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TALEN ENERGY

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U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
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10 CFR 50.4

SUSQUEHANNA STEAM ELECTRIC STATION
ANNUAL RADIOLOGICAL ENVIRONMENTAL
OPERATING REPORT
PLA-7601

Docket No. 50-387
50-388

In accordance with the Susquehanna Steam Electric Station Units 1 and 2 Technical Specification 5.6.2, the Susquehanna Steam Electric Station Annual Radiological Environmental Operating Report is hereby submitted for the calendar year 2016.

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

This letter contains no new regulatory commitments.

Sincerely,

B. Berryman

Attachment 1: Susquehanna Steam Electric Station Annual Radiological Environmental Operating Report

Copy:

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Enclosure to PLA-7601

Susquehanna Steam Electric Station Annual Radiological Environmental Operating Report - 2016

Susquehanna Steam Electric Station

Units 1 & 2

2016 ANNUAL REPORT

Annual Radiological Environmental Operating Report

Susquehanna Nuclear, LLC
Berwick, PA
April 2017

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 and 2

Annual Radiological
Environmental Operating Report

2016

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SUSQUEHANNA STEAM ELECTRIC STATION

Units 1 & 2

2016 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

JANUARY 1 TO DECEMBER 31, 2016

Susquehanna Nuclear, LLC
Berwick, PA
April, 2017

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I. Summary

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

Ecology III was responsible for the collection of environmental samples during 2016. Teledyne Brown Engineering (TBE) was responsible for the analysis of environmental samples during 2016. The results are discussed in this report. Landauer provided the dosimetry services for SSES during 2016.

This Annual Radiological Environmental Operating Report (AREOR) conducted for SSES covers the period January 1, 2016 through December 31, 2016. During that time period, 1545 analyses were performed on 1317 samples.

Of the two man-made radionuclides (tritium [H-3] and cesium-137 [Cs-137]) detected in the environment by the Susquehanna Steam Electric Station (SSES) Radiological Environmental Monitoring Program (REMP), tritium is the only radionuclide attributable to SSES operation. The whole body and organ dose to members of the public attributable to tritium identified in REMP cooling tower blowdown samples was 7.73E-04 mRem. Tritium was included in the dose calculation because it was identified in the REMP samples of permitted water being discharged to the Susquehanna River. Cs-137 is attributed to fallout from atmospheric nuclear weapons testing. The 2016 average concentration of tritium in the cooling tower blowdown water and the 2016 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 2016 was 45.2 curies.

The 2016 average dilution factor for the Susquehanna River was 388, based on the annual average river flow of 4.65E+06 gpm and the annual average cooling tower blowdown flow of 1.20E+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 2016 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 2016 verify the adequacy of the SSES radioactive

effluent control systems.

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

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

High sensitivity iodine-131 (I-131) analyses were performed on weekly air samples. All results were less than the minimum detectable concentration.

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

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

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

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

detected were consistent with those detected in previous years. No fission or activation products were detected.

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

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

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

Fish and shoreline sediment samples were analyzed for concentrations of gamma emitting nuclides. 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, 2016, 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

Date	Sample Type	Location	Exception	Corrective Action
01/06/16 to 01/14/16	Air	8G1	Power outage (date and time unknown). Loss of 21.8 hours as determined by timer box during weekly collection Non-continuous sampler operation.	CA #16-01 AR 2016-01327 01/14/16: No action required. Air monitor resumed normal operation when power was restored. 01/14/16: Operability verified @ 1207 hours. *Ideal sample collected for sample period: 22,000 cf.* TRM requirements were met since second control location (6G1) was operational during sample period.

Date	Sample Type	Location	Exception	Corrective Action
01/14/16 to 01/27/16	Air	8G1	Power outage on 01/19/16 @ 1715 (loss of 18 hours) as determined by timer box. Air monitor was not operational upon arrival or departure on 1/20/16 (loss of 3 hours, 41 minutes) due to transformer issues near sample location as confirmed by PPL System Access. Non-continuous sampler operation	CA #16-02 CR 2016-0176 01/20/16: Power restored @1453 hours and air monitc resumed normal operation. 01/21/16: Operability verifie 1035 hours *Ideal sample collected for sample periods:* *16,200 cf (01/14/16 to 01/20* *21,300 cf (01/20/16 to 01/27* TRM requirements were me since second control locatio (6G1) was operational durin sample period.
02/23/16 to 03/01/16	Surface Water	6S6	(week 5 Feb composite) Diminished sample flow (<1.0 gpm) as discovered during weekly collection.	CA #16-03 CR 2016-051 03/01/16: Adequate sam volume collected during sa period. Maintenance reque 03/04/16: Maintenance performed by I&C and sa flow restored to required gpm. 03/08/16: Operability verifi 1005 hours. *Ideal sample collected f sample period.*
1st Quarter	Ground Water	13S7 (MW-6)	Safety concern. Unable to collect sample within quarterly time limit due to cooling tower falling ice hazard. Quarterly time frequency (92 ± 23 days from previous sample collected on 10/27/15) ended on 02/19/16.	CA #16-04 AR 2016-06 03/11/16: Sample collect Second quarter sample sch will use 01/31/16 as stop da allow collection of all on-s monitoring wells at the sa time. TRM required sampling w conducted at other groundv monitoring locations during quarter.
03/16/16 to 03/23/16	Air	12E1	Pump malfunction – inadequate air flow rate (below procedural 2.0-2.4 cfm), pump vibrating, and hot as discovered during weekly collection. No effect on continuous sampler operation	CA #16-05 CR 2016-081 03/23/16: Replaced pump performed air flow verificat 03/23/16: Operability veri @1026 hours. *< Ideal sample (15,120-30 cf) collected for sample pe but adequate to support req analyses: 14,800 cf.*

Date	Sample Type	Location	Exception	Corrective Action
2nd Quarter	TLD	7G1	Environmental TLD results not obtained due to missing TLD from 7G1 (Hazleton Industrial Park). TLD was not included in shipment for analytical results	CA #16-13 AR 2016-19232 08/16/16: 3 Q TLD installed. *Adequate number of TLDs collected from other monitoring locations. AR for tracking and trending of occurrence.*
04/06/16 to 04/13/16	Air	13S6Q (QC location)	(loss of 43.5 hours) Timer box malfunction caused air monitor to turn off as discovered during weekly collection. Non-continuous sampler operation.	CA #16-06 AR 2016-10029 04/13/16: Replaced timer box and returned air monitor to operation. 04/13/16: Operability verified @ 0944 hours. *Ideal sample collected for sample period: 16,600 cf* Required location 13S6 ran continuously during sample period.
05/09/16 to 05/16/16 05/16/16 to 05/24/16	Surface Water	6S6	Week 3 May composite Diminished sample flow (<1.0 gpm) as discovered during weekly collection. week 4 May composite Overflowing collection container (non-representative sample) for 05/16/16 to 05/17/16 as discovered by I&C during maintenance This resulted in delayed start date of 05/17/16.	CA #16-07 CR 2016-12994 05/16/16: Adequate sample volume collected during sample period. 05/17/16: Routine PM performed by I&C. Restored sample flow to 1.5 gpm. 05/17/16 @ 1045: Delayed start date and time for week 4. 05/17/16: Operability verified @ 1430 hours. *Ideal sample collected for sample periods.*
05/09/16 to 05/16/16	Surface Water	2S7	Week 3 May composite CTBD secured on 05/12/16 from 0500 to 1645 hours for planned maintenance on manhole MH-PD-07 (RTPM-1966614).	CA #16-09 CR 2016-09744 05/12/16: No corrective action required. Sampler resumed normal operation when blowdown was restored. 05/13/16: Operability verified @ 1032 hours. *Ideal sample collected for sample period.*

Date	Sample Type	Location	Exception	Corrective Action
06/2016	Broad Leaf	8G1	Loss of June control sample due to plants eaten by an animal that invaded garden plot as discovered by sample collectors during weekly air monitor collection on 06/08/16.	CA #16-08 AR 2016-151 06/12/16: Replanted garde with same broad leaf plants reinforced spaces around entrance gate with mesh lat and wire.
06/08/16 to 06/15/16	Air	12E1	(loss of 80.5 hours) Power strip surge protector malfunction caused power loss to sampler as discovered during weekly collection. Non-continuous sampler operation.	CA #16-10 CR 2016-15 06/15/16: Replaced power surge protector and timer since timer would not res Returned monitor to servi 06/15/16: Operability verifi 0928 hours *< Ideal sample (15,120-30,2 cf) collected for sample per but adequate to support req analyses: 11,000 cf*
07/12/16 to 07/19/16 07/19/16 to 07/26/16	Surface Water	2S7	Week 3 composite Week 4 composite CTBD secured for planned work associated with diffuser pipe inspection (RTPM-1919082). CTBD secured times: 07/18/16: 0400 to 2032 hours 07/19/16: 0503 to 1650 hours 07/20/16: 0420 to 1705 hours	CA #16-11 AR 2016-17 07/18/16 to 07/20/16: N corrective action require Sampler resumed norm operation when blowdown restored each day. 07/21/16: Operability verifi 0952 hours. *Ideal sample collected f sample periods.*
07/26/16 to 8/02/16	Surface Water	6S6	Week 1 Aug composite ACS out of service for approximately 1.5 hours for routine maintenance by I&C.	CA #16-12 CR 2016-18 07/29/16: CR generated by No corrective action requ since this was routine maintenance. PM date wi noted on sample collection 08/02/16: Operability verifi 0835 hours. *Ideal sample collected f sample period.*

Date	Sample Type	Location	Exception	Corrective Action
08/10/16 to 8/24/16	Air	8G1	Possible timer box malfunction – timer box reading did not match sample size (meter reading) when run time was calculated as discovered during weekly collection. No effect on continuous sampler operation.	CA #16-14 AR 2016-19516 08/17/16: Timer box was operational upon departure. 08/19/16: Replaced timer box upon Susquehanna Chemistry Support recommendation. Also replaced pump due to safety concern with electrical plug. 08/19/16: Operability verified @ 1130 hours. *Ideal sample collected for sample periods:* *21,700 cf (08/10/16 to 08/17/16)* *20,300 cf (08/17/16 to 08/24/16)*
08/17/16 to 08/24/16	Air	12E1	Timer box malfunction – digits failed to advance as discovered during weekly collection. No effect on continuous sampler operation.	CA #16-15 CR 2016-20116 08/24/16: Replaced timer box. 08/24/16: Operability verified @ 1042 hours. *Ideal sample collected for sample period:* *21,200 cf*
09/07/16 to 09/14/16	Air	10S3	Pump malfunction – inadequate air flow rate (below procedural 2.0-2.4 cfm), and making loud grinding noise as discovered during weekly collection. No effect on continuous sampler operation.	CA #16-16 AR 2016-21191 09/14/16: Replaced pump and performed air flow verification. 09/14/16: Operability verified @ 1022 hours. *< Ideal sample (15,120-30,240 cf) collected for sample period, but adequate to support required analyses:* *11,000 cf*
10/12/16 to 10/19/16	Air	8G1	(loss of 23.7 hours) Possible power outage as determined by timer box (date and time unknown) as discovered during weekly collection. Non-continuous sampler operation.	CA #16-17 CR 2016-23788 10/19/16: No corrective action required. Air monitor resumed normal operation when power was restored. 10/19/16: Operability verified @ 1157 hours. *Ideal sample collected for sample period:* *20,300 cf* TRM requirements were met since second control location (6G1) was operational during this period.

Date	Sample Type	Location	Exception	Corrective Action
11/08/16 to 11/15/16	Surface Water	6S6	Week 3 Nov composite Non-representative weekly sample. Insufficient weekly sample volume as discovered during weekly collection due to collection container's spigot not closed properly during week 2 collection on 11/08/16.	CA #16-18 CR 2016-257 11/15/16: Grab sample coll as per REMP procedure Composite container spigot more clearly labeled to ens proper closure. 11/15/16: Operability verifie 1056 hours. *Grab sample collected for v 3.* *Ideal sample for weeks 1, 2 Nov composite.*
11/21/16 to 11/29/16	Surface Water	6S6	Week 5 Nov composite ACS out of service for routine maintenance.	CA #16-19 CR 2016-2615 11/22/16: CR generated by No corrective action require since this was routine maintenance. PM date will noted on sample collection 11/29/16: Operability verifie 1345 hours. *Ideal sample collected for sample period.*
11/29/16 to 12/06/16	Surface Water	2S7	Week 1 Dec composite Composite sampler malfunction as discovered during weekly collection. Insufficient length of tubing (replaced by Chemistry personnel the previous day, 11/28/16) caused sampler to collect greater than normal sample. Sampler automatically shut off on 11/29/16 @ 0624 and sample was contained in collection container. Unable to calibrate required aliquots. Delayed start date of 12/01/16 for week 1. Non-continuous sampler operation.	CA #16-20 CR 2016-264 11/29/16: Correct length tubing installed. 12/01/16: New composi sampler installed and beg operation. Delayed start d and time of 12/01/16 @ 1 12/06/16: Operability verifi 0946 hours. *Ideal sample collected f sample period.*

Date	Sample Type	Location	Exception	Corrective Action
11/29/16 to 12/06/16	Surface Water	2S7	Week 1 Dec composite CTBD secured on 11/30/16 from 0324 to 1301 hours for planned maintenance on manhole MH-PD-07 (RTPM-2009181).	CA #16-21 CR N/A RTPM 2009181: 11/30/16: No corrective action required. Sampler resumed normal operation when blowdown was restored. 12/01/16: Operability verified @ 1331 hours. *Ideal sample collected for sample periods.*
12/06/16 to 12/13/16	Surface Water	2S7	Week 2 Dec composite Composite sampler malfunction as discovered during weekly collection. Greater than normal sample collected for sample period possibly due to air in tygon sample line causing sampler to turn off on 12/12/16 @ 1533. Delayed start date of 12/13/16 @ 1322 for week 2. Non-continuous sampler operation.	CA #16-22 CR 2016-27274 12/13/16: Tygon tubing was cleared of air and procedurally required sample aliquot obtained. Continue to monitor sampler for week 3 Dec composite. 12/13/16: Operability verified @ 1322 hours. *Ideal sample collected for sample period.*
12/07/16 to 12/14/16	Air	8G1	(loss of 4.1 hours) Possible power outage as determined by timer box (date and time unknown) as discovered during weekly collection. Non-continuous sampler operation.	CA #16-23 AR 2016-27432 12/14/16: No corrective action required. Air monitor resumed normal operation when power was restored. 12/14/16: Operability verified @ 1226 hours. *Ideal sample collected for sample period:* *19,800 cf* TRM requirements were met since second control location (6G1) was operational during this period.

Date	Sample Type	Location	Exception	Corrective Action
12/06/16 to 12/13/16	Surface Water	2S7	Week 2 Dec composite Composite sampler malfunction as discovered during weekly collection. Greater than normal sample collected for sample period possibly due to air in tygon sample line causing sampler to turn off on 12/12/16 @ 1533. Delayed start date of 12/13/16 @ 1322 for week 2. Non-continuous sampler operation.	CA #16-22 CR 2016-272 12/13/16: Tygon tubing w cleared of air and procedur required sample aliquot obtained. Continue to monitor sample week 3 Dec composite. 12/13/16: Operability verifie 1322 hours. *Ideal sample collected fo sample period.*

C. Program Changes

There were no program changes in 2016.

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 performed 160 analyses of Performance Evaluation (PE) from spiked samples of air particulate, air iodine, milk, soil, vegetation and water matrices, as part of the Teledyne Quality Control Spike Program. (Appendix D, Tables D-1 through D-3).

The PE samples, sourced from Analytics Inc., Environmental

Resource Associates (ERA) and Department of Energy's (DOE) Mixed Analyte Performance Evaluation Program (MAPEP), were evaluated against the following acceptance criteria:

1. Analytics Evaluation Criteria

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

2. ERA Evaluation Criteria

   ERA's evaluation report provides an acceptance range for controls and warning limits with associated flag values. ERA's acceptance limits are established per the United States Environmental Protection Agency (USEPA), National Environmental Laboratory Conference (NELAC) performance testing (PT) program requirements or ERA's standard operating procedure (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.

The MAPEP defines three levels of performance: Acceptable (flag = "A"), Acceptable with Warning (flag = "W"), and Not Acceptable (flag = "N"). Performance is considered acceptable when a mean result for the specified analyte is ± 20% of the reference value. Performance is acceptable with warning when a mean result falls in the range from ± 20% to ± 30% of the reference value (i.e., 20% < bias < 30%). If the bias is greater than 30%, the results are deemed not acceptable.

Teledyne Brown Engineering

For the TBE laboratory, 156 out of 160 analyses performed met the specified acceptance criteria. Four analyses did not meet the specified acceptance criteria for the following reasons and were addressed through the TBE Corrective Action Program.

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

1. Teledyne Brown Engineering's MAPEP March 2016 air particulate cross check sample is now being provided to TBE by Analytics. MAPEP's policy is to evaluate as failed non-reported nuclides that were reported in the previous study. NCR 16-14

1a. Since the Sr-90 was reported in the previous MAPEP study but not in this study MAPEP evaluated the Sr-90 for soil as failed. NCR 16-14

1b. The MAPEP March 2016 Sr-90 in vegetation was evaluated as failing a false positive test. In reviewing the data that was reported vs. the data in LIMS, it was found that the error was incorrectly reported as 0.023 rather than the correct value of 0.230. If the value had been reported with the activity and correct uncertainty of 0.301 ± 0.230, MAPEP would have evaluated the result as acceptable. NCR 16-14

2. Teledyne Brown Engineering's Analytics' March 2016 milk Sr-90 result of 15 ± 0.125 pCi/L was higher than the known value of 11.4 pCi/L with a ratio of 1.32. The upper ratio of 1.30 (acceptable with warning) was exceeded. After an extensive review of the data it is believed the technician did not rinse the filtering apparatus properly and some cross contamination from one of the internal laboratory spike samples may have been transferred to the Analytics sample. We feel the issue is specific to the March 2016 Analytics sample. NCR 16-26

3. Teledyne Brown Engineering's ERA November 2016 sample for H-3 in water was evaluated as failing. A result of 918 pCi/L was reported incorrectly due to a data entry issue. If the correct value of 9180 had been reported, ERA would have evaluated the result as acceptable. NCR 16-34

4. Teledyne Brown Engineering's Analytics' December 2016 milk Sr-90 sample result of 14.7 ± 0.26 pCi/L was higher than the known value of 10 pCi/L with a ratio of 1.47. The upper ratio of 1.30 (acceptable with warning) was exceeded. The technician entered the wrong aliquot into the LIMS system. To achieve a

lower error term TBE uses a larger aliquot of 1.2L (Normally we use 0.6L for client samples). If the technician had entered an aliquot of 1.2L into the LIMS system, the result would have been 12.2 pCi/L, which would have been considered acceptable. NCR 16-35

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

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

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

IV. Results and Discussion

The analytical results of the 2016 REMP samples are divided into categories based on exposure pathways: atmospheric, direct radiation, terrestrial, and aquatic. The analytical results for the 2016 REMP are summarized in Appendix A, Program Summary. The data for individual samples are presented in Appendix C, Data Tables. The data are compared to the formal preoperational environmental monitoring program data (April 1972 to September 1982) and to data during operations. The data collected demonstrates that the SSES REMP was conducted in compliance with the

TRM and the SSES ODCM.

A. Atmospheric

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

1. Air Particulates

Air particulate samples were collected weekly at six indicator locations (3S2, 9B1, 10S3, 12E1, 12S1 and 13S6) and two control locations (6G1 and 8G1). Each of the samples collected for the year were analyzed for gross beta. Quarterly composites of the weekly samples from each location were analyzed for specific gamma emitters.

Gross Beta

Gross beta activity was detected in 416 of 416 of the indicator location samples at concentrations ranging from 5 to 24 E-3 pCi/m^3 with an average concentration of 13 E-3 pCi/m^3, and in 104 of 104 of the control location samples at concentrations ranging from 6 to 22 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 spectroscopy was performed on each of the 32 quarterly composite samples. Beryllium-7, attributed to cosmic

ray activity in the atmosphere, was detected in all 24 indicator location composites at concentrations ranging from 74 E-3 to 185 E-3 pCi/m^3 with an average concentration of 120 E-3 pCi/m^3, and in the eight control location composites ranging in concentration from 77 to 156 E-3 pCi/m^3 with an average concentration of 114 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, 12E1, 12S1, 9B1, 10S3 and 13S6) and two control locations (6G1 and 8G1). Each of the samples collected for the year were analyzed for I-131.

<u>Iodine-131</u>

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 2016, including 32 site boundary locations, 14 outer distant locations, six special interest locations and five control locations.

The average dose rate for the 208 indicator dosimeters was 16.3 milliroentgen per standard quarter. The average control dose rate for the 19 control dosimeters was 13.3 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 2016 confirmed that the radiation levels in the vicinity of the SSES were similar to previous years. (Table C–4, Appendix C); Figure C-2 – Ambient Radiation Levels Based on Environmental Dosimetry Data from 1973 to current year are plotted as quarterly averages.

C. Terrestrial

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

1. Milk

Milk samples were collected biweekly when cows were on pasture and monthly when cows were not grazing on pasture. Animals are considered on pasture from April to October of

each year. Samples were collected in new polyethylene containers and transported in ice chests with no preservatives added to the milk.

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

Iodine-131

Iodine-131 was not detected above minimum detectable concentration in any of the 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 2016 are plotted.

Gamma Spectrometry

Naturally occurring K-40 was detected in all 60 samples with concentrations for the 40 indicator location samples ranging from 1,069 to 1,474 pCi/L with an average concentration of 1,321 pCi/L, and the 20 control location sample concentrations ranging from 1,137 to 1,517 pCi/L pCi/L with an average concentration of 1,335 pCi/L. The maximum preoperational level detected was 1,500 pCi/L with an average concentration of 1,358 pCi/L. Naturally occurring Th-228 was detected in one of the indicator samples with an average concentration of 18.6 pCi/L. Preoperational data is not available for comparison. (Table C–5, Appendix C)

All other gamma emitters were less than the LLD.

2. Groundwater

An expanded groundwater monitoring network was initiated in 2006 for the SSES as part of a site-wide hydrogeological investigation in accordance with the Nuclear Energy Institute (NEI) Groundwater Protection Initiative (GPI). The additional groundwater monitoring wells are sampled as part of the Radiological Environmental Monitoring Program (REMP) to regularly assess groundwater quality and provide early detection of any inadvertent leaks or spills of radioactive materials that could reach groundwater. Groundwater is sampled quarterly and analyzed for H-3 and gamma activity. Additionally, precipitation sampling was initiated in 2007 and analyzed for H-3 activity to assess the influence of station airborne H-3 emissions on groundwater H-3 activities.

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

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

Tritium

Tritium activity was detected above the minimum detectable concentration in 12 of the 56 indicator location samples with concentrations ranging from 130 to 225 pCi/L with an average concentration of 170 pCi/L. No H-3 was detected in any of the four control location samples. The maximum preoperational level detected was 119 pCi/L. (Table C–6, Appendix C); Figure C-4 – Annual Average Tritium Activity (pCi/L) in Precipitation and Surface Water Versus Groundwater results from 2007 to 2016 are plotted.

Gamma Spectrometry

Naturally occurring K-40 was not was detected in any of the indicator or control location samples.

Naturally occurring Th-228 was detected in two of the 56 indicator samples at a concentration of 9 pCi/L. No Th-228 was detected in the control location samples. Preoperational data is not available for comparison. (Table C-6, Appendix C)

All other gamma emitters were less than the LLD.

3. Drinking Water

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

Gross Beta

Gross beta activity was detected in six of the 12 drinking water

samples. Sample concentrations ranged from 2 to 4 pCi/L with an average concentration of 3 pCi/L. The maximum preoperational level detected was 2.8 pCi/L with an average concentration of 1.8 pCi/L. (Table C–8, Appendix C); Figure C-5 – Gross Beta Activity in Drinking Water results from 1977 to 2016 are plotted.

Tritium

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

Gamma Spectrometry

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

All other gamma emitters were less than the LLD.

4. Food Products

Food products from four indicator locations (3S3, 12F7, 11D1, and 11S6) and one control location (8G1) were collected throughout the growing season. All samples (vegetable and broadleaf) were analyzed for gamma emitters and included green beans, potatoes, field corn, rye, pumpkin, kale, swiss chard and collards.

Gamma Spectrometry

Naturally occurring Be-7, attributed to cosmic ray activity in the atmosphere, was detected in 9 of the 36 indicator location

samples with concentrations ranging from 235 to 547 pCi/kg wet with an average concentration of 400 pCi/kg wet, and in three of the control location samples with concentrations ranging from 202 to 310 pCi/kg wet with an average concentration of 272 pCi/kg wet. Preoperational data is not available for comparison.

Naturally occurring K-40 was detected in all 36 indicator location samples with concentrations ranging from 1,426 to 7,824 pCi/kg wet with an average concentration of 5,077 pCi/kg wet, and in all 12 control location samples with concentrations ranging from 3,761 to 5,704 pCi/kg wet with an average concentration of 4,565 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 detected in one of the control location samples with a concentration of 64 pCi/kg wet. Preoperational data is not available for comparison. (Table C-9, Appendix C)

All other gamma emitters were less than the LLD.

5. Soil

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

Gamma Spectrometry

Naturally occurring K-40 was detected in all four indicator location samples at concentrations ranging from 9,969 to 13,170 pCi/kg dry with an average concentration of 11,317 pCi/kg dry, and in both of the control location samples at concentrations ranging from 9,174 to 10,290 pCi/kg dry with an average concentration of 9,732 pCi/kg dry. The maximum preoperational level detected was 11,000 pCi/kg dry with an average concentration of 9,800 pCi/kg dry.

Cesium-137 was detected in three of the indicator location at concentrations ranging from 104 to 129 pCi/kg dry with an average concentration of 115 pCi/kg dry. Cesium-137 was not detected in any of the control location samples. The maximum preoperational level detected was 1,200 pCi/kg dry with an average concentration of 700 pCi/kg dry.

Naturally occurring Ra-226 was detected in two of the indicator location samples at concentrations ranging from 1,620 to 2,991 pCi/kg dry with an average concentration of 2,306 pCi/kg dry, and was not detected in any of the control location samples. The maximum preoperational level detected was 1,300 pCi/kg dry with an average concentration of 1,100 pCi/kg dry.

Naturally occurring Ac-228 was detected in all four of the indicator location samples at concentrations ranging from 689 to 955 pCi/kg dry with an average concentration of 826 pCi/kg dry, and in all of the control location samples at concentrations ranging from 948 to 998 pCi/kg dry with an average concentration of 973 pCi/kg dry. Preoperational data is not

available for comparison.

Naturally occurring Th-228 was detected in all of the four indicator location samples at concentrations ranging from 754 to 893 pCi/kg dry and an average concentration of 826 pCi/kg dry, and in all of the control location samples at concentrations ranging from 760 to 853 pCi/kg dry with an average concentration of 807 pCi/kg dry. The maximum preoperational level detected was 1,300 pCi/kg dry with an average concentration of 1,100 pCi/kg dry. (Table C–10, Appendix C)

All other gamma emitters were less than the LLD.

D. Aquatic

Aquatic samples include surface water, fish and sediment samples.

1. Surface Water

Surface water samples were collected routinely at six indicator locations (6S5, 2S7, LTAW, 4S7, 5S12 and 7S12) and one control location (6S6). Each sample was analyzed for H-3 and gamma emitters.

Tritium

Tritium activity was detected in 12 of 40 indicator location samples with concentrations ranging from 167 to 4,730 pCi/L with an average concentration of 1,526 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 2016. Tritium was not detected in any of the control location samples. The maximum preoperational level detected was 319 pCi/L, with an average concentration of 140 pCi/L. (Table C-11, Appendix C) Figure C-6 – Tritium Activity in Surface Water, results from 1972 to 2016 are plotted.

Gamma Spectrometry

Naturally occurring K-40 was detected in 1 of the 40 indicator location samples with a concentration of 42 pCi/L. Naturally occurring K-40 was not detected in any of the control locations. Preoperational data is not available for comparison.

Naturally occurring Th-228 was detected in 5 of the 40 indicator location samples with concentrations ranging from 3 to 7 pCi/L with an average concentration of 6 pCi/L, and in 2 of the control location samples at concentrations ranging from 6 to 8 pCi/L with an average concentration of 7 pCi/L. Preoperational data is not available for comparison. (Table C-11, Appendix C)

Iodine-131

Iodine-131 was not detected in any of the indicator or control samples. The maximum preoperational level detected was 0.43 pCi/L, with an average concentration of 0.33 pCi/L. (Table C-11, Appendix C)

All other gamma emitters were less than the LLD.

2. Fish

Edible species of fish were collected in the spring and fall of 2016 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 eight indicator location samples at concentrations ranging from 2,791 to 4,275 pCi/kg wet with an average concentration of 3,676 pCi/kg wet, and in six control location samples at concentrations ranging from 2,723 to 3,723 pCi/kg wet with an average concentration of 3,263 pCi/kg wet. The maximum preoperational level detected was 3,600 pCi/kg dry with an average concentration of 3,871 pCi/kg dry. (Table C–12, Appendix C)

All other gamma emitters were less than the LLD

3. Shoreline Sediment

Sediment samples were collected from the Susquehanna River in the spring and fall at two indicator locations (7B and 12F)

and one control location (2B). Each sample was analyzed for gamma emitters.

Gamma Spectroscopy

Naturally occurring K-40 was detected in all four of the indicator location samples at concentrations ranging from 7,975 to 12,310 pCi/kg dry with an average concentration of 10,666 pCi/kg dry, and in two of the control location samples with concentrations ranging from 11,620 to 14,130 pCi/kg dry with an average concentration of 12,875 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 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 at concentrations ranging from 1,720 to 2,473 pCi/kg dry with an average concentration of 2,094 pCi/kg dry and found in one of the control location samples with an average concentration of 2,699 pCi/kg dry. 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 849 to 1,327 pCi/kg dry with an average concentration of 1,046 pCi/kg dry, and in one of the control location samples at concentrations ranging from 1,149 to 1,307 pCi/kg dry with an average concentration of 1,228 pCi/kg dry. Preoperational data is not

available for comparison. (Table C-13, Appendix C)

Naturally occurring Th-228 was detected in all of the four indicator location samples at concentrations ranging from 838 to 1,419 pCi/kg dry with an average concentration of 1,122 pCi/kg dry, and in all three of the control location samples at concentrations ranging from 1,054 and 1,383 pCi/kg dry with an average concentration of 1,219 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 2016 LAND USE CENSUS

Ecology III, Inc. conducted a Land Use Census during the 2016 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, 2016 miles	Nearest Garden Sept, 2016 miles	Nearest Dairy Farm Sept, 2016 miles
1	N	1.3	3.2	>5.0
2	NNE	1.0	2.3 [a,c,e]	>5.0
3	NE	0.9	2.7	>5.0
4	ENE	2.1	2.4 [a,b,c]	>5.0
5	E	1.4	4.3	4.5 [d]
6	ESE	0.5	3.1	>5.0
7	SE	0.5	0.6	>5.0
8	SSE	0.6	2.9	>5.0
9	S	1.0	3.1	>5.0
10	SSW	0.9	1.3	>5.0
11	SW	1.5	1.9	>5.0
12	WSW	1.3	1.3	1.7 [d]
13	W	1.2	2.0	5.0
14	WNW	1.1	1.3	>5.0
15	NW	0.8	0.9 [a,c]	>5.0
16	NNW	0.6	4.0	>5.0

a Chickens raised for consumption at this location

b Ducks raised for consumption at this location

c Eggs consumed from chickens at this location

d Fruits/vegetables raised for consumption at this location

e Beef cattle raised for consumption at this location

The 2016 Land Use Census results are summarized in the above table.

V. Annotations to Previous AREOR

Condition report 2015-14348 (6/12/2015) documented REMP dosimeter exposure period discrepancy for location 12S3 (Confers Lane). The results were correct in the report, however the CR was missed in the Program Exceptions section of the report.

Condition report; 2015-12591 (4/30/2015), 2015-17103 (6/13/2015) and 2015-23515 (8/26/2015) documented TRO 3.11.4.1 entry for temporary loss

of power with non-continuous sampling for REMP air monitor location 12S1 (West Building). The results were correct in the report, however the CR was missed in the Program Exceptions section of the report.

Condition report 2015-32263 (12/03/2017) documented TRO 3.11.4.1 entry for planned maintenance/cleaning of the cooling tower blowdown line resulting in no flow to REMP sampler 2S7 (CTBD). The action taken had no impact to REMP sampling as there was no flow to cooling tower blowdown during the planned maintenance evolution. The results were correct in the report, however the CR was missed in the Program Exceptions section of the report.

VI. Conclusions

The Radiological Environmental Monitoring Program for SSES was conducted during 2016 in accordance with the SSES TRM and ODCM. The LLD values required by the TRM and ODCM were achieved for this reporting period (See Appendix A and Appendix C). The objectives of the program were also met during this period. The data collected assists in demonstrating that SSES was operated in compliance with TRM and ODCM requirements.

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

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

VII. References

[1] Annual Radiological Environmental Operating Report, January 1 to December 31, 2016, prepared by Teledyne Brown Engineering, Knoxville TN.

[2] Final Safety Analysis Report

[3] Final Environmental Statement

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[5] Google Earth. 2016. Website: http://earth.google.com.

[6] Pennsylvania Department of Transportation. 1990. Columbia County General Highway Map. PA DOT, Harrisburg, PA.

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[8] Susquehanna Nuclear, LLC. 2013. Radiological Environmental Monitoring Program, ODCM-QA-008, Rev. 16 *in* Susquehanna Steam Electric Station Offsite Dose Calculation Manual, Docket Nos. 50-387 and 50-388.

[9] Susquehanna Steam Electric Station, 5-mile radius aerial photograph, REMPE-182244-0. Susquehanna Nuclear, Berwick, PA

[10] United States Geological Survey. 1976. Berwick Quadrangle Topographic Map. 7.5 minute series. USGS, Reston, VA.

[11] United States Geological Survey. 1977. Sybertsville Quadrangle Topographic Map. 7.5 minute series. USGS, Reston, VA.

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

[13] Susquehanna Nuclear, "Engineering Study, EC-ENVR-1012 (Revision 2, February 2013)", Interpretation of Environmental Direct Radiation Results.

[14] Susquehanna Nuclear, Tritium Release REMP Calculation (RETDAS) V.3.6.6) – March 2016.

[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 29, 2015 to January 01, 2017

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 DIRECTIOI	MEAN (3) RANGE		CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASURMENTS
Air Particulates (E-3 pCi/m^3)	GR-B	416	10	1.285E+01 (312/312) (4.620E+00 - 2.350E+01)	12E1 4.7 MILES WSW	1.311E+01 (5.750E+00 - 2.160E+01)	(52/52)	1.218E+01 (104/104) (5.520E+00 - 2.230E+01)	0
	GAMMA	32							
	BE-7	32	N/A	1.200E+02 (24/24) (7.417E+01 - 1.853E+02)	3S2 0.5 MILES NE	1.277E+02 (7.417E+01 - 1.853E+02)	(4/4)	1.138E+02 (8/8) (7.747E+01 - 1.556E+02)	0
	K-40	32	N/A	3.479E+00 (24/24) (-5.857E+00 - 1.469E+01)	10S3 SSW	6.440E+00 (-1.193E+00 - 1.469E+01)	(4/4)	6.790E-01 (8/8) (-5.029E+00 - 8.611E+00)	0
	CS-134	32	50	2.754E-01 (24/24) (-5.498E-01 - 1.153E+00)	12E1 4.7 MILES WSW	5.240E-01 (2.239E-01 - 1.153E+00)	(4/4)	2.827E-01 (8/8) (-2.384E-02 - 6.568E-01)	0
	CS-137	32	60	-4.752E-03 (24/24) (-1.093E+00 - 5.443E-01)	10S3 SSW	2.135E-01 (6.007E-02 - 5.443E-01)	(4/4)	-6.352E-02 (8/8) (-5.600E-01 - 4.790E-01)	0
Charcoal (E-3 pCi/m^3)	GAMMA	416							
	I-131	416	70	-2.02E-01 (312/312) (-1.241E+01 - 1.223E+01)	12S1 0.4 MILES WSW	5.66E-02 (-9.903E+00 - 6.769E+00)	(52/52)	-1.32E-01 (104/104) (-1.025E+01 - 1.193E+01)	0
Ambient Radiation (mR/std. qtr.)	OSLD	227	N/A	1.63E+01 (208/208) (4.900E+00 - 4.370E+01)	9S2 0.2 MILES S	4.06E+01 (3.700E+01 - 4.370E+01)	(4/4)	1.33E+01 (19/19) (6.700E+00 - 1.790E+01)	0
Milk (pCi/l)	I-131	60	1	2.215E-02 (40/40) (-4.820E-01 - 6.210E-01)	13E3 5.0 MILES W	9.308E-02 (-2.300E-01 - 6.210E-01)	(20/20)	6.526E-02 (20/20) (-1.330E-01 - 5.100E-01)	0
	GAMMA	60							
	K-40	60	N/A	1.321E+03 (40/40) (1.069E+03 - 1.474E+03)	10G1 14 MILES SSW	1.335E+03 (1.137E+03 - 1.517E+03)	(20/20)	1.335E+03 (20/20) (1.137E+03 - 1.517E+03)	0
	CS-134	60	15	-1.402E+00 (40/40) (-7.545E+00 - 2.293E+00)	5E2 4.5 MILES E	-9.208E-01 (-5.136E+00 - 2.293E+00)	(20/20)	-9.226E-01 (20/20) (-8.840E+00 - 1.172E+01)	0

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

Reporting Period: December 29, 2015 to January 01, 2017

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 DIRECTIOI	MEAN (3) RANGE		CONTROL LOCATION MEAN (3) RANGE		NUMBER OF NONROUTINE REPORTED MEASURMENTS
Milk (cont'd) (pCi/l)	CS-137	60	18	-1.018E+00 (-6.251E+00 -	(40/40) 3.932E+00)	10G1 14 MILES SSW	4.533E-01 (-4.509E+00 - 5.281E+00)	(20/20)	4.533E-01 (-4.509E+00 -	(20/20) 5.281E+00)	0
	BA-140	60	60	2.692E-01 (-2.143E+01 -	(40/40) 1.717E+01)	5E2 4.5 MILES E	2.039E+00 (-2.143E+01 - 1.568E+01)	(20/20)	6.538E-01 (-1.329E+01 -	(20/20) 2.264E+01)	0
	LA-140	60	15	2.311E-01 (-7.060E+00 -	(40/40) 7.168E+00)	5E2 4.5 MILES E	1.172E+00 (-6.971E+00 - 7.168E+00)	(20/20)	-1.510E+00 (-8.068E+00 -	(20/20) 3.668E+00)	0
	TH-228	60	N/A	6.022E-01 (-8.750E+00 -	(40/40) 1.862E+01)	10G1 14 MILES SSW	1.489E+00 (-9.444E+00 - 9.071E+00)	(20/20)	1.489E+00 (-9.444E+00 -	(20/20) 9.071E+00)	0
Ground Water (pCi/l)	H-3	60	2000	8.785E+01 (-5.110E+01 -	(56/56) 2.250E+02)	1S3 0.1 MILES N	1.750E+02 (1.590E+02 - 2.120E+02)	(4/4)	5.258E+01 (1.680E+01 -	(4/4) 9.620E+01)	0
	GAMMA	60									
	K-40	60	N/A	2.687E+01 (-6.137E+01 -	(56/56) 1.054E+02)	6S11A	6.357E+01 (2.657E+01 - 1.054E+02)	(4/4)	1.159E+00 (-6.192E+01 -	(4/4) 6.258E+01)	0
	MN-54	60	15	-2.614E-01 (-5.265E+00 -	(56/56) 4.292E+00)	6S12	1.167E+00 (-3.309E-01 - 3.883E+00)	(4/4)	1.800E-02 (-1.482E+00 -	(4/4) 1.629E+00)	0
	CO-58	60	15	-3.976E-01 (-6.487E+00 -	(56/56) 3.419E+00)	2S8	1.280E+00 (5.509E-02 - 2.761E+00)	(4/4)	-4.223E-01 (-2.833E+00 -	(4/4) 4.181E+00)	0
	FE-59	60	30	1.000E+00 (-1.299E+01 -	(56/56) 1.056E+01)	6S11A	4.211E+00 (-4.159E+00 - 1.056E+01)	(4/4)	1.752E+00 (-6.893E+00 -	(4/4) 9.728E+00)	0
	CO-60	60	15	1.827E-01 (-4.251E+00 -	(56/56) 5.228E+00)	2S2 0.9 MILES NNE	2.460E+00 (3.394E-02 - 5.228E+00)	(4/4)	2.725E-02 (-1.429E+00 -	(4/4) 1.218E+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 29, 2015 to January 01, 2017

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 DIRECTIOI	MEAN (3) RANGE		CONTROL LOCATION MEAN (3) RANGE		NUMBER OF NONROUTINE REPORTED MEASURMENTS
Ground Water (cont'd) (pCi/l)	ZN-65	60	30	-2.590E+00 (-1.958E+01 -	(56/56) 9.907E+00)	11S2 0.4 MILES SW	3.430E+00 (-2.892E+00 -	(4/4) 8.910E+00)	2.095E+00 (-2.609E+00 -	(4/4) 5.126E+00)	0
	NB-95	60	15	1.253E+00 (-6.139E+00 -	(56/56) 1.166E+01)	2S8	3.177E+00 (1.128E+00 -	(4/4) 4.462E+00)	2.446E+00 (-1.279E+00 -	(4/4) 8.008E+00)	0
	ZR-95	60	30	-2.281E-02 (-5.856E+00 -	(56/56) 6.828E+00)	6S10 0.4 MILES ESE	2.104E+00 (-1.608E+00 -	(4/4) 4.598E+00)	5.013E-01 (-4.044E+00 -	(4/4) 3.772E+00)	0
	I-131	60	15	-4.095E-01 (-9.163E+00 -	(56/56) 8.763E+00)	7S11	3.941E+00 (-1.953E+00 -	(4/4) 8.763E+00)	-1.579E+00 (-6.109E+00 -	(4/4) 4.023E+00)	0
	CS-134	60	15	-8.371E-01 (-8.826E+00 -	(56/56) 1.010E+01)	13S7 0.2 MILES W	2.025E+00 (-8.015E-01 -	(4/4) 4.668E+00)	1.648E+00 (1.939E-01 -	(4/4) 2.676E+00)	0
	CS-137	60	18	-4.886E-01 (-7.688E+00 -	(56/56) 3.598E+00)	6S10 0.4 MILES ESE	8.791E-01 (-6.645E-01 -	(4/4) 2.843E+00)	-1.532E+00 (-8.149E+00 -	(4/4) 3.442E+00)	0
	BA-140	60	60	2.465E-01 (-3.489E+01 -	(56/56) 2.460E+01)	4S8 0.1 MILES ENE	1.082E+01 (-5.483E-01 -	(4/4) 2.176E+01)	-8.861E+00 (-1.809E+01 -	(4/4) 3.139E+00)	0
	LA-140	60	15	1.378E-01 (-6.748E+00 -	(56/56) 6.527E+00)	4S9 0.3 MILES ENE	3.133E+00 (1.073E+00 -	(4/4) 4.675E+00)	4.046E-01 (-2.858E+00 -	(4/4) 7.444E+00)	0
	TH-228	60	N/A	1.002E+00 (-1.104E+01 -	(56/56) 1.126E+01)	6S11A	5.054E+00 (-4.164E-01 -	(4/4) 9.331E+00)	2.231E+00 (-6.718E+00 -	(4/4) 7.741E+00)	0
Drinking Water (pCi/l)	GR-B	12	4	2.015E+00 (5.470E-02 -	(12/12) 3.890E+00)	12H2 26 MILES WSW	2.015E+00 (5.470E-02 -	(12/12) 3.890E+00)	0.00E+00		0
	H-3	12	2000	6.77E+01 (-6.700E+01 -	(12/12) 1.520E+02)	12H2 26 MILES WSW	6.77E+01 (-6.700E+01 -	(12/12) 1.520E+02)	0.00E+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 29, 2015 to January 01, 2017

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 DIRECTIOI	MEAN (3) RANGE		CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASURMENTS
Drinking Water (cont'd)	GAMMA	12								
(pCi/l)	K-40	12	N/A	2.43E+00 (-3.522E+01 -	(12/12) 3.056E+01)	12H2 26 MILES WSW	2.43E+00 (-3.522E+01 -	(12/12) 3.056E+01)	0.00E+00	0
	MN-54	12	15	-2.229E-01 (-1.427E+00 -	(12/12) 9.334E-01)	12H2 26 MILES WSW	-2.229E-01 (-1.427E+00 -	(12/12) 9.334E-01)	0.00E+00	0
	CO-58	12	15	-2.307E-02 (-1.668E+00 -	(12/12) 1.698E+00)	12H2 26 MILES WSW	-2.307E-02 (-1.668E+00 -	(12/12) 1.698E+00)	0.00E+00	0
	FE-59	12	30	1.627E+00 (-2.398E+00 -	(12/12) 5.819E+00)	12H2 26 MILES WSW	1.627E+00 (-2.398E+00 -	(12/12) 5.819E+00)	0.00E+00	0
	CO-60	12	15	2.324E-01 (-4.457E-01 -	(12/12) 1.688E+00)	12H2 26 MILES WSW	2.324E-01 (-4.457E-01 -	(12/12) 1.688E+00)	0.00E+00	0
	ZN-65	12	30	-1.860E+00 (-4.940E+00 -	(12/12) 2.194E-01)	12H2 26 MILES WSW	-1.860E+00 (-4.940E+00 -	(12/12) 2.194E-01)	0.00E+00	0
	NB-95	12	15	4.914E-01 (-1.305E+00 -	(12/12) 1.709E+00)	12H2 26 MILES WSW	4.914E-01 (-1.305E+00 -	(12/12) 1.709E+00)	0.00E+00	0
	ZR-95	12	30	-1.453E-01 (-2.334E+00 -	(12/12) 2.169E+00)	12H2 26 MILES WSW	-1.453E-01 (-2.334E+00 -	(12/12) 2.169E+00)	0.00E+00	0
	I-131	12	15	5.840E-01 (-6.901E+00 -	(12/12) 7.351E+00)	12H2 26 MILES WSW	5.840E-01 (-6.901E+00 -	(12/12) 7.351E+00)	0.00E+00	0
	CS-134	12	15	-7.632E-01 (-3.967E+00 -	(12/12) 1.827E+00)	12H2 26 MILES WSW	-7.632E-01 (-3.967E+00 -	(12/12) 1.827E+00)	0.00E+00	0

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

Reporting Period: December 29, 2015 to January 01, 2017

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 DIRECTIOI	MEAN (3) RANGE		CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASURMENTS
Drinking Water (cont'd) (pCi/l)	CS-137	12	18	9.184E-02 (12/12) (-8.130E-01 - 1.774E+00)	12H2 26 MILES WSW	9.184E-02 (-8.130E-01 - 1.774E+00)	(12/12)	0.00E+00	0
	BA-140	12	60	-1.660E-01 (12/12) (-1.136E+01 - 6.798E+00)	12H2 26 MILES WSW	-1.660E-01 (-1.136E+01 - 6.798E+00)	(12/12)	0.00E+00	0
	LA-140	12	15	-1.194E+00 (12/12) (-3.448E+00 - 2.472E+00)	12H2 26 MILES WSW	-1.194E+00 (-3.448E+00 - 2.472E+00)	(12/12)	0.00E+00	0
Food/Garden Crops (pCi/kg wet)	GAMMA	48							
	BE-7	48	N/A	1.968E+02 (36/36) (-1.642E+02 - 5.466E+02)	11S6 0.5 MILES SW	2.422E+02 (-8.102E+00 - 5.466E+02)	(15/15)	1.537E+02 (12/12) (-2.801E+00 - 3.102E+02)	0
	K-40	48	N/A	5.077E+03 (36/36) (1.426E+03 - 7.824E+03)	3S3 0.9 MILES NE	5.691E+03 (3.999E+03 - 7.824E+03)	(15/15)	4.565E+03 (12/12) (3.761E+03 - 5.704E+03)	0
	MN-54	48	N/A	-1.617E+00 (36/36) (-1.817E+01 - 1.076E+01)	12F7 8.3 MILES WSW	4.997E+00 (4.366E+00 - 5.683E+00)	(3/3)	1.687E+00 (12/12) (-7.297E+00 - 1.691E+01)	0
	CO-58	48	N/A	3.769E-02 (36/36) (-1.689E+01 - 1.327E+01)	12F7 8.3 MILES WSW	6.057E+00 (4.097E+00 - 9.880E+00)	(3/3)	1.109E+00 (12/12) (-7.731E+00 - 8.028E+00)	0
	FE-59	48	N/A	2.618E+00 (36/36) (-6.589E+01 - 4.800E+01)	11D1 3.3 MILES SW	1.719E+01 (9.636E+00 - 2.726E+01)	(3/3)	1.163E+01 (12/12) (-7.136E+01 - 7.885E+01)	0
	CO-60	48	N/A	1.050E+00 (36/36) (-2.327E+01 - 2.581E+01)	8G1 12 MILES SSE	5.169E+00 (-6.137E+00 - 2.953E+01)	(12/12)	5.169E+00 (12/12) (-6.137E+00 - 2.953E+01)	0
	ZN-65	48	N/A	-1.868E+01 (36/36) (-1.033E+02 - 3.941E+01)	11D1 3.3 MILES SW	2.857E+00 (-2.336E+01 - 3.941E+01)	(3/3)	-2.174E+01 (12/12) (-5.604E+01 - 2.268E-01)	0

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

Reporting Period: December 29, 2015 to January 01, 2017

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 DIRECTIOI	MEAN (3) RANGE		CONTROL LOCATION MEAN (3) RANGE		NUMBER OF NONROUTINE REPORTED MEASURMENTS
Food/Garden Crops (cont'd) (pCi/kg wet)	NB-95	48	N/A	2.968E+00 (-1.824E+01 -	(36/36) 2.042E+01)	12F7 8.3 MILES WSW	6.567E+00 (3.648E+00 -	(3/3) 8.347E+00)	2.615E+00 (-1.705E+01 -	(12/12) 1.837E+01)	0
	ZR-95	48	N/A	1.852E+00 (-2.774E+01 -	(36/36) 3.362E+01)	11S6 0.5 MILES SW	5.043E+00 (-1.451E+01 -	(15/15) 3.362E+01)	-2.302E+00 (-2.614E+01 -	(12/12) 2.639E+01)	0
	I-131	48	60	-2.575E+00 (-2.668E+01 -	(36/36) 2.181E+01)	11D1 3.3 MILES SW	5.592E+00 (-4.535E+00 -	(3/3) 1.245E+01)	-2.519E+00 (-1.365E+01 -	(12/12) 1.193E+01)	0
	CS-134	48	60	-7.073E+00 (-5.824E+01 -	(36/36) 3.336E+01)	12F7 8.3 MILES WSW	-2.989E-01 (-1.220E+00 -	(3/3) 2.672E-01)	-7.875E+00 (-2.958E+01 -	(12/12) 1.251E+01)	0
	CS-137	48	80	-1.114E+00 (-1.870E+01 -	(36/36) 1.473E+01)	11D1 3.3 MILES SW	5.154E+00 (2.985E+00 -	(3/3) 8.007E+00)	3.886E+00 (-6.430E+00 -	(12/12) 1.803E+01)	0
	BA-140	48	N/A	1.048E+01 (-8.218E+01 -	(36/36) 8.024E+01)	12F7 8.3 MILES WSW	2.501E+01 (-8.196E+00 -	(3/3) 8.024E+01)	8.201E+00 (-2.814E+01 -	(12/12) 4.089E+01)	0
	LA-140	48	N/A	-5.227E-01 (-1.981E+01 -	(36/36) 1.836E+01)	11D1 3.3 MILES SW	1.265E+01 (1.135E+01 -	(3/3) 1.393E+01)	-3.968E+00 (-1.988E+01 -	(12/12) 1.330E+01)	0
	AC-228	48	N/A	9.840E+00 (-5.003E+01 -	(36/36) 6.159E+01)	11D1 3.3 MILES SW	1.892E+01 (-1.883E+01 -	(3/3) 3.819E+01)	1.552E+01 (-2.198E+01 -	(12/12) 9.388E+01)	0
	TH-228	48	N/A	1.042E+01 (-4.353E+01 -	(36/36) 5.642E+01)	11S6 0.5 MILES SW	1.513E+01 (-2.405E+01 -	(15/15) 5.642E+01)	1.069E+01 (-2.009E+01 -	(12/12) 6.404E+01)	0
Soil (pCi/kg dry)	GAMMA	6									
	K-40	6	N/A	1.132E+04 (9.969E+03 -	(4/4) 1.317E+04)	10S3 SSW	1.157E+04 (9.969E+03 -	(2/2) 1.317E+04)	9.732E+03 (9.174E+03 -	(2/2) 1.029E+04)	0
	CS-134	6	150	-4.775E+00 (-2.662E+01 -	(4/4) 1.884E+01)	8G1 12 MILES SSE	2.407E+01 (1.801E+01 -	(2/2) 3.012E+01)	2.407E+01 (1.801E+01 -	(2/2) 3.012E+01)	0

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

Reporting Period: December 29, 2015 to January 01, 2017

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 DIRECTIOI	MEAN (3) RANGE		CONTROL LOCATION MEAN (3) RANGE		NUMBER OF NONROUTINE REPORTED MEASURMENTS
Soil (cont'd) (pCi/kg dry)	CS-137	6	180	9.971E+01 (5.474E+01 -	(4/4) 1.294E+02)	10S3 SSW	1.166E+02 (1.037E+02 -	(2/2) 1.294E+02)	5.027E+01 (2.388E+01 -	(2/2) 7.665E+01)	0
	RA-226	6	N/A	1.978E+03 (1.460E+03 -	(4/4) 2.991E+03)	10S3 SSW	2.226E+03 (1.460E+03 -	(2/2) 2.991E+03)	1.210E+03 (5.979E+02 -	(2/2) 1.822E+03)	0
	AC-228	6	N/A	8.261E+02 (6.894E+02 -	(4/4) 9.549E+02)	8G1 12 MILES SSE	9.729E+02 (9.483E+02 -	(2/2) 9.975E+02)	9.729E+02 (9.483E+02 -	(2/2) 9.975E+02)	0
	TH-228	6	N/A	8.258E+02 (7.544E+02 -	(4/4) 8.927E+02)	12S1 0.4 MILES WSW	8.470E+02 (8.012E+02 -	(2/2) 8.927E+02)	8.067E+02 (7.603E+02 -	(2/2) 8.530E+02)	0
Surface Water (pCi/l)	H-3	52	2000	5.359E+02 (-3.510E+01 -	(40/40) 4.730E+03)	2S7 0.1 MILES NNE	1.591E+03 (1.250E+02 -	(12/12) 4.730E+03)	2.958E+01 (-5.340E+01 -	(12/12) 1.100E+02)	0
	GAMMA	52									
	K-40	52	N/A	1.64E+01 (-3.006E+01 -	(40/40) 1.009E+02)	LTAW 0.7 MILES NE	3.85E+01 (1.506E+01 -	(4/4) 6.512E+01)	-2.13E+01 (-2.914E+02 -	(12/12) 3.677E+01)	0
	MN-54	52	15	-2.77E-01 (-3.405E+00 -	(40/40) 3.072E+00)	LTAW 0.7 MILES NE	2.92E-01 (-3.056E+00 -	(4/4) 3.072E+00)	-5.55E-02 (-9.516E-01 -	(12/12) 4.657E-01)	0
	CO-58	52	15	-6.21E-01 (-4.529E+00 -	(40/40) 1.713E+00)	6S5 0.9 MILES ESE	-1.57E-01 (-7.807E-01 -	(12/12) 7.355E-01)	-1.97E-01 (-9.419E-01 -	(12/12) 4.320E-01)	0
	FE-59	52	30	1.34E+00 (-7.078E+00 -	(40/40) 7.520E+00)	LTAW 0.7 MILES NE	2.86E+00 (1.623E+00 -	(4/4) 4.224E+00)	1.68E-01 (-2.258E+00 -	(12/12) 2.229E+00)	0
	CO-60	52	15	1.80E-01 (-5.142E+00 -	(40/40) 3.916E+00)	4S7 0.4 MILES ENE	1.15E+00 (2.857E-01 -	(4/4) 2.160E+00)	2.03E-01 (-1.059E+00 -	(12/12) 9.640E-01)	0

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

Reporting Period: December 29, 2015 to January 01, 2017

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 DIRECTIOI	MEAN (3) RANGE		CONTROL LOCATION MEAN (3) RANGE		NUMBER OF NONROUTINE REPORTED MEASURMENTS
Surface Water (cont'd) (pCi/l)	ZN-65	52	30	-2.61E+00 (-1.877E+01 -	(40/40) 9.591E+00)	4S7 0.4 MILES ENE	3.34E+00 (-8.826E+00 - 9.591E+00)	(4/4)	-9.44E-01 (-4.634E+00 -	(12/12) 2.418E+00)	0
	NB-95	52	15	8.19E-01 (-3.623E+00 -	(40/40) 9.831E+00)	4S7 0.4 MILES ENE	3.79E+00 (-8.491E-01 - 9.831E+00)	(4/4)	-3.45E-02 (-1.847E+00 -	(12/12) 8.230E-01)	0
	ZR-95	52	30	-4.28E-01 (-7.553E+00 -	(40/40) 6.173E+00)	7S12 0.3 MILES SE	2.26E+00 (-1.263E-01 - 3.164E+00)	(4/4)	6.45E-02 (-1.886E+00 -	(12/12) 1.630E+00)	0
	I-131	52	15	-2.29E-01 (-5.814E+00 -	(40/40) 7.252E+00)	5S12 0.4 MILES E	1.56E+00 (-4.312E-01 - 4.532E+00)	(4/4)	5.64E-01 (-6.239E+00 -	(12/12) 4.336E+00)	0
	CS-134	52	15	-1.37E+00 (-8.611E+00 -	(40/40) 6.083E+00)	5S12 0.4 MILES E	6.43E-01 (-3.031E+00 - 6.083E+00)	(4/4)	-1.33E+00 (-4.263E+00 -	(12/12) 1.264E+00)	0
	CS-137	52	18	-4.03E-01 (-8.543E+00 -	(40/40) 7.275E+00)	LTAW 0.7 MILES NE	1.70E+00 (-1.692E+00 - 7.275E+00)	(4/4)	-4.79E-02 (-6.726E-01 -	(12/12) 3.404E-01)	0
	BA-140	52	60	1.31E+00 (-2.099E+01 -	(40/40) 1.838E+01)	LTAW 0.7 MILES NE	7.31E+00 (2.292E+00 - 1.167E+01)	(4/4)	-6.42E-02 (-1.126E+01 -	(12/12) 1.152E+01)	0
	LA-140	52	15	-9.75E-01 (-6.478E+00 -	(40/40) 4.333E+00)	4S7 0.4 MILES ENE	6.57E-01 (-3.921E+00 - 4.264E+00)	(4/4)	5.49E-01 (-1.218E+00 -	(12/12) 3.398E+00)	0
	TH-228	52	N/A	1.21E+00 (-9.588E+00 -	(40/40) 8.326E+00)	6S5 0.9 MILES ESE	2.55E+00 (-8.330E-01 - 7.058E+00)	(12/12)	-2.38E-02 (-1.721E+01 -	(12/12) 7.723E+00)	0
Fish (pCi/kg wet)	GAMMA	14									
	K-40	14	N/A	3.676E+03 (2.791E+03 -	(8/8) 4.275E+03)	LTAW 0.7 MILES NE	3.708E+03 (3.464E+03 - 3.952E+03)	(2/2)	3.263E+03 (2.723E+03 -	(6/6) 3.723E+03)	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 29, 2015 to January 01, 2017

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 DIRECTIOI	MEAN (3) RANGE		CONTROL LOCATION MEAN (3) RANGE		NUMBER OF NONROUTINE REPORTED MEASURMENTS
Fish (cont'd) (pCi/kg wet)	MN-54	14	130	8.048E+00 (-2.869E+01 -	(8/8) 5.032E+01)	IND 0.9-1.4 MILES ESE	1.433E+01 (-1.127E+01 -	(6/6) 5.032E+01)	4.706E+00 (-2.467E+01 -	(6/6) 2.834E+01)	0
	CO-58	14	130	-1.163E+01 (-2.673E+01 -	(8/8) 9.773E+00)	2H 30 MILES NNE	1.044E+01 (-2.331E+01 -	(6/6) 3.211E+01)	1.044E+01 (-2.331E+01 -	(6/6) 3.211E+01)	0
	FE-59	14	260	-9.040E+00 (-7.783E+01 -	(8/8) 6.669E+01)	2H 30 MILES NNE	2.210E+01 (-3.797E+00 -	(6/6) 6.890E+01)	2.210E+01 (-3.797E+00 -	(6/6) 6.890E+01)	0
	CO-60	14	130	2.835E+00 (-3.407E+01 -	(8/8) 2.936E+01)	LTAW 0.7 MILES NE	1.442E+01 (-5.264E-01 -	(2/2) 2.936E+01)	4.425E+00 (-2.114E+01 -	(6/6) 3.867E+01)	0
	ZN-65	14	260	-2.245E+01 (-1.367E+02 -	(8/8) 3.266E+01)	LTAW 0.7 MILES NE	2.173E+01 (1.079E+01 -	(2/2) 3.266E+01)	-1.364E+01 (-4.850E+01 -	(6/6) 4.070E+01)	0
	CS-134	14	130	-7.320E+00 (-3.769E+01 -	(8/8) 1.603E+01)	IND 0.9-1.4 MILES ESE	-3.794E+00 (-3.769E+01 -	(6/6) 1.603E+01)	-3.227E+01 (-7.117E+01 -	(6/6) -7.261E+00)	0
	CS-137	14	150	4.955E+00 (-9.420E+00 -	(8/8) 1.852E+01)	IND 0.9-1.4 MILES ESE	8.248E+00 (-9.420E+00 -	(6/6) 1.852E+01)	-7.577E+00 (-2.079E+01 -	(6/6) 7.310E+00)	0
Sediment (pCi/kg dry)	GAMMA	6									
	K-40	6	N/A	1.067E+04 (7.975E+03 -	(4/4) 1.231E+04)	2B 1.6 MILES NNE	1.288E+04 (1.162E+04 -	(2/2) 1.413E+04)	1.288E+04 (1.162E+04 -	(2/2) 1.413E+04)	0
	CS-134	6	150	3.087E+01 (4.490E+00 -	(4/4) 6.105E+01)	7B 1.2 MILES SE	5.011E+01 (3.917E+01 -	(2/2) 6.105E+01)	-2.970E+00 (-4.667E+01 -	(2/2) 4.073E+01)	0
	CS-137	6	180	2.600E+01 (-4.108E+01 -	(4/4) 6.999E+01)	7B 1.2 MILES SE	5.185E+01 (3.371E+01 -	(2/2) 6.999E+01)	4.726E+01 (1.847E+01 -	(2/2) 7.604E+01)	0

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

Reporting Period: December 29, 2015 to January 01, 2017

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 DIRECTIOI	MEAN (3) RANGE		CONTROL LOCATION MEAN (3) RANGE		NUMBER OF NONROUTINE REPORTED MEASURMENTS
Sediment (cont'd) (pCi/kg dry)	RA-226	6	N/A	2.067E+03 (1.720E+03 -	(4/4) 2.473E+03)	2B 1.6 MILES NNE	2.233E+03 (1.766E+03 - 2.699E+03)	(2/2)	2.233E+03 (1.766E+03 -	(2/2) 2.699E+03)	0
	AC-228	6	N/A	1.046E+03 (8.488E+02 -	(4/4) 1.327E+03)	2B 1.6 MILES NNE	1.228E+03 (1.149E+03 - 1.307E+03)	(2/2)	1.228E+03 (1.149E+03 -	(2/2) 1.307E+03)	0
	TH-228	6	N/A	1.122E+03 (8.376E+02 -	(4/4) 1.419E+03)	7B 1.2 MILES SE	1.371E+03 (1.323E+03 - 1.419E+03)	(2/2)	1.219E+03 (1.054E+03 -	(2/2) 1.383E+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 Requirmeents (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, Soil
12S1	0.4 mi.WSW;	41.088436	-76.154314	Air
13S6	0.4 mi.W;	41.091771	-76.153869	Air
3S2	0.5 mi NE;	41.095716	-76.140207	Air
12S1	0.4 mi.WSW;	41.088436	-76.154314	Soil
2S8	0.1 mi.NNE;	41.094991	-76.044207	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
3S2	0.5 mi.NE;	41.095716	-76.140207	Precipitation
12S1	0.4 mi.WSW;	41.088436	-76.154314	Precipitation
11S6	0.5 mi.SW;	41.085305	-76.152022	Broadleaf
3S3	0.9 mi.NE;	41.101856	-76.133090	Broadleaf
5S10	0.7 mi.E;	41.0.93899	-76.132814	Broadleaf
Site 1	0.1 mi.ESE;	41.092275	-76.145022	Precipitation
Site 2	0.1 mi.SSE;	41.091309	-76.145708	Precipitation
Site 3	0.1 mi.WSW;	41.091243	-76.147345	Precipitation
Site 4	0.1 mi.NW;	41.093321	-76.147316	Precipitation
FROM ONE to FIVE MILES FROM THE SSES				
IND	0.9 mi.ESE;	41.085141	-76.130174	Fish
IND	1.4 mi.ESE;	41.075618	-76.132682	Fish
2B **	1.6 mi.NNE;	41.112441	-76.134758	Sediment
7B	1.2 mi.SE;	41.078924	-76.131548	Sediment
9B1	1.3 mi.SSW;	41.085264	-76.152128	Air, Precipitation
12E1	4.7 mi.WSW;	41.072418	-76.230554	Air
5E2	4.5 mi.E;	41.085184	-76.061099	Milk
8C1	2.9 mi.SSE;	41.054518	-76.129027	Broadleaf
10B5	1.3 mi.SSW;	41.075404	-76.157422	Broadleaf

TABLE B-1 (cont'd)

SAMPLING LOCATIONS

STATION CODE	STATION LOCATION	LATITUDINAL DEG.	LONGITUDINAL DEG.	SAMPLE TYPE
FROM ONE to FIVE MILES FROM THE SSES				
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
6G1 **	13.5 mi.ESE;	41.018989	-75.906515	Air
8G1 **	12 mi.SSE;	40.928886	-76.055092	Air, Precipitation, Soil, Broadleaf
10G1 **	14 mi.SSW;	40.934847	-76.284449	Milk
12F3 **	5.2 mi.WSW;	41.054491	-76.232176	Ground water
12F7	8.3 mi.WSW;	41.036689	-76.286776	Food Products
11F2	5.5 mi.SW;	41.045741	-76.242128	Food products
15G1 **	11.4 mi.NW;	41.188578	-76.324598	Broadleaf
OSLD LOCATIONS				
LESS THAN ONE MILE FROM THE SSES				
1S2	0.2 mi.N;	41.09566	-76.146121	OSLD
2S2	0.9 mi.NNE;	41.10207	-76.141192	OSLD
2S3	0.2 mi.NNE;	41.09486	-76.144101	OSLD
3S2	0.5 mi.NE;	41.09574	-76.140086	OSLD
3S3	0.9 mi.NE;	41.10183	-76.133127	OSLD
4S3	0.2 mi.ENE;	41.09322	-76.141934	OSLD
4S6	0.7 mi.ENE;	41.09687	-76.133807	OSLD
5S4	0.8 mi.E;	41.09286	-76.131604	OSLD
5S7	0.3 mi.E;	41.09199	-76.141165	OSLD
6S4	0.2 mi.ESE;	41.09132	-76.142616	OSLD
6S9	0.2 mi.ESE;	41.09067	-76.142966	OSLD
7S6	0.2 mi.SE;	41.08972	-76.14359	OSLD

* Special Interest Area (other than controls)
** Control Location

TABLE B-1 (cont'd)

SAMPLING LOCATIONS

STATION CODE	STATION LOCATION	LATITUDINAL	LONGITUDINAL	SAMPLE TYPE
LESS THAN ONE MILE FROM THE SSES		DEG.	DEG.	
7S7	0.4 mi.SE;	41.08745	-76.14203	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	E-III, Appendix 2	TBE-2008 Gross Alpha and/or Gross Beta Activity in Various Matrices.
Air	I-131	Weekly	E-III, Appendix 2	TBE-2012 Radioiodine in Various Matrices
Air	Gamma	Quarterly	E-III, Appendix 2	TBE-2007 Gamma Emitting Radioisotope Analysis
Drinking Water	Gross Beta	Monthly	E-III, 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)	E-III, 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)	E-III, Appendix 3, 4, 5, 6, & 7	TBE-2007 Gamma Emitting Radioisotope Analysis.
Ground Water	Tritium	Quarterly	E-III, Appendix 8	TBE-2010 Tritium and Carbon-14 Analysis by Liquid Scintillation
Ground Water	Gamma	Quarterly	E-III, Appendix 8	TBE-2007 Gamma Emitting Radioisotope Analysis

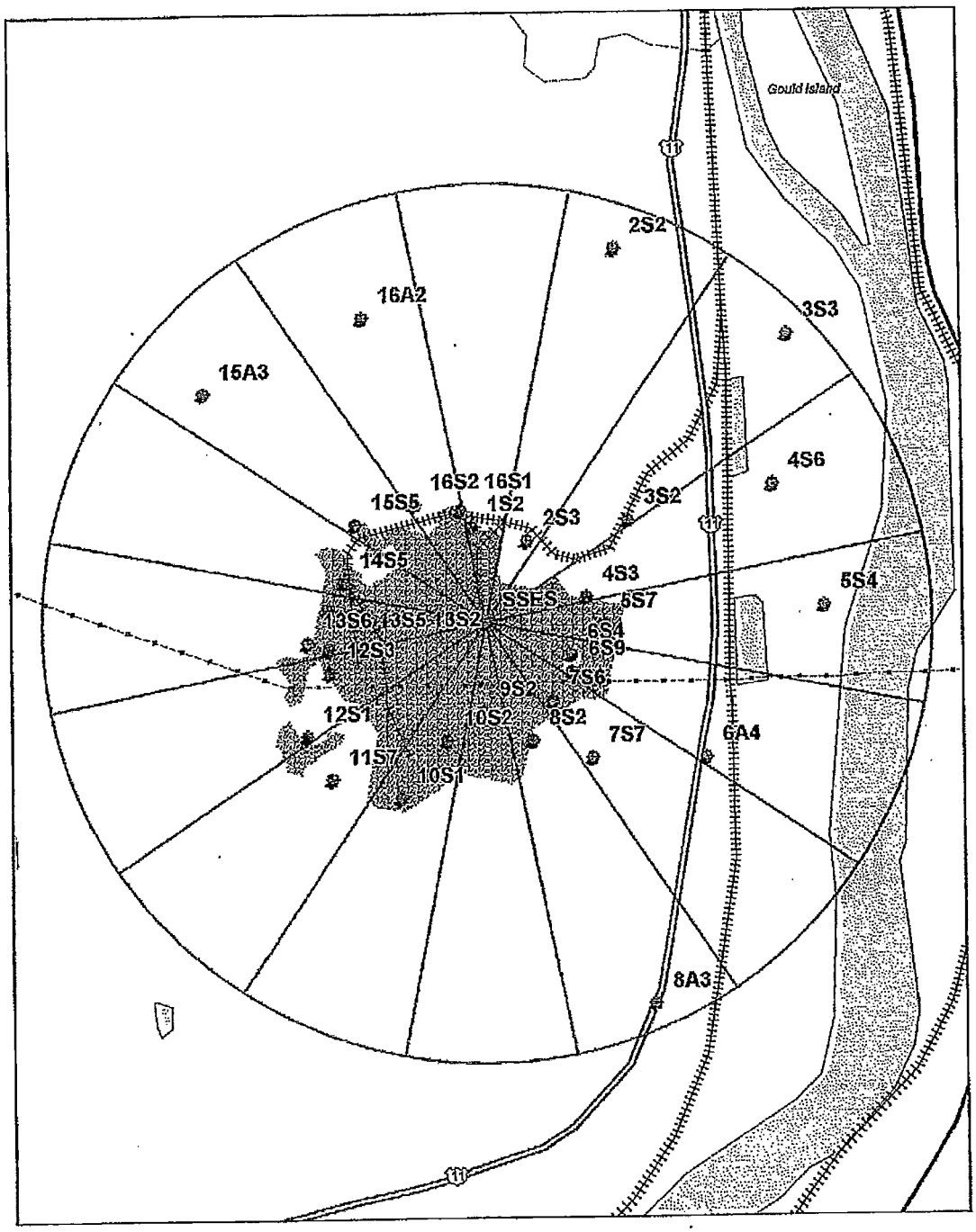
TABLE B-2 (cont'd)

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	E-III, Appendix 10	TBE-2010 Tritium and Carbon-14 Analysis by Liquid Scintillation
Milk	Gamma	Monthly/Bi-Weekly	E-III, Appendix 9	TBE-2007 Gamma Emitting Radioisotope Analysis
Milk	I-131	Monthly/Bi-Weekly	E-III, Appendix 9	TBE-2012 Radioiodine in Various Matrices
Fish	Gamma	Semi-Annually (Spring/Fall)	E-III, Appendix 11	TBE-2007 Gamma Emitting Radioisotope Analysis
Sediment	Gamma	Semi-Annually (Spring/Fall)	E-III, Appendix 12	TBE-2007 Gamma Emitting Radioisotope Analysis
Fruits & Vegetables	Gamma	In Season (When available)	E-III, Appendix 13 E-III, Appendix 15	TBE-2007 Gamma Emitting Radioisotope Analysis
Soil	Gamma	Annually	E-III, Appendix 14	TBE-2007 Gamma Emitting Radioisotope Analysis

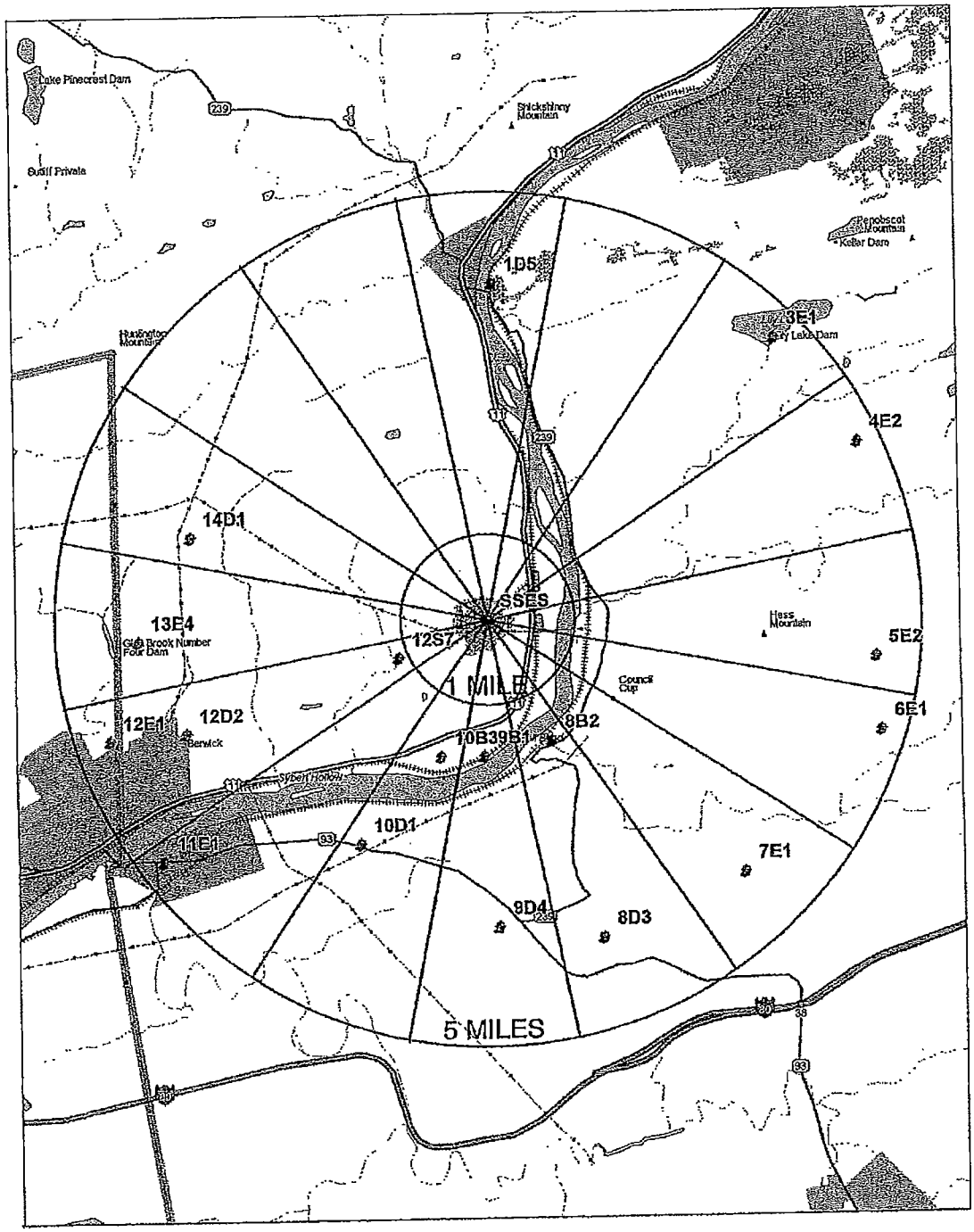
MAP B-1

Direct Radiation Monitoring Locations Within One Mile



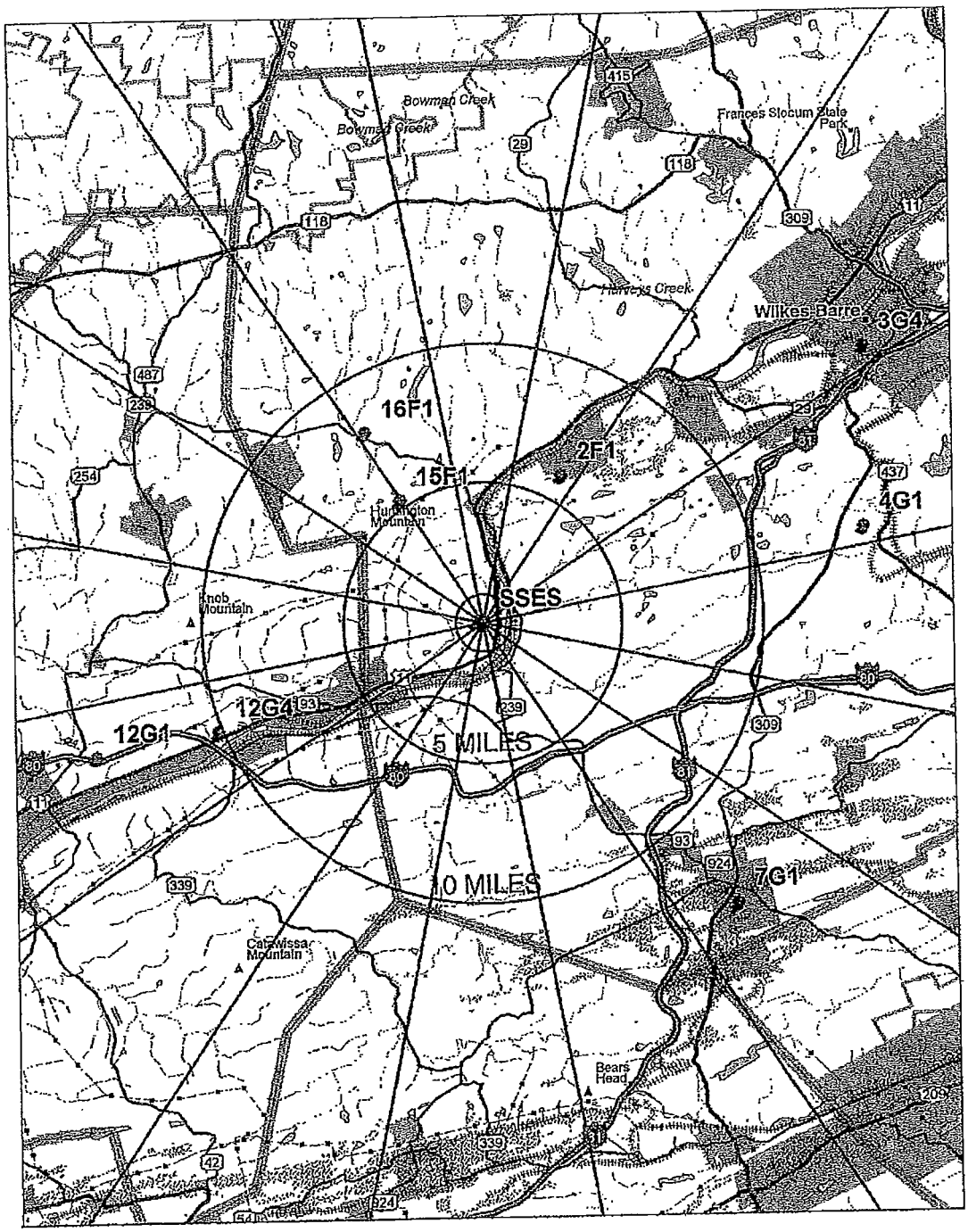
MAP B-2

Direct Radiation Monitoring Locations From One to Five Miles



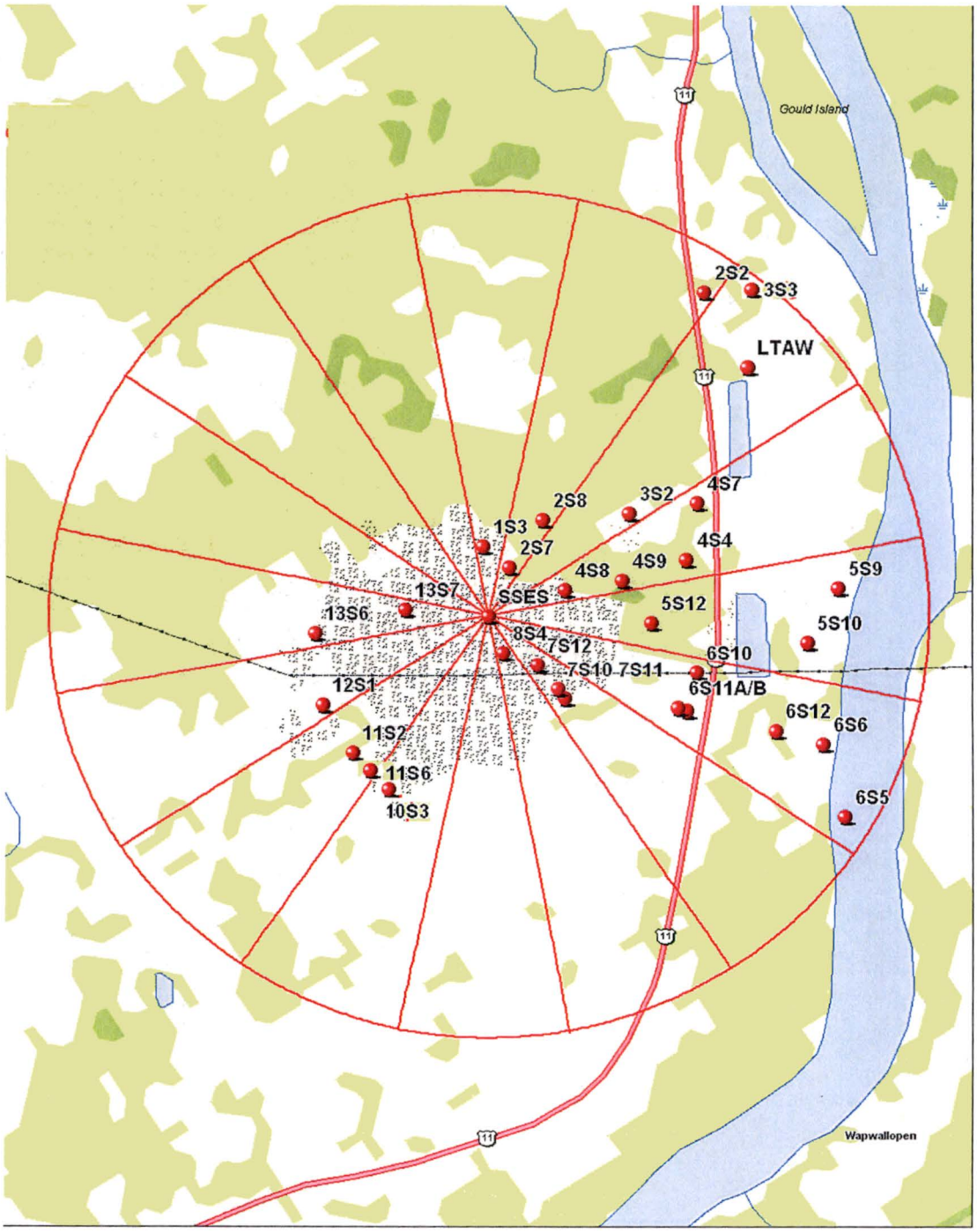
MAP B-3

Direct Radiation Monitoring Locations Greater Than Five Miles



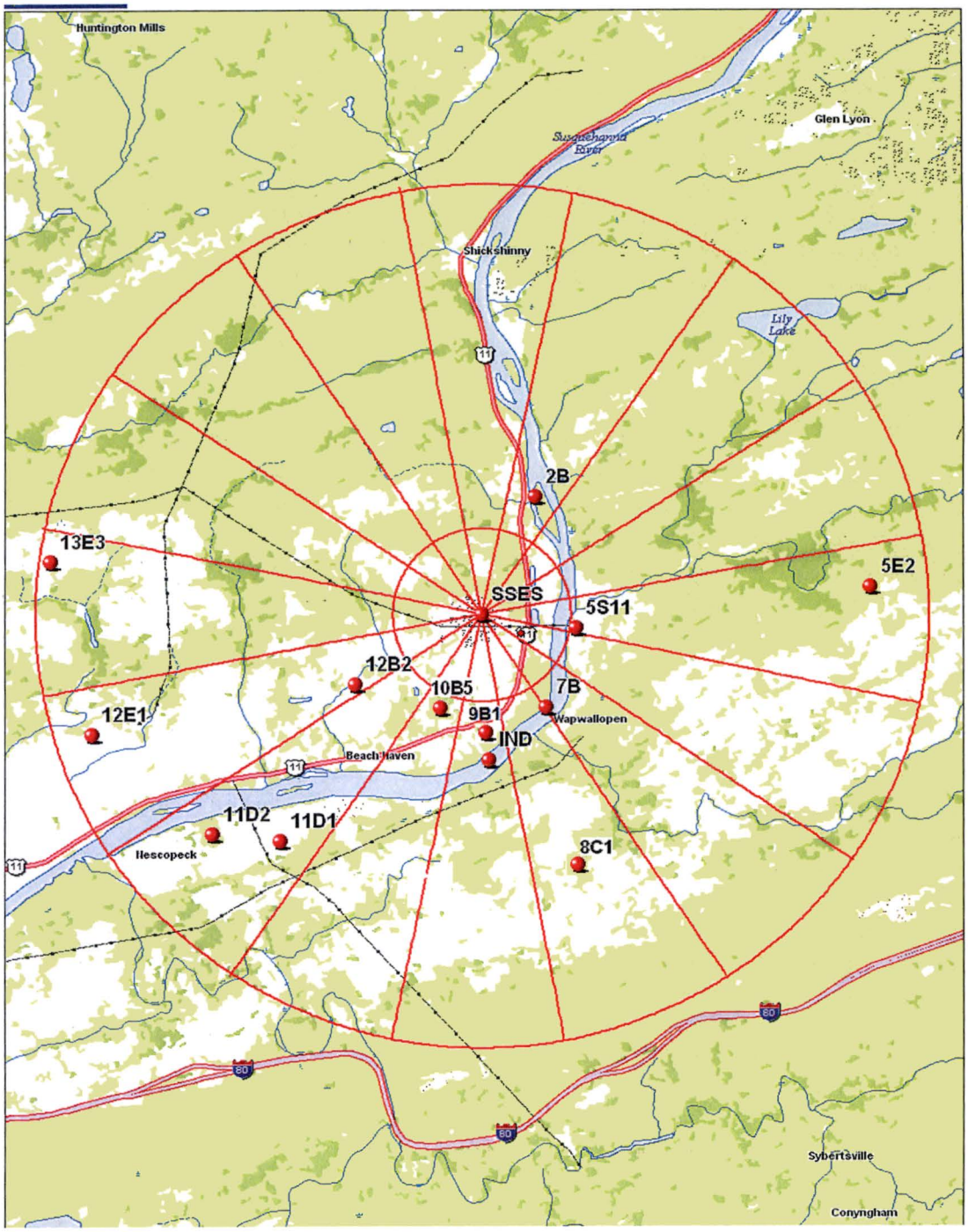
MAP B-4

Environmental Sampling Locations Within One Mile



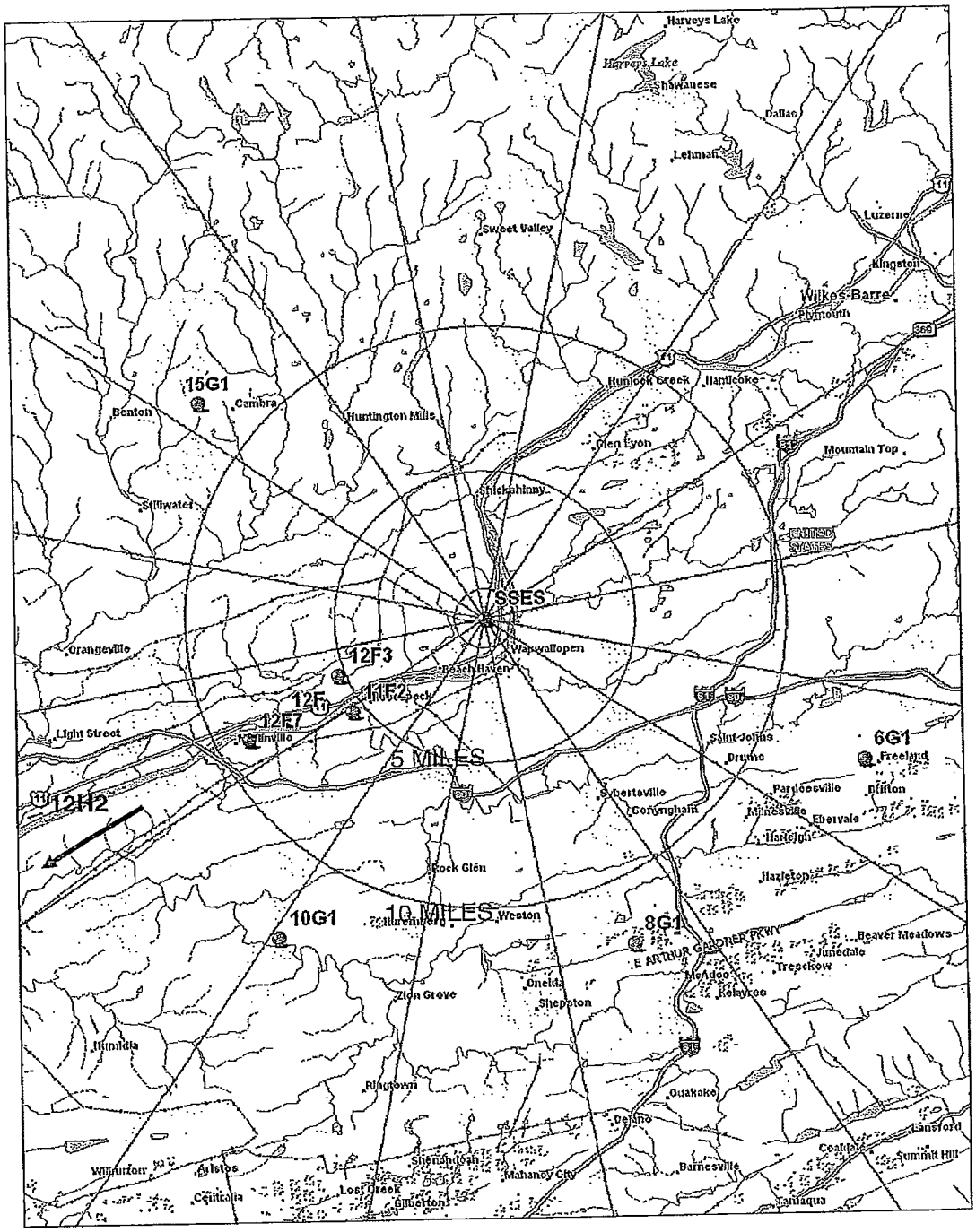
MAP B-5

Environmental Sampling Locations From One to Five Miles



MAP B-6

Environmental Sampling Locations Greater Than Five Miles



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APPENDIX C

DATA TABLES

TABLE C-1 **GROSS BETA ANALYSES OF AIR PARTICULATE FILTERS**
SUSQUEHANNA STEAM ELECTRIC STATION, 2016

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

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

TABLE C-1

GROSS BETA ANALYSES OF AIR PARTICULATE FILTERS SUSQUEHANNA STEAM ELECTRIC STATION, 2016

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

COLLECTION PERIOD	9B1	10S3
12/30/15 - 01/06/16	13 ± 2	15 ± 2
01/06/16 - 01/14/16	15 ± 2	15 ± 2
01/14/16 - 01/20/16	15 ± 3	13 ± 3
01/20/16 - 01/27/16	11 ± 2	9 ± 2
01/27/16 - 02/03/16	11 ± 2	13 ± 2
02/03/16 - 02/10/16	8 ± 2	10 ± 2
02/10/16 - 02/17/16	7 ± 2	7 ± 2
02/17/16 - 02/24/16	9 ± 2	10 ± 2
02/24/16 - 03/02/16	12 ± 2	10 ± 2
03/02/16 - 03/09/16	13 ± 2	14 ± 2
03/09/16 - 03/16/16	11 ± 2	11 ± 2
03/16/16 - 03/23/16	11 ± 2	10 ± 2
03/23/16 - 03/30/16	11 ± 2	13 ± 2
03/30/16 - 04/06/16	12 ± 2	14 ± 2
04/06/16 - 04/13/16	11 ± 2	11 ± 2
04/13/16 - 04/20/16	13 ± 2	13 ± 2
04/20/16 - 04/27/16	14 ± 2	14 ± 2
04/27/16 - 05/04/16	6 ± 2	8 ± 2
05/04/16 - 05/11/16	5 ± 2	5 ± 2
05/11/16 - 05/18/16	9 ± 2	9 ± 2
05/18/16 - 05/25/16	15 ± 2	12 ± 2
05/25/16 - 06/01/16	22 ± 3	19 ± 3
06/01/16 - 06/08/16	11 ± 2	12 ± 2
06/08/16 - 06/15/16	8 ± 2	10 ± 2
06/15/16 - 06/22/16	12 ± 2	12 ± 2
06/22/16 - 06/29/16	14 ± 2	15 ± 2
06/29/16 - 07/06/16	10 ± 2	12 ± 2
07/06/16 - 07/13/16	14 ± 2	14 ± 2
07/13/16 - 07/20/16	13 ± 2	14 ± 2
07/20/16 - 07/27/16	16 ± 2	15 ± 2
07/27/16 - 08/03/16	14 ± 2	13 ± 2
08/03/16 - 08/10/16	16 ± 2	15 ± 2
08/10/16 - 08/17/16	7 ± 2	8 ± 2
08/17/16 - 08/24/16	15 ± 2	15 ± 2
08/24/16 - 08/31/16	14 ± 2	15 ± 2
08/31/16 - 09/07/16	20 ± 3	19 ± 3
09/07/16 - 09/14/16	13 ± 2	13 ± 4
09/14/16 - 09/21/16	14 ± 2	14 ± 2
09/21/16 - 09/28/16	15 ± 2	17 ± 3
09/28/16 - 10/05/16	9 ± 2	6 ± 2
10/05/16 - 10/12/16	13 ± 2	12 ± 2
10/12/16 - 10/19/16	15 ± 2	15 ± 2
10/19/16 - 10/26/16	11 ± 2	10 ± 2
10/26/16 - 11/02/16	14 ± 2	13 ± 2
11/02/16 - 11/09/16	18 ± 3	19 ± 3
11/09/16 - 11/16/16	15 ± 2	20 ± 3
11/16/16 - 11/22/16	21 ± 3	20 ± 3
11/22/16 - 11/30/16	12 ± 2	15 ± 2
11/30/16 - 12/07/16	10 ± 2	10 ± 2
12/07/16 - 12/14/16	15 ± 2	14 ± 2
12/14/16 - 12/21/16	12 ± 2	14 ± 2
12/21/16 - 12/28/16	21 ± 3	21 ± 3
AVERAGE	13 ± 7	13 ± 7

TABLE C-2 **GAMMA SPECTROSCOPIC ANALYSES OF COMPOSITED AIR PARTICULATE FILTE SUSQUEHANNA STEAM ELECTRIC STATION, 2016**

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

SITE	COLLECTION PERIOD	Be-7	K-40	Cs-134	Cs-137
6G1	12/30/15 - 03/30/16	91 ± 23	< 11	< 1	< 1
	03/30/16 - 06/29/16	156 ± 28	< 23	< 1	< 2
	06/29/16 - 09/28/16	145 ± 22	< 17	< 1	< 1
	09/28/16 - 12/28/16	98 ± 24	< 25	< 1	< 1
	AVERAGE	122 ± 65	-	-	-
8G1	12/30/15 - 03/30/16	77 ± 18	< 14	< 1	< 1
	03/30/16 - 06/29/16	130 ± 27	< 22	< 1	< 1
	06/29/16 - 09/28/16	104 ± 17	< 19	< 1	< 1
	09/28/16 - 12/28/16	110 ± 24	< 13	< 1	< 1
	AVERAGE	105 ± 44		-	-
3S2	12/30/15 - 03/30/16	86 ± 21	< 16	< 1	< 1
	03/30/16 - 06/29/16	185 ± 28	< 5	< 1	< 1
	06/29/16 - 09/28/16	165 ± 27	< 28	< 2	< 1
	09/28/16 - 12/28/16	74 ± 16	< 15	< 1	< 1
	AVERAGE	128 ± 111	-	-	-
12E1	12/30/15 - 03/30/16	88 ± 31	< 27	< 2	< 2
	03/30/16 - 06/29/16	145 ± 35	< 26	< 1	< 1
	06/29/16 - 09/28/16	127 ± 20	< 15	< 1	< 1
	09/28/16 - 12/28/16	100 ± 19	< 25	< 1	< 1
	AVERAGE	115 ± 51	-	-	-
12S1	12/30/15 - 03/30/16	136 ± 25	< 7	< 1	< 1
	03/30/16 - 06/29/16	132 ± 27	< 22	< 1	< 1
	06/29/16 - 09/28/16	120 ± 20	< 11	< 1	< 1
	09/28/16 - 12/28/16	102 ± 24	< 28	< 2	< 1
	AVERAGE	123 ± 31	-	-	-
13S6	12/30/15 - 03/30/16	90 ± 32	< 31	< 2	< 2
	03/30/16 - 06/29/16	132 ± 30	< 26	< 2	< 1
	06/29/16 - 09/28/16	131 ± 21	< 22	< 1	< 1
	09/28/16 - 12/28/16	91 ± 20	< 19	< 1	< 1
	AVERAGE	111 ± 47	-	-	-
10S3	12/30/15 - 03/30/16	97 ± 18	< 11	< 1	< 1
	03/30/16 - 06/29/16	143 ± 25	< 24	< 1	< 1
	06/29/16 - 09/28/16	117 ± 25	< 30	< 2	< 2
	09/28/16 - 12/28/16	117 ± 19	< 20	< 1	< 1
	AVERAGE	119 ± 38	-	-	-
9B1	12/30/15 - 03/30/16	124 ± 22	< 17	< 1	< 1
	03/30/16 - 06/29/16	153 ± 24	< 18	< 1	< 1
	06/29/16 - 09/28/16	137 ± 31	< 34	< 2	< 2
	09/28/16 - 12/28/16	86 ± 18	< 20	< 1	< 1
	AVERAGE	125 ± 57	-	-	-

TABLE C-3 **IODINE-131 ANALYSES OF AIR IODINE SAMPLES**
SUSQUEHANNA STEAM ELECTRIC STATION, 2016

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

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

TABLE C-3

IODINE-131 ANALYSES OF AIR IODINE SAMPLES SUSQUEHANNA STEAM ELECTRIC STATION, 2016

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

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

TABLE C-4 ENVIRONMENTAL OPTICALLY STIMULATED LUMINESCENCE DOSIMETRY RESULTS
SUSQUEHANNA STEAM ELECTRIC STATION, 2016

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

LOCATION	First Quarter 1/7/2016 to 4/20/2016	Second Quarter 4/20/2016 to 7/6/2016	Third Quarter 7/6/2016 to 10/5/2016	Fourth Quarter 10/5/2016 to 1/13/2017
ONSITE				
1S2	16.7 ± 0.1	16.7 ± 1.4	22.1 ± 0.1	23.1 ± 0.7
2S2	11.0 ± 0.5	14.0 ± 0.1	14.4 ± 0.5	16.0 ± 0.5
2S3	14.6 ± 1.8	17.2 ± 0.1	20.1 ± 0.6	20.3 ± 1.1
3S2	10.5 ± 0.3	11.8 ± 0.4	13.2 ± 0.4	14.7 ± 1.0
3S3	10.4 ± 0.1	13.2 ± 1.4	12.9 ± 0.1	14.5 ± 0.9
4S3	15.8 ± 0.9	20.0 ± 1.4	20.3 ± 0.6	19.8 ± 1.7
4S6	10.2 ± 0.7	12.5 ± 0.0	14.2 ± 0.9	15.2 ± 1.4
5S4	9.26 ± 0.9	12.8 ± 0.2	13.4 ± 0.9	12.9 ± 1.3
5S7	11.8 ± 0.6	14.7 ± 1.0	14.3 ± 0.2	15.4 ± 0.6
6S4	19.0 ± 0.5	22.2 ± 2.8	23.9 ± 1.0	25.4 ± 0.4
6S9	18.1 ± 0.7	20.2 ± 0.2	23.2 ± 1.2	24.4 ± 1.3
7S6	18.2 ± 1.8	19.3 ± 0.3	22.5 ± 1.3	22.2 ± 1.3
7S7	9.35 ± 0.4	11.5 ± 0.9	12.2 ± 0.1	14.0 ± 0.4
8S2	18.7 ± 0.8	20.4 ± 0.1	24.2 ± 1.3	26.0 ± 0.3
9S2	38.5 ± 2.0	37.0 ± 1.2	43.7 ± 2.0	43.2 ± 5.5
10S1	10.4 ± 0.4	13.9 ± 0.2	14.8 ± 0.9	15.5 ± 0.4
10S2	29.1 ± 0.7	29.6 ± 0.7	33.5 ± 1.8	31.5 ± 0.6
11S7	10.1 ± 0.3	14.7 ± 0.3	14.7 ± 0.9	14.6 ± 0.6
12S1	11.5 ± 0.6	15.7 ± 0.5	15.5 ± 0.2	16.1 ± 0.3
12S3	14.3 ± 0.6	17.3 ± 0.3	19.9 ± 0.6	19.5 ± 0.8
12S7	9.71 ± 0.9	11.6 ± 1.4	14.2 ± 0.7	15.1 ± 3.1
13S2	19.0 ± 2.2	23.8 ± 0.6	24.3 ± 3.3	24.8 ± 0.9
13S5	22.5 ± 0.8	25.1 ± 0.5	26.9 ± 1.1	30.7 ± 3.6
13S6	18.5 ± 1.5	17.1 ± 0.1	19.7 ± 1.3	20.2 ± 0.6
14S5	14.3 ± 0.8	17.2 ± 1.4	19.7 ± 0.7	19.0 ± 0.9
15S5	12.3 ± 0.3	14.5 ± 0.6	17.3 ± 1.7	16.3 ± 0.8
16S1	15.7 ± 0.9	18.2 ± 0.4	20.7 ± 0.8	22.0 ± 0.4
16S2	17.1 ± 2.0	18.4 ± 1.1	20.2 ± 1.5	18.2 ± 1.4

See the comments at the end of this table.

TABLE C-4 ENVIRONMENTAL OPTICALLY STIMULATED LUMINESCENCE DOSIMETRY RESULTS SUSQUEHANNA STEAM ELECTRIC STATION, 2016

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

LOCATION	First Quarter 1/7/2016 to 4/20/2016	Second Quarter 4/20/2016 to 7/6/2016	Third Quarter 7/6/2016 to 10/5/2016	Fourth Quarter 10/5/2016 to 1/13/2017
0-1 MILE OFFSITE				
6A4	12.7 ± 1.3	15.9 ± 2.0	16.7 ± 0.2	17.8 ± 0.1
8A3	9.08 ± 0.2	12.1 ± 0.4	13.4 ± 0.9	13.2 ± 0.6
15A3	8.59 ± 0.5	12.4 ± 0.3	13.0 ± 0.1	14.1 ± 0.5
16A2	8.81 ± 0.7	11.2 ± 2.0	13.6 ± 1.1	14.1 ± 1.1
1-2 MILES OFFSITE				
8B2	7.29 ± 1.3	11.7 ± 2.4	15.5 ± 0.5	12.8 ± 1.5
9B1	14.4 ± 0.5	18.6 ± 1.4	19.3 ± 0.8	21.1 ± 2.4
10B3	9.66 ± 1.0	12.6 ± 1.0	13.4 ± 1.5	13.9 ± 2.2
2-4 MILES OFFSITE				
1D5	7.60 ± 1.1	14.1 ± 0.8	16.5 ± 0.5	14.9 ± 1.9
8D3	7.56 ± 1.6	12.9 ± 0.5	16.9 ± 2.4	16.0 ± 0.4
9D4	7.83 ± 0.3	14.2 ± 2.7	16.7 ± 1.3	16.2 ± 1.0
10D1	8.86 ± 0.1	13.2 ± 0.7	16.2 ± 0.1	16.3 ± 2.4
12D2	14.7 ± 0.1	15.7 ± 0.2	18.0 ± 0.1	17.0 ± 0.2
14D1	10.4 ± 0.5	13.3 ± 1.1	16.5 ± 0.6	15.9 ± 0.3
4-5 MILES OFFSITE				
3E1	5.70 ± 0.6	10.4 ± 0.3	13.0 ± 1.3	13.1 ± 0.8
4E2	8.40 ± 0.3	14.4 ± 0.8	17.2 ± 0.8	16.2 ± 1.5
5E2	8.80 ± 0.4	14.7 ± 0.7	15.4 ± 1.1	15.6 ± 1.1
6E1	10.4 ± 1.9	15.9 ± 0.3	17.7 ± 0.4	16.9 ± 0.4
7E1	9.90 ± 2.5	14.1 ± 0.3	16.7 ± 1.2	16.4 ± 1.5
11E1	4.90 ± 0.4	9.10 ± 1.1	11.7 ± 0.4	12.2 ± 0.3
12E1	7.90 ± 0.3	12.6 ± 0.2	13.2 ± 0.6	14.2 ± 0.9
13E4	14.4 ± 1.6	16.8 ± 0.5	19.3 ± 1.6	19.6 ± 2.6

See the comments at the end of this table.

TABLE C-4 ENVIRONMENTAL OPTICALLY STIMULATED LUMINESCENCE DOSIMETRY RESULTS
SUSQUEHANNA STEAM ELECTRIC STATION, 2016

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

LOCATION	First Quarter 1/7/2016 to 4/20/2016	Second Quarter 4/20/2016 to 7/6/2016	Third Quarter 7/6/2016 to 10/5/2016	Fourth Quarter 10/5/2016 to 1/13/2017
5-10 MILES OFFSITE				
2F1	8.50 ± 0.1	13.0 ± 0.5	13.7 ± 0.3	14.7 ± 0.8
15F1	13.8 ± 1.1	15.7 ± 0.5	18.8 ± 0.6	17.4 ± 1.4
16F1	14.4 ± 0.8	17.0 ± 1.7	17.1 ± 0.4	20.0 ± 1.7
10-20 MILES OFFSITE				
3G4	9.80 ± 0.2	14.3 ± 1.1	16.7 ± 1.8	16.6 ± 0.4
4G1	10.9 ± 0.4	15.5 ± 0.6	17.9 ± 2.2	16.9 ± 1.5
7G1	9.00 ± 0.1	(4)	16.3 ± 0.0	16.6 ± 0.1
12G1	6.70 ± 0.1	11.4 ± 0.6	13.3 ± 0.6	12.5 ± 2.1
12G4	7.00 ± 0.7	12.9 ± 1.2	15.0 ± 0.4	13.2 ± 0.3

See the comments at the end of this table.

LOCATION				
INDICATOR				
Average (5)	12.9 ± 11.7	16.0 ± 9.8	18.0 ± 11.2	18.3 ± 11.2
CONTROL				
Average (5)	8.70 ± 3.61	13.5 ± 3.5	15.8 ± 3.5	15.2 ± 4.3

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, 2016

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	01/04/16	< 0.1	1266 ± 236	< 9	< 10	< 37	< 12	< 16
	02/09/16	< 0.3	1410 ± 157	< 5	< 6	< 31	< 8	< 11
	03/14/16	< 0.3	1479 ± 208	< 8	< 11	< 35	< 7	< 17
	04/11/16	< 0.3	1357 ± 241	< 9	< 12	< 40	< 9	< 19
	04/25/16	< 0.2	1317 ± 143	< 6	< 6	< 25	< 5	< 12
	05/09/16	< 0.7	1517 ± 198	< 7	< 8	< 26	< 7	< 13
	05/23/16	< 0.8	1386 ± 143	< 6	< 6	< 36	< 12	< 10
	06/06/16	< 0.6	1433 ± 151	< 6	< 6	< 36	< 8	< 13
	06/20/16	< 0.6	1191 ± 196	< 7	< 9	< 38	< 9	< 15
	07/05/16	< 0.7	1378 ± 190	< 6	< 6	< 30	< 10	< 14
	07/17/16	< 0.4	1342 ± 221	< 9	< 10	< 28	< 13	< 17
	08/01/16	< 0.4	1382 ± 210	< 8	< 9	< 47	< 11	< 20
	08/15/16	< 0.8	1367 ± 157	< 7	< 8	< 26	< 5	< 14
	08/29/16	< 0.3	1333 ± 232	< 8	< 11	< 41	< 11	< 16
	09/12/16	< 0.5	1189 ± 201	< 8	< 11	< 38	< 8	< 16
	09/26/16	< 0.5	1137 ± 208	< 10	< 10	< 34	< 11	< 19
	10/10/16	< 0.3	1273 ± 159	< 12	< 10	< 34	< 7	< 20
	10/24/16	< 0.2	1361 ± 155	< 7	< 7	< 43	< 11	< 14
	11/07/16	< 0.7	1296 ± 212	< 8	< 10	< 41	< 5	< 20
	12/05/16	< 0.5	1281 ± 172	< 7	< 8	< 29	< 8	< 10
	AVERAGE	-	1335 ± 191	-	-	-	-	-
13E3	01/04/16	< 0.2	1312 ± 217	< 9	< 9	< 36	< 14	< 16
	02/09/16	< 0.3	1316 ± 171	< 8	< 7	< 39	< 12	< 14
	03/14/16	< 0.5	1204 ± 235	< 7	< 10	< 40	< 10	< 18
	04/11/16	< 0.3	1389 ± 240	< 8	< 10	< 39	< 14	< 19
	04/25/16	< 0.2	1320 ± 160	< 7	< 7	< 27	< 8	< 14
	05/09/16	< 0.7	1418 ± 243	< 9	< 8	< 34	< 8	< 18
	05/23/16	< 1.0	1306 ± 118	< 5	< 5	< 30	< 10	< 11
	06/06/16	< 0.5	1455 ± 153	< 6	< 6	< 33	< 9	< 13
	06/20/16	< 0.6	1330 ± 247	< 7	< 8	< 34	< 13	< 16
	07/05/16	< 0.5	1316 ± 227	< 8	< 9	< 45	< 9	< 17
	07/17/16	< 0.6	1236 ± 172	< 6	< 8	< 29	< 8	< 13
	08/01/16	< 0.4	1307 ± 195	< 6	< 9	< 43	< 10	< 16
	08/15/16	< 0.7	1377 ± 153	< 6	< 6	< 21	< 8	< 13
	08/29/16	< 0.6	1390 ± 157	< 6	< 7	< 28	< 5	< 13
	09/12/16	< 0.5	1277 ± 160	< 7	< 7	< 28	< 7	< 13
	09/26/16	< 0.3	1376 ± 245	< 7	< 10	< 28	< 11	< 18
	10/10/16	< 0.3	1123 ± 206	< 9	< 11	< 41	< 14	< 18
	10/24/16	< 0.2	1422 ± 221	< 8	< 9	< 53	< 13	< 9.5
	11/07/16	< 0.7	1356 ± 175	< 6	< 8	< 35	< 5	< 14
	12/05/16	< 0.6	1368 ± 203	< 8	< 8	< 31	< 11	< 15
	AVERAGE	-	1330 ± 157	-	-	-	-	-

TABLE C-5 **IODINE-131 AND GAMMA SPECTROSCOPIC ANALYSES OF MILK SUSQUEHANNA STEAM ELECTRIC STATION, 2016**

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	01/04/16	< 0.2	1080 ± 201	< 9	< 11	< 42	< 10	< 17
	02/09/16	< 0.3	1400 ± 170	< 6	< 6	< 28	< 4	< 12
	03/14/16	< 0.4	1272 ± 175	< 6	< 8	< 24	< 8	< 11
	04/11/16	< 0.4	1254 ± 198	< 7	< 9	< 32	< 12	< 16
	04/25/16	< 0.2	1069 ± 224	< 9	< 10	< 34	< 9	< 21
	05/09/16	< 0.7	1359 ± 213	< 7	< 9	< 39	< 11	< 16
	05/23/16	< 0.9	1474 ± 163	< 7	< 7	< 42	< 12	< 14
	06/07/16	< 0.6	1147 ± 98	< 4	< 5	< 22	< 8	< 8.3
	06/20/16	< 0.6	1246 ± 169	< 7	< 8	< 36	< 9	< 14
	07/05/16	< 0.6	1410 ± 173	< 6	< 6	< 35	< 9	< 12
	07/17/16	< 0.5	1298 ± 207	< 9	< 8	< 41	< 10	< 21
	08/01/16	< 0.6	1297 ± 220	< 7	< 10	< 47	< 12	< 20
	08/15/16	< 0.7	1197 ± 185	< 8	< 10	< 35	< 11	< 13
	08/29/16	< 0.3	1455 ± 199	< 7	< 5	< 31	< 9	< 15
	09/12/16	< 0.4	1451 ± 175	< 6	< 9	< 27	< 7	< 14
	09/26/16	< 0.4	1238 ± 150	< 5	< 6	< 27	< 8	< 10
	10/10/16	< 0.3	1360 ± 167	< 7	< 8	< 28	< 10	< 14
	10/24/16	< 0.3	1382 ± 159	< 7	< 8	< 44	< 13	19 ± 10
	11/07/16	< 0.5	1369 ± 210	< 9	< 11	< 39	< 15	< 17
	12/05/16	< 0.7	1474 ± 187	< 7	< 8	< 33	< 9	< 14
	AVERAGE	-	1312 ± 247	-	-	-	-	19 ± 0

TABLE C-6 **TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF GROUND WATER**
SUSQUEHANNA STEAM ELECTRIC STATION, 2016

Results in pCi/Liter ± 2 sigma

SITE	COLLECTION DATE	H-3	<---------GAMMA EMITTERS--------->													
			K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140	Th-228
12F3	02/05/16	< 148	< 153	< 6	< 7	< 16	< 6	< 14	< 6	< 11	< 11	< 6	< 7	< 27	< 9	< 14
	05/03/16	< 133	< 77	< 5	< 4	< 10	< 4	< 8	< 5	< 8	< 6	< 5	< 4	< 21	< 7	< 7
	07/22/16	< 143	< 127	< 7	< 5	< 23	< 7	< 15	< 7	< 13	< 12	< 7	< 7	< 30	< 14	< 16
	11/03/16	< 147	< 122	< 9	< 8	< 23	< 10	< 16	< 12	< 16	< 15	< 9	< 8	< 40	< 14	< 18
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2S2	02/05/16	< 147	< 149	< 7	< 8	< 21	< 8	< 20	< 6	< 14	< 10	< 6	< 7	< 35	< 10	< 14
	05/03/16	< 133	< 82	< 6	< 4	< 16	< 9	< 10	< 7	< 10	< 11	< 6	< 6	< 28	< 6	< 14
	07/22/16	< 143	< 82	< 9	< 7	< 27	< 11	< 11	< 10	< 16	< 14	< 8	< 9	< 30	< 15	< 15
	11/03/16	< 145	< 128	< 8	< 6	< 20	< 7	< 18	< 10	< 14	< 13	< 8	< 8	< 37	< 13	< 17
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2S8	01/29/16	< 147	< 65	< 5	< 6	< 15	< 5	< 10	< 7	< 9	< 10	< 5	< 5	< 26	< 11	< 10
	05/16/16	< 146	< 76	< 3	< 4	< 10	< 4	< 6	< 4	< 7	< 15	< 3	< 4	< 31	< 11	< 6
	09/01/16	< 146	< 71	< 8	< 9	< 20	< 7	< 18	< 9	< 13	< 14	< 11	< 10	< 36	< 12	< 19
	11/15/16	< 140	< 42	< 5	< 5	< 17	< 4	< 9	< 6	< 9	< 15	< 5	< 5	< 31	< 10	< 9
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4S4	02/05/16	< 148	< 75	< 8	< 8	< 21	< 8	< 15	< 7	< 12	< 11	< 7	< 8	< 35	< 11	< 13
	05/03/16	< 133	< 198	< 7	< 7	< 15	< 6	< 16	< 9	< 14	< 14	< 9	< 9	< 35	< 11	< 18
	07/22/16	< 142	< 137	< 8	< 7	< 18	< 7	< 15	< 8	< 15	< 14	< 10	< 8	< 37	< 11	< 18
	11/03/16	< 145	< 126	< 8	< 8	< 21	< 8	< 9	< 10	< 12	< 13	< 7	< 7	< 46	< 9	< 17
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6S10	02/05/16	< 146	< 137	< 6	< 7	< 15	< 8	< 10	< 5	< 11	< 11	< 7	< 7	< 33	< 10	< 16
	05/03/16	< 132	< 158	< 7	< 8	< 16	< 7	< 14	< 7	< 11	< 14	< 7	< 7	< 35	< 9	< 16
	07/22/16	< 141	< 66	< 8	< 9	< 22	< 3	< 13	< 8	< 15	< 14	< 7	< 8	< 33	< 15	< 15
	11/03/16	< 143	< 58	< 7	< 6	< 16	< 9	< 13	< 7	< 13	< 15	< 7	< 8	< 31	< 13	< 14
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE C-6 **TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF GROUND WATER**
SUSQUEHANNA STEAM ELECTRIC STATION, 2016

Results in pCi/Liter ± 2 sigma

SITE	COLLECTION DATE	H-3	<--------GAMMA EMITTERS-------->													
			K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140	Th-228
11S2	02/05/16	< 148	< 70	< 8	< 7	< 20	< 8	< 17	< 8	< 13	< 11	< 8	< 8	< 30	< 8	< 15
	05/03/16	< 134	< 158	< 8	< 8	< 18	< 5	< 19	< 10	< 16	< 15	< 7	< 9	< 39	< 11	< 16
	07/22/16	< 145	< 65	< 4	< 4	< 12	< 5	< 8	< 4	< 7	< 7	< 4	< 5	< 17	< 7	< 8
	11/03/16	< 144	< 84	< 8	< 6	< 15	< 5	< 14	< 7	< 10	< 12	< 6	< 8	< 31	< 9	< 12
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13S7	03/11/16	185 ± 92	< 111	< 7	< 7	< 15	< 8	< 12	< 6	< 10	< 13	< 7	< 7	< 35	< 9	< 17
	05/10/16	156 ± 94	< 14	< 1	< 2	< 5	< 2	< 3	< 2	< 3	< 10	< 1	< 2	< 16	< 6	< 3
	08/22/16	< 145	< 33	< 2	< 2	< 5	< 2	< 4	< 2	< 3	< 8	< 2	< 2	< 16	< 5	< 4
	11/08/16	< 144	< 55	< 5	< 6	< 12	< 5	< 10	< 7	< 11	< 10	< 7	< 7	< 30	< 7	< 14
	AVERAGE	171 ± 41	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1S3	01/31/16	159 ± 96	< 104	< 5	< 6	< 17	< 4	< 13	< 7	< 10	< 9	< 4	< 6	< 28	< 11	< 13
	05/10/16	212 ± 98	< 20	< 2	< 3	< 8	< 2	< 5	< 3	< 5	< 14	< 2	< 2	< 25	< 9	< 3
	08/25/16	168 ± 94	< 40	< 4	< 4	< 13	< 4	< 8	< 5	< 7	< 13	< 4	< 4	< 27	< 10	10 ± 6
	11/08/16	161 ± 96	< 148	< 7	< 8	< 20	< 6	< 14	< 8	< 12	< 13	< 7	< 6	< 31	< 13	< 16
	AVERAGE	175 ± 50	-	-	-	-	-	-	-	-	-	-	-	-	-	10 ± 0
4S8	02/01/16	158 ± 97	< 137	< 7	< 6	< 18	< 4	< 15	< 7	< 12	< 9	< 8	< 7	< 29	< 12	< 17
	05/10/16	< 145	< 28	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 11	< 2	< 2	< 18	< 6	7 ± 3
	08/22/16	< 144	< 32	< 4	< 4	< 12	< 4	< 7	< 4	< 6	< 15	< 3	< 3	< 34	< 9	< 7
	11/08/16	182 ± 96	< 92	< 8	< 8	< 24	< 9	< 16	< 12	< 16	< 13	< 9	< 9	< 44	< 13	< 15
	AVERAGE	170 ± 34	-	-	-	-	-	-	-	-	-	-	-	-	-	7 ± 0
4S9	02/22/16	< 144	< 29	< 5	< 5	< 14	< 5	< 12	< 6	< 10	< 8	< 6	< 6	< 20	< 9	< 11
	05/20/16	155 ± 94	< 48	< 5	< 5	< 13	< 4	< 10	< 5	< 9	< 13	< 4	< 5	< 28	< 12	< 7
	08/05/16	< 144	< 25	< 1	< 1	< 4	< 1	< 2	< 1	< 2	< 15	< 1	< 1	< 19	< 6	< 1
	11/17/16	162 ± 94	< 36	< 5	< 5	< 10	< 5	< 9	< 5	< 7	< 14	< 4	< 4	< 26	< 9	< 8
	AVERAGE	159 ± 10	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE C-6 **TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF GROUND WATER**
SUSQUEHANNA STEAM ELECTRIC STATION, 2016

Results in pCi/Liter ± 2 sigma

SITE	COLLECTION DATE	H-3	<----------GAMMA EMITTERS---------->													
			K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140	Th-228
6S11A	01/28/16	< 148	< 34	< 5	< 6	< 16	< 6	< 13	< 5	< 11	< 13	< 6	< 6	< 32	< 10	< 11
	05/12/16	< 134	< 58	< 7	< 6	< 17	< 7	< 13	< 6	< 12	< 12	< 6	< 7	< 34	< 11	< 12
	08/05/16	< 146	< 78	< 8	< 7	< 21	< 7	< 12	< 8	< 13	< 11	< 7	< 8	< 32	< 13	< 13
	11/18/16	< 142	< 55	< 6	< 6	< 17	< 7	< 12	< 7	< 10	< 14	< 5	< 6	< 33	< 11	< 11
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6S12	01/26/16	< 148	< 42	< 5	< 5	< 16	< 5	< 11	< 6	< 10	< 12	< 6	< 6	< 30	< 9	< 11
	05/08/16	< 149	< 21	< 1	< 1	< 4	< 1	< 3	< 2	< 3	< 10	< 1	< 1	< 15	< 5	< 2
	08/03/16	< 143	< 5	< 1	< 1	< 2	< 1	< 2	< 1	< 2	< 15	< 1	< 1	< 17	< 5	< 1
	11/07/16	< 146	< 182	< 8	< 7	< 22	< 9	< 17	< 10	< 14	< 14	< 9	< 7	< 40	< 12	< 17
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7S10	02/22/16	< 142	< 53	< 7	< 6	< 14	< 7	< 13	< 8	< 10	< 8	< 6	< 6	< 26	< 8	< 13
	05/17/16	< 144	< 30	< 3	< 3	< 11	< 3	< 8	< 4	< 6	< 13	< 3	< 3	< 28	< 8	< 8
	08/08/16	< 144	< 9.2	< 1	< 1	< 4	< 1	< 2	< 1	< 2	< 14	< 1	< 1	< 19	< 6	< 2
	11/14/16	< 145	< 72	< 3	< 4	< 11	< 3	< 7	< 4	< 7	< 14	< 4	< 4	< 29	< 9	< 8
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7S11	02/18/16	< 141	< 151	< 7	< 7	< 19	< 7	< 12	< 7	< 9	< 13	< 7	< 7	< 33	< 13	< 13
	05/17/16	< 146	< 75	< 4	< 4	< 10	< 3	< 8	< 4	< 7	< 15	< 3	< 4	< 23	< 8	< 6
	08/08/16	< 146	< 8.8	< 1	< 1	< 4	< 1	< 2	< 1	< 2	< 15	< 1	< 1	< 19	< 7	< 2
	11/14/16	< 140	< 29	< 4	< 4	< 11	< 4	< 8	< 4	< 7	< 15	< 4	< 4	< 27	< 9	< 6
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8S4	01/31/16	< 147	< 156	< 7	< 8	< 27	< 7	< 13	< 7	< 9	< 12	< 5	< 8	< 34	< 8	< 16
	05/10/16	< 144	< 44	< 2	< 2	< 6	< 2	< 3	< 2	< 4	< 13	< 2	< 2	< 21	< 7	< 4
	08/25/16	225 ± 100	< 70	< 4	< 3	< 10	< 3	< 8	< 5	< 6	< 12	< 3	< 3	< 27	< 9	< 8
	11/03/16	130 ± 84	< 48	< 6	< 6	< 14	< 6	< 15	< 7	< 11	< 14	< 6	< 5	< 33	< 11	< 10
	AVERAGE	178 ± 134	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE C-7

ANNUAL AVERAGE TRITIUM CONCENTRATION IN PRECIPITATION, MONITORING WELLS AND LAKE TOOK-A-WHILE (LTAW) SURFACE WATER DATA SUSQUEHANNA STEAM ELECTRIC STATION, 2016

Results in pCi/Liter ± 2 sigma

SITE	2008	2009	2010	2011	2012	2013	2014	2015	2016
Precip Sites 3S2, 12S1, 8G1 (offsite, controls)	62*	49	40	38	82	63	51	39	45
Precip Sites 1 and 2 (onsite, East of Station Reactor Bldgs)	370	230*	193	216	242	182	142	250	206
Precipitation Sites 3 and 4 (onsite, West of Station Reactor Bldgs)	414	404*	350	233	169	151	231	258	197
1S3 - MW-1 (43')	344	304	325	236	185	198	179	14	175
4S8 - MW-2 (45')	248	150	252	131	164	197	115	169	154
4S9 - MW-3 (94')	292	154	190	173	137	202	187	138	125
8S4 - MW-4 (111')	127	54	150	64	80	135	94	180	145
7S10 - MW-5 (36')	172	66	105	68	81	109	60	162	73
13S7 - MW-6 (16')	171	69	96	-6	74	106	68	70	111
2S8 - MW-7 (85')	142	134	143	34	80	111	71	79	74
6S11A - MW-8A (14')	Not installed	Not installed	Not installed	22	54	72	70	70	63
6S12 - MW-9 (28')	199	229	329	40	345	69	31	71	70
7S11 - MW-10 (132')	30	-44	45	18	6	60	21	57	13
12F3 - Groundwater Control	3	-27	-9	1	-1	23	29	55	41
LTAW- Surface Water	26	-53	-2	5	-6	45	-26	20	89

* Revised values to reflect full scope of precipitation data.

TABLE C-8 **GROSS BETA, TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF DRINKING WATER SUSQUEHANNA STEAM ELECTRIC STATION, 2016**

Results in pCi/Liter ± 2 sigma

	COLLECTION PERIOD				<--------GAMMA EMITTERS-------->												
SITE	START	STOP	Gr-B	H-3	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140
12H2	12/28/15 -	01/25/16	< 1.9	< 147	< 14	< 2	< 2	< 5	< 1	< 3	< 2	< 3	< 10	< 2	< 2	< 17	< 5
12H2	01/25/16 -	03/01/16	< 1.9	< 143	< 28	< 1	< 2	< 5	< 1	< 3	< 2	< 3	< 14	< 1	< 1	< 19	< 6
12H2	03/01/16 -	03/29/16	2.5 ± 1.3	< 146	< 28	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 9	< 2	< 2	< 17	< 5
12H2	03/29/16 -	04/26/16	< 2.1	< 132	< 15	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 9	< 1	< 2	< 16	< 5
12H2	04/26/16 -	05/31/16	< 2.1	< 145	< 32	< 2	< 2	< 7	< 2	< 3	< 2	< 4	< 14	< 2	< 2	< 22	< 7
12H2	05/31/16 -	06/28/16	< 2.1	< 141	< 16	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 14	< 2	< 2	< 22	< 7
12H2	06/28/16 -	07/26/16	3.4 ± 1.5	< 145	< 18	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 14	< 2	< 2	< 22	< 6
12H2	07/26/16 -	08/30/16	2.4 ± 1.4	< 144	< 12	< 1	< 2	< 4	< 1	< 3	< 2	< 3	< 14	< 1	< 1	< 20	< 5
12H2	08/30/16 -	09/27/16	3.9 ± 1.5	< 142	< 29	< 3	< 3	< 8	< 3	< 6	< 3	< 6	< 15	< 3	< 3	< 27	< 8
12H2	09/27/16 -	10/25/16	3.5 ± 1.6	< 146	< 21	< 2	< 2	< 8	< 2	< 4	< 3	< 5	< 15	< 2	< 2	< 22	< 8
12H2	10/25/16 -	11/28/16	3.2 ± 1.4	< 134	< 40	< 2	< 2	< 7	< 2	< 4	< 2	< 4	< 14	< 2	< 2	< 24	< 7
12H2	11/28/16 -	12/27/16	< 2.0	< 139	< 17	< 2	< 2	< 6	< 2	< 4	< 2	< 3	< 8	< 2	< 2	< 16	< 4
		AVERAGE	3.1 ± 1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE C-9 GAMMA SPECTROSCOPIC ANALYSES OF FOOD PRODUCTS (FRUITS AND VEGETABLES)
SUSQUEHANNA STEAM ELECTRIC STATION, 2016

Results in pCi/kg (wet) ± 2 sigma

SITE	COLLECTION PERIOD	Be-7	K-40	I-131	Cs-134	Cs-137	Ac-228	Th-228
8G1	07/25/16	< 215	4579 ± 551	< 25	< 24	< 19	< 94	< 43
	07/25/16	< 302	4191 ± 828	< 34	< 41	< 45	< 154	< 60
	07/25/16	< 256	3877 ± 636	< 28	< 22	< 27	< 93	< 60
	08/24/16	< 317	5704 ± 575	< 53	< 31	< 30	< 106	< 55
	08/24/16	< 212	5429 ± 660	< 39	< 25	< 24	< 87	< 40
	08/24/16	< 211	4588 ± 594	< 42	< 20	< 24	< 107	64 ± 31
	09/26/16	< 216	3761 ± 475	< 25	< 21	< 25	< 98	< 37
	09/26/16	247 ± 204	5637 ± 795	< 36	< 33	< 40	< 115	< 53
	09/26/16	< 200	3791 ± 636	< 29	< 24	< 30	< 112	< 43
	10/19/16	303 ± 107	3840 ± 269	< 18	< 12	< 12	< 50	< 20
	10/19/16	< 124	5169 ± 326	< 19	< 12	< 15	< 47	< 25
	10/19/16	202 ± 96	4209 ± 288	< 17	< 12	< 13	< 44	< 23
	AVERAGE	250 ± 101	4565 ± 1486	-	-	-	-	64 ± 0
11D1	11/17/16	< 180	4195 ± 454	< 49	< 20	< 23	< 94	< 37
	11/17/16	< 194	4789 ± 487	< 54	< 18	< 22	< 82	< 35
	11/17/16	< 127	1426 ± 240	< 41	< 16	< 15	< 73	< 27
	AVERAGE	-	3470 ± 3590	-	-	-	-	-
11S6	06/30/16	< 292	3860 ± 729	< 54	< 37	< 35	< 153	< 65
	06/30/16	< 368	5064 ± 833	< 56	< 26	< 33	< 139	< 53
	06/30/16	< 297	4251 ± 665	< 31	< 27	< 33	< 113	< 52
	07/25/16	< 242	4627 ± 747	< 32	< 34	< 31	< 130	< 61
	07/25/16	< 315	5900 ± 800	< 32	< 33	< 30	< 135	< 63
	07/25/16	< 359	5010 ± 666	< 48	< 41	< 38	< 141	< 78
	08/24/16	< 112	4218 ± 365	< 20	< 12	< 14	< 57	< 22
	08/24/16	235 ± 147	6347 ± 560	< 34	< 19	< 20	< 80	< 33
	08/24/16	< 213	5010 ± 642	< 39	< 22	< 20	< 109	< 38
	09/26/16	< 257	4605 ± 664	< 36	< 27	< 30	< 146	< 55
	09/26/16	< 365	6992 ± 737	< 53	< 48	< 43	< 155	< 83
	09/26/16	< 392	4897 ± 788	< 43	< 43	< 39	< 149	< 65
	10/19/16	503 ± 193	4683 ± 399	< 26	< 19	< 21	< 73	< 29
	10/19/16	363 ± 85	5612 ± 303	< 17	< 10	< 12	< 51	< 21
	10/19/16	547 ± 148	5329 ± 389	< 24	< 15	< 15	< 69	< 29
	AVERAGE	412 ± 283	5094 ± 1676	-	-	-	-	-

TABLE C-9 **GAMMA SPECTROSCOPIC ANALYSES OF FOOD PRODUCTS (FRUITS AND VEGETABLES)**
SUSQUEHANNA STEAM ELECTRIC STATION, 2016

Results in pCi/kg (wet) ± 2 sigma

SITE	COLLECTION PERIOD	Be-7	K-40	I-131	Cs-134	Cs-137	Ac-228	Th-228
12F7	07/27/16	< 234	2850 ± 478	< 31	< 20	< 22	< 99	< 41
	07/27/16	< 251	4169 ± 727	< 40	< 22	< 25	< 108	< 43
	10/31/16	< 162	3591 ± 425	< 26	< 14	< 13	< 76	< 30
	AVERAGE	-	3537 ± 1322	-	-	-	-	-
3S3	06/30/16	< 445	5128 ± 852	< 42	< 33	< 32	< 121	< 50
	06/30/16	< 353	4515 ± 840	< 42	< 32	< 40	< 138	< 66
	06/30/16	423 ± 204	3999 ± 757	< 39	< 25	< 38	< 134	< 50
	07/25/16	295 ± 151	5791 ± 674	< 28	< 23	< 24	< 97	< 44
	07/25/16	< 465	7824 ± 1208	< 46	< 42	< 52	< 225	< 80
	07/25/16	< 257	4837 ± 819	< 37	< 30	< 35	< 139	< 73
	08/24/16	< 226	6027 ± 619	< 36	< 17	< 24	< 96	< 35
	08/24/16	< 223	7385 ± 668	< 37	< 20	< 18	< 100	< 46
	08/24/16	< 196	5016 ± 548	< 35	< 16	< 22	< 80	< 39
	09/26/16	< 308	6082 ± 781	< 41	< 28	< 31	< 142	< 60
	09/26/16	< 351	5085 ± 760	< 49	< 33	< 44	< 154	< 84
	09/26/16	< 260	5256 ± 769	< 40	< 31	< 37	< 129	< 61
	10/19/16	266 ± 99	5735 ± 282	< 15	< 10	< 11	< 46	< 18
	10/19/16	498 ± 133	7619 ± 414	< 21	< 13	< 15	< 59	< 26
	10/19/16	466 ± 95	5064 ± 283	< 17	< 12	< 12	< 50	< 22
	AVERAGE	390 ± 207	5691 ± 2275	-	-	-	-	-

TABLE C-10 GAMMA SPECTROSCOPIC ANALYSES OF SOIL SUSQUEHANNA STEAM ELECTRIC STATION, 2016

Results in pCi/kg (dry) ± 2 sigma

SITE	COLLECTION PERIOD	K-40	Cs-134	Cs-137	Ra-226	Ac-228	Th-228
8G1	09/14/16	9174 ± 1500	< 80	< 114	< 1418	998 ± 306	853 ± 123
	09/14/16	10290 ± 1329	< 64	< 72.7	< 1562	948 ± 272	760 ± 97
	AVERAGE	9732 ± 1578	-	-	-	973 ± 70	807 ± 131
12S1	09/14/16	11000 ± 1266	< 55	111 ± 47	1620 ± 924	689 ± 240	801 ± 89
	09/14/16	11130 ± 1541	< 74	< 108	< 1475	912 ± 397	893 ± 113
	AVERAGE	11065 ± 184	-	111 ± 0	1620 ± 0	801 ± 315	847 ± 129
10S3	09/14/16	9969 ± 1394	< 59	129 ± 78	< 1276	748 ± 204	754 ± 105
	09/14/16	13170 ± 1429	< 47	104 ± 49	2991 ± 1238	955 ± 333	855 ± 104
	AVERAGE	11570 ± 4527	-	117 ± 36	2991 ± 0	851 ± 293	805 ± 142

TABLE C-11 **TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF SURFACE WATER**
SUSQUEHANNA STEAM ELECTRIC STATION, 2016

Results in pCi/Liter ± 2S

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	12/29/15 - 01/25/16	< 145	< 11	< 1	< 1	< 4	< 1	< 3	< 2	< 3	< 10	< 1	< 1	< 16	< 4	< 3
	01/25/16 - 03/01/16	< 144	< 30	< 2	< 2	< 5	< 1	< 3	< 2	< 3	< 13	< 1	< 2	< 20	< 7	< 3
	03/01/16 - 03/29/16	< 146	< 17	< 2	< 2	< 6	< 2	< 3	< 2	< 4	< 12	< 2	< 2	< 20	< 6	< 4
	03/29/16 - 04/26/16	< 134	< 21	< 1	< 1	< 4	< 1	< 2	< 1	< 2	< 7	< 1	< 1	< 13	< 4	< 2
	04/26/16 - 05/31/16	< 150	< 46	< 2	< 2	< 6	< 2	< 3	< 2	< 3	< 14	< 1	< 2	< 21	< 7	8 ± 4
	05/31/16 - 06/28/16	< 147	< 14	< 1	< 1	< 3	< 1	< 2	< 1	< 2	< 8	< 1	< 1	< 11	< 4	< 2
	06/28/16 - 07/26/16	< 146	< 17	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 15	< 2	< 2	< 23	< 6	< 4
	07/26/16 - 08/30/16	< 150	< 14	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 14	< 1	< 2	< 21	< 7	< 3
	08/30/16 - 09/27/16	< 141	< 16	< 2	< 2	< 6	< 2	< 4	< 3	< 5	< 15	< 2	< 2	< 24	< 6	< 5
	09/27/16 - 10/25/16	< 146	< 20	< 1	< 1	< 4	< 1	< 2	< 1	< 2	< 14	< 1	< 1	< 18	< 6	6 ± 3
	10/25/16 - 11/29/16	< 135	< 13	< 1	< 2	< 5	< 1	< 3	< 2	< 3	< 10	< 1	< 1	< 16	< 5	< 3
	11/29/16 - 12/27/16	< 140	< 34	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 14	< 2	< 2	< 22	< 7	< 4
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7 ± 2
2S7	12/29/15 - 01/25/16	171 ± 97	< 14	< 2	< 2	< 6	< 2	< 3	< 2	< 3	< 12	< 2	< 2	< 21	< 6	< 4
	01/25/16 - 03/01/16	779 ± 123	< 13	< 2	< 2	< 5	< 1	< 3	< 2	< 3	< 13	< 1	< 2	< 21	< 6	< 3
	03/01/16 - 03/29/16	4730 ± 532	< 16	< 2	< 2	< 6	< 2	< 3	< 2	< 3	< 11	< 2	< 2	< 19	< 6	< 4
	03/29/16 - 04/26/16	1490 ± 176	< 28	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 9	< 1	< 2	< 17	< 5	< 3
	04/26/16 - 05/31/16	2350 ± 295	< 32	< 1	< 2	< 4	< 1	< 3	< 2	< 3	< 13	< 1	< 1	< 20	< 6	< 3
	05/31/16 - 06/28/16	3500 ± 324	< 23	< 1	< 1	< 4	< 1	< 2	< 1	< 2	< 10	< 1	< 1	< 14	< 5	< 2
	06/28/16 - 07/26/16	597 ± 111	< 11	< 1	< 1	< 4	< 1	< 2	< 1	< 3	< 7	< 1	< 1	< 13	< 4	< 2
	07/26/16 - 08/30/16	1910 ± 194	42 ± 26	< 2	< 2	< 6	< 1	< 3	< 2	< 3	< 14	< 2	< 2	< 22	< 7	< 3
	08/30/16 - 09/27/16	< 145	< 14	< 1	< 2	< 5	< 1	< 3	< 2	< 3	< 10	< 1	< 1	< 16	< 5	7 ± 2
	09/27/16 - 10/25/16	2960 ± 282	< 11	< 1	< 1	< 4	< 1	< 2	< 1	< 2	< 15	< 1	< 1	< 18	< 6	< 2
	10/25/16 - 11/29/16	< 136	< 34	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 14	< 2	< 2	< 21	< 7	< 4
	11/29/16 - 12/27/16	331 ± 117	< 19	< 2	< 2	< 7	< 2	< 4	< 2	< 4	< 14	< 2	< 2	< 23	< 7	< 4
	AVERAGE	1882 ± 3016	42 ± 0	-	-	-	-	-	-	-	-	-	-	-	-	7 ± 0
6S5	01/05/16 - 01/25/16	< 146	< 13	< 1	< 1	< 5	< 1	< 3	< 2	< 2	< 7	< 1	< 1	< 13	< 5	< 2
	02/02/16 - 03/01/16	< 142	< 15	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 9	< 1	< 2	< 17	< 6	< 3
	03/08/16 - 03/29/16	< 144	< 21	< 2	< 3	< 8	< 2	< 5	< 3	< 5	< 11	< 2	< 3	< 22	< 6	< 4
	04/05/16 - 04/26/16	< 135	< 45	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 8	< 2	< 2	< 16	< 5	< 4
	05/02/16 - 05/31/16	< 147	< 46	< 2	< 3	< 9	< 2	< 5	< 3	< 5	< 12	< 2	< 2	< 23	< 8	6 ± 2

TABLE C-11 TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF SURFACE WATER
SUSQUEHANNA STEAM ELECTRIC STATION, 2016

Results in pCi/Liter ± 2S

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	06/07/16 - 06/28/16	< 148	< 17	< 1	< 1	< 3	< 1	< 2	< 1	< 2	< 6	< 1	< 1	< 10	< 3	< 2
(cont'd)	07/05/16 - 07/26/16	< 142	< 21	< 1	< 1	< 4	< 1	< 3	< 1	< 2	< 8	< 1	< 1	< 14	< 4	3 ± 2
	08/02/16 - 08/30/16	< 147	< 17	< 2	< 2	< 7	< 2	< 4	< 2	< 4	< 12	< 2	< 2	< 20	< 7	< 3
	09/06/16 - 09/27/16	< 141	< 17	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 10	< 2	< 2	< 18	< 5	7 ± 3
	10/04/16 - 10/25/16	< 149	< 14	< 1	< 2	< 5	< 1	< 3	< 2	< 4	< 14	< 1	< 2	< 22	< 7	6 ± 3
	10/25/16 - 11/29/16	< 139	< 16	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 13	< 2	< 2	< 21	< 7	< 3
	12/06/16 - 12/27/16	< 140	< 45	< 2	< 3	< 9	< 2	< 5	< 3	< 5	< 11	< 2	< 2	< 22	< 7	< 4
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6 ± 3
4S7	02/05/16 - 02/05/16	280 ± 101	< 179	< 8	< 7	< 23	< 8	< 13	< 8	< 14	< 14	< 7	< 9	< 33	< 13	< 17
	05/03/16 - 05/03/16	< 136	< 65	< 9	< 8	< 23	< 9	< 18	< 9	< 14	< 15	< 8	< 8	< 43	< 13	< 17
	07/22/16 - 07/22/16	< 144	< 98	< 5	< 5	< 15	< 6	< 14	< 6	< 8	< 10	< 5	< 5	< 23	< 6	< 12
	11/07/16 - 11/07/16	< 147	< 157	< 9	< 8	< 24	< 8	< 25	< 12	< 14	< 11	< 7	< 9	< 36	< 13	< 20
	AVERAGE	280 ± 0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LTAW	02/05/16 - 02/05/16	< 148	< 156	< 8	< 8	< 20	< 7	< 17	< 9	< 15	< 11	< 8	< 8	< 40	< 12	< 15
	05/03/16 - 05/03/16	< 136	< 123	< 6	< 6	< 17	< 6	< 13	< 7	< 10	< 10	< 6	< 7	< 35	< 10	< 14
	07/22/16 - 07/22/16	< 145	< 53	< 5	< 6	< 16	< 6	< 11	< 5	< 9	< 9	< 4	< 6	< 29	< 10	< 11
	11/07/16 - 11/07/16	< 146	< 93	< 8	< 9	< 26	< 5	< 21	< 9	< 12	< 11	< 9	< 12	< 32	< 12	< 17
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5S12	02/05/16 - 02/05/16	< 146	< 82	< 10	< 9	< 17	< 8	< 16	< 11	< 17	< 14	< 8	< 7	< 44	< 12	< 16
	05/03/16 - 05/03/16	< 136	< 106	< 8	< 8	< 20	< 10	< 17	< 7	< 12	< 14	< 8	< 6	< 47	< 12	< 17
	07/22/16 - 07/22/16	< 145	< 49	< 6	< 4	< 17	< 5	< 12	< 4	< 11	< 11	< 6	< 7	< 24	< 10	< 11
	11/07/16 - 11/07/16	< 149	< 137	< 7	< 7	< 18	< 6	< 13	< 9	< 12	< 11	< 9	< 9	< 29	< 5	< 18
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7S12	02/05/16 - 02/05/16	< 148	< 50	< 6	< 5	< 17	< 6	< 14	< 5	< 11	< 9	< 6	< 6	< 28	< 9	< 14
	05/03/16 - 05/03/16	< 137	< 97	< 6	< 7	< 14	< 8	< 10	< 7	< 11	< 12	< 7	< 6	< 24	< 10	< 12
	07/22/16 - 07/22/16	< 146	< 48	< 5	< 5	< 13	< 5	< 11	< 6	< 9	< 8	< 4	< 5	< 24	< 7	< 10
	11/07/16 - 11/07/16	167 ± 84	< 97	< 8	< 9	< 28	< 9	< 19	< 11	< 19	< 11	< 8	< 11	< 32	< 13	< 17
	AVERAGE	167 ± 0	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE C-12 **GAMMA SPECTROSCOPIC ANALYSIS OF FISH**
SUSQUEHANNA STEAM ELECTRIC STATION, 2016

Results in pCi/kg (wet) ± 2 sigma

SITE	COLLECTION PERIOD	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Cs-134	Cs-137
2H									
Shorthead Redhorse	04/23/16	2723 ± 904	< 58	< 53	< 179	< 51	< 113	< 63	< 63
Channel Catfish	04/23/16	3133 ± 1207	< 70	< 62	< 207	< 75	< 167	< 56	< 63
Small Mouth Bass	04/23/16	3098 ± 737	< 51	< 42	< 113	< 46	< 86	< 44	< 45
Small Mouth Bass	11/05/16	3723 ± 821	< 53	< 56	< 165	< 43	< 140	< 47	< 38
White Sucker	11/05/16	3202 ± 1071	< 61	< 71	< 167	< 46	< 142	< 47	< 53
Walleye	11/05/16	3701 ± 834	< 29	< 37	< 110	< 43	< 95	< 42	< 38
	AVERAGE	3263 ± 385	-	-	-	-	-	-	-
IND									
Small Mouth Bass	04/22/16	4003 ± 623	< 35	< 30	< 90	< 44	< 70	< 32	< 38
Channel Catfish	04/22/16	3317 ± 871	< 42	< 40	< 114	< 36	< 93	< 41	< 44
Shorthead Redhorse	04/22/16	3577 ± 911	< 41	< 50	< 122	< 55	< 99	< 53	< 60
White Sucker	11/04/16	4275 ± 789	< 70	< 57	< 160	< 62	< 143	< 64	< 69
Walleye	11/04/16	4026 ± 959	< 53	< 48	< 126	< 56	< 123	< 49	< 47
Small Mouth Bass	11/04/16	2791 ± 1164	< 94	< 71	< 236	< 60	< 187	< 74	< 87
	AVERAGE	3665 ± 1099	-	-	-	-	-	-	-
LTAW									
Large Mouth Bass	11/06/16	3952 ± 711	< 33	< 27	< 97	< 30	< 93	< 34	< 35
Trout	11/06/16	3464 ± 1221	< 65	< 63	< 152	< 80	< 169	< 69	< 60
	AVERAGE	3708 ± 690	-	-	-	-	-	-	-

TABLE C-13 **GAMMA SPECTROSCOPIC ANALYSES OF SHORELINE SEDIMENT SUSQUEHANNA STEAM ELECTRIC STATION, 2016**

Results in pCi/kg (dry) ± 2 sigma

SITE	COLLECTION PERIOD	K-40	Cs-134	Cs-137	Ra-226	Ac-228	Th-228
2B	04/22/16	11620 ± 1926	< 95	< 137	< 2582	1149 ± 559	1383 ± 201
	10/31/16	14130 ± 1746	< 96	< 104	2699 ± 1666	1307 ± 335	1054 ± 189
	AVERAGE	12875 ± 3550	-	-	2699 ± 0	1228 ± 112	1219 ± 465
7B	04/22/16	12250 ± 1785	< 79	< 101	< 1496	958 ± 361	1323 ± 140
	10/31/16	12310 ± 1440	< 79	< 87	2473 ± 1269	1327 ± 306	1419 ± 189
	AVERAGE	12280 ± 85	-	-	2473 ± 0	1142 ± 261	1371 ± 136
12F	04/22/16	10130 ± 1279	< 63	< 68	2089 ± 1210	1051 ± 359	910 ± 127
	10/31/16	7975 ± 1050	< 54	< 75	1720 ± 1121	849 ± 247	838 ± 98
	AVERAGE	9053 ± 3048	-	-	1905 ± 522	950 ± 286	874 ± 103

FIGURE C-1 - GROSS BETA ACTIVITY IN AIR PARTICULATES

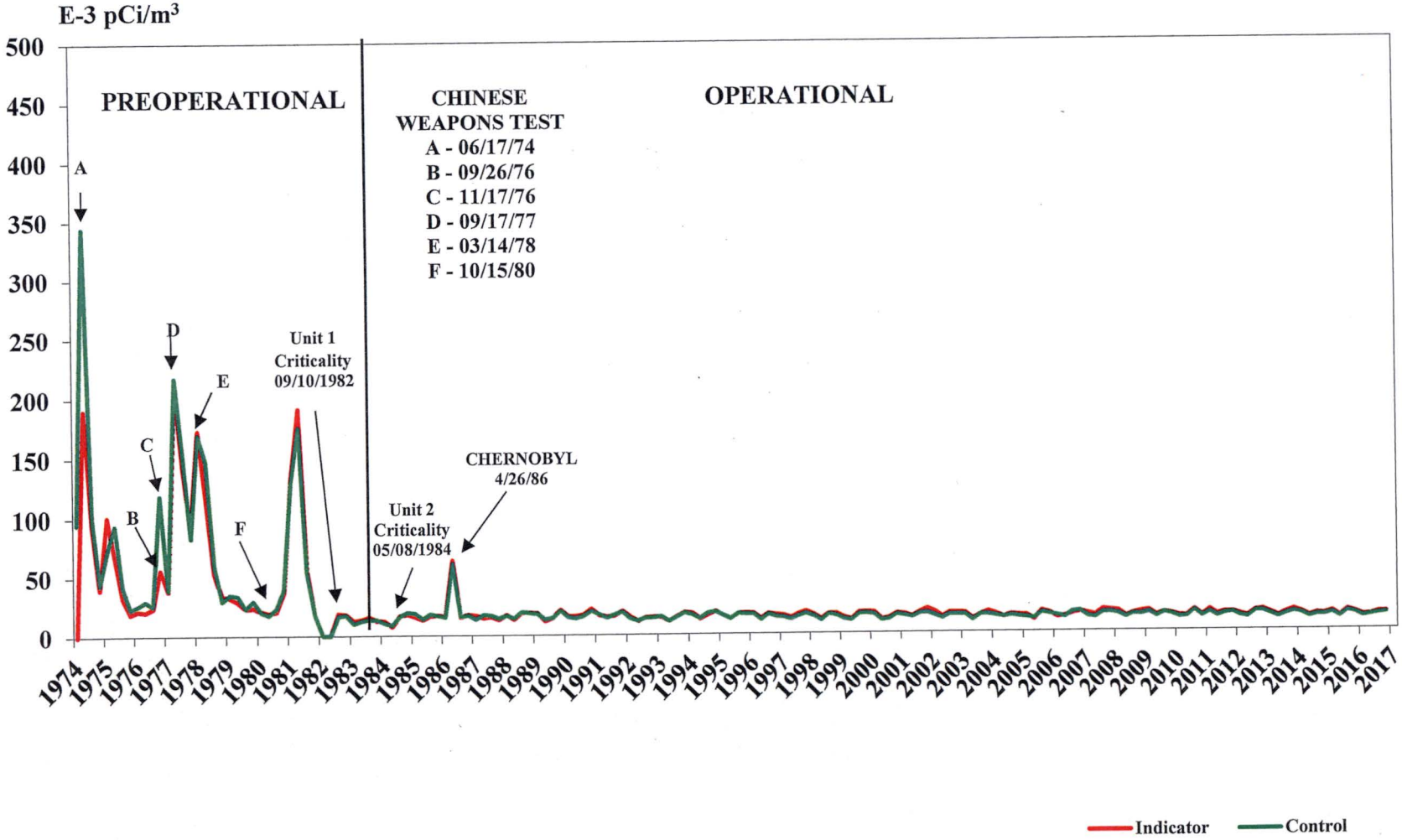


FIGURE C-2 - AMBIENT RADIATION LEVELS BASED ON ENVIRONMENTAL DOSIMETRY DATA

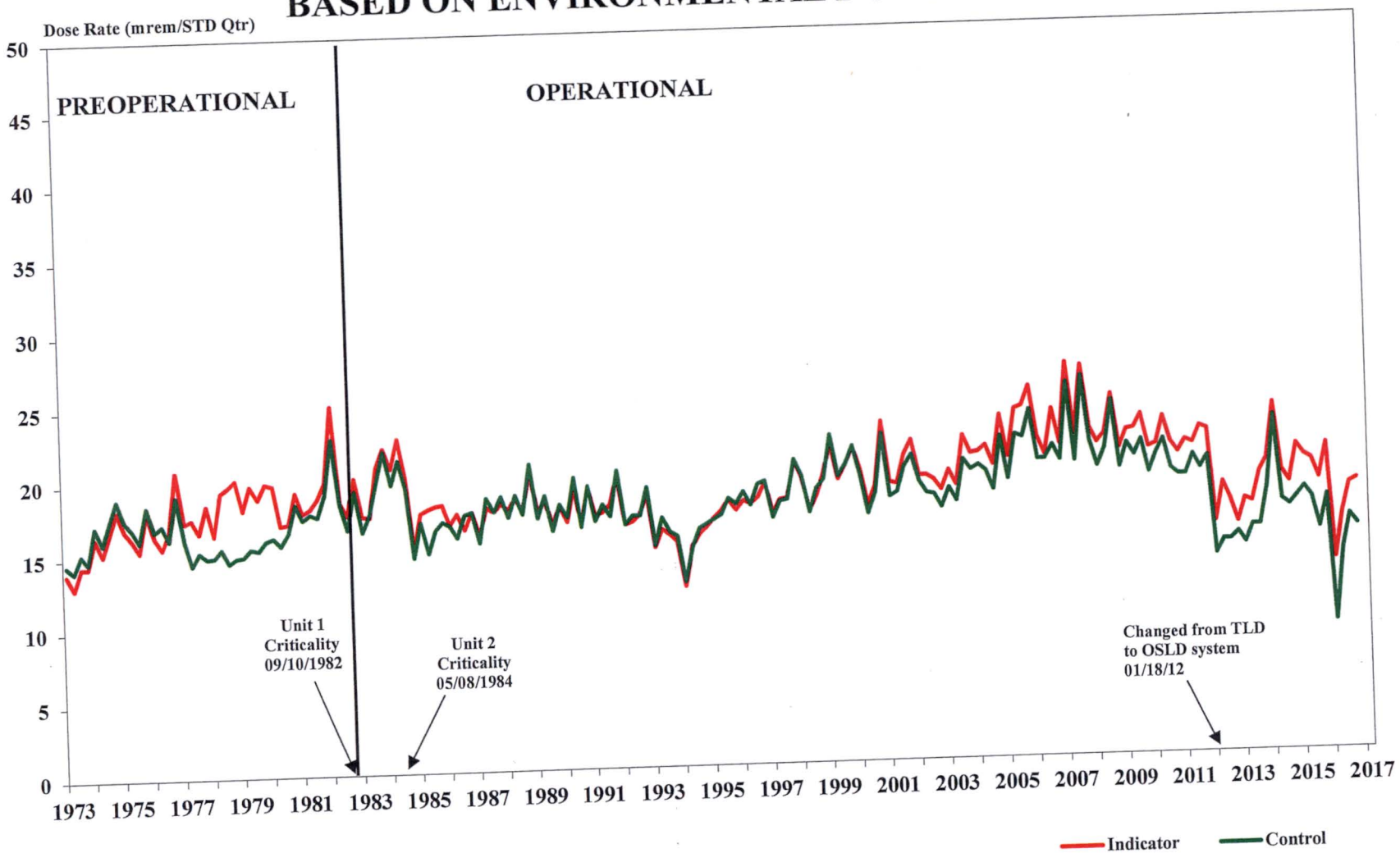


FIGURE C-3 - IODINE-131 ACTIVITY IN MILK

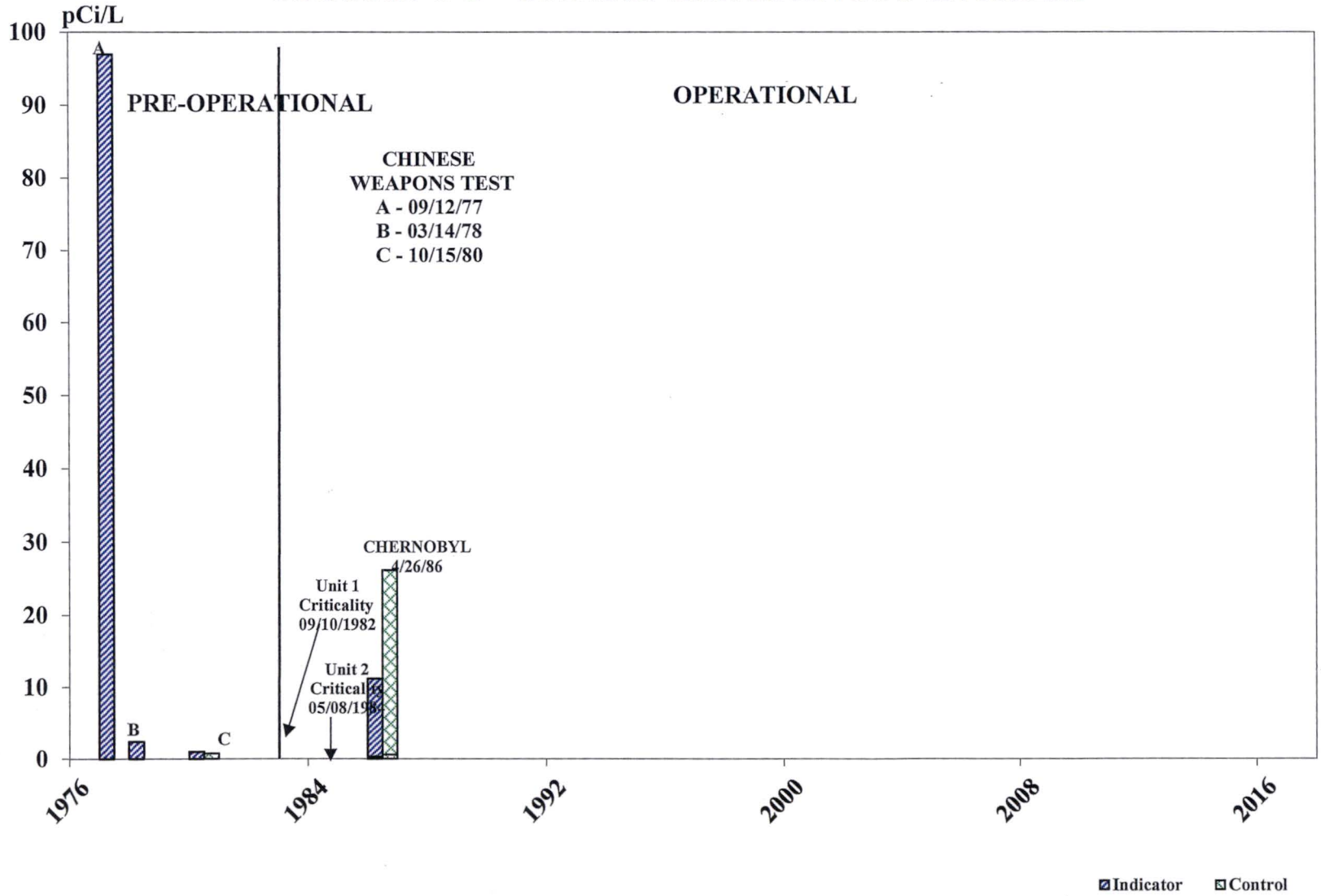


FIGURE C-4 - ANNUAL AVERAGE TRITIUM ACTIVITY IN PRECIPITATION AND SURFACE WATER VERSUS GROUND WATER

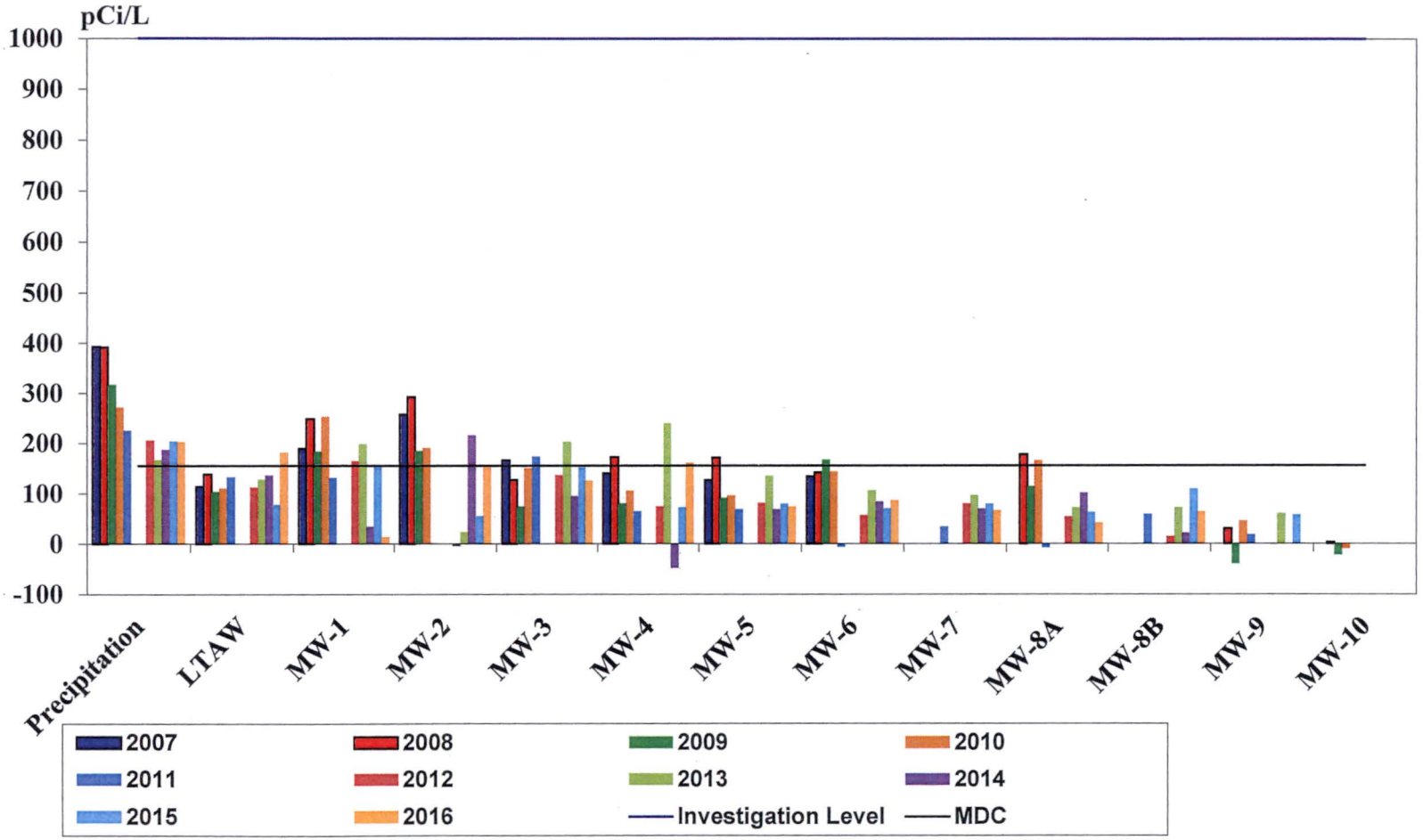


FIGURE C-5 - GROSS BETA ACTIVITY IN DRINKING WATER

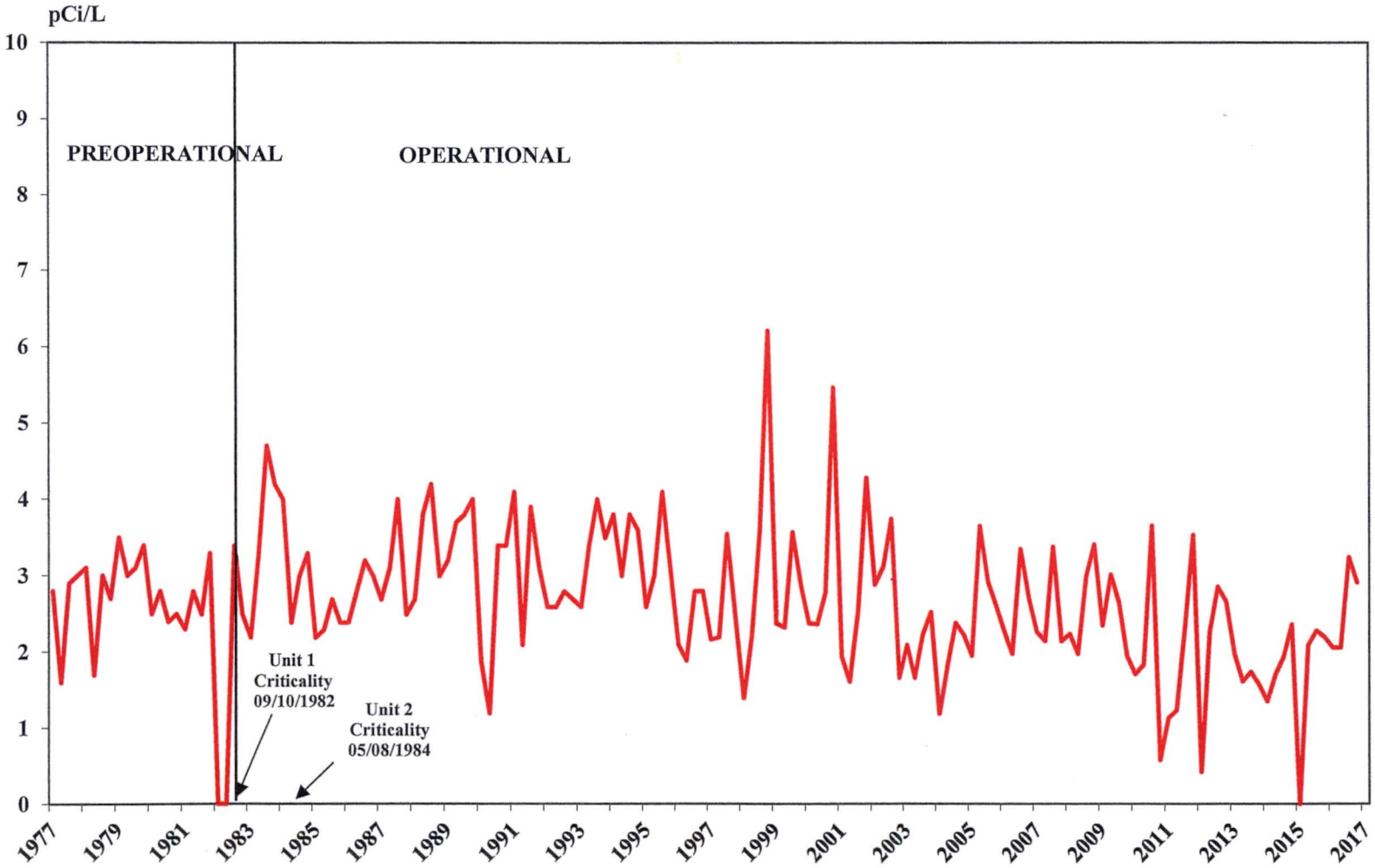
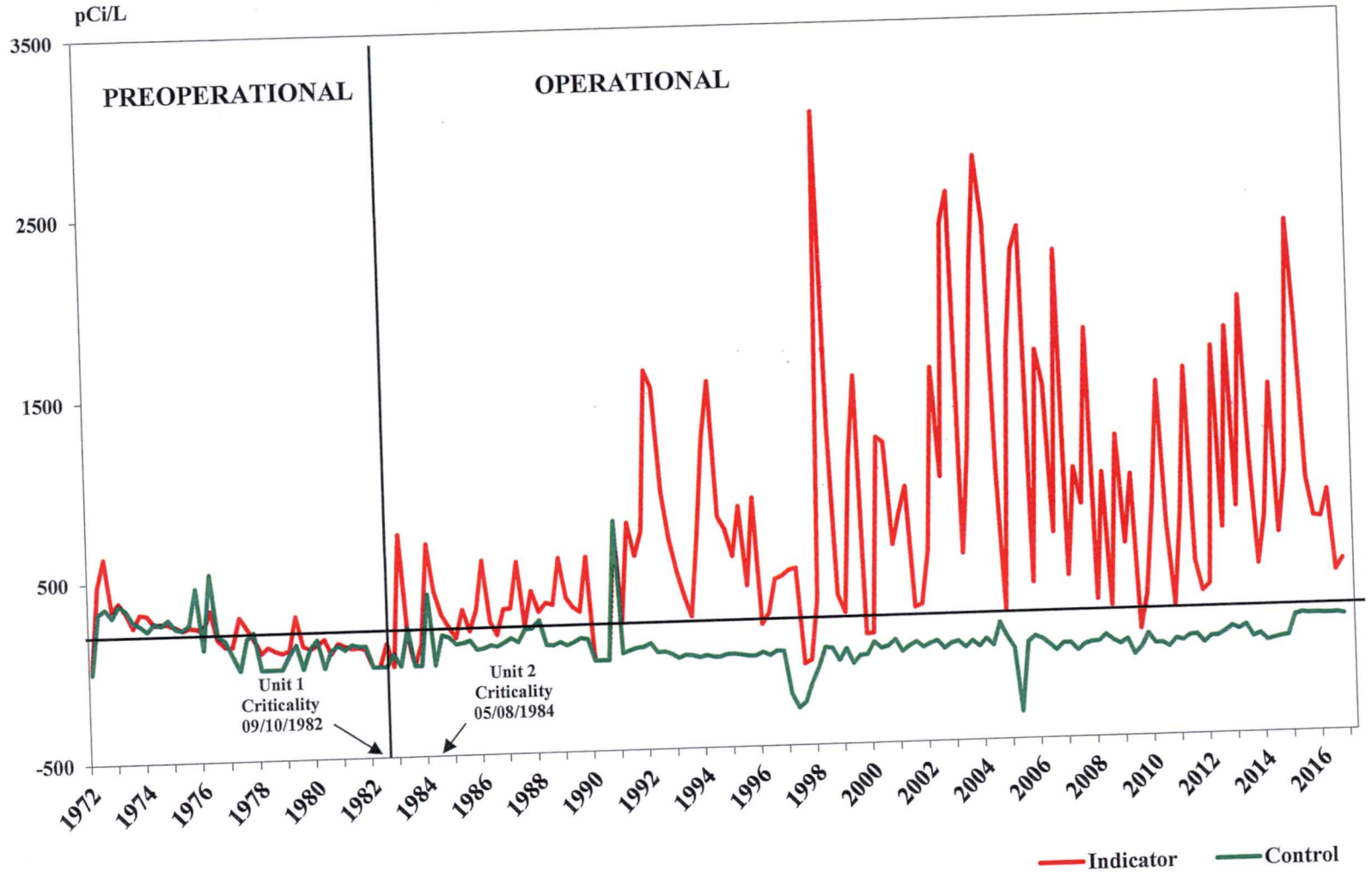


FIGURE C-6 - TRITIUM ACTIVITY IN SURFACE WATER



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APPENDIX D

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

TABLE D-1 **ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM**
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES
(PAGE 1 OF 3)

Month/Year	Identification Number	Matrix	Nuclide	Units	Reported Value (a)	Known Value (b)	Ratio (c) TBE/Analytics	Evaluation (d)
March 2016	E11476	Milk	Sr-89	pCi/L	97	86.7	1.12	A
			Sr-90	pCi/L	15	11.4	1.32	N(2)
	E11477	Milk	I-131	pCi/L	85.9	82.2	1.05	A
			Ce-141	pCi/L	106	98.4	1.08	A
			Cr-51	pCi/L	255	243	1.05	A
			Cs-134	pCi/L	134	130	1.03	A
			Cs-137	pCi/L	174	161	1.08	A
			Co-58	pCi/L	123	117	1.05	A
			Mn-54	pCi/L	141	117	1.21	W
			Fe-59	pCi/L	152	131	1.16	A
			Zn-65	pCi/L	193	179	1.08	A
			Co-60	pCi/L	259	244	1.06	A
	E11479	AP	Ce-141	pCi	69	81.1	0.85	A
			Cr-51	pCi	242	201	1.20	W
			Cs-134	pCi	98.1	107.0	0.92	A
			Cs-137	pCi	136	133	1.02	A
			Co-58	pCi	91.9	97	0.95	A
			Mn-54	pCi	98.6	96.2	1.02	A
			Fe-59	pCi	98.8	108	0.91	A
			Zn-65	pCi	131	147	0.89	A
			Co-60	pCi	209	201	1.04	A
	E11478	Charcoal	I-131	pCi	85.3	88.3	0.97	A
	E11480	Water	Fe-55	pCi/L	1800	1666	1.08	A
June 2016	E11537	Milk	Sr-89	pCi/L	94.4	94.4	1.00	A
			Sr-90	pCi/L	13.4	15.4	0.87	A
	E11538	Milk	I-131	pCi/L	96.8	94.5	1.02	A
			Ce-141	pCi/L	129	139	0.93	A
			Cr-51	pCi/L	240	276	0.87	A
			Cs-134	pCi/L	157	174	0.90	A
			Cs-137	pCi/L	117	120	0.98	A
			Co-58	pCi/L	131	142	0.92	A
			Mn-54	pCi/L	128	125	1.02	A
			Fe-59	pCi/L	132	122	1.08	A
			Zn-65	pCi/L	235	235	1.00	A
			Co-60	pCi/L	169	173	0.98	A

(a) Teledyne Brown Engineering reported result.

(b) 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.

(c) Ratio of Teledyne Brown Engineering to Analytics results.

(d) 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.

(2) NCR 16-26 was initiated

TABLE D-1

ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES

Month/Year	Identification Number	Matrix	Nuclide	Units	Reported Value (a)	Known Value (b)	Ratio (c) TBE/Analytics	Evaluation (d)
June 2016	E11539	Charcoal	I-131	pCi	86.1	89.4	0.96	A
	E11540	AP	Ce-141	pCi	105	99.8	1.05	A
			Cr-51	pCi	216	198.0	1.09	A
			Cs-134	pCi	113	125	0.90	A
			Cs-137	pCi	94.5	86.6	1.09	A
			Co-58	pCi	101	102	0.99	A
			Mn-54	pCi	88.8	90.2	0.98	A
			Fe-59	pCi	82	87.5	0.94	A
			Zn-65	pCi	174	169	1.03	A
			Co-60	pCi	143	124	1.15	A
	E11541	Water	Fe-55	pCi/L	164	186	0.88	A
September 2016	E11609	Milk	Sr-89	pCi/L	90	90.9	0.99	A
			Sr-90	pCi/L	13.3	13.7	0.97	A
	E11610	Milk	I-131	pCi/L	80.4	71.9	1.12	A
			Ce-141	pCi/L	81.3	93	0.87	A
			Cr-51	pCi/L	198	236	0.84	A
			Cs-134	pCi/L	122	136	0.90	A
			Cs-137	pCi/L	119	119	1.00	A
			Co-58	pCi/L	92.2	97.4	0.95	A
			Mn-54	pCi/L	156	152	1.03	A
			Fe-59	pCi/L	97.5	90.6	1.08	A
			Zn-65	pCi/L	189	179	1.06	A
			Co-60	pCi/L	131	135	0.97	A
	E11611	Charcoal	I-131	pCi	52.4	59.9	0.87	A
	E11612	AP	Ce-141	pCi	67.5	63.6	1.06	A
			Cr-51	pCi	192	161.0	1.19	A
			Cs-134	pCi	91.4	92.6	0.99	A
			Cs-137	pCi	93.9	80.8	1.16	A
			Co-58	pCi	66	66.4	0.99	A
			Mn-54	pCi	104	104	1.00	A
			Fe-59	pCi	60.5	61.8	0.98	A
			Zn-65	pCi	140	122	1.15	A
			Co-60	pCi	119	91.9	1.29	W

(a) Teledyne Brown Engineering reported result.

(b) 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.

(c) Ratio of Teledyne Brown Engineering to Analytics results.

(d) 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	Reported Value (a)	Known Value (b)	Ratio (c) TBE/Analytics	Evaluation
September 2016	E11613	Water	Fe-55	pCi/L	1990	1670	1.19	A
	E11614	Soil	Ce-141	pCi/g	0.153	0.175	0.87	A
			Cr-51	pCi/g	0.482	0.441	1.09	A
			Cs-134	pCi/g	0.270	0.254	1.06	A
			Cs-137	pCi/g	0.313	0.299	1.05	A
			Co-58	pCi/g	0.177	0.182	0.97	A
			Mn-54	pCi/g	0.340	0.285	1.19	A
			Fe-59	pCi/g	0.206	0.17	1.21	W
			Zn-65	pCi/g	0.388	0.335	1.16	A
			Co-60	pCi/g	0.284	0.252	1.13	A
December 2016	E11699	Milk	Sr-89	pCi/L	95	74.2	1.28	W
			Sr-90	pCi/L	14.7	10	1.47	N(3)
	E11700	Milk	I-131	pCi/L	97.5	97.4	1.00	A
			Ce-141	pCi/L	136	143	0.95	A
			Cr-51	pCi/L	247	280	0.88	A
			Cs-134	pCi/L	164	178	0.92	A
			Cs-137	pCi/L	120	126	0.95	A
			Co-58	pCi/L	139	146	0.95	A
			Mn-54	pCi/L	126	129	0.98	A
			Fe-59	pCi/L	114	125	0.91	A
			Zn-65	pCi/L	237	244	0.97	A
			Co-60	pCi/L	168	178	0.94	A
	E11701	Charcoal	I-131	pCi	95.6	98	0.98	A
	E11702	AP	Ce-141	pCi	91.7	97.7	0.94	A
			Cr-51	pCi	210	192.0	1.09	A
			Cs-134	pCi	122	122	1.00	A
			Cs-137	pCi	93.9	86.4	1.09	A
			Co-58	pCi	92	100	0.92	A
			Mn-54	pCi	93.7	88.5	1.06	A
			Fe-59	pCi	84.9	84.5	1.00	A
			Zn-65	pCi	176	167	1.05	A
			Co-60	pCi	151	122	1.24	W
	E11702	AP	Sr-89	pCi	79.1	92	0.86	A
			Sr-90	pCi	10	12.5	0.80	A
	E11703	Water	Fe-55	pCi/L	2180	1800	1.21	W

(a) Teledyne Brown Engineering reported result.

(b) 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.

(c) Ratio of Teledyne Brown Engineering to Analytics results.

(d) 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.

(3) NCR 16-35 was initiated

TABLE D-2

ERA ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES

Month/Year	Identification Number	Media	Nuclide	Units	Reported Value (a)	Known Value (b)	Acceptance Limits	Evaluation (c)
May 2016	RAD-105	Water	Sr-89	pCi/L	48.9	48.2	37.8 - 55.6	A
			Sr-90	pCi/L	25.0	28.5	20.7 - 33.1	A
			Ba-133	pCi/L	53.1	58.8	48.7 - 64.9	A
			Cs-134	pCi/L	40.9	43.3	34.6 - 47.6	A
			Cs-137	pCi/L	84.8	78.4	70.6 - 88.9	A
			Co-60	pCi/L	108	102	91.8 - 114	A
			Zn-65	pCi/L	226	214	193 - 251	A
			Gr-A	pCi/L	38.9	62.7	32.9 - 77.8	A
			Gr-B	pCi/L	41.9	39.2	26.0 - 46.7	A
			I-131	pCi/L	24.1	26.6	22.1 - 31.3	A
			U-Nat	pCi/L	4.68	4.64	3.39 - 5.68	A
			H-3	pCi/L	7720	7840	6790 - 8620	A
November 2016	RAD-107	Water	Sr-89	pCi/L	43.0	43.3	33.4-50.5	A
			Sr-90	pCi/L	30.0	33.6	24.6-38.8	A
			Ba-133	pCi/L	47.8	54.9	45.4-60.7	A
			Cs-134	pCi/L	72.9	81.8	67.0-90.0	A
			Cs-137	pCi/L	189	210	189-233	A
			Co-60	pCi/L	58.4	64.5	58.0-73.4	A
			Zn-65	pCi/L	243	245	220-287	A
			Gr-A	pCi/L	37.2	68.4	35.9-84.5	A
			Gr-B	pCi/L	35.1	33.9	22.1-41.6	A
			I-131	pCi/L	23.5	26.3	21.9-31.0	A
			U-Nat	pCi/L	49.2	51.2	41.6-56.9	A
			H-3	pCi/L	918	9820	8540-10800	N(5)
	MRAD-25	AP	Gr-A	pCi/Filter	56.8	71.2	23.9-111	A

(a) Teledyne Brown Engineering reported result.

(b) 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.

(c) ERA evaluation: A=acceptable. Reported result falls within the Warning Limits. NA=not acceptable. Reported result falls outside of the Control Limits. CE=check for Error. Reported result falls within the Control Limits and outside of the Warning Limit.

(5) NCR 16-34 was initiated

TABLE D-3 **DOE's MIXED ANALYTE PERFORMANCE EVALUATION PROGRAM (MAPEP)**
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES

Month/Year	Identification Number	Media	Nuclide	Units	Reported Value (a)	Known Value (b)	Acceptance Range	Evaluation
March 2016	16-MaW34	Water	Am-241	Bq/L	0.008		(1)	A
			Ni-63	Bq/L	12.4	12.3	8.6-16.0	A
			Pu-238	Bq/L	1.4900	1.2440	0.871-1.617	A
			Pu-239/240	Bq/L	0.729	0.641	0.449-0.833	A
	16-MaS34	Soil	Ni-63	Bq/kg	1140	1250.0	875-1625	A
			Sr-90	Bq/kg	8.15		(1)	A
	16-RdF34	AP	U-234/233	Bq/sample	0.1620	0.1650	0.116-0.215	A
			U-238	Bq/sample	0.163	0.172	0.120-0.224	A
	16-GrF34	AP	Gr-A	Bq/sample	0.608	1.20	0.36-2.04	A
			Gr-B	Bq/sample	0.8060	0.79	0.40-1.19	A
	16-RdV34	Vegetation	Cs-134	Bq/sample	10.10	10.62	7.43-13.81	A
			Cs-137	Bq/sample	6.0	5.62	3.93-7.31	A
			Co-57	Bq/sample	13.3000	11.8	8.3-15.3	A
			Co-60	Bq/sample	0.013		(1)	A
			Mn-54	Bq/sample	0.0150		(1)	A
			Sr-90	Bq/sample	0.301		(1)	N(4)
			Zn-65	Bq/sample	10.500	9.6	6.7-12.5	A
September 2016	16-MaW35	Water	Am-241	Bq/L	0.626	0.814	.570-1058	W
			Ni-63	Bq/L	12.4	17.2	12.0-22.4	A
			Pu-238	Bq/L	1.23	1.13	0.79-1.47	W
			Pu-239/240	Bq/L	0.0318	0.013	(1)	A
	16-MaS35	Soil	Ni-63	Bq/kg	724	990	693-1287	A
			Sr-90	Bq/kg	747	894	626-1162	A
	16-RdF35	AP	U-234/233	Bq/sample	0.160	0.15	0.105-0.195	A
			U-238	Bq/sample	0.157	0.156	0.109-0.203	A
	16-RdV35	Vegetation	Cs-134	Bq/sample	-0.103		(1)	A
			Cs-137	Bq/sample	5.64	5.54	3.88-7.20	A
			Co-57	Bq/sample	7.38	6.81	4.77-8.85	A
			Co-60	Bq/sample	4.81	4.86	3.40-6.32	A
			Mn-54	Bq/sample	7.4	7.27	5.09-9.45	A
			Sr-90	Bq/sample	0.774	0.80	0.56-1.04	A
			Zn-65	Bq/sample	5.46	5.4	3.78-7.02	A

(1) False positive test.

(a) Teledyne Brown Engineering reported result.

(b) 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.

(c) DOE/MAPEP evaluation: A=acceptable, W=acceptable with warning, N=not acceptable.

(4)NCR 16-14 was initiated

ABLE D-4 SUSQUEHANNA REMP LABORATORY SPIKE PROGRAM
ANALYTICS ENVIRONMENTAL RADIOACTIVTY CROSS CHECK PROGRAM - 2016
QUALITY CONTROL SPIKE PROGRAM
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES (TBE)
(PAGE 1 OF 5)

Month/Year	Identification Number	Matrix	Nuclide	Units	Analytics Calculated Results (a)	TBE Results (a)	TBE/Analytics Ratio	
September 2016	E11636	Soil	Ce-141	pCi/kg	175 ± 6	138 ± 32	0.79	(1)
			Cr-51	pCi/kg	441 ± 15	442 ± 183	1.00	
			Cs-134	pCi/kg	254 ± 8	233 ± 15	0.92	
			Cs-137	pCi/kg	299 ± 10	306 ± 21	1.02	
			Co-58	pCi/kg	182 ± 6	166 ± 22	0.91	
			Mn-54	pCi/kg	285 ± 9	298 ± 23	1.05	
			Fe-59	pCi/kg	170 ± 6	158 ± 21	0.93	
			Zn-65	pCi/kg	335 ± 11	370 ± 37	1.10	
			Co-60	pCi/kg	252 ± 8	261 ± 15	1.04	
March 2016	E11462	Milk	I-131	pCi/L	77.7 ± 3	87 ± 3	1.12	
			Ce-141	pCi/L	117.0 ± 4	130 ± 10	1.11	
			Cr-51	pCi/L	290 ± 10	314 ± 47	1.08	
			Cs-134	pCi/L	155 ± 5	157 ± 5	1.01	
			Cs-137	pCi/L	192 ± 6	208 ± 8	1.08	
			Co-58	pCi/L	140 ± 5	146 ± 8	1.04	
			Mn-54	pCi/L	139 ± 5	166 ± 8	1.19	
			Fe-59	pCi/L	156 ± 5	178 ± 11	1.14	
			Zn-65	pCi/L	213 ± 7	232 ± 17	1.09	
			Co-60	pCi/L	291 ± 10	303 ± 7	1.04	
June 2016	E11542	Milk	I-131	pCi/L	95.6 ± 3	96.1 ± 3	1.01	
			Ce-141	pCi/L	151 ± 5	142 ± 15	0.94	
			Cr-51	pCi/L	301 ± 10	269 ± 182	0.89	
			Cs-134	pCi/L	190 ± 6	181 ± 8	0.95	
			Cs-137	pCi/L	131 ± 4	136 ± 9	1.04	
			Co-58	pCi/L	155 ± 5	146 ± 9	0.94	
			Mn-54	pCi/L	137 ± 5	141 ± 10	1.03	
			Fe-59	pCi/L	133 ± 4	162 ± 15	1.22	
			Zn-65	pCi/L	257 ± 9	305 ± 19	1.19	
			Co-60	pCi/L	188 ± 6	191 ± 7	1.02	
September 2016	E11632	Milk	I-131	pCi/L	72.1 ± 2	80.0 ± 8	1.11	
			Ce-141	pCi/L	132 ± 4	103 ± 14	0.78	(1)
			Cr-51	pCi/L	333 ± 11	284 ± 68	0.85	
			Cs-134	pCi/L	192 ± 6	176 ± 6	0.92	
			Cs-137	pCi/L	168 ± 6	173 ± 10	1.03	
			Co-58	pCi/L	138 ± 5	130 ± 9	0.94	
			Mn-54	pCi/L	215 ± 7	211 ± 10	0.98	
			Fe-59	pCi/L	128 ± 4	127 ± 15	0.99	
			Zn-65	pCi/L	253 ± 8	260 ± 17	1.03	
			Co-60	pCi/L	191 ± 6	171 ± 7	0.90	

(a) Counting error is two standard deviations.
(1) NCR 17-04 was inititiated to address the failure.

TABLE D-4 **SUSQUEHANNA REMP LABORATORY SPIKE PROGRAM**
ANALYTICS ENVIRONMENTAL RADIOACTIVTY CROSS CHECK PROGRAM - 2016
QUALITY CONTROL SPIKE PROGRAM
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES (TBE)
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Month/Year	Identification Number	Matrix	Nuclide	Units	Analytics Calculated Results (a)	TBE Results (a)	TBE/Analyt Ratio
December 2016	E11707	Milk	I-131	pCi/L	96.2 ± 3	98.3 ± 2	1.02
			Ce-141	pCi/L	158 ± 5	149 ± 12	0.94
			Cr-51	pCi/L	309 ± 10	294 ± 63	0.95
			Cs-134	pCi/L	197 ± 7	179 ± 7	0.91
			Cs-137	pCi/L	140 ± 5	141 ± 9	1.01
			Co-58	pCi/L	162 ± 5	162 ± 10	1.00
			Mn-54	pCi/L	143 ± 5	140 ± 9	0.98
			Fe-59	pCi/L	138 ± 5	140 ± 15	1.01
			Zn-65	pCi/L	270 ± 9	269 ± 19	1.00
			Co-60	pCi/L	197 ± 7	193 ± 8	0.98
March 2016	E11463	Ap Filter	Ce-141	pCi/L	56.5 ± 2	58.7 ± 13	1.04
			Cr-51	pCi/L	140 ± 5	148 ± 16	1.06
			Cs-134	pCi/L	75 ± 3	76 ± 7	1.01
			Cs-137	pCi/L	92 ± 3	92 ± 11	1.00
			Co-58	pCi/L	67 ± 2	64 ± 12	0.96
			Mn-54	pCi/L	67 ± 2	68 ± 11	1.01
			Fe-59	pCi/L	75 ± 3	81 ± 17	1.08
			Zn-65	pCi/L	102 ± 4	81 ± 26	0.79
			Co-60	pCi/L	140 ± 5	147 ± 10	1.05
March 2016	E11464	Ap Filter	Ce-141	pCi	64.8 ± 5	57 ± 15	0.88
			Cr-51	pCi	171 ± 13	172 ± 96	1.01
			Cs-134	pCi	89 ± 7	88 ± 7	0.99
			Cs-137	pCi	105 ± 8	110 ± 12	1.05
			Co-58	pCi	76 ± 6	77 ± 13	1.01
			Mn-54	pCi	81.5 ± 6	84 ± 13	1.03
			Fe-59	pCi	86.5 ± 6	90 ± 20	1.04
			Zn-65	pCi	123 ± 9	106 ± 20	0.86
			Co-60	pCi	165 ± 12	181 ± 9	1.10
March 2016	E11465	Ap Filter	Ce-141	pCi	54 ± 2	54 ± 10	1.00
			Cr-51	pCi	133 ± 5	163 ± 59	1.23
			Cs-134	pCi	71 ± 2	73 ± 6	1.03
			Cs-137	pCi	88.3 ± 3	90 ± 10	1.02
			Co-58	pCi	64.4 ± 2	61 ± 9	0.95
			Mn-54	pCi	64 ± 2	68 ± 10	1.06
			Fe-59	pCi	71.8 ± 3	76 ± 15	1.06
			Zn-65	pCi	97.9 ± 3	108 ± 15	1.10
			Co-60	pCi	134 ± 5	137 ± 8	1.02

(a) Counting error is two standard deviations.

(1) NCR 17-04 was inititiated to address the failure.

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ANALYTICS ENVIRONMENTAL RADIOACTIVTY CROSS CHECK PROGRAM - 2016
QUALITY CONTROL SPIKE PROGRAM
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES (TBE)
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Month/Year	Identification Number	Matrix	Nuclide	Units	Analytics Calculated Results (a)	TBE Results (a)	TBE/Analytics Ratio	
June 2016	E11543	Ap Filter	Ce-141	pCi	103 ± 4	122 ± 21	1.18	
			Cr-51	pCi	205 ± 7	206 ± 34	1.00	
			Cs-134	pCi	130 ± 5	120 ± 9	0.92	
			Cs-137	pCi	90 ± 3	83 ± 12	0.92	
			Co-58	pCi	106 ± 4	94 ± 16	0.89	
			Mn-54	pCi	93.4 ± 3	106 ± 10	1.13	
			Fe-59	pCi	91 ± 3	95 ± 25	1.04	
			Zn-65	pCi	175 ± 6	167 ± 23	0.95	
			Co-60	pCi	129 ± 5	165 ± 10	1.28	(1)
June 2016	E11544	Ap Filter	Ce-141	pCi	109 ± 4	129 ± 12	1.18	
			Cr-51	pCi	217 ± 8	233 ± 73	1.07	
			Cs-134	pCi	137 ± 5	130 ± 4	0.95	
			Cs-137	pCi	95 ± 3	93 ± 7	0.98	
			Co-58	pCi	112 ± 4	103 ± 8	0.92	
			Mn-54	pCi	99 ± 3	105 ± 7	1.06	
			Fe-59	pCi	95.7 ± 3	97 ± 13	1.01	
			Zn-65	pCi	185 ± 6	193 ± 12	1.04	
			Co-60	pCi	136 ± 5	175 ± 6	1.29	(1)
June 2016	E11545	Ap Filter	Ce-141	pCi	99.4 ± 3	111 ± 26	1.12	
			Cr-51	pCi	197 ± 7	233 ± 15	1.18	
			Cs-134	pCi	125 ± 4	123 ± 8	0.98	
			Cs-137	pCi	86.3 ± 3	88 ± 12	1.02	
			Co-58	pCi	102 ± 4	93 ± 17	0.91	
			Mn-54	pCi	89.8 ± 3	94 ± 15	1.05	
			Fe-59	pCi	87.2 ± 3	87 ± 26	1.00	
			Zn-65	pCi	169 ± 6	161 ± 32	0.95	
			Co-60	pCi	124 ± 4	167 ± 11	1.35	(1)
December 2016	E11708	Ap Filter	Ce-141	pCi	106 ± 4	92 ± 13	0.87	
			Cr-51	pCi	208 ± 7	202 ± 74	0.97	
			Cs-134	pCi	132 ± 5	128 ± 14	0.97	
			Cs-137	pCi	94 ± 3	94 ± 14	1.00	
			Co-58	pCi	109 ± 4	117 ± 13	1.07	
			Mn-54	pCi	96 ± 3	97 ± 12	1.01	
			Fe-59	pCi	93 ± 3	95 ± 18	1.02	
			Zn-65	pCi	181 ± 6	174 ± 22	0.96	
			Co-60	pCi	132 ± 5	154 ± 10	1.17	

(a) Counting error is two standard deviations.
(1) NCR 17-04 was inititiated to address the failure.

TABLE D-4 SUSQUEHANNA REMP LABORATORY SPIKE PROGRAM
ANALYTICS ENVIRONMENTAL RADIOACTIVTY CROSS CHECK PROGRAM - 2016
QUALITY CONTROL SPIKE PROGRAM
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES (TBE)
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Month/Year	Identification Number	Matrix	Nuclide	Units	Analytics Calculated Results (a)	TBE Results (a)	TBE/Analyt Ratio
December 2016	E11709	Ap Filter	Ce-141	pCi	98.4 ± 3	84 ± 14	0.85
			Cr-51	pCi	192 ± 7	230 ± 75	1.20
			Cs-134	pCi	122 ± 4	115 ± 16	0.94
			Cs-137	pCi	87 ± 3	99 ± 14	1.14
			Co-58	pCi	101 ± 4	98 ± 15	0.97
			Mn-54	pCi	89 ± 3	84 ± 14	0.94
			Fe-59	pCi	85.8 ± 3	90 ± 16	1.05
			Zn-65	pCi	168 ± 6	158 ± 27	0.94
			Co-60	pCi	122 ± 4	142 ± 11	1.16
December 2016	E11710	Ap Filter	Ce-141	pCi	102 ± 4	84 ± 13	0.82
			Cr-51	pCi	200 ± 7	202 ± 76	1.01
			Cs-134	pCi	127 ± 4	118 ± 14	0.93
			Cs-137	pCi	90 ± 3	99 ± 13	1.10
			Co-58	pCi	105 ± 4	105 ± 15	1.00
			Mn-54	pCi	92.2 ± 3	94 ± 12	1.02
			Fe-59	pCi	89 ± 3	87 ± 18	0.98
			Zn-65	pCi	174 ± 6	201 ± 23	1.16
			Co-60	pCi	127 ± 4	155 ± 11	1.22
March 2016	E11146	Water	H-3	pCi/L	4630 ± 154	4510 ± 522	0.97
June 2016	E11213	Water	H-3	pCi/L	4490 ± 150	4520 ± 507	1.01
September 2016	E11272	Water	H-3	pCi/L	1800 ± 60	1590 ± 185	0.88
December 2016	E11406	Water	H-3	pCi/L	550 ± 18	587 ± 114	1.07
March 2016	E11466	Charcoal	I-131	pCi	88.4 ± 3	83.4 ± 3	0.94
March 2016	E11467	Charcoal	I-131	pCi	88.4 ± 3	85.2 ± 3	0.96
March 2016	E11468	Charcoal	I-131	pCi	88.4 ± 3	83.4 ± 4	0.94
September 2016	E11633	Charcoal	I-131	pCi	60.0 ± 2	67.9 ± 26	1.13
September 2016	E11634	Charcoal	I-131	pCi	59.7 ± 2	61.1 ± 26	1.02
September 2016	E11635	Charcoal	I-131	pCi	59.9 ± 2	57.8 ± 28	0.96

(a) Counting error is two standard deviations.

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SUSQUEHANNA REMP LABORATORY SPIKE PROGRAM
ANALYTICS ENVIRONMENTAL RADIOACTIVTY CROSS CHECK PROGRAM - 2016
QUALITY CONTROL SPIKE PROGRAM
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES (TBE)

onth/Year	Identification Number	Matrix	Nuclide	Units	Analytics Calculated Results (a)	TBE Results (a)	TBE/Analytics Ratio
ecember 2016	E11711	Charcoal	I-131	pCi	97.5 ± 3	99.3 ± 12	1.02
ecember 2016	E11712	Charcoal	I-131	pCi	98.0 ± 3	108.0 ± 11	1.10
ecember 2016	E11713	Charcoal	I-131	pCi	97.6 ± 3	99 ± 14	1.02

(a) Counting error is two standard deviations.

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APPENDIX E

REMP SAMPLE EQUIPMENT OPERABILITY TRENDING

TABLE E-1

REMP SAMPLING EQUIPTMENT OPERABILITY TRENDING
SUSQUEHANNA STEAM ELECTRIC STATION

Percent (%) Operability

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

*Planned power outage by PPL Electric Utilities

**Auto-Composite sampler problems, March through June. New Auto-Composite sampler installed in July 2014.