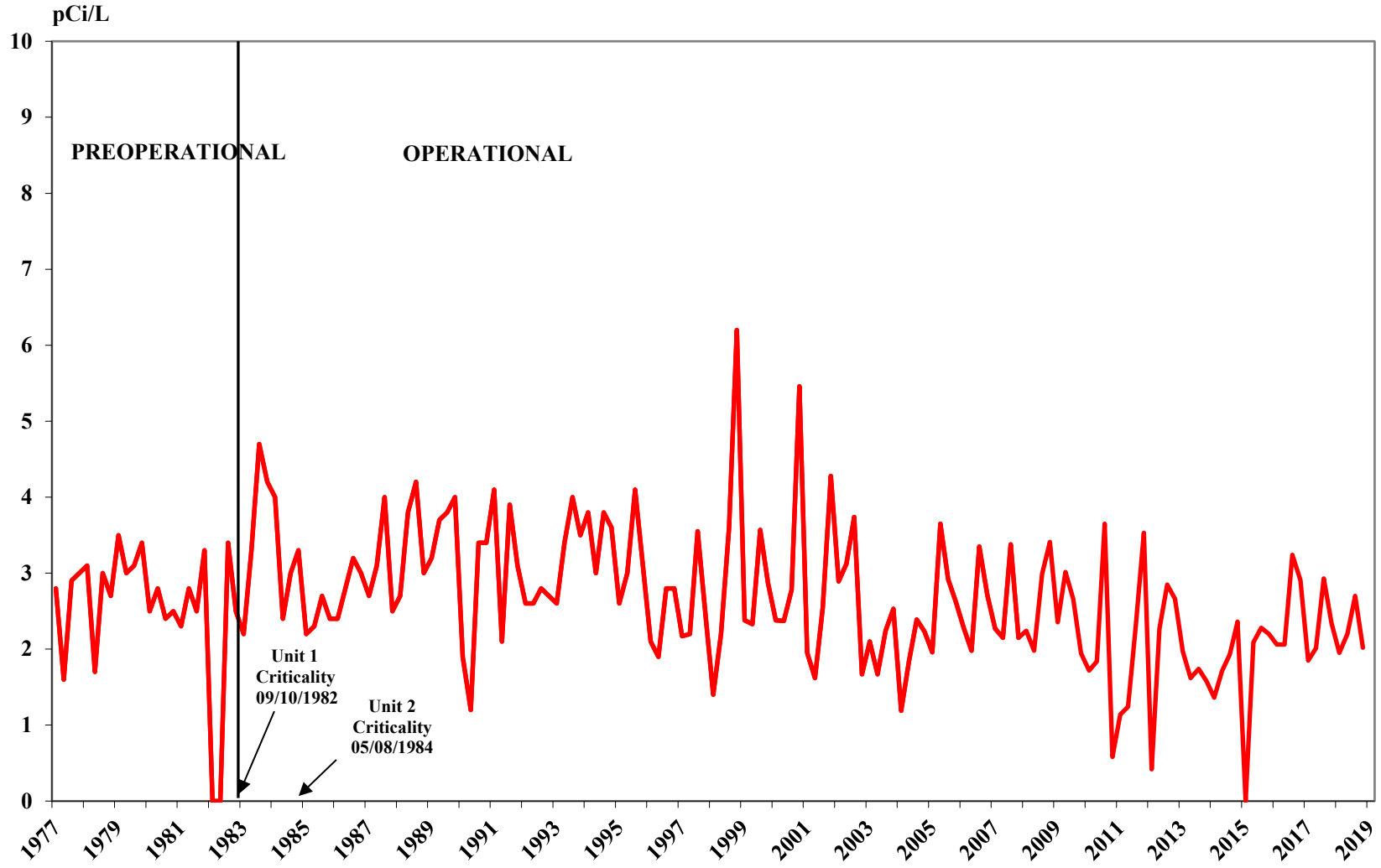
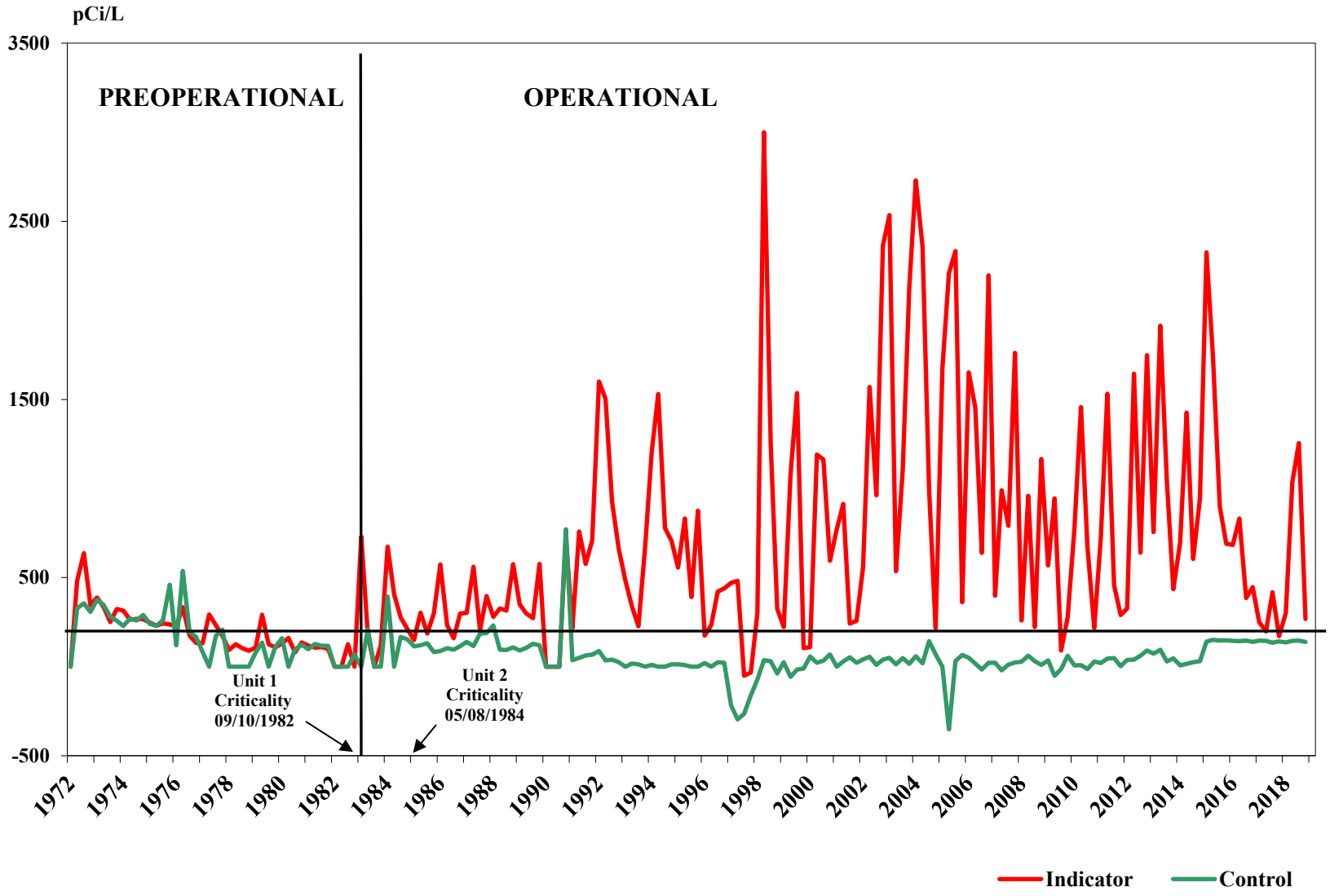


FIGURE C-6 - TRITIUM ACTIVITY IN SURFACE WATER



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APPENDIX D

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

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

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Ratio of TBE to Analytics Result	Evaluation [b]
March 2018	E12133	Milk	Sr-89	pCi/L	76.1	90.1	0.84	A
			Sr-90	pCi/L	12.2	12.5	0.98	A
	E12134	Milk	Ce-141	pCi/L	77.8	77.0	1.01	A
			Co-58	pCi/L	105	114	0.92	A
			Co-60	pCi/L	181	187	0.97	A
			Cr-51	pCi/L	298	326	0.92	A
			Cs-134	pCi/L	150	180	0.84	A
			Cs-137	pCi/L	164	172	0.95	A
			Fe-59	pCi/L	140	139	1.01	A
			I-131	pCi/L	105	108.0	0.97	A
			Mn-54	pCi/L	133	131	1.01	A
			Zn-65	pCi/L	242	244	0.99	A
	E12135	Charcoal	I-131	pCi	93.7	95.4	0.98	A
	E12136	AP	Ce-141	pCi	92.6	85.3	1.09	A
			Co-58	pCi	130	126	1.03	A
			Co-60	pCi	237	207	1.14	A
			Cr-51	pCi	411	361	1.14	A
			Cs-134	pCi	194	199	0.98	A
			Cs-137	pCi	200	191	1.05	A
			Fe-59	pCi	160	154	1.04	A
			Mn-54	pCi	152	145	1.05	A
			Zn-65	pCi	267	271	0.99	A
	E12137	Water	Fe-55	pCi/L	1990	1700	1.17	A
	E12138	Soil	Ce-141	pCi/g	0.148	0.118	1.26	W
			Co-58	pCi/g	0.171	0.174	0.98	A
			Co-60	pCi/g	0.297	0.286	1.04	A
			Cr-51	pCi/g	0.537	0.498	1.08	A
			Cs-134	pCi/g	0.274	0.275	1.00	A
			Cs-137	pCi/g	0.355	0.337	1.05	A
			Fe-59	pCi/g	0.243	0.212	1.15	A
			Mn-54	pCi/g	0.228	0.201	1.14	A
			Zn-65	pCi/g	0.395	0.374	1.06	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]
June 2018	E12205	Milk	Sr-89	pCi/L	74.9	84.6	0.89	A
			Sr-90	pCi/L	10.5	11.4	0.92	A
	E12206	Milk	Ce-141	pCi/L	89.2	82.2	1.08	A
			Co-58	pCi/L	94.8	89	1.07	A
			Co-60	pCi/L	125	113	1.10	A
			Cr-51	pCi/L	256	239	1.07	A
			Cs-134	pCi/L	112	114	0.99	A
			Cs-137	pCi/L	107	98.8	1.08	A
			Fe-59	pCi/L	95.9	86.0	1.12	A
			I-131	pCi/L	69.8	71.9	0.97	A
			Mn-54	pCi/L	138	130	1.06	A
			Zn-65	pCi/L	186	157	1.18	A
	E12207	Charcoal	I-131	pCi	69.6	72.2	0.96	A
	E12208	AP	Ce-141	pCi	151	165	0.92	A
			Co-58	pCi	174	178	0.98	A
			Co-60	pCi	290	227	1.28	W
			Cr-51	pCi	452	478	0.95	A
			Cs-134	pCi	215	227	0.95	A
			Cs-137	pCi	206	198	1.04	A
			Fe-59	pCi	180	172	1.05	A
			Mn-54	pCi	265	260	1.02	A
			Zn-65	pCi	280	315	0.89	A
	E12209	Water	Fe-55	pCi/L	1790	1740	1.03	A
	E12210	AP	Sr-89	pCi	77.8	90.3	0.86	A
			Sr-90	pCi	9.54	12.2	0.78	W

(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 2018	E12271	Milk	Sr-89	pCi/L	79.4	81.7	0.97	A
			Sr-90	pCi/L	12.2	14.8	0.82	A
	E12272	Milk	Ce-141	pCi/L	152	128	1.19	A
			Co-58	pCi/L	161	144	1.12	A
			Co-60	pCi/L	208	190	1.10	A
			Cr-51	pCi/L	244	265	0.92	A
			Cs-134	pCi/L	124	123	1.01	A
			Cs-137	pCi/L	166	147	1.13	A
			Fe-59	pCi/L	158	119	1.32	N(1)
			I-131	pCi/L	83.1	58.2	1.43	N(2)
			Mn-54	pCi/L	191	167	1.14	A
			Zn-65	pCi/L	229	201	1.14	A
	E12273	Charcoal	I-131	pCi	83.0	80.7	1.03	A
	E12274	AP	Ce-141	pCi	101	85.6	1.18	A
			Co-58	pCi	92.7	96.0	0.97	A
			Co-60	pCi	142	127	1.12	A
			Cr-51	pCi	218	177	1.23	W
			Cs-134	pCi	81.2	81.9	0.99	A
			Cs-137	pCi	99.0	98.5	1.01	A
			Fe-59	pCi	93.7	79.7	1.18	A
			Mn-54	pCi	116	112	1.04	A
			Zn-65	pCi	139	134	1.04	A
	E12302	Water	Fe-55	pCi/L	2120	1820	1.17	A
	E12276	Soil	Ce-141	pCi/g	0.259	0.221	1.17	A
			Co-58	pCi/g	0.279	0.248	1.12	A
			Co-60	pCi/g	0.367	0.328	1.12	A
			Cr-51	pCi/g	0.597	0.457	1.31	N [3]
			Cs-134	pCi/g	0.261	0.212	1.23	W
			Cs-137	pCi/g	0.376	0.330	1.14	A
			Fe-59	pCi/g	0.248	0.206	1.20	A
			Mn-54	pCi/g	0.317	0.289	1.10	A
			Zn-65	pCi/g	0.407	0.347	1.17	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 18-20***
*(2) See **NCR 18-24***
*(3) See **NCR 18-21***

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]
December 2018	E12313	Milk	Sr-89	pCi/L	71.9	91.9	0.78	W
			Sr-90	pCi/L	12.1	13.3	0.91	A
	E12314	Milk	Ce-141	pCi/L	124	133	0.93	A
			Co-58	pCi/L	110	119	0.93	A
			Co-60	pCi/L	202	212	0.95	A
			Cr-51	pCi/L	292	298	0.98	A
			Cs-134	pCi/L	146	171	0.85	A
			Cs-137	pCi/L	118	121	0.98	A
			Fe-59	pCi/L	120	114	1.05	A
			I-131	pCi/L	94.2	93.3	1.01	A
			Mn-54	pCi/L	151	154	0.98	A
			Zn-65	pCi/L	266	264	1.01	A
	E12315	Charcoal	I-131	pCi	94.8	89.9	1.05	A
	E12316A	AP	Ce-141	pCi	92.3	94.0	0.98	A
			Co-58	pCi	73.4	83.8	0.88	A
			Co-60	pCi	137	150	0.91	A
			Cr-51	pCi	202	210	0.96	A
			Cs-134	pCi	115	121	0.95	A
			Cs-137	pCi	85.0	85.4	1.00	A
			Fe-59	pCi	83.1	80.8	1.03	A
			Mn-54	pCi	104	109	0.96	A
			Zn-65	pCi	168	187	0.90	A
	E12317	Water	Fe-55	pCi/L	2110	1840	1.15	A
	E12318	AP	Sr-89	pCi	81.1	83.0	0.98	A
			Sr-90	pCi	11.4	12.0	0.95	A

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

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

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

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

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

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

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Acceptance Range	Evaluation [b]
February 2018	18-MaS38	Soil	Ni-63	Bq/kg	9.94		*(1)*	A
			Sr-90	Bq/kg	0.846		*(1)*	A
	18-MaW38	Water	Am-241	Bq/L	0.785	0.709	0.496 - 0.922	A
			Ni-63	Bq/L	12.6	14.0	9.8 - 18.2	A
			Pu-238	Bq/L	0.0214	0.023	*(2)*	A
			Pu-239/240	Bq/L	0.544	0.600	0.420 - 0.780	A
	18-RdF38	AP	U-234/233	Bq/sample	0.111	0.124	0.087 - 0.161	A
			U-238	Bq/sample	0.123	0.128	0.090 - 0.166	A
	18-RdV38	Vegetation	Cs-134	Bq/sample	2.46	3.23	2.26 - 4.20	W
			Cs-137	Bq/sample	3.14	3.67	2.57 - 4.77	A
			Co-57	Bq/sample	4.12	4.42	3.09 - 5.75	A
			Co-60	Bq/sample	1.86	2.29	1.60 - 2.98	A
			Mn-54	Bq/sample	2.21	2.66	1.86 - 3.46	A
			Sr-90	Bq/sample				NR[3]
			Zn-65	Bq/sample	-0.201		*(1)*	A
November 2018	18-MaS39	Soil	Ni-63	Bq/kg	703	765	536 - 995	A
			Sr-90	Bq/kg	137	193	*135 - 251*	W
	18-MaW39	Water	Am-241	Bq/L	0.0363		*(1)*	A
			Ni-63	Bq/L	6.18	7.0	4.9 - 9.1	A
			Pu-238	Bq/L	0.73	0.674	0.472 - 0.876	A
			Pu-239/240	Bq/L	0.89	0.928	0.650 - 1.206	A
	18-RdF39	AP	U-234/233	Bq/sample	0.159	0.152	0.106 - 0.198	A
			U-238	Bq/sample	0.162	0.158	0.111 - 0.205	A
	18-RdV39	Vegetation	Cs-134	Bq/sample	1.85	1.94	1.36 - 2.52	A
			Cs-137	Bq/sample	2.5	2.36	1.65 - 3.07	A
			Co-57	Bq/sample	3.53	3.31	2.32 - 4.30	A
			Co-60	Bq/sample	1.6	1.68	1.18 - 2.18	A
			Mn-54	Bq/sample	2.61	2.53	1.77 - 3.29	A
			Sr-90	Bq/sample	0.338	0.791	0.554 - 1.028	N[4]
			Zn-65	Bq/sample	1.32	1.37	*0.96 - 1.78*	A

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

(b) DOE/MAPEP evaluation:

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

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

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

(1) False positive test

(2) Sensitivity evaluation

*(3) See **NCR 18-09***

*(4) See **NCR 18-25***

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

Month/Year	Identrification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Acceptance Limits	Evaluation [b]
March 2018	MRAD-28	AP	GR-A	pCi/sample	65.7	43.4	22.7 - 71.5	A
			GR-B	pCi/sample	57.2	52	31.5 - 78.6	A
April 2018	RAD-113	Water	Ba-133	pCi/L	91.2	91.5	77.1 - 101	A
			Cs-134	pCi/L	70.4	75.9	62.0 - 83.5	A
			Cs-137	pCi/L	122	123	111 - 138	A
			Co-60	pCi/L	64.8	64.3	57.9 - 73.2	A
			Zn-65	pCi/L	98.6	86.7	78.0 - 104	A
			GR-A	pCi/L	32.8	28.6	14.6 - 37.5	A
			GR-B	pCi/L	62.9	73.7	51.4 - 81.1	A
			U-Nat	pCi/L	6.7	6.93	5.28 - 8.13	A
			H-3	pCi/L	17100	17200	15000 - 18900	A
			Sr-89	pCi/L	38.6	48.8	38.3 - 56.2	A
			Sr-90	pCi/L	27.1	26.5	19.2 - 30.9	A
			I-131	pCi/L	26.7	24.6	20.4 - 29.1	A
September 2018	MRAD-29	AP	GR-A	pCi/sample	49.7	55.3	28.9 - 91.1	A
		AP	GR-B	pCi/sample	75.3	86.5	52.4 - 131	A
October 2018	RAD-115	Water	Ba-133	pCi/L	15.2	16.3	11.9 - 19.4	A
			Cs-134	pCi/L	85.9	93.0	76.4 - 102	A
			Cs-137	pCi/L	229	235	212 - 260	A
			Co-60	pCi/L	81.9	80.7	72.6 - 91.1	A
			Zn-65	pCi/L	348	336	302 - 392	A
			GR-A	pCi/L	38.9	60.7	31.8 - 75.4	A
			GR-B	pCi/L	36.5	41.8	27.9 - 49.2	A
			U-Nat	pCi/L	17.48	20.9	16.8 - 23.4	A
			H-3	pCi/L	2790	2870	2410 - 3170	A
			I-131	pCi/L	26.9	27.2	22.6 - 32.0	A
			Sr-89	pCi/L	57.2	56.9	45.5 - 64.6	A
			Sr-90	pCi/L	36.8	31.4	22.9- 36.4	N[1]

(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 18-23***

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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	2018
Air Particulate & Charcoal	3S2	SSES Backup Met. Tower	99.9	99.3	98.9	99.9	100	99	100	99.9	99.9
	12S1	West Building	99.9	100	99.9	99.9	100	100	100	99.1	99.7
	13S6	Former Laydown Area, West of Confers Lane	100	99.7	99.1	99.9	100	97	100	100	99.9
	12E1	Berwick Hospital	100	100	99.9	100.0	100	98	99.1	100	100
	6G1	Freeland Substation	100	100	99.9	99.9	100	90*	100	100	100
	8G1	PPL System Facilities Center, Humboldt Industrial Park	99.7	100	99.8	99.9	100	100	99.2	99.9	99.9
	10S3	E of Confers Lane, S of Towers Club	-	-	-	-	-	-	100	99.5	99.9
	9B1	Transmission Line, E of Route 11	-	-	-	-	-	-	100	99.9	99.9
Drinking Water	12H2	Danville Water Company	100	100	100	100.0	100	100	100	100	100
Surface Water	2S7	Cooling Tower Blowdown Discharge Line	98.0	99.1	98.1	98.1	69**	100	99.1	100	100
	6S6	River Water Intake Line	100	95.5	93.4	93.2	93	98	99.7	99.9	99.9

* Planned power outage by Electric Utilities
** Auto- Compsite sampler problems, March through June. New Auto- Compsite sampler installed in July.