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U. S. Nuclear Regulatory Commission
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SUSQUEHANNA STEAM ELECTRIC STATION
ANNUAL RADIOLOGICAL ENVIRONMENTAL
OPERATING REPORT
PLA-7464

Docket Nos. 50-387
and 50-388

The Susquehanna Steam Electric Station Annual Radiological Environmental Operating Report is hereby submitted for the calendar year 2015 in accordance with Technical Specification 5.6.2.

Should you have any questions or require additional information, please contact Mr. Jason R. Jennings, Manager – Nuclear Regulatory Affairs at (570) 542-3155.

This letter contains no new regulatory commitments.

Jon A. Franke

Enclosure

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Enclosure to PLA-7464

Susquehanna Steam Electric Station Annual Radiological Environmental Operating Report – 2015

Susquehanna Steam Electric Station

Units 1 & 2

2015 ANNUAL REPORT

Annual Radiological Environmental Operating Report

Susquehanna Nuclear, LLC
Berwick, PA
April 2016

Enclosure to PLA-7464

Susquehanna Steam Electric Station Annual Radiological Environmental Operating Report – 2015

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 and 2

Annual Radiological
Environmental Operating Report

2015

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SUSQUEHANNA STEAM ELECTRIC STATION

Units 1 & 2

2015 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

JANUARY 1 TO DECEMBER 31, 2015

Susquehanna Nuclear, LLC
Berwick, PA
April, 2016

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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 2015. Teledyne Brown Engineering (TBE) was responsible for the analysis of environmental samples during 2015. The results are discussed in this report. Landauer provided the dosimetry services for SSES during 2015.

This Annual Radiological Environmental Operating Report (AREOR) conducted for SSES covers the period January 1, 2015 through December 31, 2015. During that time period, 1534 analyses were performed on 1307 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 8.50E-04 mRem. Tritium was included in the dose calculation because it was identified in the REMP samples of permitted water being discharged to the Susquehanna River. The 2015 average concentration of tritium in the cooling tower blowdown water and the 2015 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 2015 was 56.7 curies.

The 2015 average dilution factor for the Susquehanna River was 433, based on the annual average river flow of 5.59E+06 gpm and the annual average cooling tower blowdown flow of 1.29E+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 2015 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 2015 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 not detected in any of the soil samples in 2015. 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 and orchards.

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 & 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, 2015, 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. To 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 are sited where it is expected that radiation and radioactive material that might originate from the station would be detectable. Control locations are 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 are evaluated with respect to analogous fluctuations at control locations. Indicator and control location data are 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. The LLD is an "a priori" number which 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. The MDC is an "a posteriori" number which 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 deviations 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 that level.

B. Program Exceptions

Date	Sample Type	Location	Exception	Corrective Action
01/14/15 to 01/21/15	Air	6G1	Diminished air flow (1.9 cfm – below procedural flow of 2.0-2.4 cfm) as discovered during weekly collection. No effect on continuous sampler operation.	CA #15-01 AR 2015-02855 01/21/15: Adjusted air flow to 2.2 cfm. Valid sample volume collected for sample period: 20,300 cf
01/21/15 to 01/28/15	Air	3S2	Timer box malfunction – digits failed to advance (reset button became lodged against gas meter) as discovered during weekly collection. No effect on continuous sampler operation.	CA #15-02 AR 2015-02858 01/28/15: Timer box reset and monitored to ensure digits were advancing properly. Valid sample volume collected for sample period: 22,200 cf

Date	Sample Type	Location	Exception	Corrective Action
1st Quarter	Ground Water	13S7 (MW-6)	No sample - Safety concern. Unable to collect sample within quarterly time limit due to cooling tower falling ice hazard.	CA #15-07 AR 2015-09837 04/01/05: Will sample next quarter. TRM required sampling was conducted at other groundwater monitoring locations during first quarter.
03/31/15 to 04/07/15	Surface Water	6S6	Week 1 April composite Diminished sample flow (<1.5 gpm) as discovered during weekly collection.	CA #15-03 CR 2015-09511 04/07/15: Adequate sample volume collected during sample period. Maintenance requested. 04/08/15: Maintenance performed (RTPM 1824697) and sample flow restored to required 1.5 gpm. 04/14/15: Operability verified. Valid sample collected for sample period.
04/01/15 to 04/08/15	Air	6G1	Pump malfunction – inadequate air flow rate (below procedural 2.0-2.4 cfm) as discovered during weekly collection. No effect on continuous sampler operation.	CA #15-04 CR 2015-09824 04/08/15: Adjusted air flow rate, but pump did not respond. Pump replaced. Air flow verified. Atypical low sample volume collected for sample period: 13,700 cf
04/01/15 to 04/08/15	Air	13S6	Power outage/pump failure as discovered during weekly collection. Non-continuous sampler operation for sample period (operational only 56 hours according to timer box).	CA #15-05 CR 2015-09818 04/08/15: Reset circuit breaker, but pump failed to operate. Pump replaced. Air flow verified. Atypical low sample volume collected for sample period: 7,100 cf.
04/01/15 to 04/08/15	Air	13S6Q	Power outage as discovered during weekly collection. Non-continuous sampler operation for sample period (operational only 56.2 hours according to timer box).	CA #15-06 CR 2015-09818 04/08/15: Reset circuit breaker. Power restored. Atypical low sample volume collected for sample period: 7,300 cf.

Date	Sample Type	Location	Exception	Corrective Action
04/08/15 to 04/15/15	Air	6G1	No power to air monitor as discovered during weekly collection. Initial power loss on 4/15/15 @ 0837 that will continue until 5/20/15 for planned maintenance work by Susquehanna Nuclear. Non-continuous sampler operation for sample period (loss of 2 hours). 04/15/15 to 05/20/15 Air monitor was not operational due to planned power outage for maintenance work by Susquehanna Nuclear.	CA #15-08 CR 2015-10797 4/15/15: No action required. Air monitor will resume normal operation when power is restored. Valid sample collected for sample period: 21,500 cf TRM requirements were met since second control location (8G1) was operational during this period. 05/20/15: Power restored @1810 hours. 05/27/15: Operability verified. Valid sample volume collected for sample period 5/20/15 to 5/27/15: 20,400 cf
06/03/15 to 06/10/15	Air	12E1	Pump inoperative, but power to sampler as discovered during weekly collection. Non-continuous sampler operation for sample period (stop date and time unknown).	CA #15-09 CR-2015-16592 06/10/15: Pump replaced. Air flow verified. Atypical low sample volume collected for sample period: 11,300 cf
06/09/15 to 06/16/15	Surface Water	6S6	Week 2 June composite Diminished sample flow (<1.5 gpm) as discovered during weekly collection.	CA #15-10 CR 2015-17293 06/16/15: Adequate sample volume collected during sample period. Maintenance requested. 06/19/15: Maintenance performed (ZWO 1910153). Restored sample flow to 1.5 gpm. 06/23/15: Operability verified. Valid sample collected for sample period.
3rd Quarter 2015	Ground Water	4S9 (MW-3)	No sample - Safety concern. Unable to collect sample within quarterly time limit due to inaccessibility of sampling site (risk of falling dead trees near site).	CA #15-11 AR 2015-21793 08/04/15: Will sample next quarter. TRM required sampling was conducted at other groundwater monitoring locations during third quarter. 12/08/15: Dead trees cut and removed. 12/14/15: 4th quarter sample collected during quarterly time frame.

Date	Sample Type	Location	Exception	Corrective Action
08/04/15 to 08/11/15	Surface Water	6S6	Week 2 Aug composite No sample flow as discovered during weekly collection. Sampler taken out of service on 08/10/15 @ 1000 for piping work (PCWO 1820471) resulting in early stop date. 08/11/15 to 08/18/15 – Week 3 Aug composite Delayed start date of 08/14/15 @ 1615 hours.	CA #15-12 CR 2015-22260 08/11/15: Adequate sample volume collected during sample period. 08/14/15: Sample flow restored @ 1615 hours. 08/18/15: Operability verified. Valid sample collected for sample periods.
08/12/15 to 08/20/15	Air	6G1	Power outage for maintenance work by Susquehanna Nuclear on 08/19/15 from 0832 to 1243 hours as discovered during weekly collection. Non-continuous sampler operation during sample period (loss of 4 hours, 11 minutes)	CA #15-13 CR 2015-23117 08/20/15: No action required. Air monitor resumed normal operation when power was restored. Valid sample volume collected for sample period: 23,700 cf TRM requirements were met since second control location (8G1) was operational during this period.
08/20/15 to 08/26/15	Air	12E1	Timer box malfunction – digits failed to advance as discovered during weekly collection. No effect on continuous sampler operation.	CA #15-14 AR 2015-23563 08/26/15: Replaced timer box. Verified operability. Valid sample volume collected for sample period: 19,300 cf.
10/20/15 to 10/26/15	Surface Water	6S6	Week 4 Oct composite Insufficient sample volume (<1 gallon) as discovered during weekly collection due to diminished sample flow and clogged lines during sample period. Sampler was operational at time of sample collection.	CA #15-15 CR 2015-29231 10/26/15: Grab sample collected from sample flow line @1404 to meet procedural requirements. 10/26/15: Routine monthly maintenance performed from 1000-1100 (prior to weekly sample collection). Sample lines cleaned and flow restored. Grab sample collected for sample period.
10/21/15 to 10/28/15	Air	12E1	Timer box malfunction – digits failed to advance as discovered during weekly collection. No effect on continuous sampler operation.	CA #15-16 AR 2015-29236 10/28/15: Timer box reset and monitored to ensure digits were advancing properly. Valid sample volume collected for sample period: 23,600 cf.

Date	Sample Type	Location	Exception	Corrective Action
10/21/15 to 10/28/15	Air	12S1 9B1	Power outage on 10/28/15. Non-continuous sampler operation during sample period (loss of hours - 12S1 = 1.75; 9B1 = 2).	CA #15-18 CR 2015-29103 10/28/15: No action required. Air monitors resumed normal operation when power was restored. Valid sample volume collected for sample period: 12S1 = 22,400 cf, 9B1 = 21,900 cf)
10/28/15 to 11/04/15	Air	3S2	Power outage/pump failure on 10/28/15 as found during power outage follow-up inspection on 10/30/15. Non-continuous sampler operation during sample period (loss of 52.6 hours).	CA #15-17 CR 2015-29390 10/30/15: Pump replaced. Air flow verified. Valid sample volume collected for sample period: 16,800 cf.
10/28/15 to 11/04/15	Air	13S6 13S6Q	Power outage on 10/28/15. Non-continuous sampler operation during sample period (loss of 5.3 hours each monitor).	CA #15-19 CR 2015-29894 11/04/15: No action required. Air monitors resumed normal operation when power was restored. Valid sample volume collected for sample period: 13S6 = 22,400 cf; 13S6Q = 21,400 cf
11/10/15 to 11/17/15	Surface Water	6S6	Week 3 Nov composite Diminished sample flow (<1.5 gpm) as discovered during weekly collection.	CA #15-20 CR 2015-31166 11/17/15: Adequate sample volume collected during sample period. Maintenance requested. 11/23/15: Maintenance performed (WO 1873371) and sample flow restored to 1.5 gpm. Valid sample collected for sample period.

C. Program Changes

Two AP filter and Air Iodine locations, 9B1 and 10S3 were added to the program in 2015.

No samples were collected at location 5S9 in 2015. An alternate location, 6S6 was used in the place of 5S9.

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 139 analyses of Performance Evaluation (PE) containing 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, Susquehanna Nuclear supplied by 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 result and Analytics' known value. 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 control 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, 131 out of 139 analyses performed met the specified acceptance criteria. Eight analyses (AP - Cr-51, U-234/233, Gr-A, Sr-90; Soil Sr-90; Water Ni-63, U natural; Vegetation Sr-90 samples) did not meet the specified acceptance criteria for the following reasons and were addressed through the TBE Corrective Action Program:

Please note: the Department of Energy (DOE) Mixed Analyte Performance Evaluation Program (MAPEP) samples are created to mimic conditions found at DOE sites which in no way resemble typical environmental samples.

1. Teledyne Brown Engineering's Analytics' June 2015 air particulate Cr-51 result of 323 ± 45.5 pCi was higher than the known value of 233 pCi with a ratio of 1.39. The upper ratio of 1.30 (acceptable with warning) was exceeded. The air particulate sample is counted at a distance above the surface of the detector to avoid detector summing which could alter the results. Chromium-51 has the shortest half-life (27.7 days) and the lowest gamma energy (320.08 keV) of this mixed nuclide sample. Additionally, Cr-51 has only one gamma energy and also has a low intensity (9.38 gamma photons produced per 100 disintegrations). This geometry produces a larger error for the Cr-51 and other gamma emitters as any distance from the detector decreases the counting rate and the probability of accurately detecting the nuclide energy. Taking into consideration the uncertainty, the activity of Cr-51 overlaps with

the known value at a ratio of 1.19, which would statistically be considered acceptable. NCR 15-18

2. Teledyne Brown Engineering's MAPEP March 2015 soil Sr-90 result of 286 Total Bq/kg was lower than the known value of 653 Bq/kg, exceeding the lower acceptance range of 487 Bq/kg. The failure was due to incomplete digestion of the sample. Incomplete digestion of samples causes some of the sample to be left behind and is not present in the digested sample utilized for analysis. The procedure has been updated to include a more robust digestion using stirring during the heating. The MAPEP September 2014 soil Sr-90 series prior to this study was evaluated as acceptable with a result of 694 and an acceptance range of 601 – 1115 Bq/kg. The MAPEP September 2015 series soil Sr-90 after this study was evaluated as acceptable with a result of 429 and an acceptance range of 298 – 553 Bq/kg. We feel the issue is specific to the March 2015 MAPEP sample. NCR 15-13

3. Teledyne Brown Engineering's MAPEP March 2015 air particulate U-234/233 result of 0.0211 ± 0.0120 Bq/sample was higher than the known value of 0.0155 Bq/sample, exceeding the upper acceptance range of 0.0202 Bq/sample. Although evaluated as a failure, taking into consideration the uncertainty, TBE's result would overlap with the known value, which is statistically considered acceptable. MAPEP spiked the sample with significantly more U-238 activity (a found to known ratio of 0.96) than the U-234/233. Due to the extremely low activity, it was difficult to quantify the U-234/233. NCR 15-13

4. Teledyne Brown Engineering's MAPEP March 2015 air particulate gross alpha result of 0.448 Bq/sample was lower than the known value of 1.77 Bq/sample, exceeding the lower

acceptance range of 0.53 Bq/sample. The instrument efficiency used for gross alpha is determined using a non-attenuated alpha standard. The MAPEP filter has the alphas embedded in the filter, requiring an attenuated efficiency. When samples contain alpha particles that are embedded in the sample media, due to the size of the alpha particle, some of the alpha particles are absorbed by the media and cannot escape to be counted. When the sample media absorbs the alpha particles this is known as self-absorption or attenuation. The calibration must include a similar configuration/media to correct for the attenuation. In order to correct the low bias, TBE will create an attenuated efficiency for MAPEP air particulate filters. The MAPEP September series air particulate gross alpha result of 0.47 Bq/sample was evaluated as acceptable with a range of 0.24 – 1.53 Bq/sample. Air particulate Gross alpha analyses for power plants are not evaluated as a direct count sample, which the MAPEP sample is. Power plant air particulate filters for gross alpha go through an acid digestion prior to counting. NCR 15-13

5. Teledyne Brown Engineering's MAPEP September water Ni-63 result of 11.8 ± 10.8 Bq/L was higher than the known value of 8.55 Bq/L, exceeding the upper acceptance range of 11.12 Bq/L. The Ni-63 half-life is approximately 100 years. Nickel-63 is considered to be a "soft" or low energy beta emitter, which means that the beta energy is very low. The maximum beta energy for Ni-63 is approximately 65 keV, much lower than other more common nuclides such as Co-60 (maximum beta energy of 1549 keV). The original sample was run with a 10 mL aliquot which was not sufficient for the low level of Ni-63 in the sample. The rerun aliquot of 30 mL produced an acceptable result of 8.81 Bq/L. NCR 15-21

6. Teledyne Brown Engineering's MAPEP September air particulate Sr-90 result of 1.48 Bq/sample was lower than the known value of 2.18 Bq/sample, exceeding the lower acceptance range of 1.53 Bq/sample. In the past, MAPEP has added substances (unusual compounds found in DOE complexes) to various matrices that have resulted in incomplete removal of the isotope of interest for the laboratories analyzing the cross checks. TBE suspects that this may be the cause of this error. Many compounds, if not properly accounted for or removed in the sample matrix, can cause interferences to either indicate lower activity or higher activity. TBE will no longer analyze the air particulate Sr-90 through MAPEP but will participate in the Analytics cross check program to perform both Sr-89 and Sr-90 in the air particulate matrix. NCR 15-21

7. Teledyne Brown Engineering's MAPEP September vegetation Sr-90 result of 0.386 Bq/sample was lower than the known value of 1.30 Bq/sample, exceeding the lower acceptance range of 0.91 Bq/sample. In the past, MAPEP has added substances (unusual compounds found in DOE complexes) to various matrices that have resulted in incomplete removal of the isotope of interest for the laboratories analyzing the cross checks. TBE suspects that this maybe the cause of this error. Many compounds, if not properly accounted for or removed in the sample matrix, can cause interferences to either indicate lower activity or higher activity. NCR 15-21

8. Teledyne Brown Engineering's ERA November water Uranium natural result of 146.9 pCi/L was higher than the known value of 56.2 pCi/L, exceeding the upper acceptance limit of 62.4 pCi/L. The technician failed to dilute the original sample, but used the entire 12 mL sample. When the results were recalculated without the dilution and using the 12 mL aliquot,

the result of 57.16 agreed with the assigned value of 56.2. NCR 15-19

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 becomes poorer, the criteria for determining acceptability become wider.

The TBE laboratory performed 139 analyses of Performance Evaluation (PE) containing spiked samples of air particulate, air iodine, milk, soil and water matrices. (Appendix D, Table D-4)

For the TBE laboratory, 134 out of 139 analyses performed met the specified acceptance criteria. Five analyses (two Cr-51 and one Fe-59 in an air particulate, a Cr-51 in soil and Ce-141 in milk) did not meet the specified acceptance criteria or internal QA requirements. The TBE laboratory initiated Nonconformance Report 16-06 to address the failures.

IV. Results and Discussion

The analytical results of the 2015 REMP samples are divided into categories based on exposure pathways: atmospheric, direct radiation, terrestrial, and

aquatic. The analytical results for the 2015 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 historical 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 includes the collection of air particulate, 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.

<u>Gross Beta</u>

Gross beta activity was detected in 312 of 312 of the indicator location samples at concentrations ranging from 3 to 30 E-3 pCi/m^3 with an average concentration of 14 E-3 pCi/m^3, and in 99 of 99 of the control location samples at concentrations ranging from 6 to 28 E-3 pCi/m^3 with an average of 14 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 66 E-3 to 149 E-3 pCi/m^3 with an average concentration of 98 E-3 pCi/m^3, and in the eight control location composites ranging in concentration from 78 to 143 E-3 pCi/m^3 with an average concentration of 97 E-3 pCi/m^3.

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

All other gamma emitters were less than the LLD.

2. Air Iodine

Filtered air iodine samples were collected weekly at six indicator locations (3S2, 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.

Iodine-131

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

B. Direct Radiation

Ambient radiation levels in the environs were measured with a pair of optically stimulated luminescent dosimeters (OSLD) composed of aluminum oxide crystals supplied and processed by Landauer. Packets containing OSLDs for quarterly exposure were placed in the owner-controlled area and around the Site at various distances and in each land based meteorological sector. Emphasis was placed on special interest areas such as population centers, nearby residences, and schools.

A total of 57 locations were monitored for direct radiation during 2015, including 32 site boundary locations, 14 outer distance locations, six special interest locations and five control locations.

The average dose rate for the 208 indicator dosimeters was 20.2 milliroentgen per standard quarter. The average control dose rate for the 20 control dosimeters was 16.1 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 2015 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 includes the collection of milk, groundwater, drinking water, vegetation and soil samples.

1. Milk

Milk samples were collected semi-monthly when cows were on pasture and monthly when cows were not grazing on open 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 2015 are plotted.

Gamma Spectrometry

Naturally occurring K-40 was detected in all 60 samples with concentrations for the 40 indicator location samples ranging from 1,331 to 1,580 pCi/L with an average concentration of 1,380 pCi/L, and the 20 control location sample concentrations ranging from 1,039 to 1,514 pCi/L pCi/L with an average concentration of 1,380 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 not detected in any of the samples. 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 provides 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 concentrations which makes its way into surface water and soil where it eventually seeps into shallow groundwater. The annual average H-3 concentration 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, Surface Water Versus Ground Water.

Ground water 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 7 of the 54 indicator location samples with concentrations ranging from 145 to 272 pCi/L with an average concentration of 197 pCi/L. No Tritium 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, Surface Water Versus Ground Water results from 2007 to 2015 are plotted.

Gamma Spectrometry

Naturally occurring K-40 was detected in five of the 54 indicator samples. Sample concentrations ranged from 43 to 174 pCi/L with an average concentration of 78 pCi/L. No K-40 was detected in the control location samples.

Naturally occurring Th-228 was detected in one of the 54 indicator samples at a concentration of 13 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 1.8 to 2.8 pCi/L with an average concentration of 2.2 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 2015 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, kale, swiss chard and collards.

Gamma Spectrometry

Naturally occurring Be-7, attributed to cosmic ray activity in the atmosphere, was detected in 17 of the 30 indicator location samples with concentrations ranging from 242 to 639 pCi/kg wet with an average concentration of 435 pCi/kg wet, and in three of the control location samples with concentrations ranging from 293 to 501 pCi/kg wet with an average concentration of 401 pCi/kg wet. Preoperational data is not available for comparison.

Naturally occurring K-40 was detected in all 34 indicator location samples with concentrations ranging from 2,262 to 12,963 pCi/kg wet with an average concentration of 5,460 pCi/kg wet, and in all 15 control location samples with concentrations ranging from 2,881 to 6,932 pCi/kg wet with an average concentration of 4,763 pCi/kg wet. The maximum preoperational level detected was 4,800 pCi/kg wet with an average concentration of 2,140 pCi/kg wet.

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

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

All other gamma emitters were less than the LLD.

5. Soil

Soil samples were collected annually from two indicator locations (12S1 and 10S3) and one control location (8G1).

Each sample was analyzed for gamma emitters.

Gamma Spectrometry

Naturally occurring K-40 was detected in both indicator location samples at concentrations ranging from 8,897 to 12,930 pCi/kg dry with an average concentration of 11,139 pCi/kg dry, and in both of the control location samples at concentrations ranging from 9,920 to 9,920 pCi/kg dry with an average concentration of 9,742 pCi/kg dry. The maximum preoperational level detected was 1,100 pCi/kg dry with an average concentration of 9,800 pCi/kg dry.

Cesium-137 was not detected in any of the indicator location or 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 2,452 to 2,912 pCi/kg dry with an average concentration of 2,682 pCi/kg dry, and in one of the control location samples at a concentration of 3,284pCi/kg dry. The maximum preoperational level detected was 1,300 pCi/kg dry with an average concentration of 1,100 pCi/kg dry.

Naturally occurring Ac-228 was detected in three of the indicator location samples at concentrations ranging from 816 to 1,243 pCi/kg dry with an average concentration of 1,017 pCi/kg dry, and in all of the control location samples at concentrations ranging from 717 to 1,059 pCi/kg dry with an average concentration of 888 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 709 to 963 pCi/kg dry and an average concentration of 829 pCi/kg dry, and in both of the control location samples at concentrations ranging from 932 to 1,025 pCi/kg dry with an average concentration of 979 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.

<u>Tritium</u>

Tritium activity was detected in 16 of 40 indicator location samples with concentrations ranging from 179 to 4,340 pCi/L with an average concentration of 1,492 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 2015. 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 2015 are plotted.]

Gamma Spectrometry

Naturally occurring K-40 was detected in 4 of the 40 indicator location samples with concentrations ranging from 39 to 104 pCi/L with an average concentration of 64 pCi/L, and in two of the 13 control location samples with concentrations ranging from 38 to 44 pCi/L with an average concentration of 41 pCi/L. Preoperational data is not available for comparison.

Naturally occurring Th-228 was not detected in any of the indicator or control locations. Preoperational data is not available for comparison. (Table C-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 2015 at two indicator locations (IND [Susquehanna River] and LTAW) and one control location (2H [Susquehanna River]). Each sample was analyzed for gamma emitters.

Gamma Spectrometry

Naturally occurring K-40 was detected in all seven indicator location samples at concentrations ranging from 2,277 to 4,493 pCi/kg wet with an average concentration of 3,441 pCi/kg wet, and in all six control location samples at concentrations ranging from 3,306 to 4,723 pCi/kg wet with an average concentration of 3,632 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 9,673 to 13,230 pCi/kg dry with an average concentration of 12,136

pCi/kg dry, and in both of the control location samples with concentrations ranging from 9,811 to 13,360 pCi/kg dry with an average concentration of 11,586 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 not detected in any of the indicator location samples, but found in one of the three control location samples with a concentration of 2,245 p/Ci/kg. The maximum preoperational level detected was 1,900 pCi/kg dry with an average concentration of 700 pCi/kg dry.

Naturally occurring Ac-228 was detected in all four indicator location samples at concentrations ranging from 795 to 1,229 pCi/kg dry with an average concentration of 1,060 pCi/kg dry, and in both of the control location samples at concentrations ranging from 946 to 1,297 pCi/kg dry with an average concentration of 1,130 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 787 to 1,272 pCi/kg dry with an average concentration of 1,024 pCi/kg dry, and in all three of the control location samples at concentrations ranging from 1,012 and 1,282 pCi/kg dry with an average concentration of 1,147 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 2015 LAND USE CENSUS

Ecology III, Inc. conducted a Land Use Census during the 2015 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, 2015 miles	Nearest Garden Sept, 2015 miles	Nearest Dairy Farm Sept, 2015 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 2015 Land Use Census results are summarized in the above table.

V. Annotations to Previous AREOR

There are no annotations to previous AREOR.

VI. Conclusions

The Radiological Environmental Monitoring Program for SSES was conducted during 2015 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 historical results collected since commercial operation, it is concluded that operation of the SSES had no significant radiological impact on the health and safety of the public or the environment.

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

VII. References

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[3] Final Environmental Statement

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[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 2015.

[15] NCRP Report No. 160, "Ionizing Radiation Exposure of the Population of the United States", (2009).

APPENDIX A

PROGRAM SUMMARY

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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, 2014 to January 01, 2016

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSIS PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN (3) RANGE	CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASURMENTS
Air Particulates (E-3 pCi/m^3)	GR-B	411	10	1.40E+01 (312/312) (3.070E+00 - 2.980E+01)	3S2 0.5 MILES NE	1.45E+01 (52/52) (4.470E+00 - 2.980E+01)	1.35E+01 (99/99) (4.060E+00 - 2.810E+01)	0
	GAMMA	32						
	BE-7	32	N/A	9.83E+01 (24/24) (6.637E+01 - 1.494E+02)	3S2 0.5 MILES NE	1.08E+02 (4/4) (8.358E+01 - 1.440E+02)	9.70E+01 (8/8) (7.810E+01 - 1.426E+02)	0
	K-40	32	N/A	2.30E+00 (24/24) (-4.488E+00 - 1.442E+01)	13S6 0.4 MILES W	5.99E+00 (4/4) (-1.844E+00 - 1.165E+01)	5.35E+00 (8/8) (-4.401E+00 - 1.984E+01)	0
	CS-134	32	50	2.75E-01 (24/24) (-7.367E-01 - 9.179E-01)	9B1 S	3.88E-01 (4/4) (-2.809E-01 - 7.412E-01)	1.53E-01 (8/8) (-9.822E-01 - 1.164E+00)	0
	CS-137	32	60	1.14E-01 (24/24) (-4.464E-01 - 6.842E-01)	13S6 0.4 MILES W	2.65E-01 (4/4) (-2.394E-01 - 6.312E-01)	1.40E-01 (8/8) (-2.914E-01 - 6.018E-01)	0
Charcoal (E-3 pCi/m^3)	GAMMA	411						
	I-131	411	70	1.52E-01 (312/312) (-1.113E+01 - 1.339E+01)	9B1 S	1.10E+00 (52/52) (-9.706E+00 - 1.339E+01)	1.04E+00 (99/99) (-9.351E+00 - 1.333E+01)	0
Ambient Radiation (mR/std. qtr.)	OSLD	228	N/A	2.02E+01 (208/208) (1.010E+01 - 5.645E+01)	9S2 0.2 MILES S	4.48E+01 (4/4) (3.344E+01 - 5.645E+01)	1.61E+01 (20/20) (9.230E+00 - 2.181E+01)	0
Milk (pCi/l)	I-131	60	1	-1.52E-01 (40/40) (-7.080E-01 - 2.030E-01)	10G1 14 MILES SSW	-9.24E-02 (20/20) (-6.410E-01 - 3.980E-01)	-9.24E-02 (20/20) (-6.410E-01 - 3.980E-01)	0
	GAMMA	60						
	K-40	60	N/A	1.38E+03 (40/40) (1.131E+03 - 1.580E+03)	13E3 5.0 MILES W	1.38E+03 (20/20) (1.135E+03 - 1.580E+03)	1.30E+03 (20/20) (1.039E+03 - 1.514E+03)	0
	CS-134	60	15	-2.95E+00 (40/40) (-1.205E+01 - 3.261E+00)	10G1 14 MILES SSW	-1.62E+00 (20/20) (-8.397E+00 - 2.109E+00)	-1.62E+00 (20/20) (-8.397E+00 - 2.109E+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, 2014 to January 01, 2016

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSIS PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE		LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN (3) RANGE		CONTROL LOCATION MEAN (3) RANGE		NUMBER OF NONROUTINE REPORTED MEASURMENTS
Milk (cont'd) (pCi/l)	CS-137	60	18	6.58E-01 (-4.022E+00 -	(40/40) 6.752E+00)	5E2 4.5 MILES E	1.13E+00 (-8.861E-01 -	(20/20) 4.065E+00)	-2.93E-02 (-4.374E+00 -	(20/20) 4.064E+00)	0
	BA-140	60	60	-1.95E-01 (-2.964E+01 -	(40/40) 3.262E+01)	10G1 14 MILES SSW	1.89E+00 (-1.490E+01 -	(20/20) 1.778E+01)	1.89E+00 (-1.490E+01 -	(20/20) 1.778E+01)	0
	LA-140	60	15	-3.11E-01 (-7.375E+00 -	(40/40) 5.850E+00)	13E3 5.0 MILES W	2.60E-01 (-7.375E+00 -	(20/20) 5.850E+00)	-8.39E-01 (-5.214E+00 -	(20/20) 7.357E+00)	0
	TH-228	60	N/A	-5.00E-02 (-9.115E+00 -	(40/40) 1.280E+01)	10G1 14 MILES SSW	1.42E+00 (-7.190E+00 -	(20/20) 1.020E+01)	1.42E+00 (-7.190E+00 -	(20/20) 1.020E+01)	0
Ground Water (pCi/l)	H-3	58	N/A	7.97E+01 (-5.240E+01 -	(54/54) 3.170E+02)	4S8 0.1 MILES ENE	1.56E+02 (5.710E+01 -	(4/4) 2.720E+02)	1.39E+01 (-4.100E+00 -	(4/4) 5.770E+01)	0
	GAMMA	58									
	K-40	58	N/A	2.28E+01 (-5.878E+01 -	(54/54) 1.740E+02)	4S4 0.5 MILES ENE	5.10E+01 (2.254E+01 -	(4/4) 7.873E+01)	3.12E+00 (-4.846E+01 -	(4/4) 4.076E+01)	0
	MN-54	58	15	-4.56E-01 (-3.779E+00 -	(54/54) 2.028E+00)	4S9 0.3 MILES ENE	9.13E-01 (-2.460E-01 -	(3/3) 1.852E+00)	-1.29E+00 (-3.117E+00 -	(4/4) -4.984E-01)	0
	CO-58	58	15	9.26E-02 (-6.528E+00 -	(54/54) 3.290E+00)	2S2 0.9 MILES NNE	1.51E+00 (-5.296E-01 -	(4/4) 3.290E+00)	-4.69E-01 (-3.271E+00 -	(4/4) 1.247E+00)	0
	FE-59	58	30	1.70E+00 (-7.276E+00 -	(54/54) 1.517E+01)	7S10 0.3 MILES SE	6.86E+00 (3.792E+00 -	(4/4) 1.055E+01)	-1.72E+00 (-1.515E+01 -	(4/4) 3.749E+00)	0
	CO-60	58	15	3.78E-01 (-2.999E+00 -	(54/54) 3.421E+00)	7S10 0.3 MILES SE	1.75E+00 (-7.691E-02 -	(4/4) 3.421E+00)	-1.00E-01 (-1.529E+00 -	(4/4) 1.927E+00)	0

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Reporting Period: December 29, 2014 to January 01, 2016

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSIS PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN (3) RANGE	CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASURMENTS
Ground Water (cont'd) (pCi/l)	ZN-65	58	30	-2.58E+00 (54/54) (-1.058E+01 - 8.751E+00)	6S11A	5.88E-01 (4/4) (-2.125E+00 - 4.764E+00)	-5.40E+00 (4/4) (-1.690E+01 - 2.218E+00)	0
	NB-95	58	15	4.10E-01 (54/54) (-4.917E+00 - 5.048E+00)	12F3 5.2 MILES WSW	1.89E+00 (4/4) (-1.557E+00 - 4.311E+00)	1.89E+00 (4/4) (-1.557E+00 - 4.311E+00)	0
	ZR-95	58	30	-3.95E-02 (54/54) (-5.414E+00 - 3.763E+00)	2S2 0.9 MILES NNE	2.05E+00 (4/4) (-6.904E-01 - 3.643E+00)	1.22E+00 (4/4) (-2.925E+00 - 6.430E+00)	0
	I-131	58	15	8.04E-02 (54/54) (-7.324E+00 - 7.362E+00)	2S8	2.43E+00 (4/4) (2.573E-01 - 5.055E+00)	1.06E+00 (4/4) (-1.320E+00 - 3.887E+00)	0
	CS-134	58	15	-1.24E+00 (54/54) (-7.543E+00 - 9.338E+00)	2S8	5.89E-01 (4/4) (-3.999E-01 - 1.898E+00)	-1.22E+00 (4/4) (-2.181E+00 - 3.521E-01)	0
	CS-137	58	18	-1.07E-01 (54/54) (-5.703E+00 - 5.894E+00)	7S11	1.68E+00 (4/4) (-7.001E-01 - 5.894E+00)	3.63E-01 (4/4) (-1.784E+00 - 2.590E+00)	0
	BA-140	58	60	-7.36E-02 (54/54) (-2.222E+01 - 1.199E+01)	4S4 0.5 MILES ENE	6.23E+00 (4/4) (-3.837E+00 - 1.196E+01)	-2.21E+00 (4/4) (-7.691E+00 - 4.352E+00)	0
	LA-140	58	15	-6.75E-01 (54/54) (-6.924E+00 - 3.573E+00)	6S10 0.4 MILES ESE	2.08E+00 (4/4) (1.213E+00 - 3.204E+00)	1.49E+00 (4/4) (-3.310E+00 - 7.631E+00)	0
	TH-228	58	N/A	3.32E-01 (54/54) (-8.946E+00 - 1.610E+01)	12F3 5.2 MILES WSW	5.58E+00 (4/4) (2.177E+00 - 8.813E+00)	5.58E+00 (4/4) (2.177E+00 - 8.813E+00)	0
Drinking Water (pCi/l)	GR-B	12	4	1.83E+00 (12/12) (7.180E-01 - 2.750E+00)	12H2 26 MILES WSW	1.83E+00 (12/12) (7.180E-01 - 2.750E+00)	0.00E+00	0
	H-3	12	2000	6.77E+01 (12/12) (-6.700E+01 - 1.520E+02)	12H2 26 MILES WSW	6.77E+01 (12/12) (-6.700E+01 - 1.520E+02)	0.00E+00	0

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Reporting Period: December 29, 2014 to January 01, 2016

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSIS PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE		LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN (3) RANGE		CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASURMENTS
Drinking Water (cont'd)	GAMMA	12								
(pCi/l)	K-40	12	N/A	2.43E+00	(12/12)	12H2	2.43E+00	(12/12)	0.00E+00	0
				(-3.522E+01 -	3.056E+01)	26 MILES WSW	(-3.522E+01 -	3.056E+01)		
	MN-54	12	15	-3.95E-01	(12/12)	12H2	-3.95E-01	(12/12)	0.00E+00	0
				(-1.349E+00 -	6.791E-01)	26 MILES WSW	(-1.349E+00 -	6.791E-01)		
	CO-58	12	15	-3.93E-01	(12/12)	12H2	-3.93E-01	(12/12)	0.00E+00	0
				(-1.151E+00 -	4.014E-01)	26 MILES WSW	(-1.151E+00 -	4.014E-01)		
	FE-59	12	30	1.08E-01	(12/12)	12H2	1.08E-01	(12/12)	0.00E+00	0
				(-3.840E+00 -	4.222E+00)	26 MILES WSW	(-3.840E+00 -	4.222E+00)		
	CO-60	12	15	4.73E-01	(12/12)	12H2	4.73E-01	(12/12)	0.00E+00	0
				(-4.823E-01 -	1.864E+00)	26 MILES WSW	(-4.823E-01 -	1.864E+00)		
	ZN-65	12	30	-2.65E+00	(12/12)	12H2	-2.65E+00	(12/12)	0.00E+00	0
				(-6.148E+00 -	4.812E-01)	26 MILES WSW	(-6.148E+00 -	4.812E-01)		
	NB-95	12	15	2.61E-01	(12/12)	12H2	2.61E-01	(12/12)	0.00E+00	0
				(-4.054E-01 -	1.319E+00)	26 MILES WSW	(-4.054E-01 -	1.319E+00)		
	ZR-95	12	30	2.77E-02	(12/12)	12H2	2.77E-02	(12/12)	0.00E+00	0
				(-1.376E+00 -	1.869E+00)	26 MILES WSW	(-1.376E+00 -	1.869E+00)		
	I-131	12	15	-4.22E-01	(12/12)	12H2	-4.22E-01	(12/12)	0.00E+00	0
				(-4.972E+00 -	2.916E+00)	26 MILES WSW	(-4.972E+00 -	2.916E+00)		
	CS-134	12	15	-2.07E+00	(12/12)	12H2	-2.07E+00	(12/12)	0.00E+00	0
				(-5.229E+00 -	3.081E-01)	26 MILES WSW	(-5.229E+00 -	3.081E-01)		

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MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSIS PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN (3) RANGE	CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASURMENTS
Drinking Water (cont'd) (pCi/l)	CS-137	12	18	-1.17E-01 (12/12) (-1.263E+00 - 7.073E-01)	12H2 26 MILES WSW	-1.17E-01 (12/12) (-1.263E+00 - 7.073E-01)	0.00E+00	0
	BA-140	12	60	-1.86E-01 (12/12) (-1.106E+01 - 9.469E+00)	12H2 26 MILES WSW	-1.86E-01 (12/12) (-1.106E+01 - 9.469E+00)	0.00E+00	0
	LA-140	12	15	-5.33E-01 (12/12) (-2.461E+00 - 1.553E+00)	12H2 26 MILES WSW	-5.33E-01 (12/12) (-2.461E+00 - 1.553E+00)	0.00E+00	0
Food/Garden Crops (pCi/kg wet)	GAMMA	49						
	BE-7	49	N/A	3.09E+02 (34/34) (-7.878E+01 - 6.392E+02)	3S3 0.9 MILES NE	3.87E+02 (15/15) (1.630E+02 - 6.392E+02)	2.05E+02 (15/15) (9.394E+01 - 5.011E+02)	0
	K-40	49	N/A	5.46E+03 (34/34) (2.262E+03 - 1.296E+04)	11D1 3.3 MILES SW	1.03E+04 (2/2) (7.716E+03 - 1.296E+04)	4.76E+03 (15/15) (2.881E+03 - 6.932E+03)	0
	MN-54	49	N/A	-2.17E+00 (34/34) (-1.338E+01 - 8.715E+00)	8G1 12 MILES SSE	-6.87E-01 (15/15) (-2.092E+01 - 8.369E+00)	-6.87E-01 (15/15) (-2.092E+01 - 8.369E+00)	0
	CO-58	49	N/A	-3.03E-01 (34/34) (-1.617E+01 - 1.692E+01)	11S6 0.5 MILES SW	6.29E-01 (15/15) (-8.407E+00 - 1.692E+01)	-1.27E+00 (15/15) (-1.177E+01 - 2.394E+01)	0
	FE-59	49	N/A	4.53E+00 (34/34) (-4.528E+01 - 7.058E+01)	12F7 8.3 MILES WSW	3.63E+01 (2/2) (1.563E+01 - 5.704E+01)	-1.51E+00 (15/15) (-3.972E+01 - 3.659E+01)	0
	CO-60	49	N/A	2.65E+00 (34/34) (-1.457E+01 - 2.293E+01)	11D1 3.3 MILES SW	1.45E+01 (2/2) (5.977E+00 - 2.293E+01)	1.35E+00 (15/15) (-1.591E+01 - 1.029E+01)	0
	ZN-65	49	N/A	-2.12E+01 (34/34) (-8.781E+01 - 4.947E+01)	12F7 8.3 MILES WSW	4.47E+01 (2/2) (3.995E+01 - 4.947E+01)	-1.52E+01 (15/15) (-4.374E+01 - 3.691E+01)	0

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Food/Garden Crops (cont'd) (pCi/kg wet)	NB-95	49	N/A	4.08E+00 (-1.663E+01 - 1.718E+01)	(34/34)	12F7 8.3 MILES WSW	1.46E+01 (1.389E+01 - 1.520E+01)	(2/2)	4.70E+00 (-7.680E+00 - 1.553E+01)	(15/15)	0
	ZR-95	49	N/A	4.13E+00 (-2.230E+01 - 2.923E+01)	(34/34)	3S3 0.9 MILES NE	4.71E+00 (-2.230E+01 - 2.923E+01)	(15/15)	2.34E+00 (-2.299E+01 - 3.499E+01)	(15/15)	0
	I-131	49	60	-1.33E+00 (-3.393E+01 - 2.041E+01)	(34/34)	12F7 8.3 MILES WSW	5.06E+00 (-4.135E+00 - 1.426E+01)	(2/2)	-1.23E-01 (-1.458E+01 - 2.300E+01)	(15/15)	0
	CS-134	49	60	-7.32E+00 (-4.685E+01 - 2.073E+01)	(34/34)	12F7 8.3 MILES WSW	4.30E+00 (-1.214E+01 - 2.073E+01)	(2/2)	-7.65E+00 (-2.711E+01 - 9.207E+00)	(15/15)	0
	CS-137	49	80	3.08E+00 (-1.320E+01 - 2.836E+01)	(34/34)	3S3 0.9 MILES NE	7.49E+00 (-5.588E+00 - 2.836E+01)	(15/15)	-1.50E+00 (-1.124E+01 - 9.152E+00)	(15/15)	0
	BA-140	49	N/A	6.72E+00 (-8.525E+01 - 1.038E+02)	(34/34)	12F7 8.3 MILES WSW	2.23E+01 (5.827E+00 - 3.867E+01)	(2/2)	4.12E+00 (-8.261E+01 - 9.107E+01)	(15/15)	0
	LA-140	49	N/A	-6.03E-01 (-2.892E+01 - 1.895E+01)	(34/34)	12F7 8.3 MILES WSW	1.04E+01 (1.803E+00 - 1.895E+01)	(2/2)	1.70E+00 (-2.421E+01 - 1.371E+01)	(15/15)	0
	AC-228	49	N/A	5.09E+00 (-4.270E+01 - 9.778E+01)	(34/34)	8G1 12 MILES SSE	1.44E+01 (-5.129E+01 - 5.994E+01)	(15/15)	1.44E+01 (-5.129E+01 - 5.994E+01)	(15/15)	0
	TH-228	49	N/A	-2.19E+00 (-3.736E+01 - 3.164E+01)	(34/34)	12F7 8.3 MILES WSW	1.36E+01 (-1.101E-01 - 2.726E+01)	(2/2)	-8.51E-01 (-2.263E+01 - 2.463E+01)	(15/15)	0
Soil (pCi/kg dry)	GAMMA	6									
	K-40	6	N/A	1.11E+04 (8.897E+03 - 1.293E+04)	(4/4)	12S1 0.4 MILES WSW	1.25E+04 (1.197E+04 - 1.293E+04)	(2/2)	9.74E+03 (9.564E+03 - 9.920E+03)	(2/2)	0
	CS-134	6	150	5.84E+00 (-4.865E+01 - 3.960E+01)	(4/4)	12S1 0.4 MILES WSW	1.62E+01 (2.417E-01 - 3.218E+01)	(2/2)	-2.14E+01 (-4.861E+01 - 5.810E+00)	(2/2)	0

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Soil (cont'd) (pCi/kg dry)	CS-137	6	180	8.99E+01 (4/4) (3.413E+01 - 1.593E+02)	10S3 SSW	1.23E+02 (2/2) (8.741E+01 - 1.593E+02)	4.17E+01 (2/2) (-2.539E-01 - 8.361E+01)	0
	RA-226	6	N/A	1.87E+03 (4/4) (9.716E+02 - 2.912E+03)	8G1 12 MILES SSE	2.72E+03 (2/2) (2.150E+03 - 3.284E+03)	2.72E+03 (2/2) (2.150E+03 - 3.284E+03)	0
	AC-228	6	N/A	7.88E+02 (4/4) (1.009E+02 - 1.243E+03)	10S3 SSW	9.04E+02 (2/2) (8.156E+02 - 9.917E+02)	8.88E+02 (2/2) (7.166E+02 - 1.059E+03)	0
	TH-228	6	N/A	8.29E+02 (4/4) (7.091E+02 - 9.628E+02)	8G1 12 MILES SSE	9.79E+02 (2/2) (9.321E+02 - 1.025E+03)	9.79E+02 (2/2) (9.321E+02 - 1.025E+03)	0
Surface Water (pCi/l)	H-3	53	2000	6.31E+02 (40/40) (-8.870E+01 - 4.340E+03)	2S7 0.1 MILES NNE	1.92E+03 (12/12) (2.290E+02 - 4.340E+03)	4.17E+01 (13/13) (-9.240E+01 - 1.280E+02)	0
	GAMMA	53						
	K-40	53	N/A	1.83E+01 (40/40) (-4.731E+01 - 1.279E+02)	7S12 0.3 MILES SE	4.27E+01 (4/4) (-4.731E+01 - 1.042E+02)	5.01E+00 (13/13) (-2.210E+01 - 4.411E+01)	0
	MN-54	53	15	-3.86E-01 (40/40) (-4.016E+00 - 2.704E+00)	4S7 0.4 MILES ENE	7.68E-02 (4/4) (-1.877E+00 - 2.704E+00)	2.40E-02 (13/13) (-9.821E-01 - 9.985E-01)	0
	CO-58	53	15	-2.53E-01 (40/40) (-2.602E+00 - 2.546E+00)	4S7 0.4 MILES ENE	3.36E-01 (4/4) (-1.221E+00 - 2.546E+00)	-7.30E-02 (13/13) (-1.453E+00 - 6.600E-01)	0
	FE-59	53	30	1.38E+00 (40/40) (-5.052E+00 - 8.023E+00)	5S12 0.4 MILES E	2.58E+00 (4/4) (-1.968E+00 - 6.738E+00)	2.07E+00 (13/13) (1.590E-01 - 5.755E+00)	0
	CO-60	53	15	-1.53E-01 (40/40) (-5.711E+00 - 2.047E+00)	2S7 0.1 MILES NNE	5.02E-01 (12/12) (-6.016E-02 - 1.673E+00)	-9.19E-02 (13/13) (-1.205E+00 - 5.287E-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, 2014 to January 01, 2016

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSIS PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE		LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN (3) RANGE		CONTROL LOCATION MEAN (3) RANGE		NUMBER OF NONROUTINE REPORTED MEASURMENTS
Surface Water (cont'd) (pCi/l)	ZN-65	53	30	-1.93E+00 (-1.090E+01 - 9.515E+00)	(40/40)	LTAW 0.7 MILES NE	-7.49E-01 (-1.090E+01 - 9.515E+00)	(4/4)	-1.69E+00 (-5.803E+00 - 1.024E+00)	(13/13)	0
	NB-95	53	15	5.82E-01 (-2.536E+00 - 4.628E+00)	(40/40)	LTAW 0.7 MILES NE	1.59E+00 (-5.384E-01 - 4.628E+00)	(4/4)	4.42E-01 (-5.952E-01 - 1.642E+00)	(13/13)	0
	ZR-95	53	30	1.02E-02 (-5.119E+00 - 3.625E+00)	(40/40)	5S12 0.4 MILES E	1.59E+00 (-2.135E-01 - 3.625E+00)	(4/4)	-5.45E-01 (-3.567E+00 - 8.544E-01)	(13/13)	0
	I-131	53	15	-6.61E-01 (-9.396E+00 - 6.854E+00)	(40/40)	6S6 0.8 MILES ESE	8.30E-01 (-7.991E+00 - 7.773E+00)	(13/13)	8.30E-01 (-7.991E+00 - 7.773E+00)	(13/13)	0
	CS-134	53	15	-1.06E+00 (-7.145E+00 - 3.123E+00)	(40/40)	7S12 0.3 MILES SE	-5.56E-01 (-1.505E+00 - 1.112E+00)	(4/4)	-8.89E-01 (-3.426E+00 - 9.604E-01)	(13/13)	0
	CS-137	53	18	-5.62E-02 (-3.374E+00 - 1.636E+00)	(40/40)	2S7 0.1 MILES NNE	1.35E-01 (-6.061E-01 - 7.252E-01)	(12/12)	-4.85E-02 (-1.630E+00 - 1.150E+00)	(13/13)	0
	BA-140	53	60	4.12E-01 (-1.780E+01 - 9.531E+00)	(40/40)	LTAW 0.7 MILES NE	3.25E+00 (-7.870E+00 - 9.531E+00)	(4/4)	1.62E+00 (-6.392E+00 - 1.373E+01)	(13/13)	0
	LA-140	53	15	2.75E-01 (-3.312E+00 - 5.222E+00)	(40/40)	4S7 0.4 MILES ENE	1.65E+00 (-1.642E+00 - 4.954E+00)	(4/4)	-4.33E-01 (-2.678E+00 - 3.057E+00)	(13/13)	0
	TH-228	53	N/A	1.16E+00 (-6.337E+00 - 8.897E+00)	(40/40)	7S12 0.3 MILES SE	3.77E+00 (6.468E-01 - 6.931E+00)	(4/4)	7.44E-01 (-5.848E-01 - 4.654E+00)	(13/13)	0
Fish (pCi/kg wet)	GAMMA	13									
	K-40	13	N/A	3.44E+03 (2.277E+03 - 4.493E+03)	(7/7)	2H 30 MILES NNE	3.87E+03 (3.306E+03 - 4.723E+03)	(6/6)	3.87E+03 (3.306E+03 - 4.723E+03)	(6/6)	0
	MN-54	13	130	-4.49E+00 (-3.403E+01 - 9.770E+00)	(7/7)	2H 30 MILES NNE	1.46E+00 (-1.895E+01 - 2.941E+01)	(6/6)	1.46E+00 (-1.895E+01 - 2.941E+01)	(6/6)	0

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

Reporting Period: December 29, 2014 to January 01, 2016

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSIS PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE		LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN (3) RANGE		CONTROL LOCATION MEAN (3) RANGE		NUMBER OF NONROUTINE REPORTED MEASURMENTS
Fish (cont'd) (pCi/kg wet)	CO-58	13	130	-7.85E+00 (-3.831E+01 -	(7/7) 1.255E+01)	2H 30 MILES NNE	3.60E+00 (-2.145E+01 -	(6/6) 2.152E+01)	3.60E+00 (-2.145E+01 -	(6/6) 2.152E+01)	0
	FE-59	13	260	1.47E+01 (-5.308E+01 -	(7/7) 1.679E+02)	IND 0.9-1.4 MILES ESE	2.54E+01 (-5.308E+01 -	(6/6) 1.679E+02)	-8.06E+00 (-6.060E+01 -	(6/6) 8.224E+01)	0
	CO-60	13	130	2.75E+00 (-8.873E+00 -	(7/7) 2.240E+01)	LTAW 0.7 MILES NE	7.16E+00 -7.16E+00	(1/1)	-9.99E-01 (-2.022E+01 -	(6/6) 1.275E+01)	0
	ZN-65	13	260	-7.99E+01 (-1.559E+02 -	(7/7) -1.840E+01)	2H 30 MILES NNE	-4.23E+01 (-1.335E+02 -	(6/6) 5.864E+01)	-4.23E+01 (-1.335E+02 -	(6/6) 5.864E+01)	0
	CS-134	13	130	-2.10E+01 (-7.598E+01 -	(7/7) 1.623E+01)	2H 30 MILES NNE	-3.54E+00 (-2.001E+01 -	(6/6) 2.574E+01)	-3.54E+00 (-2.001E+01 -	(6/6) 2.574E+01)	0
	CS-137	13	150	8.63E-01 (-6.373E+00 -	(7/7) 2.453E+01)	IND 0.9-1.4 MILES ESE	2.07E+00 (-5.524E+00 -	(6/6) 2.453E+01)	-3.18E+00 (-4.400E+01 -	(6/6) 5.391E+01)	0
Sediment (pCi/kg dry)	GAMMA	6									
	K-40	6	N/A	1.21E+04 (9.673E+03 -	(4/4) 1.323E+04)	7B 1.2 MILES SE	1.28E+04 (1.259E+04 -	(2/2) 1.305E+04)	1.16E+04 (9.811E+03 -	(2/2) 1.336E+04)	0
	CS-134	6	150	6.30E-01 (-2.263E+01 -	(4/4) 2.031E+01)	7B 1.2 MILES SE	4.37E+00 (-1.158E+01 -	(2/2) 2.031E+01)	-1.01E+01 (-1.755E+01 -	(2/2) -2.627E+00)	0
	CS-137	6	180	8.69E+00 (-1.161E+00 -	(4/4) 3.055E+01)	2B 1.6 MILES NNE	4.54E+01 (3.191E+01 -	(2/2) 5.878E+01)	4.54E+01 (3.191E+01 -	(2/2) 5.878E+01)	0
	RA-226	6	N/A	1.61E+03 (1.118E+03 -	(4/4) 2.049E+03)	2B 1.6 MILES NNE	1.95E+03 (1.657E+03 -	(2/2) 2.245E+03)	1.95E+03 (1.657E+03 -	(2/2) 2.245E+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, 2014 to January 01, 2016

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSIS PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN (3) RANGE	CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASURMENTS
Sediment (cont'd) (pCi/kg dry)	AC-228	6	N/A	1.06E+03 (4/4) (7.954E+02 - 1.229E+03)	7B 1.2 MILES SE	1.20E+03 (2/2) (1.165E+03 - 1.229E+03)	1.13E+03 (2/2) (9.637E+02 - 1.297E+03)	0
	TH-228	6	N/A	1.02E+03 (4/4) (7.874E+02 - 1.272E+03)	2B 1.6 MILES NNE	1.15E+03 (2/2) (1.012E+03 - 1.282E+03)	1.15E+03 (2/2) (1.012E+03 - 1.282E+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).

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	AP/C
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	AP/C, Soil, 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
10D3	3.5 mi.SSW;	41.045449	-76.171899	Milk

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.	
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
8G1 **	12 mi.SSE;	40.928886	-76.055092	Soil
8G1 **	12 mi.SSE;	40.928886	-76.055092	Precipitation
8G1 **	12 mi.SSE;	40.928886	-76.055092	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 DEG.	LONGITUDINAL DEG.	SAMPLE TYPE
LESS THAN ONE MILE FROM THE SSES				
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

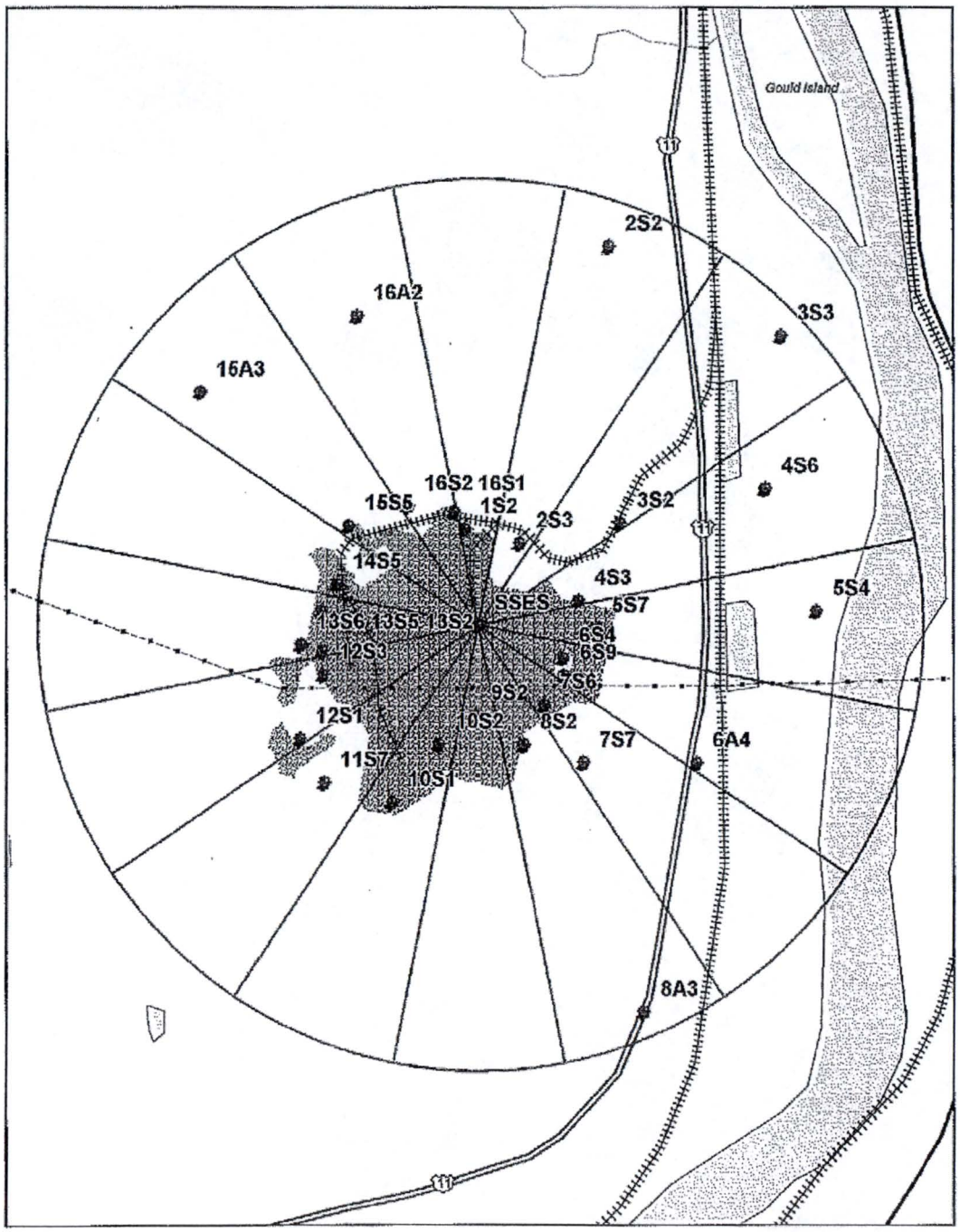
TABLE B-2 (cont'd)

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

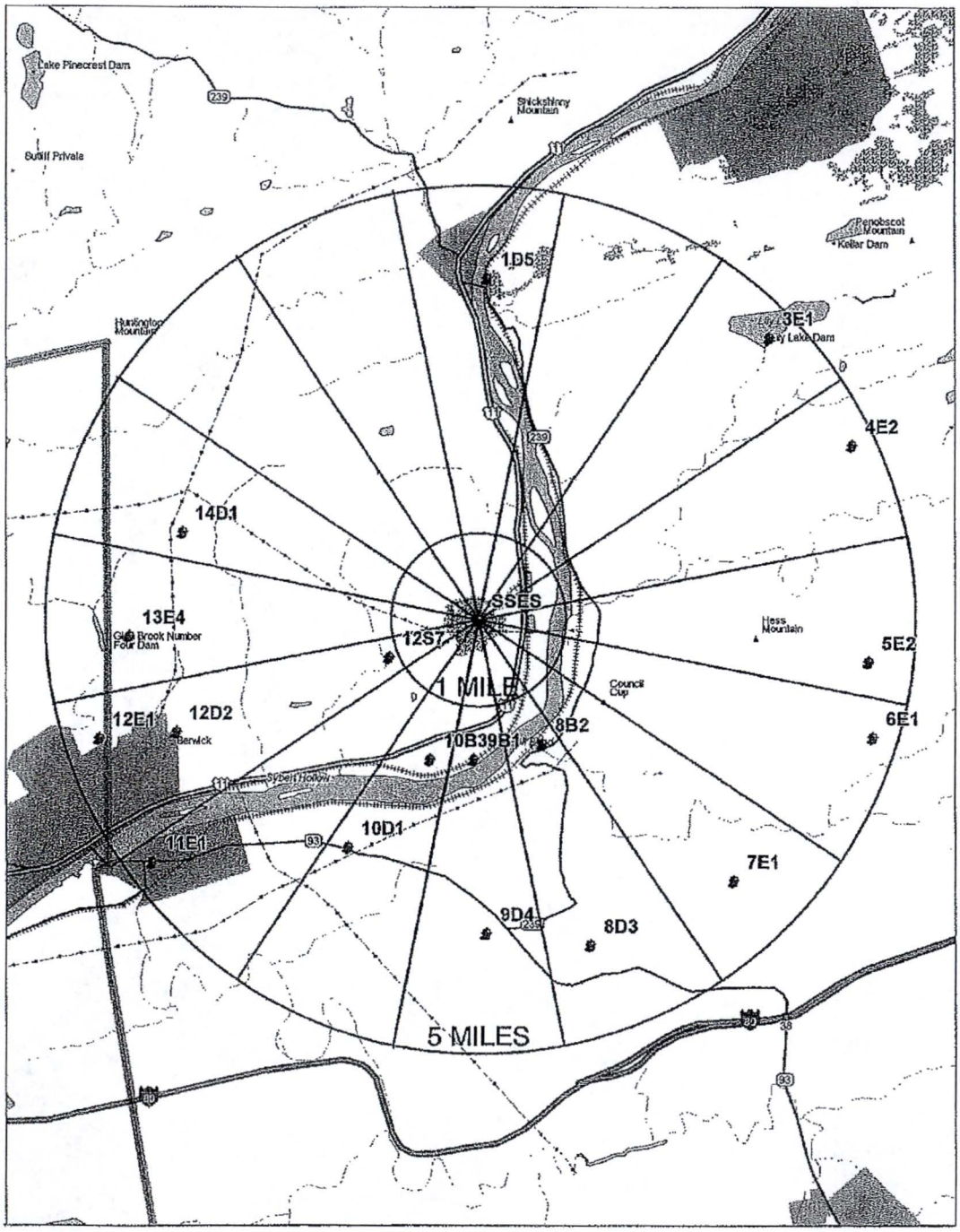
MAP B-1

Direct Radiation Monitoring Locations Within One Mile



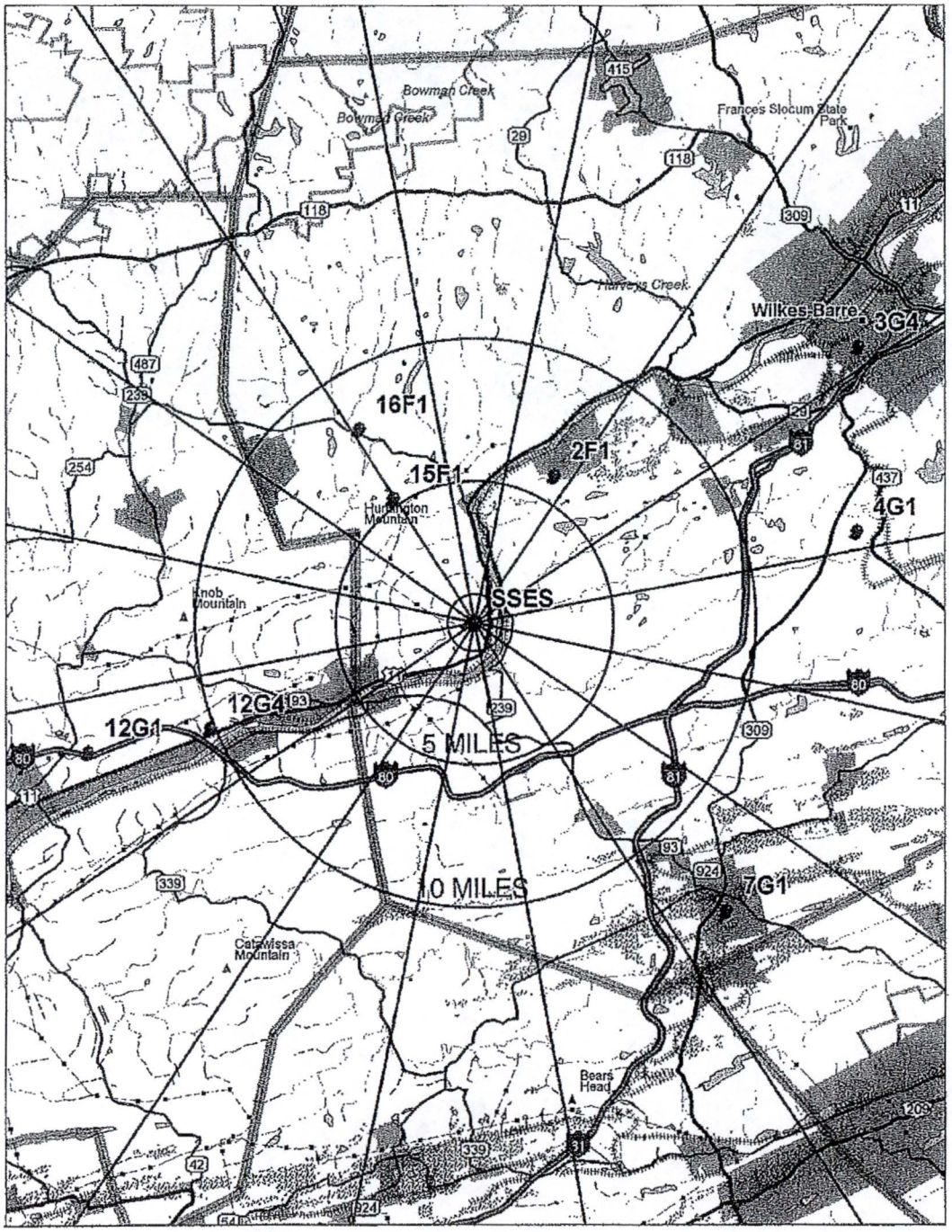
MAP B-2

Direct Radiation Monitoring Locations From One to Five Miles



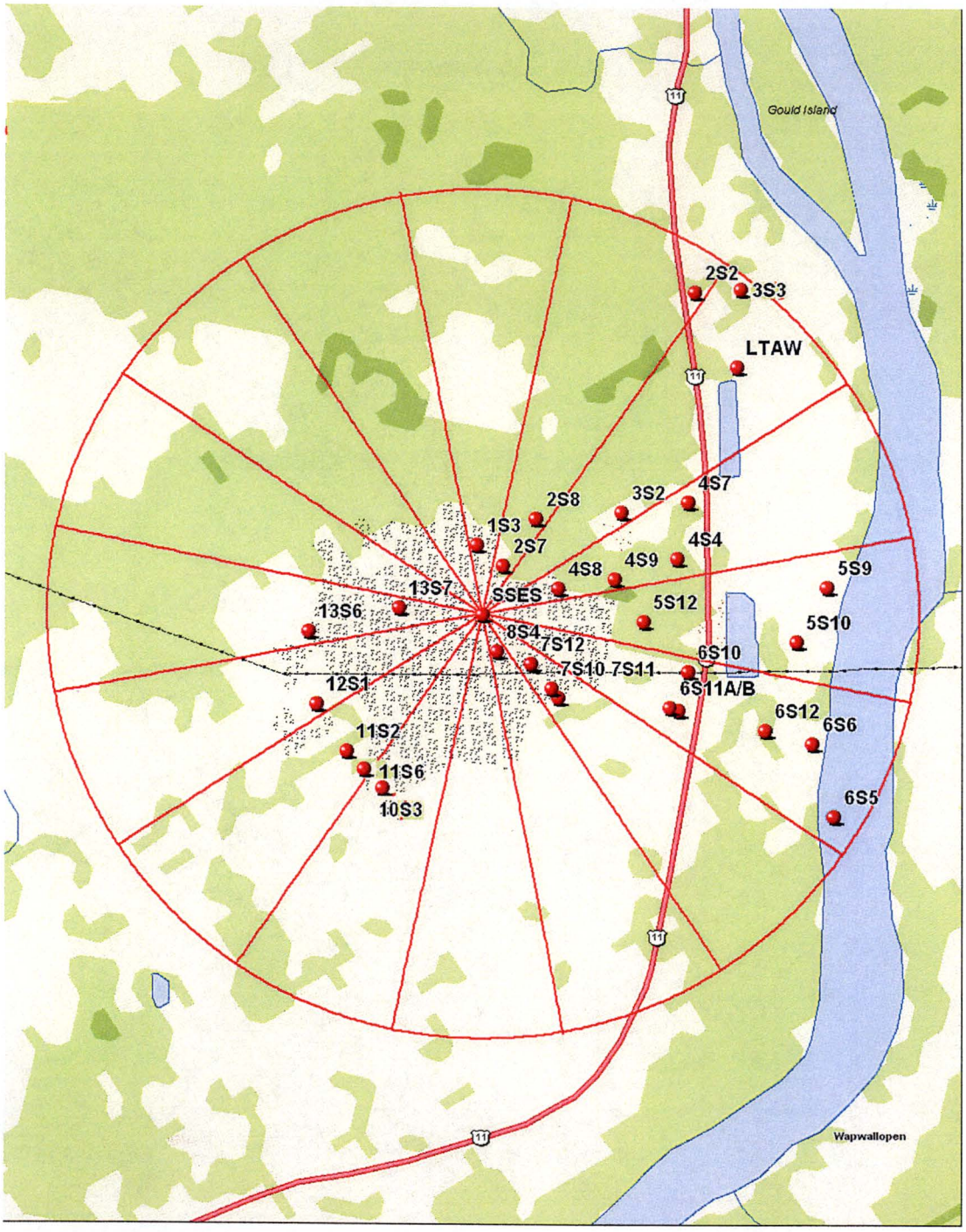
MAP B-3

Direct Radiation Monitoring Locations Greater Than Five Miles



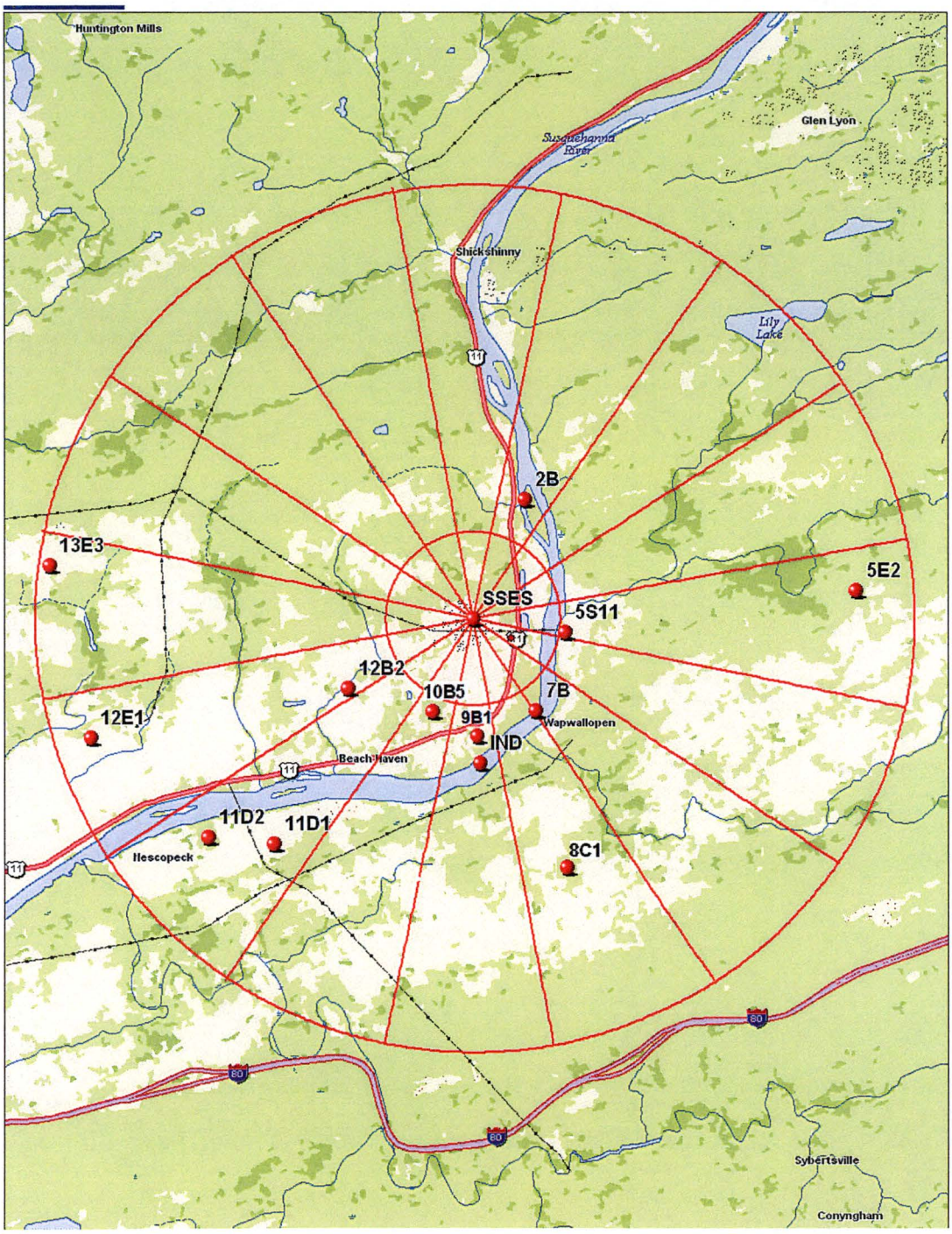
MAP B-4

Environmental Sampling Locations Within One Mile



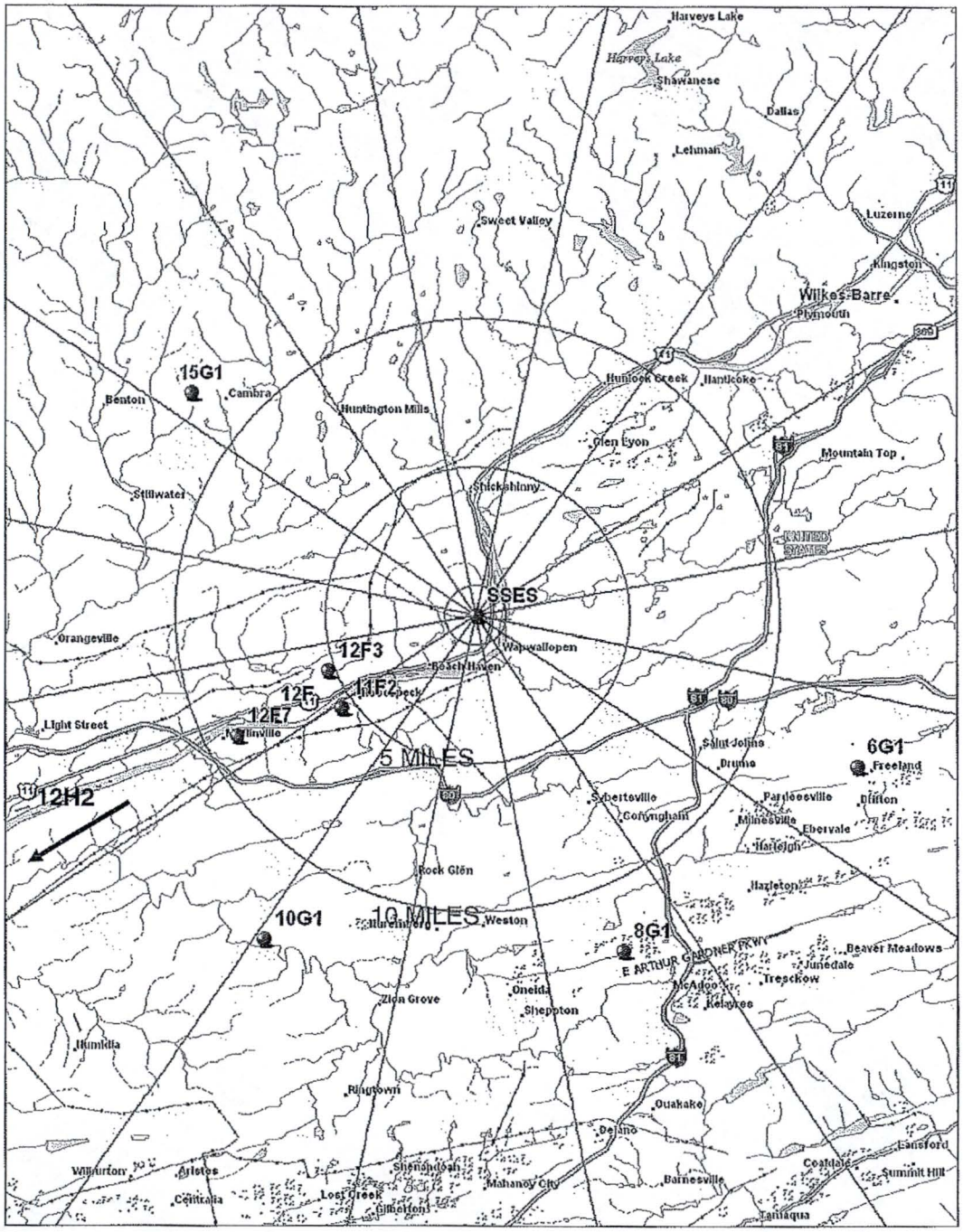
MAP B-5

Environmental Sampling Locations Within One to Five Miles



MAP B-6

Environmental Sampling Locations Greater Than Five Miles



APPENDIX C

DATA TABLES

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TABLE C-1 **GROSS BETA ANALYSES OF AIR PARTICULATE FILTERS SUSQUEHANNA STEAM ELECTRIC STATION, 2015**

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

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

(1) SEE PROGRAM CHANGES SECTION FOR EXPLANATION

TABLE C-1 **GROSS BETA ANALYSES OF AIR PARTICULATE FILTERS SUSQUEHANNA STEAM ELECTRIC STATION, 2015**

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

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

TABLE C-2 GAMMA SPECTROSCOPIC ANALYSES OF COMPOSITED AIR PARTICULATE FILTERS SUSQUEHANNA STEAM ELECTRIC STATION, 2015

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

SITE	COLLECTION PERIOD	Be-7	K-40	Cs-134	Cs-137
6G1	12/30/14 - 04/01/15	86 ± 25	< 17	< 1	< 1
	04/01/15 - 07/01/15	113 ± 29	< 37	< 2	< 2
	07/01/15 - 09/30/15	97 ± 42	< 18	< 2	< 2
	09/30/15 - 12/30/15	81 ± 21	< 24	< 1	< 1
	AVERAGE	94 ± 28	-	-	-
8G1	12/30/14 - 04/01/15	78 ± 23	< 20	< 1	< 1
	04/01/15 - 07/01/15	94 ± 23	< 17	< 1	< 1
	07/01/15 - 09/30/15	143 ± 25	< 17	< 1	< 1
	09/30/15 - 12/30/15	84 ± 19	20 ± 9	< 1	< 1
	AVERAGE	100 ± 59	20 ± 0	-	-
3S2	12/30/14 - 04/01/15	99 ± 20	< 22	< 1	< 1
	04/01/15 - 07/01/15	104 ± 21	< 16	< 1	< 1
	07/01/15 - 09/30/15	144 ± 30	< 28	< 2	< 2
	09/30/15 - 12/30/15	84 ± 20	< 10	< 1	< 1
	AVERAGE	108 ± 52	-	-	-
12E1	12/30/14 - 04/01/15	95 ± 39	< 31	< 2	< 2
	04/01/15 - 07/01/15	101 ± 20	< 18	< 1	< 1
	07/01/15 - 09/30/15	149 ± 25	< 13	< 1	< 1
	09/30/15 - 12/30/15	67 ± 29	< 30	< 2	< 2
	AVERAGE	103 ± 69	-	-	-
12S1	12/30/14 - 04/01/15	96 ± 24	< 24	< 1	< 1
	04/01/15 - 07/01/15	82 ± 19	< 18	< 1	< 1
	07/01/15 - 09/30/15	107 ± 21	< 20	< 1	< 1
	09/30/15 - 12/30/15	66 ± 24	< 16	< 1	< 1
	AVERAGE	88 ± 35	-	-	-
13S6	12/30/14 - 04/01/15	110 ± 27	< 16	< 1	< 1
	04/01/15 - 07/01/15	93 ± 20	< 22	< 1	< 1
	07/01/15 - 09/30/15	126 ± 26	< 9	< 1	< 1
	09/30/15 - 12/30/15	70 ± 15	< 13	< 1	< 1
	AVERAGE	100 ± 48	-	-	-

TABLE C-2 GAMMA SPECTROSCOPIC ANALYSES OF COMPOSITED AIR PARTICULATE FILTERS SUSQUEHANNA STEAM ELECTRIC STATION, 2015

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

SITE	COLLECTION PERIOD	Be-7	K-40	Cs-134	Cs-137
10S3	12/30/14 - 04/01/15	104 ± 37	< 30	< 1	< 1
	04/01/15 - 07/01/15	100 ± 24	< 17	< 1	< 1
	07/01/15 - 09/30/15	107 ± 30	< 23	< 2	< 2
	09/30/15 - 12/30/15	82 ± 18	< 17	< 1	< 1
	AVERAGE	98 ± 23	-	-	-
9B1	12/30/14 - 04/01/15	108 ± 29	< 29	< 2	< 2
	04/01/15 - 07/01/15	95 ± 22	< 13	< 1	< 1
	07/01/15 - 09/30/15	97 ± 28	< 14	< 1	< 1
	09/30/15 - 12/30/15	74 ± 23	< 23	< 2	< 1
	AVERAGE	94 ± 28	-	-	-

TABLE C-3 **IODINE-131 ANALYSES OF AIR IODINE SAMPLES SUSQUEHANNA STEAM ELECTRIC STATION, 2015**

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

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

(1) SEE PROGRAM CHANGES SECTION FOR EXPLANATION

TABLE C-3 **IODINE-131 ANALYSES OF AIR IODINE SAMPLES SUSQUEHANNA STEAM ELECTRIC STATION, 2015**

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

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

TABLE C-4 **ENVIRONMENTAL OPTICALLY STIMULATED LUMINESCENCE DOSIMETRY RESULTS SUSQUEHANNA STEAM ELECTRIC STATION, 2015**

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

LOCATION	First Quarter 1/9/2015 to 4/10/2015	Second Quarter 4/10/2015 to 7/6/2015	Third Quarter 7/6/2015 to 10/8/2015	Fourth Quarter 10/8/2015 to 1/7/2016
ONSITE				
1S2	25.8 ± 2.2	24.5 ± 2.1	24.6 ± 2.2	29.4 ± 0.7
2S2	16.8 ± 1.3	17.0 ± 0.3	16.4 ± 1.4	18.3 ± 1.6
2S3	21.5 ± 1.1	23.9 ± 0.2	21.6 ± 0.8	23.4 ± 1.2
3S2	16.6 ± 1.3	19.2 ± 0.4	13.2 ± 0.3	18.0 ± 0.8
3S3	14.6 ± 0.6	16.0 ± 1.3	14.5 ± 0.4	16.7 ± 0.3
4S3	23.8 ± 1.2	22.9 ± 1.9	20.7 ± 0.4	25.2 ± 0.6
4S6	15.7 ± 2.8	17.1 ± 0.1	13.5 ± 0.1	16.7 ± 0.4
5S4	14.4 ± 0.6	15.1 ± 0.4	12.4 ± 1.9	17.0 ± 2.1
5S7	18.1 ± 0.3	17.1 ± 1.5	15.6 ± 0.9	24.4 ± 0.9
6S4	27.8 ± 0.6	26.0 ± 0.1	23.9 ± 0.4	28.7 ± 0.4
6S9	25.9 ± 1.2	23.0 ± 0.2	25.7 ± 1.9	31.0 ± 0.6
7S6	20.8 ± 1.2	20.0 ± 1.5	22.6 ± 2.6	29.3 ± 1.7
7S7	14.1 ± 0.7	15.4 ± 1.2	14.2 ± 1.7	16.3 ± 0.5
8S2	27.1 ± 0.2	24.3 ± 1.2	23.5 ± 1.9	33.2 ± 0.0
9S2	48.2 ± 2.6	33.4 ± 1.5	41.0 ± 1.7	56.5 ± 1.6
10S1	17.0 ± 0.4	16.9 ± 0.2	13.9 ± 0.1	23.1 ± 0.9
10S2	34.1 ± 1.1	30.6 ± 0.8	33.7 ± 2.4	43.1 ± 1.4
11S7	16.3 ± 0.5	16.2 ± 1.7	14.5 ± 0.3	41.1 ± 2.8
12S1	18.9 ± 0.7	18.3 ± 1.0	16.2 ± 0.1	45.8 ± 1.6
12S3	29.1 ± 1.6	21.8 ± 0.0	18.0 ± 0.8	45.4 ± 1.0
12S7	15.5 ± 0.6	16.1 ± 0.7	13.5 ± 1.7	16.2 ± 0.1
13S2	23.0 ± 3.4	24.9 ± 3.7	25.9 ± 1.1	41.3 ± 1.1
13S5	25.7 ± 3.3	25.8 ± 2.5	28.8 ± 5.2	42.3 ± 1.7
13S6	23.2 ± 1.0	22.5 ± 0.6	21.2 ± 1.8	38.8 ± 0.1
14S5	21.4 ± 1.3	21.0 ± 0.2	20.3 ± 1.6	35.0 ± 1.1
15S5	19.6 ± 0.7	18.0 ± 0.1	18.4 ± 2.8	20.0 ± 0.1
16S1	22.5 ± 1.1	25.0 ± 3.4	23.6 ± 0.6	25.0 ± 0.2
16S2	23.6 ± 2.3	23.8 ± 0.7	23.4 ± 0.9	24.1 ± 1.8

See the comments at the end of this table.

TABLE C-4 **ENVIRONMENTAL OPTICALLY STIMULATED LUMINESCENCE DOSIMETRY RESULTS SUSQUEHANNA STEAM ELECTRIC STATION, 2015**

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

LOCATION	First Quarter 1/9/2015 to 4/10/2015	Second Quarter 4/10/2015 to 7/6/2015	Third Quarter 7/6/2015 to 10/8/2015	Fourth Quarter 10/8/2015 to 1/7/2016
0-1 MILE OFFSITE				
6A4	18.2 ± 1.4	19.8 ± 1.6	17.1 ± 1.7	20.9 ± 0.7
8A3	15.6 ± 0.9	15.5 ± 2.1	14.2 ± 0.7	15.7 ± 1.2
15A3	14.2 ± 0.6	15.6 ± 0.1	14.5 ± 0.0	18.0 ± 1.5
16A2	14.8 ± 0.6	15.1 ± 0.2	13.2 ± 0.8	15.6 ± 1.0
1-2 MILES OFFSITE				
8B2	16.5 ± 0.9	15.9 ± 0.5	13.6 ± 0.0	11.1 ± 1.4
9B1	20.4 ± 0.6	22.8 ± 1.1	19.2 ± 1.0	22.0 ± 0.9
10B3	15.8 ± 0.3	16.7 ± 1.0	13.2 ± 0.5	15.0 ± 0.8
2-4 MILES OFFSITE				
1D5	16.8 ± 0.9	17.8 ± 0.2	17.2 ± 0.8	15.5 ± 2.8
8D3	16.9 ± 0.2	16.7 ± 0.9	16.8 ± 1.0	13.5 ± 1.1
9D4	15.8 ± 3.1	18.1 ± 1.0	15.2 ± 0.0	16.4 ± 0.1
10D1	17.9 ± 2.4	17.0 ± 1.1	14.0 ± 0.3	13.1 ± 1.1
12D2	16.6 ± 0.7	19.4 ± 0.7	18.3 ± 0.6	19.6 ± 0.9
14D1	17.8 ± 0.6	17.4 ± 1.4	15.5 ± 0.1	16.5 ± 0.3
4-5 MILES OFFSITE				
3E1	14.2 ± 0.6	13.8 ± 0.2	13.1 ± 1.2	10.2 ± 0.6
4E2	18.8 ± 0.9	18.6 ± 0.2	17.1 ± 1.7	14.3 ± 0.4
5E2	17.4 ± 1.1	17.7 ± 1.5	15.7 ± 1.4	13.7 ± 0.6
6E1	19.3 ± 0.2	19.8 ± 2.1	16.9 ± 1.2	16.9 ± 0.9
7E1	18.6 ± 0.0	17.5 ± 0.8	16.0 ± 1.0	14.7 ± 0.4
11E1	13.6 ± 1.3	12.8 ± 1.0	10.1 ± 0.7	11.4 ± 0.4
12E1	15.9 ± 0.6	17.6 ± 2.6	13.5 ± 0.3	15.2 ± 0.3
13E4	16.3 ± 0.9	20.2 ± 0.9	18.7 ± 1.7	24.4 ± 0.3

See the comments at the end of this table.

TABLE C-4 **ENVIRONMENTAL OPTICALLY STIMULATED LUMINESCENCE DOSIMETRY RESULTS SUSQUEHANNA STEAM ELECTRIC STATION, 2015**

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

LOCATION	First Quarter 1/9/2015 to 4/10/2015	Second Quarter 4/10/2015 to 7/6/2015	Third Quarter 7/6/2015 to 10/8/2015	Fourth Quarter 10/8/2015 to 1/7/2016
5-10 MILES OFFSITE				
2F1	16.9 ± 0.6	17.4 ± 1.1	14.7 ± 1.5	13.8 ± 0.9
15F1	17.3 ± 2.1	19.8 ± 0.3	17.4 ± 1.1	18.2 ± 1.1
16F1	20.1 ± 1.2	20.1 ± 0.4	17.2 ± 0.6	21.1 ± 1.8
10-20 MILES OFFSITE				
3G4	21.8 ± 1.6	18.4 ± 1.2	16.0 ± 0.8	17.2 ± 1.0
4G1	19.6 ± 0.6	19.2 ± 0.6	16.6 ± 1.9	15.7 ± 1.6
7G1	17.1 ± 0.9	16.5 ± 2.0	15.2 ± 1.5	14.0 ± 0.4
12G1	15.1 ± 0.4	14.9 ± 1.0	15.4 ± 1.0	9.2 ± 0.4
12G4	16.8 ± 2.6	15.7 ± 0.4	13.4 ± 0.5	13.3 ± 0.1

See the comments at the end of this table.

LOCATION				
INDICATOR				
Average (5)	23.5 ± 3.8	19.0 ± 8.2	18.2 ± 8.0	20.7 ± 11.3
CONTROL				
Average (5)	22.7 ± 0.7	17.0 ± 4.4	16.6 ± 2.6	17.2 ± 2.7

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, 2015**

Results in pCi/Liter ± 2 sigma

SITE	COLLECTION PERIOD	I-131	K-40	Cs-134	Cs-137	Ba-140	La-140	Th-228
10G1	01/05/15	< 0.4	1477 ± 133	< 5	< 5	< 19	< 3	< 8
	02/04/15	< 0.7	1298 ± 143	< 6	< 7	< 38	< 10	< 14
	03/09/15	< 0.5	1185 ± 183	< 7	< 7	< 48	< 7	< 15
	04/06/15	< 0.3	1249 ± 159	< 6	< 7	< 40	< 13	< 13
	04/20/15	< 0.5	1478 ± 130	< 5	< 7	< 45	< 11	< 12
	05/04/15	< 0.2	1269 ± 119	< 5	< 5	< 34	< 7	< 11
	05/18/15	< 0.6	1470 ± 306	< 7	< 11	< 45	< 9	< 16
	06/01/15	< 0.3	1345 ± 141	< 6	< 7	< 36	< 10	< 14
	06/15/15	< 0.2	1235 ± 229	< 7	< 9	< 30	< 10	< 16
	06/29/15	< 0.4	1039 ± 219	< 9	< 13	< 55	< 14	< 16
	07/14/15	< 0.7	1171 ± 166	< 5	< 6	< 21	< 6	< 12
	07/27/15	< 0.2	1262 ± 110	< 5	< 5	< 26	< 7	< 9
	08/10/15	< 0.3	1166 ± 144	< 6	< 7	< 44	< 13	< 13
	08/24/15	< 0.6	1411 ± 182	< 8	< 9	< 30	< 8	< 17
	09/08/15	< 0.3	1258 ± 191	< 9	< 10	< 32	< 11	< 17
	09/22/15	< 0.3	1195 ± 163	< 8	< 8	< 29	< 8	< 17
	10/06/15	< 0.2	1514 ± 294	< 10	< 11	< 40	< 10	< 23
	10/20/15	< 0.6	1268 ± 214	< 9	< 10	< 44	< 7	< 20
	11/09/15	< 0.6	1244 ± 144	< 7	< 7	< 28	< 8	< 12
	12/07/15	< 0.4	1415 ± 181	< 7	< 8	< 33	< 9	< 18
	AVERAGE	-	1297 ± 254	-	-	-	-	-
13E3	01/05/15	< 0.9	1432 ± 159	< 6	< 7	< 25	< 8	< 10
	02/04/15	< 0.7	1502 ± 167	< 6	< 7	< 35	< 10	< 11
	03/09/15	< 0.5	1444 ± 184	< 7	< 7	< 45	< 13	< 13
	04/06/15	< 0.5	1438 ± 167	< 7	< 9	< 44	< 14	< 14
	04/20/15	< 0.5	1321 ± 125	< 5	< 6	< 42	< 11	< 12
	05/04/15	< 0.4	1487 ± 149	< 6	< 6	< 39	< 14	< 13
	05/18/15	< 0.5	1353 ± 261	< 11	< 10	< 46	< 11	< 23
	06/01/15	< 0.4	1270 ± 163	< 3	< 5	< 26	< 5	< 9
	06/15/15	< 0.2	1377 ± 242	< 9	< 9	< 47	< 13	< 14
	06/29/15	< 0.4	1334 ± 197	< 8	< 9	< 55	< 15	< 15
	07/14/15	< 0.8	1295 ± 210	< 8	< 8	< 34	< 11	< 15
	07/27/15	< 0.2	1387 ± 127	< 4	< 5	< 23	< 9	< 10
	08/10/15	< 0.5	1580 ± 174	< 6	< 6	< 37	< 9	< 13
	08/24/15	< 0.5	1365 ± 225	< 8	< 11	< 32	< 12	< 15
	09/08/15	< 0.3	1520 ± 233	< 7	< 10	< 33	< 7	< 16
	09/22/15	< 0.4	1468 ± 241	< 11	< 11	< 41	< 10	< 20
	10/06/15	< 0.3	1248 ± 148	< 7	< 10	< 28	< 7	< 13
	10/20/15	< 0.6	1135 ± 230	< 12	< 14	< 46	< 14	< 23
	11/09/15	< 0.9	1273 ± 168	< 6	< 9	< 30	< 10	< 13
	12/07/15	< 0.5	1380 ± 224	< 8	< 10	< 36	< 11	< 17
	AVERAGE	-	1380 ± 215	-	-	-	-	-

TABLE C-5 **IODINE-131 AND GAMMA SPECTROSCOPIC ANALYSES OF MILK SUSQUEHANNA STEAM ELECTRIC STATION, 2015**

Results in pCi/Liter ± 2 sigma

SITE	COLLECTION PERIOD	I-131	K-40	Cs-134	Cs-137	Ba-140	La-140	Th-228
5E2	01/05/15	< 0.5	1255 ± 102	< 4	< 4	< 16	< 4	< 9
	02/04/15	< 0.5	1408 ± 166	< 6	< 7	< 33	< 7	< 13
	03/09/15	< 0.6	1393 ± 141	< 3	< 3	< 20	< 5	< 8
	04/06/15	< 0.3	1469 ± 172	< 6	< 6	< 40	< 12	< 15
	04/20/15	< 0.8	1446 ± 167	< 6	< 7	< 47	< 14	< 14
	05/04/15	< 0.3	1511 ± 128	< 5	< 5	< 34	< 10	< 10
	05/18/15	< 0.7	1131 ± 225	< 11	< 10	< 38	< 13	< 21
	06/01/15	< 0.4	1334 ± 145	< 5	< 7	< 30	< 9	< 12
	06/15/15	< 0.2	1282 ± 209	< 9	< 9	< 31	< 7	< 18
	06/29/15	< 0.3	1175 ± 166	< 6	< 6	< 31	< 12	< 13
	07/14/15	< 0.9	1235 ± 175	< 6	< 8	< 35	< 6	< 14
	07/27/15	< 0.2	1423 ± 115	< 5	< 6	< 25	< 7	< 9
	08/10/15	< 0.5	1262 ± 123	< 4	< 5	< 26	< 10	< 10
	08/24/15	< 0.6	1515 ± 214	< 8	< 11	< 33	< 10	< 18
	09/08/15	< 0.3	1304 ± 210	< 11	< 13	< 40	< 12	< 20
	09/22/15	< 0.3	1420 ± 227	< 9	< 9	< 31	< 9	< 18
	10/06/15	< 0.2	1482 ± 190	< 6	< 8	< 26	< 3	< 14
	10/20/15	< 0.6	1443 ± 227	< 11	< 10	< 39	< 7	< 20
	11/09/15	< 0.7	1479 ± 174	< 6	< 7	< 34	< 8	< 14
	12/07/15	< 0.5	1452 ± 252	< 6	< 7	< 29	< 11	< 16
	AVERAGE	-	1371 ± 230	-	-	-	-	-

TABLE C-6 **TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF GROUND WATER SUSQUEHANNA STEAM ELECTRIC STATION, 2015**

Results in pCi/Liter ± 2 sigma

SITE	COLLECTION PERIOD	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	Th-228
12F3	03/09/15	< 147	< 33	< 3	< 4	< 9	< 3	< 7	< 4	< 6	< 10	< 3	< 3	< 19	< 6	< 6
	06/11/15	< 141	< 77	< 4	< 4	< 13	< 4	< 9	< 5	< 9	< 10	< 4	< 5	< 25	< 8	< 8
	08/31/15	< 147	< 48	< 5	< 6	< 11	< 6	< 13	< 7	< 9	< 8	< 6	< 6	< 28	< 7	< 11
	11/17/15	< 147	< 173	< 8	< 8	< 17	< 8	< 22	< 11	< 14	< 12	< 9	< 9	< 35	< 14	< 21
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2S2	03/09/15	< 146	< 56	< 3	< 4	< 10	< 4	< 6	< 4	< 6	< 11	< 3	< 4	< 22	< 8	< 7
	06/11/15	< 146	< 46	< 5	< 5	< 14	< 5	< 8	< 4	< 9	< 13	< 5	< 5	< 29	< 11	< 9
	08/31/15	< 145	< 113	< 7	< 7	< 18	< 8	< 12	< 9	< 13	< 10	< 7	< 6	< 34	< 9	< 15
	11/16/15	< 148	< 77	< 3	< 8	< 11	< 4	< 16	< 6	< 11	< 11	< 8	< 10	< 27	< 6	< 16
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2S8	02/11/15	< 142	< 65	< 4	< 4	< 9	< 3	< 6	< 5	< 8	< 15	< 6	< 5	< 31	< 5	< 11
	05/28/15	< 144	< 22	< 1	< 1	< 4	< 1	< 3	< 2	< 2	< 5	< 1	< 1	< 10	< 3	< 2
	08/10/15	< 142	< 56	< 6	< 6	< 17	< 6	< 12	< 7	< 11	< 14	< 6	< 6	< 38	< 10	< 12
	11/09/15	< 146	43 ± 28	< 1	< 1	< 3	< 1	< 3	< 2	< 3	< 4	< 1	< 1	< 9	< 2	< 3
	AVERAGE	-	43 ± 0	-	-	-	-	-	-	-	-	-	-	-	-	-
4S4	03/09/15	< 145	< 94	< 4	< 5	< 13	< 4	< 9	< 5	< 9	< 11	< 4	< 5	< 31	< 8	13 ± 5
	06/11/15	< 139	< 41	< 4	< 4	< 12	< 4	< 8	< 4	< 8	< 11	< 4	< 5	< 26	< 7	< 8
	08/31/15	< 146	< 81	< 8	< 8	< 18	< 9	< 17	< 8	< 16	< 11	< 7	< 8	< 33	< 9	< 17
	11/16/15	< 148	< 101	< 9	< 9	< 22	< 9	< 21	< 10	< 15	< 12	< 11	< 9	< 38	< 13	< 17
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13 ± 0
6S10	03/09/15	< 148	< 108	< 4	< 4	< 13	< 5	< 10	< 5	< 9	< 15	< 4	< 5	< 33	< 11	< 9
	06/11/15	< 139	< 71	< 5	< 5	< 15	< 4	< 9	< 5	< 8	< 11	< 5	< 5	< 27	< 11	< 9
	08/31/15	< 145	< 32	< 6	< 6	< 17	< 8	< 13	< 5	< 12	< 9	< 6	< 6	< 31	< 10	< 13
	11/16/15	< 144	< 65	< 4	< 4	< 10	< 3	< 8	< 3	< 6	< 7	< 4	< 4	< 19	< 6	< 9
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11S2	03/09/15	< 138	< 98	< 5	< 5	< 12	< 4	< 7	< 5	< 10	< 13	< 4	< 5	< 32	< 7	< 10
	06/11/15	< 142	174 ± 60	< 5	< 5	< 22	< 6	< 13	< 7	< 10	< 13	< 4	< 5	< 32	< 8	< 9
	08/31/15	< 149	< 92	< 7	< 7	< 20	< 8	< 17	< 9	< 14	< 11	< 8	< 8	< 34	< 12	< 14
	11/16/15	< 147	< 98	< 4	< 5	< 12	< 4	< 10	< 5	< 8	< 8	< 4	< 5	< 21	< 7	< 9
	AVERAGE	-	174 ± 0	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE C-6 **TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF GROUND WATER**
SUSQUEHANNA STEAM ELECTRIC STATION, 2015

Results in pCi/Liter ± 2 sigma

SITE	COLLECTION PERIOD	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	Th-228
13S7	02/12/15	(1)														
	05/09/15	< 143	< 52	< 2	< 3	< 9	< 2	< 4	< 3	< 4	< 7	< 2	< 2	< 40	< 12	< 4
	08/07/15	< 148	< 51	< 5	< 5	< 15	< 5	< 9	< 5	< 8	< 15	< 5	< 5	< 30	< 10	< 10
	10/27/15	< 147	< 15	< 2	< 2	< 6	< 2	< 3	< 2	< 3	< 12	< 2	< 2	< 20	< 6	< 3
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1S3	02/08/15	< 140	< 35	< 3	< 4	< 12	< 4	< 8	< 5	< 8	< 15	< 4	< 4	< 32	< 8	< 9
	05/09/15	212 ± 97	< 42	< 2	< 2	< 9	< 1	< 5	< 3	< 5	< 5	< 2	< 2	< 36	< 12	< 5
	08/07/15	< 150	< 112	< 5	< 7	< 9	< 6	< 11	< 7	< 12	< 13	< 5	< 7	< 35	< 13	< 12
	10/27/15	< 146	< 29	< 1	< 2	< 5	< 2	< 3	< 2	< 3	< 12	< 2	< 2	< 18	< 6	< 3
	AVERAGE	212 ± 0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4S8	02/08/15	< 139	< 64	< 4	< 4	< 9	< 4	< 6	< 4	< 8	< 14	< 3	< 3	< 31	< 7	< 7
	05/09/15	272 ± 101	53 ± 35	< 2	< 2	< 7	< 1	< 4	< 2	< 4	< 6	< 2	< 2	< 36	< 13	< 4
	08/07/15	167 ± 99	< 46	< 5	< 5	< 15	< 6	< 9	< 5	< 8	< 15	< 5	< 5	< 28	< 10	< 10
	10/27/15	< 146	60 ± 32	< 2	< 2	< 7	< 2	< 4	< 2	< 4	< 15	< 2	< 2	< 24	< 8	< 4
	AVERAGE	220 ± 148	56 ± 10	-	-	-	-	-	-	-	-	-	-	-	-	-
4S9	02/11/15	< 139	< 92	< 5	< 5	< 14	< 5	< 10	< 6	< 11	< 14	< 5	< 6	< 31	< 10	< 10
	05/27/15	162 ± 97	< 30	< 4	< 4	< 11	< 4	< 7	< 4	< 8	< 14	< 4	< 4	< 26	< 8	< 8
	12/14/15	< 142	< 131	< 6	< 6	< 16	< 7	< 11	< 6	< 11	< 12	< 7	< 7	< 34	< 9	< 15
	AVERAGE	162 ± 0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6S11A	02/11/15	< 146	< 34	< 4	< 4	< 8	< 4	< 8	< 4	< 8	< 11	< 3	< 4	< 24	< 10	< 7
	05/27/15	145 ± 95	< 63	< 7	< 7	< 20	< 7	< 13	< 8	< 11	< 12	< 7	< 7	< 35	< 11	< 11
	08/10/15	224 ± 102	< 117	< 5	< 8	< 21	< 8	< 16	< 7	< 12	< 14	< 5	< 7	< 37	< 11	< 13
	11/02/15	< 146	61 ± 28	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 7	< 2	< 2	< 15	< 5	< 4
	AVERAGE	185 ± 112	61 ± 0	-	-	-	-	-	-	-	-	-	-	-	-	-

(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

TABLE C-6 **TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF GROUND WATER SUSQUEHANNA STEAM ELECTRIC STATION, 2015**

Results in pCi/Liter ± 2 sigma

SITE	COLLECTION PERIOD	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	Th-228
6S12	02/07/15	< 143	< 19	< 2	< 2	< 7	< 2	< 5	< 3	< 4	< 9	< 2	< 2	< 19	< 6	< 4
	05/08/15	< 143	< 23	< 2	< 3	< 10	< 2	< 4	< 3	< 5	< 6	< 2	< 3	< 49	< 14	< 4
	08/06/15	< 143	< 69	< 4	< 4	< 12	< 4	< 9	< 4	< 8	< 14	< 4	< 4	< 30	< 9	< 9
	11/03/15	< 145	< 17	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 8	< 2	< 2	< 16	< 4	< 4
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7S10	02/12/15	< 142	< 45	< 4	< 5	< 13	< 5	< 9	< 5	< 8	< 11	< 5	< 5	< 27	< 10	< 9
	06/03/15	< 144	< 46	< 4	< 4	< 13	< 4	< 9	< 5	< 8	< 8	< 4	< 4	< 23	< 8	< 7
	08/11/15	< 149	< 144	< 6	< 6	< 19	< 6	< 12	< 7	< 11	< 14	< 6	< 6	< 34	< 12	< 13
	11/30/15	< 148	< 193	< 8	< 7	< 28	< 11	< 16	< 9	< 13	< 13	< 7	< 7	< 37	< 12	< 19
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7S11	02/12/15	< 140	< 23	< 5	< 5	< 14	< 5	< 11	< 5	< 9	< 13	< 4	< 5	< 31	< 9	< 9
	06/03/15	< 142	< 94	< 4	< 4	< 13	< 4	< 7	< 4	< 7	< 8	< 4	< 4	< 21	< 7	< 8
	08/11/15	< 138	< 69	< 7	< 8	< 19	< 7	< 14	< 6	< 11	< 13	< 7	< 7	< 35	< 15	< 11
	11/30/15	< 146	< 197	< 8	< 7	< 23	< 7	< 15	< 8	< 13	< 11	< 6	< 10	< 25	< 8	< 14
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8S4	02/08/15	< 139	< 36	< 3	< 4	< 11	< 4	< 8	< 5	< 7	< 15	< 4	< 3	< 29	< 9	< 6
	05/09/15	< 146	< 23	< 2	< 2	< 6	< 2	< 3	< 2	< 3	< 10	< 2	< 2	< 35	< 14	< 4
	08/07/15	221 ± 100	< 48	< 4	< 5	< 11	< 4	< 9	< 4	< 8	< 14	< 4	< 5	< 31	< 8	< 10
	10/27/15	< 271	< 13	< 1	< 2	< 5	< 1	< 3	< 2	< 3	< 11	< 1	< 1	< 17	< 5	< 3
	AVERAGE	269 ± 136	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE C-7

ANNUAL AVERAGE TRITIUM CONCENTRATION IN PRECIPITATION, MONITORING WELLS AND LAKE TOOK-A-WHILE (LTAW) SURFACE WATER DATA SUSQUEHANNA STEAM ELECTRIC STATION, 2015

Results in pCi/Liter ± 2 sigma

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

* 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, 2015**

Results in pCi/Liter ± 2 sigma

	SAMPLING PERIOD				<----------GAMMA EMITTERS---------->												
STATION ID	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	12/29/14 -	01/26/15	2.2 ± 1.4	< 144	< 38	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 14	< 2	< 2	< 22	< 6
12H2	01/26/15 -	03/03/15	< 2.1	< 144	< 14	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 14	< 2	< 2	< 22	< 6
12H2	03/03/15 -	03/31/15	< 2.1	< 150	< 17	< 1	< 1	< 3	< 1	< 2	< 1	< 2	< 14	< 1	< 1	< 17	< 5
12H2	03/31/15 -	04/28/15	< 1.8	< 133	< 31	< 2	< 2	< 7	< 2	< 4	< 2	< 4	< 15	< 2	< 2	< 24	< 8
12H2	04/28/15	06/02/15	< 1.9	< 149	< 31	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 10	< 2	< 2	< 18	< 7
12H2	06/02/15 -	06/30/15	2.0 ± 1.3	< 148	< 26	< 1	< 2	< 5	< 1	< 3	< 2	< 3	< 15	< 1	< 2	< 20	< 6
12H2	06/30/15 -	07/28/15	< 2.1	< 143	< 50	< 2	< 2	< 7	< 2	< 5	< 3	< 5	< 14	< 2	< 2	< 24	< 8
12H2	07/28/15 -	09/01/15	2.2 ± 1.3	< 145	< 15	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 13	< 2	< 2	< 21	< 6
12H2	09/01/15 -	09/29/15	2.8 ± 1.5	< 143	< 14	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 9	< 2	< 2	< 16	< 5
12H2	09/29/15 -	10/27/15	1.8 ± 1.1	< 149	< 46	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 12	< 2	< 2	< 21	< 6
12H2	10/27/15 -	12/01/15	< 2.2	< 146	< 32	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 12	< 1	< 2	< 19	< 6
12H2	12/01/15 -	12/28/15	2.2 ± 1.3	< 143	< 15	< 2	< 2	< 6	< 2	< 3	< 2	< 3	< 10	< 2	< 2	< 18	< 5
		AVERAGE	2.2 ± 0.7	152 ± 0	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE C-9 **GAMMA SPECTROSCOPIC ANALYSES OF FOOD PRODUCTS (FRUITS AND VEGETABLES)**
SUSQUEHANNA STEAM ELECTRIC STATION, 2015

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	6/28/2015	< 225	6021 ± 581	< 56	< 22	< 24	< 100	< 37
	6/28/2015	< 126	6140 ± 356	< 34	< 12	< 14	< 58	< 25
	6/28/2015	< 184	3123 ± 375	< 43	< 18	< 19	< 81	< 26
	7/19/2015	501 ± 197	6932 ± 662	< 49	< 21	< 27	< 105	< 36
	7/19/2015	< 172	5444 ± 528	< 50	< 19	< 21	< 91	< 40
	7/19/2015	< 224	3156 ± 425	< 41	< 16	< 18	< 71	< 31
	8/23/2015	< 173	5175 ± 762	< 33	< 29	< 24	< 114	< 52
	8/23/2015	< 308	6801 ± 832	< 42	< 37	< 37	< 138	< 66
	8/23/2015	< 249	2881 ± 494	< 31	< 24	< 28	< 97	< 54
	9/19/2015	< 271	4439 ± 619	< 35	< 25	< 25	< 87	< 45
	9/19/2015	< 298	5603 ± 846	< 50	< 35	< 33	< 123	< 66
	9/19/2015	< 278	3140 ± 568	< 31	< 18	< 25	< 112	< 47
	10/31/2015	293 ± 178	4406 ± 459	< 46	< 20	< 22	< 84	< 32
	10/31/2015	< 292	5046 ± 609	< 52	< 27	< 26	< 117	< 51
	10/31/2015	409 ± 172	3136 ± 428	< 42	< 19	< 20	< 90	< 36
	AVERAGE	401 ± 209	4859 ± 2843	-	-	-	-	-
11D1	12/4/2015	< 266	7716 ± 865	< 54	< 31	< 32	< 134	< 60
	12/4/2015	< 290	12960 ± 1066	< 53	< 28	< 37	< 141	< 69
	AVERAGE		10338 ± 7416					
11S6	6/28/2015	430 ± 248	5539 ± 671	< 58	< 20	< 25	< 94	< 45
	6/28/2015	309 ± 175	6143 ± 778	< 59	< 30	< 31	< 114	< 43
	6/28/2015	277 ± 184	5686 ± 532	< 51	< 18	< 20	< 79	< 36
	7/19/2015	334 ± 163	6753 ± 491	< 45	< 17	< 19	< 75	< 35
	7/19/2015	544 ± 248	6515 ± 653	< 50	< 23	< 23	< 93	< 41
	7/19/2015	513 ± 167	5079 ± 453	< 35	< 19	< 19	< 77	< 32
	8/23/2015	< 219	5680 ± 700	< 30	< 25	< 26	< 103	< 47
	8/23/2015	< 323	5223 ± 721	< 42	< 34	< 32	< 146	< 70
	8/23/2015	< 244	4663 ± 574	< 29	< 18	< 29	< 103	< 46
	9/19/2015	< 265	5255 ± 748	< 39	< 28	< 29	< 135	< 51
	9/19/2015	< 293	5850 ± 861	< 45	< 34	< 31	< 163	< 68
	9/19/2015	< 329	5245 ± 751	< 38	< 29	< 27	< 95	< 53

TABLE C-9 **GAMMA SPECTROSCOPIC ANALYSES OF FOOD PRODUCTS (FRUITS AND VEGETABLES)**
SUSQUEHANNA STEAM ELECTRIC STATION, 2015

Results in pCi/kg (wet) ± 2 sigma

SITE	COLLECTION PERIOD	Be-7	K-40	I-131	Cs-134	Cs-137	Ac-228	Th-228
	10/31/2015	< 215	4998 ± 571	< 47	< 25	< 26	< 94	< 40
	10/31/2015	384 ± 208	5274 ± 631	< 45	< 21	< 22	< 95	< 39
	10/31/2015	556 ± 231	4197 ± 496	< 47	< 21	< 23	< 88	< 41
	AVERAGE	418 ± 205	5561 ± 1471	-	-	-	-	-
12F7	08/03/15	< 233	2690 ± 371	< 59	< 28	< 28	< 101	< 47
	12/07/15	< 199	2262 ± 584	< 34	< 29	< 32	< 105	< 46
	AVERAGE		2476 ± 605					
3S3	6/28/2015	261 ± 160	4802 ± 562	< 56	< 21	< 21	< 80	< 42
	6/28/2015	< 204	5770 ± 561	< 56	< 20	< 24	< 94	< 33
	6/28/2015	583 ± 227	4410 ± 515	< 59	< 23	< 25	< 95	< 39
	7/19/2015	469 ± 185	6159 ± 489	< 46	< 20	< 22	< 75	< 38
	7/19/2015	474 ± 257	6115 ± 581	< 48	< 18	< 23	< 82	< 39
	7/19/2015	639 ± 217	4607 ± 447	< 38	< 18	< 19	< 64	< 30
	8/23/2015	< 370	5104 ± 759	< 38	< 33	< 36	< 157	< 67
	8/23/2015	< 360	6200 ± 837	< 38	< 31	< 42	< 96	< 58
	8/23/2015	387 ± 181	5067 ± 741	< 34	< 25	< 33	< 120	< 57
	9/19/2015	< 371	5347 ± 781	< 46	< 33	< 40	< 142	< 55
	9/19/2015	< 406	5669 ± 844	< 53	< 36	< 46	< 149	< 60
	9/19/2015	452 ± 271	4261 ± 789	< 36	< 24	< 37	< 136	< 50
	10/31/2015	309 ± 175	5189 ± 536	< 49	< 21	< 24	< 75	< 42
	10/31/2015	478 ± 261	5244 ± 515	< 43	< 24	< 27	< 96	< 43
	10/31/2015	< 296	4077 ± 430	< 53	< 26	< 28	< 82	< 46
	AVERAGE	429 ± 261	5217 ± 1336	-	-	-	-	-

TABLE C-10 GAMMA SPECTROSCOPIC ANALYSES OF SOIL
SUSQUEHANNA STEAM ELECTRIC STATION, 2015

Results in pCi/kg (dry) ± 2 sigma

SITE	COLLECTION PERIOD	K-40	Cs-134	Cs-137	Ra-226	Ac-228	Th-228
8G1	9/23/2015	9564 ± 1826	< 84	< 119	3284 ± 2094	1059 ± 410	1025 ± 160
	9/23/2015	9920 ± 1944	< 64	< 114	< 1780	717 ± 337	932 ± 249
	MEAN	9742 ± 503	-	-	3534 ± 0	888 ± 242	979 ± 66
12S1	9/23/2015	11970 ± 1412	< 60	< 96	< 1349	< 180	867 ± 117
	9/23/2015	12930 ± 1811	< 79	< 111	2452 ± 1585	1243 ± 313	963 ± 161
	MEAN	12450 ± 1358	-	-	2452 ± 0	1243 ± 0	915 ± 68
10S3	09/23/15	8897 ± 1922	< 103	< 166	< 2741	816 ± 418	709 ± 161
	09/23/15	10760 ± 1419	< 77	< 112	2912 ± 1613	992 ± 318	778 ± 115
	MEAN	9829 ± 2635	-	-	2541 ± 0	904 ± 125	744 ± 49

TABLE C-11 **TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF SURFACE WATER SUSQUEHANNA STEAM ELECTRIC STATION, 2015**

Results in pCi/liter ± 2S

SITE	COLLECTION PERIOD	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	Th-228
6S6 (1)	12/29/14 - 01/26/15	< 143	< 23	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 11	< 2	< 2	< 18	< 5	< 3
	01/26/15 - 03/03/15	< 142	< 14	< 1	< 2	< 5	< 1	< 3	< 2	< 3	< 13	< 1	< 2	< 19	< 6	< 3
	03/03/15 - 03/31/15	< 144	< 12	< 1	< 2	< 5	< 1	< 2	< 2	< 3	< 13	< 1	< 1	< 19	< 5	< 2
	03/31/15 - 04/28/15	< 137	< 21	< 1	< 1	< 4	< 1	< 2	< 1	< 2	< 8	< 1	< 1	< 13	< 4	< 2
	04/28/15 - 06/02/15	< 150	< 36	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 12	< 2	< 2	< 21	< 6	< 4
	06/02/15 - 06/30/15	< 150	< 25	< 1	< 2	< 6	< 2	< 3	< 2	< 3	< 12	< 1	< 2	< 18	< 6	< 3
	06/30/15 - 07/28/15	< 149	< 34	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 11	< 2	< 2	< 20	< 6	< 3
	07/28/15 - 09/01/15	< 148	38 ± 23	< 2	< 2	< 6	< 2	< 3	< 2	< 3	< 12	< 2	< 2	< 19	< 7	< 3
	09/01/15 - 09/29/15	< 145	< 18	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 10	< 2	< 2	< 18	< 6	< 3
	09/29/15 - 10/20/15	< 145	< 37	< 2	< 2	< 6	< 2	< 3	< 2	< 4	< 14	< 2	< 2	< 21	< 6	< 3
	10/26/15 - 10/26/15	< 150	< 41	< 4	< 4	< 12	< 4	< 7	< 5	< 6	< 9	< 4	< 5	< 21	< 5	< 9
	10/26/15 - 12/01/15	< 149	< 15	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 14	< 2	< 2	< 22	< 6	< 4
	12/01/15 - 12/29/15	< 145	44 ± 26	< 2	< 2	< 7	< 2	< 4	< 2	< 4	< 12	< 2	< 2	< 20	< 6	< 4
	AVERAGE	-	41 ± 9	-	-	-	-	-	-	-	-	-	-	-	-	-
2S7	12/29/14 - 01/26/15	920 ± 130	< 11	< 1	< 1	< 4	< 1	< 3	< 2	< 3	< 8	< 1	< 1	< 14	< 5	< 2
	01/26/15 - 3/3/2015	3160 ± 290	< 13	< 1	< 2	< 5	< 2	< 3	< 2	< 3	< 12	< 1	< 2	< 20	< 6	< 3
	03/03/15 - 03/31/15	2340 ± 228	< 12	< 1	< 2	< 5	< 1	< 3	< 2	< 3	< 13	< 1	< 1	< 18	< 6	< 2
	03/31/15 - 04/28/15	3620 ± 324	< 19	< 2	< 2	< 8	< 2	< 4	< 2	< 4	< 13	< 2	< 2	< 23	< 8	< 3
	04/28/15 - 06/02/15	4340 ± 384	64 ± 28	< 1	< 2	< 4	< 2	< 3	< 2	< 3	< 14	< 1	< 1	< 19	< 6	< 3
	06/02/15 - 06/30/15	1810 ± 188	< 29	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 12	< 1	< 2	< 20	< 7	< 3
	06/30/15 - 07/28/15	2040 ± 199	< 45	< 2	< 2	< 7	< 2	< 4	< 2	< 4	< 12	< 2	< 2	< 20	< 7	< 4
	07/28/15 - 09/01/15	1680 ± 186	< 12	< 1	< 2	< 4	< 1	< 3	< 2	< 3	< 10	< 1	< 1	< 17	< 5	< 2
	09/01/15 - 09/29/15	1190 ± 146	< 12	< 1	< 2	< 3	< 1	< 3	< 2	< 3	< 8	< 1	< 1	< 15	< 4	< 3
	09/29/15 - 10/26/15	519 ± 112	< 30	< 2	< 2	< 5	< 2	< 3	< 2	< 4	< 11	< 2	< 2	< 19	< 5	< 4
	10/26/15 - 12/01/15	1150 ± 148	< 16	< 2	< 2	< 6	< 2	< 3	< 2	< 3	< 13	< 2	< 2	< 20	< 7	< 3
	12/01/15 - 12/29/15	229 ± 101	< 15	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 11	< 2	< 2	< 19	< 6	< 3
	AVERAGE	1917 ± 1261	64 ± 0	-	-	-	-	-	-	-	-	-	-	-	-	-
6S5	01/06/15 - 01/26/15	< 136	< 47	< 3	< 3	< 10	< 3	< 7	< 3	< 6	< 12	< 3	< 3	< 24	< 8	< 4
	02/03/15 - 03/03/15	< 147	< 32	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 9	< 2	< 2	< 16	< 6	< 3
	03/10/15 - 03/31/15	179 ± 95	< 11	< 1	< 2	< 5	< 1	< 3	< 2	< 3	< 11	< 1	< 2	< 17	< 5	< 3
	04/07/15 - 04/28/15	< 137	< 24	< 1	< 2	< 5	< 2	< 3	< 2	< 3	< 9	< 1	< 1	< 15	< 5	< 2
	05/04/15 - 06/02/15	271 ± 104	< 49	< 2	< 2	< 6	< 2	< 4	< 2	< 3	< 11	< 1	< 2	< 18	< 6	< 3
	06/09/15 - 06/30/15	< 149	< 38	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 11	< 2	< 2	< 19	< 7	< 4

(1) SEE PROGRAM CHANGES SECTION FOR EXPLANATION

TABLE C-11 **TRITIUM AND GAMMA SPECTROSCOPIC ANALYSES OF SURFACE WATER**
SUSQUEHANNA STEAM ELECTRIC STATION, 2015

Results in pCi/liter ± 2S

SITE	COLLECTION PERIOD	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	Th-228
	07/07/15 - 07/28/15	207 ± 97	48 ± 27	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 10	< 2	< 2	< 18	< 6	< 4
	08/04/15 - 09/01/15	< 148	< 19	< 2	< 2	< 8	< 2	< 4	< 2	< 4	< 11	< 2	< 2	< 21	< 8	< 3
	09/08/15 - 09/29/15	< 143	< 14	< 2	< 2	< 4	< 2	< 3	< 2	< 4	< 8	< 2	< 2	< 15	< 5	< 4
	10/06/15 - 10/26/15	< 146	< 35	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 10	< 2	< 2	< 18	< 5	< 4
	11/03/15 - 12/01/15	< 150	39 ± 25	< 2	< 2	< 6	< 2	< 3	< 2	< 4	< 10	< 2	< 2	< 18	< 7	< 3
	12/08/15 - 12/29/15	< 143	< 16	< 1	< 2	< 6	< 2	< 4	< 2	< 3	< 8	< 2	< 2	< 14	< 5	< 3
	AVERAGE	219 ± 94	44 ± 13	-	-	-	-	-	-	-	-	-	-	-	-	-
4S7	03/16/15 - 03/16/15	< 147	< 63	< 4	< 4	< 11	< 4	< 9	< 5	< 8	< 9	< 4	< 4	< 23	< 9	< 10
	06/11/15 - 06/11/15	219 ± 100	< 43	< 4	< 5	< 13	< 5	< 9	< 4	< 7	< 10	< 4	< 4	< 22	< 8	< 8
	08/31/15 - 08/31/15	< 147	< 119	< 9	< 8	< 21	< 4	< 15	< #	< 12	< 12	< 7	< 9	< 26	< 13	< 19
	11/16/15 - 11/16/15	< 144	< 89	< 5	< 5	< 13	< 5	< 9	< 5	< 8	< 7	< 5	< 4	< 18	< 8	< 10
	AVERAGE	219 ± 0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LTAW	03/16/15 - 03/16/15	< 143	< 76	< 6	< 7	< 21	< 8	< 16	< 9	< 13	< 11	< 7	< 8	< 40	< 14	< 12
	06/11/15 - 06/11/15	< 146	< 38	< 5	< 5	< 16	< 5	< 11	< 5	< 9	< 13	< 5	< 5	< 32	< 9	< 10
	08/31/15 - 08/31/15	< 147	< 144	< 8	< 7	< 22	< 7	< 16	< 9	< 14	< 11	< 7	< 9	< 33	< 9	< 15
	11/16/15 - 11/16/15	< 146	< 39	< 4	< 4	< 10	< 5	< 9	< 5	< 7	< 6	< 5	< 4	< 19	< 6	< 9
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5S12	03/16/15 - 03/16/15	< 150	< 147	< 6	< 6	< 17	< 7	< 13	< 7	< 10	< 13	< 6	< 6	< 29	< 13	< 14
	06/11/15 - 06/11/15	< 146	< 115	< 5	< 6	< 15	< 6	< 11	< 6	< 10	< 14	< 5	< 5	< 34	< 12	< 11
	08/31/15 - 08/31/15	< 149	< 63	< 9	< 7	< 26	< 8	< 17	< 9	< 17	< 12	< 7	< 10	< 35	< 7	< 16
	11/16/15 - 11/16/15	< 149	< 126	< 6	< 6	< 20	< 6	< 15	< 7	< 11	< 8	< 7	< 7	< 29	< 10	< 10
	AVERAGE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7S12	03/16/15 - 03/16/15	< 146	< 52	< 4	< 5	< 13	< 5	< 9	< 5	< 9	< 10	< 5	< 5	< 26	< 10	< 11
	06/11/15 - 06/11/15	< 150	< 57	< 5	< 5	< 12	< 5	< 11	< 5	< 8	< 13	< 5	< 6	< 32	< 8	< 10
	08/31/15 - 08/31/15	< 148	< 122	< 6	< 7	< 16	< 5	< 15	< 7	< 10	< 9	< 6	< 7	< 27	< 9	< 15
	11/16/15 - 11/16/15	< 147	104 ± 52	< 3	< 3	< 5	< 3	< 6	< 3	< 7	< 6	< 4	< 4	< 18	< 4	< 8
	AVERAGE	-	104 ± 0	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE C-12 **GAMMA SPECTROSCOPIC ANALYSIS OF FISH**
SUSQUEHANNA STEAM ELECTRIC STATION, 2015

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									
Smallmouth Bass	05/05/15	3306 ± 723	< 41	< 53	< 145	< 47	< 79	< 48	< 43
Channel Catfish	05/05/15	4543 ± 1017	< 50	< 62	< 173	< 54	< 110	< 57	< 49
Shorthead Redhorse	05/05/15	3877 ± 956	< 76	< 85	< 201	< 88	< 139	< 79	< 80
Channel Catfish	09/21/15	3387 ± 1118	< 63	< 57	< 169	< 53	< 127	< 70	< 63
Shorthead Redhorse	09/21/15	3387 ± 1115	< 84	< 81	< 191	< 74	< 184	< 71	< 90
Smallmouth Bass	09/21/15	4723 ± 1256	< 67	< 78	< 157	< 70	< 200	< 69	< 71
	AVERAGE	3871 ± 1254	-	-	-	-	-	-	-
IND									
Smallmouth Bass	04/29/15	3197 ± 656	< 41	< 42	< 130	< 42	< 75	< 40	< 42
Channel Catfish	04/29/15	3308 ± 749	< 44	< 51	< 154	< 52	< 87	< 44	< 46
Shorthead Redhorse	04/29/15	4155 ± 965	< 58	< 65	< 189	< 58	< 133	< 71	< 78
Shorthead Redhorse	09/14/15	3627 ± 807	< 41	< 48	< 134	< 44	< 84	< 41	< 46
Smallmouth Bass	09/14/15	3032 ± 1146	< 40	< 30	< 114	< 35	< 42	< 25	< 35
Channel Catfish	09/17/15	4493 ± 1084	< 74	< 70	< 252	< 58	< 147	< 68	< 73
	AVERAGE	3635 ± 1156	-	-	-	-	-	-	-
LTAW									
Large Mouth Bass	09/25/15	2277 ± 1200	< 82	< 105	< 216	< 124	< 149	< 100	< 102
	AVERAGE	2277 ± 0	-	-	-	-	-	-	-

TABLE C-13 **GAMMA SPECTROSCOPIC ANALYSES OF SHORELINE SEDIMENT SUSQUEHANNA STEAM ELECTRIC STATION, 2015**

Results in pCi/kg (dry) ± 2 sigma

SITE	COLLECTION PERIOD	K-40	Cs-134	Cs-137	Ra-226	Ac-228	Th-228
2B	05/12/15	13360 ± 1502	< 69	< 78	< 1420	1297 ± 270	1282 ± 119
	10/26/15	9811 ± 1301	< 55	< 80	2245 ± 1168	964 ± 228	1012 ± 104
	AVERAGE	11586 ± 2510	-	-	2245 ± 0	1130 ± 236	1147 ± 191
7B	05/12/15	13050 ± 1263	< 58	< 72	< 1555	1165 ± 279	1021 ± 113
	10/26/15	12590 ± 1708	< 60	< 74	< 1384	1229 ± 284	1016 ± 166
	AVERAGE	12820 ± 651	-	-	-	1197 ± 91	1019 ± 4
12F	05/12/15	9673 ± 1115	< 49	< 60	< 834	795 ± 229	787 ± 97
	10/26/15	13230 ± 2030	< 94	< 106	< 2484	1051 ± 376	1272 ± 153
	AVERAGE	11452 ± 5030	-	-	-	923 ± 361	1030 ± 343

FIGURE C-1 - GROSS BETA ACTIVITY IN AIR PARTICULATES

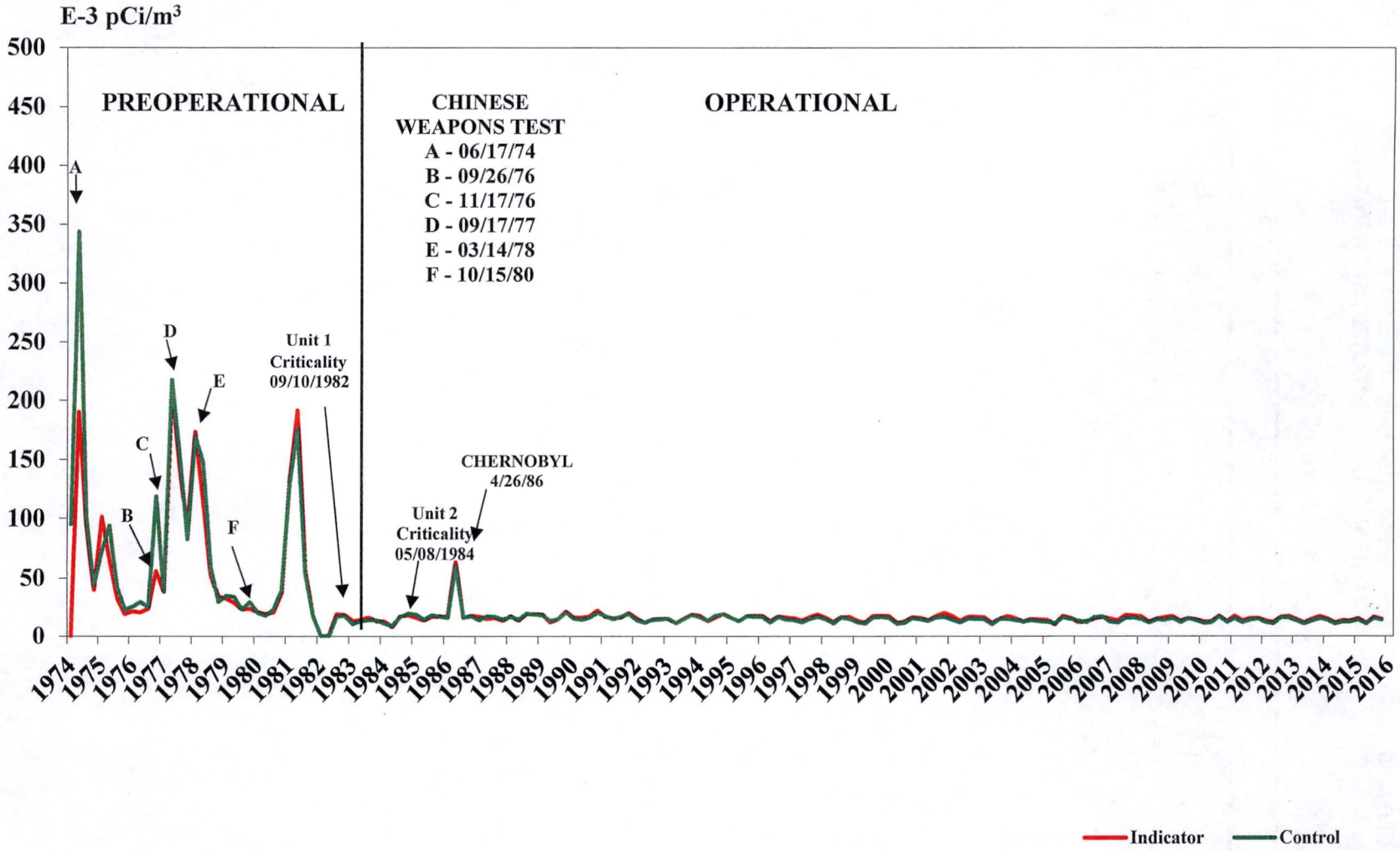


FIGURE C-2 - AMBIENT RADIATION LEVELS BASED ON ENVIRONMENTAL DOSIMETRY DATA

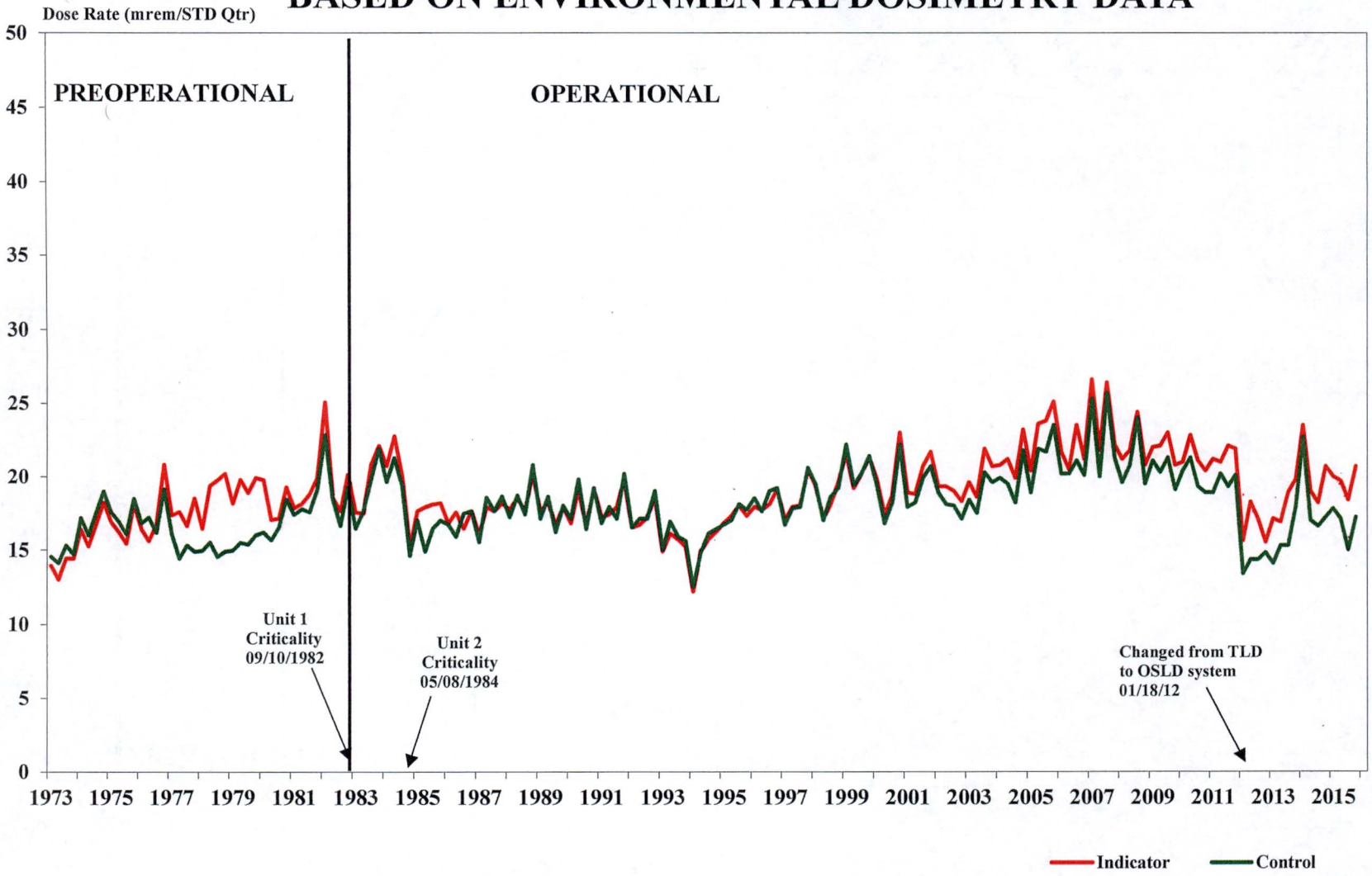


FIGURE C-3 - IODINE-131 ACTIVITY IN MILK

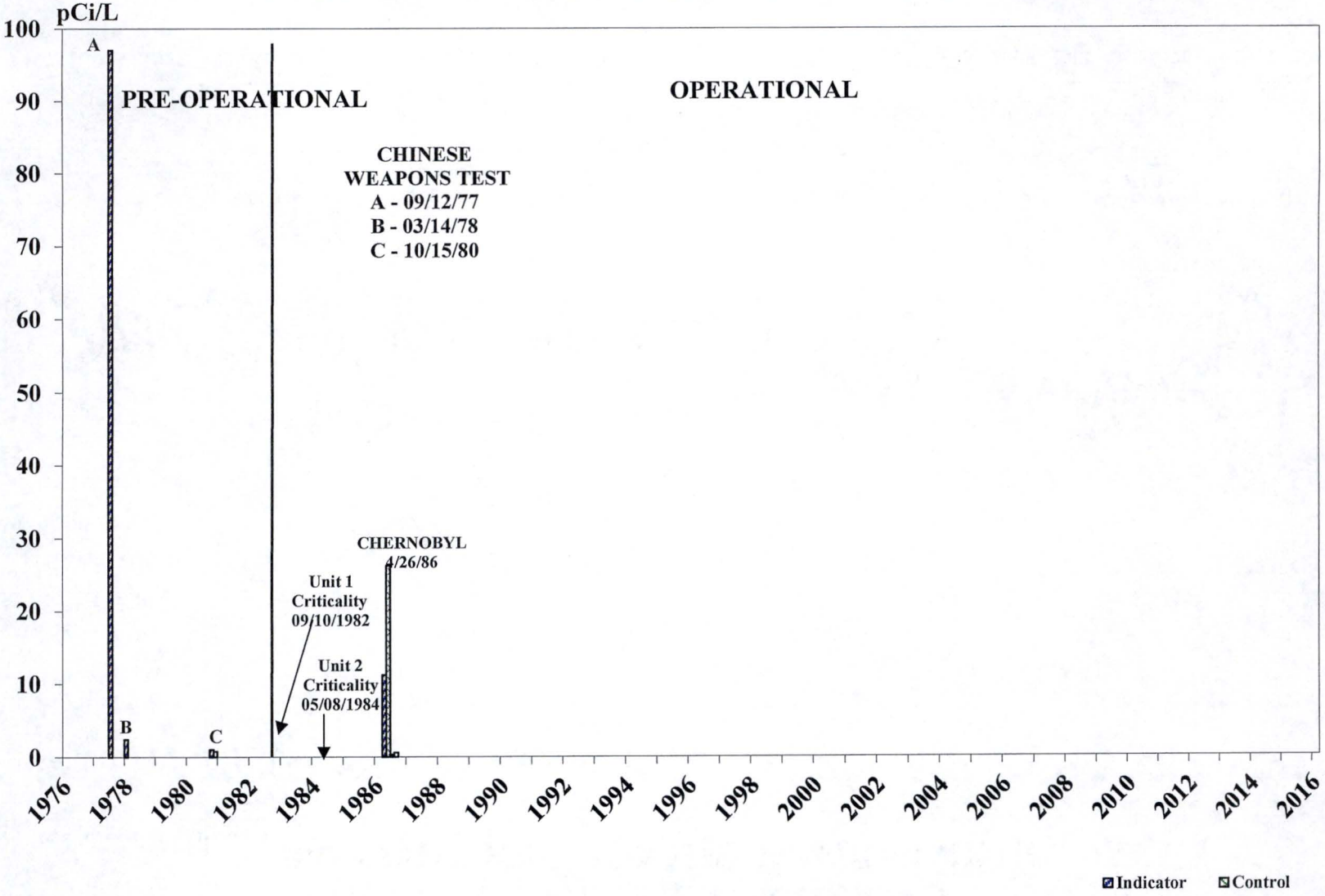


FIGURE C-4 - ANNUAL AVERAGE TRITIUM ACTIVITY IN PRECIPITATION AND SURFACE WATER VERSUS GROUND WATER

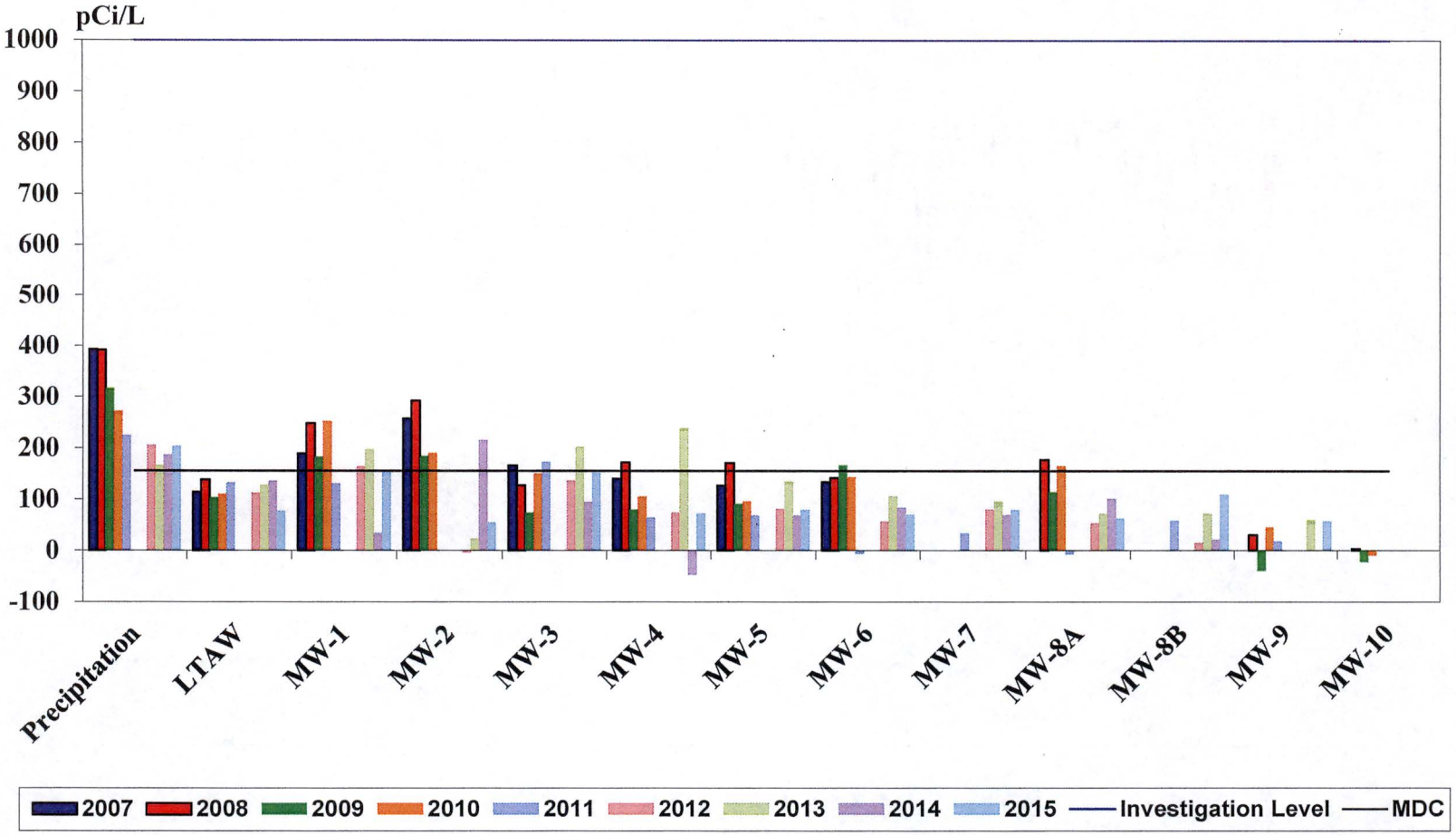


FIGURE C-5 - GROSS BETA ACTIVITY IN DRINKING WATER

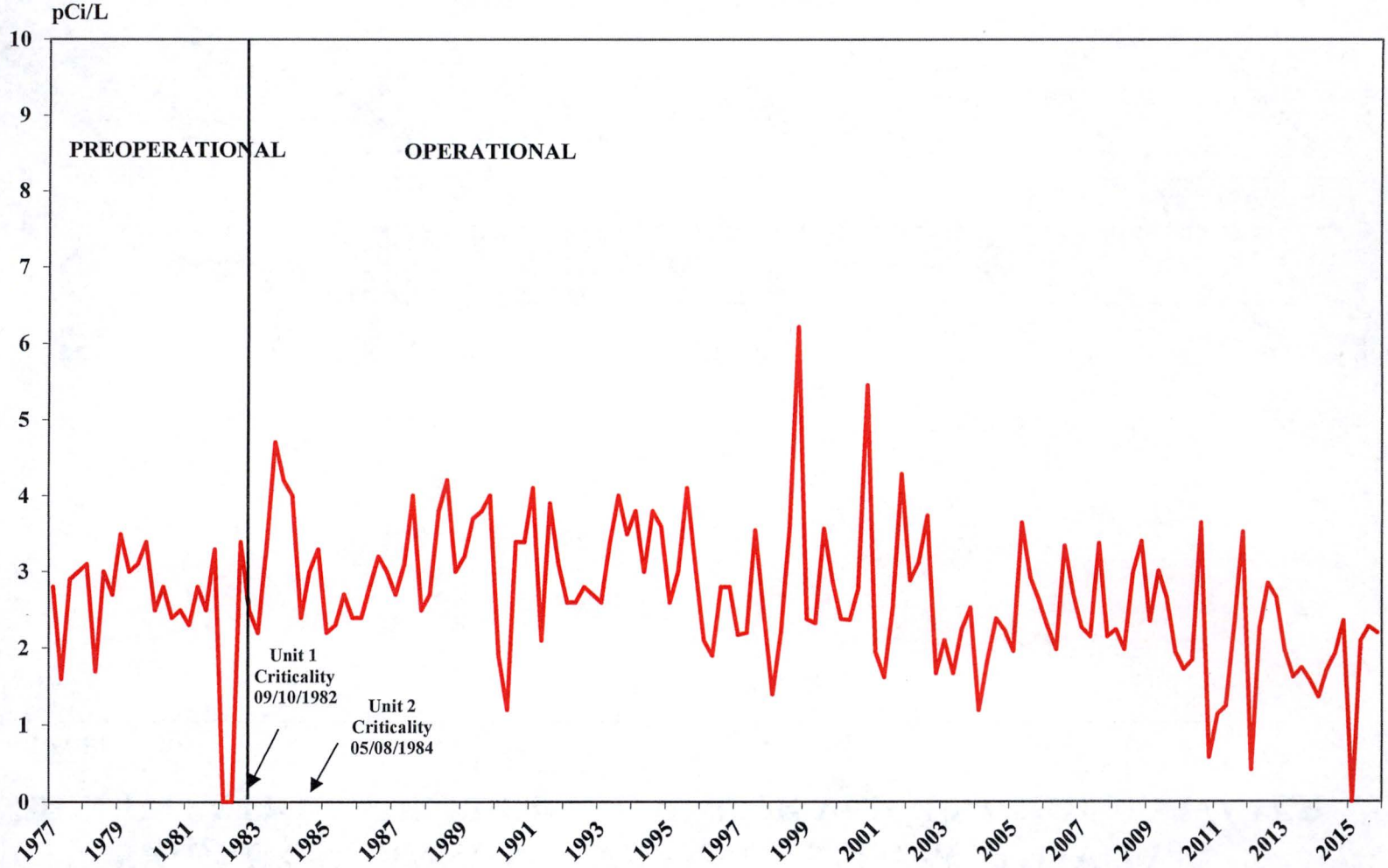
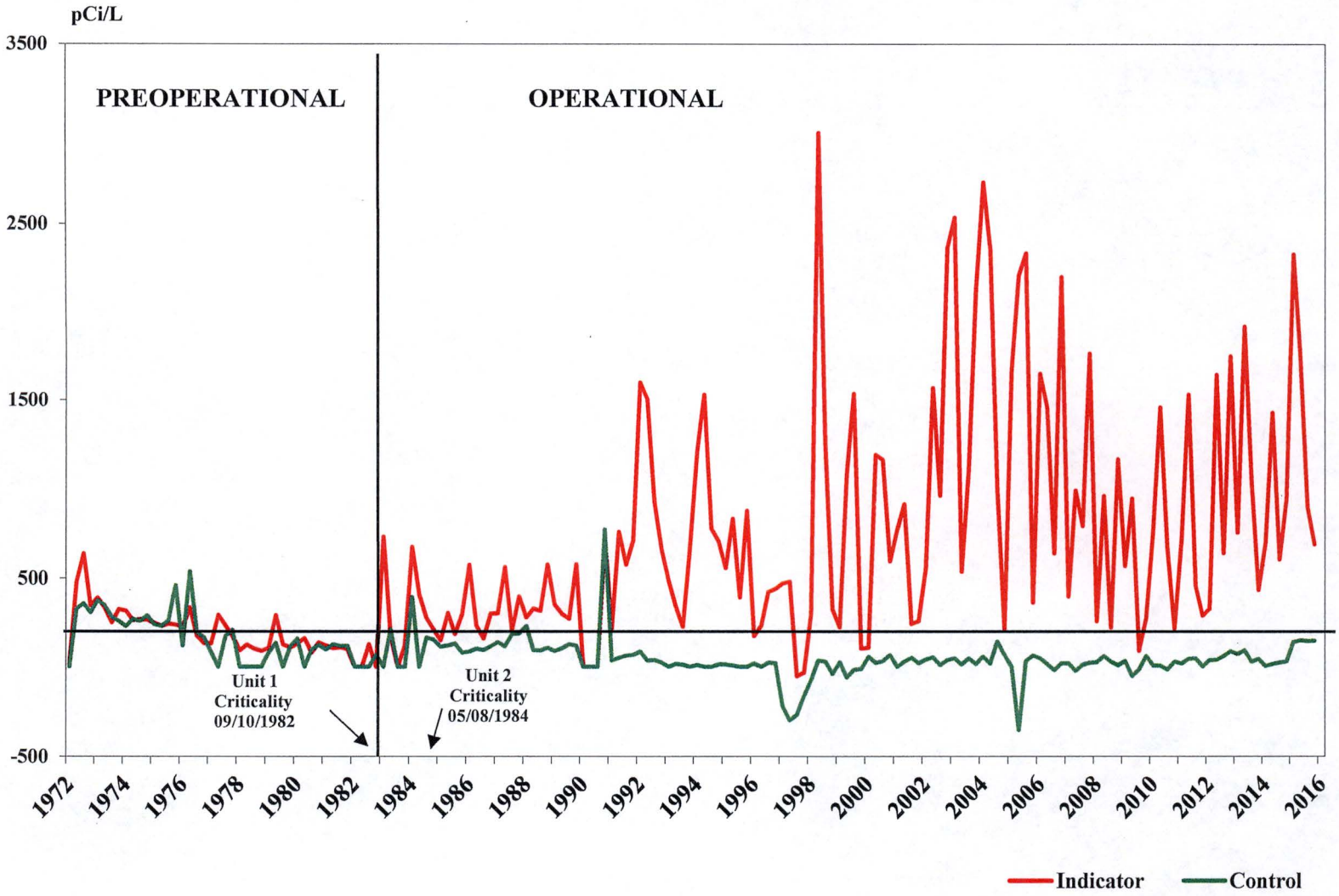


FIGURE C-6 - TRITIUM ACTIVITY IN SURFACE WATER



APPENDIX D

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

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TABLE D-1 **ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM**
TELEDYNE BROWN ENGINEERING, 2015
(PAGE 1 OF 2)

Month/Year	Identification Number	Matrix	Nuclide	Units	Reported Value (a)	Known Value (b)	Ratio (c) TBE/Analytics	Evaluation (d)
March 2015	E11181	Milk	Sr-89	pCi/L	88.9	97.2	0.91	A
			Sr-90	pCi/L	12.2	17.4	0.70	W
	E11182	Milk	I-131	pCi/L	61.3	65.1	0.94	A
			Ce-141	pCi/L	104	113	0.92	A
			Cr-51	pCi/L	265	276	0.96	A
			Cs-134	pCi/L	138	154	0.90	A
			Cs-137	pCi/L	205	207	0.99	A
			Co-58	pCi/L	178	183	0.97	A
			Mn-54	pCi/L	187	188	0.99	A
			Fe-59	pCi/L	182	177	1.03	A
			Zn-65	pCi/L	345	351	0.98	A
			Co-60	pCi/L	379	405	0.94	A
	E11184	AP	Ce-141	pCi	107	85.0	1.26	W
			Cr-51	pCi	261	224	1.17	A
			Cs-134	pCi	74.6	77.0	0.97	A
			Cs-137	pCi	99.6	102	0.98	A
			Co-58	pCi	99.8	110	0.91	A
			Mn-54	pCi	99.2	96.9	1.02	A
			Fe-59	pCi	109	119	0.92	A
			Zn-65	pCi	188	183	1.03	A
			Co-60	pCi	200	201	1.00	A
	E11183	Charcoal	I-131	pCi	82.9	85.4	0.97	A
	E11185	Water	Fe-55	pCi/L	1950	1900	1.03	A
June 2015	E11234	Milk	Sr-89	pCi/L	94.9	92.6	1.02	A
			Sr-90	pCi/L	14.3	12.7	1.13	A
	E11238	Milk	I-131	pCi/L	93.2	95.9	0.97	A
			Ce-141	pCi/L	Not provided for this study			
			Cr-51	pCi/L	349	276	1.26	W
			Cs-134	pCi/L	165	163	1.01	A
			Cs-137	pCi/L	143.0	125	1.14	A
			Co-58	pCi/L	82.0	68.4	1.20	A
			Mn-54	pCi/L	113	101	1.12	A
			Fe-59	pCi/L	184	151	1.22	W
			Zn-65	pCi/L	269	248	1.08	A
			Co-60	pCi/L	208	193	1.08	A
	E11237	AP	Ce-141	pCi	Not provided for this study			
			Cr-51	pCi	323	233	1.39	N (1)
			Cs-134	pCi	139	138	1.01	A
			Cs-137	pCi	111	106	1.05	A
			Co-58	pCi	54.0	57.8	0.93	A
			Mn-54	pCi	96.8	84.9	1.14	A
			Fe-59	pCi	162	128	1.27	W
			Zn-65	pCi	198	210	0.94	A
			Co-60	pCi	178	163	1.09	A
	E11236	Charcoal	I-131	pCi	93.9	80	1.17	A

TABLE D-1 ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM
TELEDYNE BROWN ENGINEERING, 2015
(PAGE 2 OF 2)

Month/Year	Identification Number	Matrix	Nuclide	Units	Reported Value (a)	Known Value (b)	Ratio (c) TBE/Analytics	Evaluation (d)
June 2015	E11238	Water	Fe-55	pCi/L	1890	1790	1.06	A
December 2015	E11354	Milk	Sr-89	pCi/L	96.2	86.8	1.11	A
			Sr-90	pCi/L	14.8	12.5	1.18	A
	E11355	Milk	I-131	pCi/L	95.1	91.2	1.04	A
			Ce-141	pCi/L	117	129	0.91	A
			Cr-51	pCi/L	265	281	0.94	A
			Cs-134	pCi/L	153	160	0.96	A
			Cs-137	pCi/L	119	115	1.03	A
			Co-58	pCi/L	107	110	0.97	A
			Mn-54	pCi/L	153	145	1.06	A
			Fe-59	pCi/L	117	108	1.08	A
			Zn-65	pCi/L	261	248	1.05	A
			Co-60	pCi/L	212	213	1.00	A
	E11357	AP	Ce-141	pCi	89.9	84.0	1.07	A
			Cr-51	pCi	215	184	1.17	A
			Cs-134	pCi	103	105	0.98	A
			Cs-137	pCi	76.6	74.8	1.02	A
			Co-58	pCi	76.2	71.9	1.06	A
			Mn-54	pCi	91.4	94.4	0.97	A
			Fe-59	pCi	78.6	70.3	1.12	A
			Zn-65	pCi	173	162	1.07	A
			Co-60	pCi	138	139	0.99	A
	E11422	AP	Sr-89	pCi	98.0	96.9	1.01	A
			Sr-90	pCi	10.0	14.0	0.71	W
	E11356	Charcoal	I-131	pCi	74.9	75.2	1.00	A
	E11358	Water	Fe-55	pCi/L	2160	1710	1.26	W
	E11353	Soil	Ce-141	pCi/kg	252	222	1.14	A
			Cr-51	pCi/kg	485	485	1.00	A
			Cs-134	pCi/kg	319	277	1.15	A
			Cs-137	pCi/kg	292	276	1.06	A
			Co-58	pCi/kg	193	190	1.02	A
			Mn-54	pCi/kg	258	250	1.03	A
			Fe-59	pCi/kg	218	186	1.17	A
			Zn-65	pCi/kg	457	429	1.07	A
			Co-60	pCi/kg	381	368	1.04	A

(1) AP Cr-51 - Cr-51 has the shortest half-life and the weakest gamma energy of the mixed nuclide sample, which produces a large error. Taking into account the error, the lowest value would be 119% of the reference value, which would be considered acceptable. NCR 15-18

(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-2 ERA ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM
TELEDYNE BROWN ENGINEERING, 2015
(PAGE 1 OF 1)

Month/Year	Identification Number	Media	Nuclide	Units	Reported Value (a)	Known Value (b)	Acceptance Limits	Evaluation (c)
May 2015	RAD-101	Water	Sr-89	pCi/L	45.2	63.2	51.1 - 71.2	N (1)
			Sr-90	pCi/L	28.0	41.9	30.8 - 48.1	N (1)
			Ba-133	pCi/L	80.6	82.5	63.9 - 90.8	A
			Cs-134	pCi/L	71.7	75.7	61.8 - 83.3	A
			Cs-137	pCi/L	187	189	170 - 210	A
			Co-60	pCi/L	85.7	84.5	76.0 - 95.3	A
			Zn-65	pCi/L	197	203	183 - 238	A
			Gr-A	pCi/L	26.1	42.6	22.1 - 54.0	A
			Gr-B	pCi/L	28.8	32.9	21.3 - 40.6	A
			I-131	pCi/L	23.5	23.8	19.7 - 28.3	A
			U-Nat	pCi/L	6.19	6.59	4.99 - 7.83	A
			H-3	pCi/L	3145	3280	2770 - 3620	A
011/01/2015	RAD-103	Water	Sr-89	pCi/L	40.9	35.7	26.7 - 42.5	A
			Sr-90	pCi/L	29.3	31.1	22.7 - 36.1	A
			Ba-133	pCi/L	31.5	32.5	25.9 - 36.7	A
			Cs-134	pCi/L	59.65	62.3	50.6 - 68.5	A
			Cs-137	pCi/L	156	157	141 - 175	A
			Co-60	pCi/L	70.6	71.1	64.0 - 80.7	A
			Zn-65	pCi/L	145	126	113 - 149	A
			Gr-A	pCi/L	38.2	51.6	26.9 - 64.7	A
			Gr-B	pCi/L	42.0	36.6	24.1 - 44.2	A
			I-131	pCi/L	24.8	26.3	21.9 - 31.0	A
			U-Nat	pCi/L	146.90	56.2	45.7 - 62.4	N (2)
			H-3	pCi/L	21100	21300	18700 - 23400	A

(1) Yield on the high side of our acceptance range indicates possibility of calcium interference. NCR 15-09

(2) Technician failed to dilute original sample. If dilulted, the result would have been 57.1, which fell within the acceptance limits. NCR 15-19

(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.

TABLE D-3 DOE'S MIXED ANALYTE PERFORMANCE EVALUATION PROGRAM (MAPEP)
TELEDYNE BROWN ENGINEERING, 2015
(PAGE 1 OF 1)

Month/Year	Identification Number	Media	Nuclide*	Units	Reported Value (a)	Known Value (b)	Acceptance Range	Evaluation (c)
March 2015	15-MaW32	Water	Am-241	Bq/L	0.632	0.654	0.458 - 0.850	A
			Ni-63	Bq/L	2.5		(1)	A
			Pu-238	Bq/L	0.0204	0.0089	(2)	A
			Pu-239/240	Bq/L	0.9	0.8	0.582 - 1.082	A
	15-MaS32	Soil	Ni-63	Bq/kg	392	448.0	314 - 582	A
			Sr-90	Bq/kg	286	653	487 - 849	N (3)
	15-RdF32	AP	Sr-90	Bq/sample	-0.0991		(1)	A
			U-234/233	Bq/sample	0.0211	0.0155	0.0109 - 0.0202	N (3)
			U-238	Bq/sample	0.095	0.099	0.069 - 0.129	A
	15-GrF32	AP	Gr-A	Bq/sample	0.448	1.77	0.53 - 3.01	N (3)
			Gr-B	Bq/sample	0.7580	0.75	0.38 - 1.13	A
	15-RdV32	Vegetation	Cs-134	Bq/sample	8.08	7.32	5.12 - 9.52	A
			Cs-137	Bq/sample	11.6	9.18	6.43 - 11.93	W
			Co-57	Bq/sample	-0.0096		(1)	A
			Co-60	Bq/sample	6.53	5.55	3.89 - 7.22	A
			Mn-54	Bq/sample	0.0058		(1)	A
			Sr-90	Bq/sample	0.999	1.08	0.76 - 1.40	A
			Zn-65	Bq/sample	-0.108		(1)	A
September 2015	15-MaW33	Water	Am-241	Bq/L	1.012	1.055	0.739 - 1.372	A
			Ni-63	Bq/L	11.8	8.55	5.99 - 11.12	N (4)
			Pu-238	Bq/L	0.727	0.681	0.477 - 0.885	A
			Pu-239/240	Bq/L	0.830	0.900	0.630 - 1.170	A
	15-MaS33	Soil	Ni-63	Bq/kg	635	682	477 - 887	A
			Sr-90	Bq/kg	429	425	298 - 553	A
	15-RdF33	AP	Sr-90	Bq/sample	1.48	2.18	1.53 - 2.83	N (4)
			U-234/233	Bq/sample	0.143	0.143	0.100 - 0.186	A
			U-238	Bq/sample	0.149	0.148	0.104 - 0.192	A
	15-GrF33	AP	Gr-A	Bq/sample	0.497	0.90	0.27 - 1.53	A
			Gr-B	Bq/sample	1.34	1.56	0.78 - 2.34	A
	15-RdV33	Vegetation	Cs-134	Bq/sample	6.10	5.80	4.06 - 7.54	A
			Cs-137	Bq/sample	0.0002		(1)	A
			Co-57	Bq/sample	8.01	6.62	4.63 - 8.61	W
			Co-60	Bq/sample	4.97	4.56	3.19 - 5.93	A
			Mn-54	Bq/sample	8.33	7.68	5.38 - 9.98	A
			Sr-90	Bq/sample	0.386	1.30	0.91 - 1.69	N (4)
			Zn-65	Bq/sample	6.07	5.46	3.82 - 7.10	A

(1) False positive test.

(2) Sensitivity evaluation.

(3) Soil Sr-90 - incomplete digestion of the sample resulted in low results; AP U-234/233 - extremely low activity was difficult to quantify AP Gr-A - the MAPEP filter has the activity embedded in the filter. To corrected the low bias, TBE will create an attenuated efficiency for MAPEP samples. NCR 15-13

(4) Water Ni-63 extremely low activity was difficult to quantify; AP & Vegetation Sr-90 was lost during separation, possible from substance added by MAPEP NCR 15-21.

(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.

TABLE D-4
SUSQUEHANNA REMP LABORATORY SPIKE PROGRAM
ANALYTICS ENVIRONMENTAL RADIOACTIVTY CROSS CHECK PROGRAM - 2015
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 2015	E11271	Soil	Ce-141	pCi/kg	222 ± 7	258 ± 32	1.16	
			Cr-51	pCi/kg	560 ± 19	753 ± 225	1.34	(1)
			Cs-134	pCi/kg	221 ± 7	184 ± 17	0.83	
			Cs-137	pCi/kg	344 ± 12	309 ± 27	0.90	
			Co-58	pCi/kg	274 ± 9	255 ± 28	0.93	
			Mn-54	pCi/kg	302 ± 10	314 ± 26	1.04	
			Fe-59	pCi/kg	235 ± 8	246 ± 35	1.05	
			Zn-65	pCi/kg	368 ± 12	353 ± 44	0.96	
			Co-60	pCi/kg	344 ± 12	366 ± 19	1.06	
March 2015	E11139	Milk	I-131	pCi/L	98.1 ± 3	97 ± 4	0.99	
			Ce-141	pCi/L	124.0 ± 4	112 ± 10	0.90	
			Cr-51	pCi/L	327 ± 11	296 ± 55	0.91	
			Cs-134	pCi/L	113 ± 4	103 ± 6	0.91	
			Cs-137	pCi/L	149 ± 5	141 ± 9	0.95	
			Co-58	pCi/L	161 ± 5	139 ± 10	0.86	
			Mn-54	pCi/L	142 ± 5	136 ± 9	0.96	
			Fe-59	pCi/L	174 ± 6	161 ± 14	0.93	
			Zn-65	pCi/L	267 ± 9	257 ± 22	0.96	
			Co-60	pCi/L	294 ± 10	263 ± 9	0.89	
June 2015	E11209	Milk	I-131	pCi/L	98.2 ± 3	95 ± 5	0.97	
			Ce-141	pCi/L				
			Cr-51	pCi/L	3560 ± 119	3560 ± 182	1.00	
			Cs-134	pCi/L	2100 ± 70	2030 ± 8	0.97	
			Cs-137	pCi/L	1620 ± 54	1730 ± 25	1.07	
			Co-58	pCi/L	882 ± 29	919 ± 26	1.04	
			Mn-54	pCi/L	1300 ± 43	1400 ± 25	1.08	
			Fe-59	pCi/L	1950 ± 65	2140 ± 36	1.10	
			Zn-65	pCi/L	3210 ± 107	3390 ± 56	1.06	
			Co-60	pCi/L	2490 ± 83	2540 ± 19	1.02	
September 2015	E11267A	Milk	I-131	pCi/L	89.0 ± 3	105.0 ± 11	1.18	
			Ce-141	pCi/L	190 ± 6	123 ± 15	0.65	(1)
			Cr-51	pCi/L	481 ± 16	503 ± 84	1.05	
			Cs-134	pCi/L	189 ± 6	186 ± 6	0.98	
			Cs-137	pCi/L	228 ± 8	246 ± 11	1.08	
			Co-58	pCi/L	235 ± 8	228 ± 12	0.97	
			Mn-54	pCi/L	259 ± 9	251 ± 11	0.97	
			Fe-59	pCi/L	202 ± 7	209 ± 16	1.03	
			Zn-65	pCi/L	316 ± 10	270 ± 22	0.85	
			Co-60	pCi/L	295 ± 10	280 ± 8	0.95	

(a) Counting error is two standard deviations.
(1) NCR 15-04 was inititiated to address the failure.

TABLE D-4
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TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES (TBE)
(PAGE 2 OF 5)

Month/Year	Identification Number	Matrix	Nuclide	Units	Analytics Calculated Results (a)	TBE Results (a)	TBE/Analytics Ratio
December 2015	E11399	Milk	I-131	pCi/L	93 ± 3	99.8 ± 3	1.07
			Ce-141	pCi/L	1730 ± 58	1790 ± 20	1.03
			Cr-51	pCi/L	3790 ± 126	3950 ± 143	1.04
			Cs-134	pCi/L	2160 ± 72	2100 ± 19	0.97
			Cs-137	pCi/L	1540 ± 52	1650 ± 25	1.07
			Co-58	pCi/L	1480 ± 50	1520 ± 25	1.03
			Mn-54	pCi/L	1950 ± 65	2090 ± 27	1.07
			Fe-59	pCi/L	1450 ± 48	1610 ± 29	1.11
			Zn-65	pCi/L	3340 ± 111	3650 ± 54	1.09
			Co-60	pCi/L	2870 ± 96	2980 ± 22	1.04
March 2015	E11140	Ap Filter	Ce-141	pCi/L	66.8 ± 2	77 ± 9	1.15
			Cr-51	pCi/L	176 ± 6	190 ± 68	1.08
			Cs-134	pCi/L	61 ± 2	66 ± 6	1.08
			Cs-137	pCi/L	80 ± 3	77 ± 10	0.96
			Co-58	pCi/L	86 ± 3	92 ± 12	1.07
			Mn-54	pCi/L	76.1 ± 3	90 ± 12	1.18
			Fe-59	pCi/L	94 ± 3	88 ± 17	0.94
			Zn-65	pCi/L	143 ± 5	145 ± 20	1.01
			Co-60	pCi/L	158 ± 6	170 ± 10	1.08
March 2015	E11141	Ap Filter	Ce-141	pCi	70.8 ± 2	85 ± 14	1.20
			Cr-51	pCi	186.64 ± 7	214 ± 21	1.15
			Cs-134	pCi	64 ± 2	67 ± 6	1.05
			Cs-137	pCi	85 ± 3	88 ± 10	1.04
			Co-58	pCi	91 ± 3	93 ± 10	1.02
			Mn-54	pCi	81 ± 3	84 ± 11	1.04
			Fe-59	pCi	99.1 ± 3	109 ± 14	1.10
			Zn-65	pCi	152 ± 5	147 ± 17	0.97
			Co-60	pCi	167 ± 6	175 ± 8	1.05
March 2015	E11142	Ap Filter	Ce-141	pCi	68.5 ± 2	77 ± 3	1.12
			Cr-51	pCi	180 ± 6	196 ± 24	1.09
			Cs-134	pCi	62 ± 2	63 ± 7	1.02
			Cs-137	pCi	82.1 ± 3	84 ± 10	1.02
			Co-58	pCi	88.5 ± 3	95 ± 12	1.07
			Mn-54	pCi	78.1 ± 3	86 ± 11	1.10
			Fe-59	pCi	95.9 ± 3	82 ± 19	0.86
			Zn-65	pCi	147 ± 5	137 ± 20	0.93
			Co-60	pCi	162 ± 6	167 ± 10	1.03

(a) Counting error is two standard deviations.

TABLE D-4
SUSQUEHANNA REMP LABORATORY SPIKE PROGRAM
ANALYTICS ENVIRONMENTAL RADIOACTIVTY CROSS CHECK PROGRAM - 2015
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 2015	E11210	Ap Filter	Ce-141	pCi				
			Cr-51	pCi	245 ± 9	317 ± 88	1.29	(1)
			Cs-134	pCi	144 ± 5	156 ± 9	1.08	
			Cs-137	pCi	111 ± 4	123 ± 14	1.11	
			Co-58	pCi	60 ± 2	61 ± 18	1.02	
			Mn-54	pCi	89 ± 3	91 ± 14	1.02	
			Fe-59	pCi	134 ± 5	143 ± 34	1.07	
			Zn-65	pCi	220 ± 8	225 ± 26	1.02	
			Co-60	pCi	172 ± 6	173 ± 11	1.01	
June 2015	E11211	Ap Filter	Ce-141	pCi				
			Cr-51	pCi	248 ± 9	273 ± 69	1.10	
			Cs-134	pCi	146 ± 5	162 ± 15	1.11	
			Cs-137	pCi	112 ± 4	116 ± 13	1.04	
			Co-58	pCi	61 ± 2	69 ± 18	1.13	
			Mn-54	pCi	90 ± 3	89 ± 14	0.99	
			Fe-59	pCi	136 ± 5	152 ± 41	1.12	
			Zn-65	pCi	223 ± 8	208 ± 36	0.93	
			Co-60	pCi	173 ± 6	191 ± 11	1.10	
June 2015	E11212	Ap Filter	Ce-141	pCi				
			Cr-51	pCi	231 ± 8	339 ± 83	1.47	(1)
			Cs-134	pCi	136 ± 5	136 ± 14	1.00	
			Cs-137	pCi	150 ± 4	106 ± 11	0.71	
			Co-58	pCi	57 ± 2	54 ± 16	0.95	
			Mn-54	pCi	84 ± 3	87 ± 11	1.04	
			Fe-59	pCi	127 ± 4	100 ± 33	0.79	(1)
			Zn-65	pCi	208 ± 7	204 ± 22	0.98	
			Co-60	pCi	161 ± 6	162 ± 13	1.01	
December 2015	E11400	Ap Filter	Ce-141	pCi	94 ± 3	97 ± 14	1.03	
			Cr-51	pCi	204 ± 7	195 ± 60	0.96	
			Cs-134	pCi	116 ± 4	116 ± 6	1.00	
			Cs-137	pCi	83 ± 3	81 ± 10	0.98	
			Co-58	pCi	80 ± 3	84 ± 9	1.05	
			Mn-54	pCi	105 ± 4	102 ± 10	0.97	
			Fe-59	pCi	78 ± 3	83 ± 15	1.06	
			Zn-65	pCi	180 ± 6	181 ± 17	1.01	
			Co-60	pCi	155 ± 5	160 ± 8	1.03	

(a) Counting error is two standard deviations.
(1) NCR 15-04 was inititiated to address the failure.

TABLE D-4
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Month/Year	Identification Number	Matrix	Nuclide	Units	Analytics Calculated Results (a)	TBE Results (a)	TBE/Analytics Ratio
December 2015	E11401	Ap Filter	Ce-141	pCi	85 ± 3	92 ± 7	1.08
			Cr-51	pCi	185 ± 6	217 ± 54	1.17
			Cs-134	pCi	105 ± 4	102 ± 6	0.97
			Cs-137	pCi	75 ± 3	70 ± 11	0.93
			Co-58	pCi	73 ± 3	73 ± 9	1.00
			Mn-54	pCi	95 ± 3	92 ± 9	0.97
			Fe-59	pCi	71 ± 2	71 ± 15	1.00
			Zn-65	pCi	163 ± 6	159 ± 18	0.98
			Co-60	pCi	140 ± 5	144 ± 8	1.03
December 2015	E11402	Ap Filter	Ce-141	pCi	83 ± 3	96 ± 13	1.16
			Cr-51	pCi	181 ± 6	200 ± 70	1.10
			Cs-134	pCi	103 ± 4	110 ± 7	1.07
			Cs-137	pCi	74 ± 3	79 ± 10	1.07
			Co-58	pCi	71 ± 2	72 ± 10	1.01
			Mn-54	pCi	93 ± 3	100 ± 10	1.08
			Fe-59	pCi	69 ± 2	74 ± 15	1.07
			Zn-65	pCi	160 ± 6	169 ± 21	1.06
			Co-60	pCi	138 ± 5	145 ± 9	1.05
March 2015	E11146	Water	H-3	pCi/L	4850 ± 162	4980 ± 425	1.03
June 2015	E11213	Water	H-3	pCi/L	4910 ± 164	3980 ± 361	0.81
September 2015	E11272	Water	H-3	pCi/L	4800 ± 160	4450 ± 399	0.93
December 2015	E11406	Water	H-3	pCi/L	552 ± 18	644 ± 137	1.17
March 2015	E11143	Charcoal	I-131	pCi	77.9 ± 3	78.1 ± 4	1.00
March 2015	E11144	Charcoal	I-131	pCi	79.1 ± 3	76.0 ± 5	0.96
March 2015	E11145	Charcoal	I-131	pCi	77.9 ± 3	77.8 ± 4	1.00
September 2015	E11268	Charcoal	I-131	pCi	81.6 ± 3	76.0 ± 5	0.93
September 2015	E11269	Charcoal	I-131	pCi	81.6 ± 3	81.6 ± 5	1.00
September 2015	E11270	Charcoal	I-131	pCi	81.7 ± 3	77.8 ± 7	0.95

(a) Counting error is two standard deviations.

TABLE D-4
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QUALITY CONTROL SPIKE PROGRAM
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES (TBE)
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Month/Year	Identification Number	Matrix	Nuclide	Units	Analytics Calculated Results (a)	TBE Results (a)	TBE/Analytics Ratio
December 2015	E11403A	Charcoal	I-131	pCi	75.5 ± 3	75.3 ± 5	1.00
December 2015	E11404A	Charcoal	I-131	pCi	75.3 ± 3	73.7 ± 4	0.98
December 2015	E11405A	Charcoal	I-131	pCi	75.2 ± 3	76 ± 5	1.01

(a) Counting error is two standard deviations.

APPENDIX E

REMP SAMPLE EQUIPMENT OPERABILITY TRENDING

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

Per Cent (%) Operability

SAMPLING MEDIA	SAMPLE LOCATION	DESCRIPTION	2010	2011	2012	2013	2014	2015
Air Particulate	3S2	SSES Backup Met. Tower	99.9	99.3	98.9	99.9	100	99
& Charcoal	12S1	West Building	99.9	100	99.9	99.9	100	100
	13S6	Former Laydown Area, West of Confers Lane	100	99.7	99.1	99.9	100	97
	12E1	Berwick Hospital	100	100	99.9	100.0	100	100
	6G1	Freeland Substation	100	100	99.9	99.9	100	90*
	8G1	PPL System Facilities Center, Humboldt Industrial Park	99.7	100	99.8	99.9	100	100
Drinking Water	12H2	Danville Water Company	100	100	100	100.0	100	100
Surface Water	2S7	Cooling Tower Blowdown Discharge Line	98.0	99.1	98.1	98.1	69**	100
	6S6	River Water Intake Line	100	95.5	93.4	93.2	93	98

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