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PEACH BOTTOM ATOMIC POWER STATION

UNITS 2 and 3

Annual Radiological
Environmental Operating Report

Report No. 76
January 1 through December 31, 2018

Prepared By
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Environmental Services

Exelon Generation®

Peach Bottom Atomic Power Station
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TABLE OF CONTENTS

Appendices

Figures

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II. Introduction

PBAPS is located along the Susquehanna River between Holtwood and Conowingo Dams in Peach Bottom Township, York County, Pennsylvania. PBAPS Units 2 and 3 are boiling water reactors, each with a rated full-power output of approximately 4,016 MWth while Unit 1 is a decommissioned 115 MWth High Temperature, Gas-cooled Reactor (HTGR). The initial environmental monitoring program began 5 February 1966. A summary of the Unit 1 preoperational monitoring program was presented in a previous report [1]. Preoperational summary reports [2,3] for Units 2 and 3 have been previously issued and summarize the results of all analyses performed on samples collected from 5 February 1966 through 8 August 1973.

The sampling and analysis requirements are contained in the PBAPS ODCM and the ODCM Specifications (ODCMS). This AREOR covers those analyses performed by Teledyne Brown Engineering (TBE), Landauer, Exelon Industrial Services (EIS) and GEL Laboratories on samples collected during the period 01 January 2018 through 31 December 2018.

A. Objectives

The objectives of the REMP are:

1. Provide data on measurable levels of radiation and radioactive materials in the publicly-used environs;

2. Evaluate the principal pathways of exposure to the public as described in the ODCM and determine the relationship between quantities of radioactive material released from the plant and resultant radiation doses to members of the public.

B. Implementation of the Objectives

Implementation of the objectives is accomplished by:

1. Identifying significant exposure pathways,

2. Establishing baseline radiological data of media within those pathways,

3. Continuously monitoring those media before and during plant operation to assess station radiological effects (if any) on man and the environment.

As the REMP is established to measure the impact of power plant operations (release of radionuclides) on man and the environment; it is important to understand radiation/radioactivity, the units used to measure them, and natural sources of radiation in the environment. A brief explanation is provided to differentiate between radiation from nuclear power production and other sources, be they man-made or natural. The doses produced from the other sources of radiation can be compared to the data presented in this report.

measurements were 8.8 ± 2.6 mR/standard month, consistent with those measured in previous years, indicating that the Independent Spent Fuel Storage Installation (ISFSI) had no measurable impact to the environs.

In 2018, the doses from both liquid and gaseous effluents were conservatively calculated for the Maximum Exposed Member of the Public due to PBAPS Operation. Doses calculated were well below all Offsite Dose Calculations Manual (ODCM) limits. The results of those calculations were as follows:

Effluent	Applicable Organ	Estimated Dose	Age Group	Location		% of Applicable Limit	Limit	Unit
				Distance (meters)	Direction (toward)			
Noble Gas	Gamma - Air Dose	3.02E-01	All	1.10E+03	SSE	1.51E+00	2.00E+01	mrad
Noble Gas	Beta - Air Dose	2.07E-01	All	1.10E+03	SSE	5.18E-01	4.00E+01	mrad
Noble Gas	Total Body (gamma)	2.92E-01	All	1.10E+03	SSE	2.92E+00	1.00E+01	mrem
Noble Gas	Skin (Beta)	3.80E-01	All	1.10E+03	SSE	1.27E+00	3.00E+01	mrem
Gaseous Iodine, Particulate, Carbon-14 & Tritium	Bone	1.38E-01	Child	1.50E+03	SW	4.60E-01	3.00E+01	mrem
Gaseous Iodine, Particulate, & Tritium	Thyroid	5.55E-03	Infant	1.50E+03	SW	1.85E-02	3.00E+01	mrem
Liquid	Total Body (gamma)	1.30E-04	Child	Site Boundary		2.17E-03	6.00E+00	mrem
Liquid	GI-LLI	2.28E-04	Child			1.14E-03	2.00E+01	mrem
Direct Radiation	Total Body	0.00E+00	All	1.19E+03	SSE	0.00E+00	2.20E+01	mrem

40 CFR Part 190 Compliance								
Effluent	Applicable Organ	Estimated Dose	Age Group	Location		% of Applicable Limit	Limit	Unit
				Distance (meters)	Direction (toward)			
Total Dose	Total Body	2.92E-01	All	1.19E+03	SSE	1.17E+00	2.50E+01	mrem
Total Dose	Thyroid	5.55E-03	All	1.19E+03	SSE	7.40E-03	7.50E+01	mrem
Total Dose	Bone	1.38E-01	All	1.19E+03	SSE	5.52E-01	2.50E+01	mrem
Total Dose	Total Body	2.92E-01	All	1.19E+03	SSE	9.73E+00	3.00E+00	mrem
Total Dose	Bone	1.38E-01	All	1.19E+03	SSE	4.60E+00	3.00E+00	mrem
Total Dose	Thyroid	3.07E-01	All	1.19E+03	SSE	5.59E-01	5.50E+01	mrem

II. Introduction

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C. Radiation and Radioactivity

All matter is made of atoms. An atom is the smallest part into which matter can be broken down and still maintain all its chemical properties. Nuclear radiation is energy, in the form of waves or particles that is given off by unstable, radioactive atoms. Radioactive material exists naturally and has always been a part of our environment. The earth's crust, for example, contains radioactive uranium, radium, thorium and potassium. Some radioactivity is a result of nuclear weapons testing. Examples of radioactive fallout that is normally present in environmental samples are Cs-137 and Strontium-90 (Sr-90). Some examples of radioactive materials released from a nuclear power plant are Cs-137, I-131, Sr-90 and Cobalt-60 (Co-60).

Radiation is measured in units of millirem; much like temperature is measured in degrees. A millirem is a measure of the biological effect of the energy deposited in tissue. The natural and man-made radiation dose received in one year by the average American is 300 to 400 mrem (References 5, 6, 7 in Table 1 below). Radioactivity is measured in curies. A curie is that amount of radioactive material needed to produce 3.70E+10 nuclear disintegrations per second. This is an extremely large amount of radioactivity in comparison to environmental radioactivity. That is why radioactivity in the environment is measured in picocuries. One picocurie is equal to 1.00E-12 (one trillionth) of a curie.

D. Sources of Radiation

As mentioned previously, naturally occurring radioactivity has always been a part of our environment. Table I shows the typical doses received from natural and man-made sources.

Table 1
Radiation Sources and Corresponding Doses [4]

NATURAL		MAN-MADE	
Source	Radiation Dose (millirem/year)	Source	Radiation Dose (millirem/year)
Internal, inhalation [5]	228	Medical [6]	300
External, space	33	Consumer [7]	13
Internal, ingestion	29	Industrial[8]	0.3
External, terrestrial	21	Occupational	0.5
		Weapons Fallout	<1
		Nuclear Power Plants	<1
Approximate Total	311	Approximate Total	314

Cosmic radiation from the sun and outer space penetrates the earth's atmosphere and continuously bombards us with rays and charged particles. Some of this cosmic radiation interacts with gases and particles in the atmosphere, making them radioactive in turn. These radioactive byproducts from cosmic ray bombardment are referred to as cosmogenic radionuclides. Isotopes such as Beryllium-7 (Be-7) and Carbon-14 (C-14) are formed in this way. Exposure to cosmic and cosmogenic sources of radioactivity results in a dose of 33 mrem per year.

Additionally, natural radioactivity is in our body, in the food we eat (about 29 millirem/yr), in the ground we walk on (about 21 millirem/yr), and in the air we breathe (about 228 millirem/yr). One percent of all potassium in nature is the radioactive Potassium-40 (K-40). The majority of a person's annual dose results from exposure to radon and thoron in the air we breathe. These gases and their radioactive decay products arise from the decay of naturally occurring uranium, thorium and radium in soil and in building products such as brick, stone and concrete. Radon and thoron levels vary greatly with location, primarily due to changes in the concentration of uranium and thorium in the soil. Residents at some locations in Colorado, New York, Pennsylvania, and New Jersey have a higher annual dose as a result of higher levels of radon/thoron gases in these areas. In total, these various sources of naturally occurring radiation and radioactivity contribute to a total dose of about 311 mrem per year.

In addition to natural radiation, we are normally exposed to radiation from a number of man-made sources. The single largest dose from man-made sources result from therapeutic and diagnostic applications of x-rays and radiopharmaceuticals. The annual dose to an individual in the U.S. from medical and dental exposure is about 300 mrem. Consumer products, such as televisions and smoke detectors, contribute about 13 mrem/yr. Much smaller doses result from weapons fallout and nuclear power plants (less than 1 mrem/yr). Typically, the average person in the United States receives about 314 mrem per year from man-made sources.

Some of the natural radioactive nuclides discussed above were identified in PBAPS REMP samples. The typical power production radionuclides, described in the next sections, were not identified and thus it can be concluded that PBAPS did not impact man and the environs during the 2018 operating period.

III. Program Description

A. Sample Collection

Exelon Industrial Services (EIS) collected samples for the REMP for PBAPS Exelon Nuclear. This section describes the collection methods used by EIS to obtain environmental samples for the PBAPS REMP in 2018. Sample locations and descriptions can be found in Table B-1 and Figures B-1 through B-3, Appendix B. The collection procedures used by EIS are listed in Table B-2, Appendix B.

Aquatic Environment

The aquatic environment was evaluated by performing radiological analyses on samples of surface water, drinking water, fish and sediment. Surface water is sampled from two locations as prescribed by the ODCM: one upstream (1LL) and one downstream (1MM) of the plant discharge canal. Drinking water is sampled from a control location (6I) and up to 3 locations nearest to public drinking water supplies. Two locations are identified in the ODCM as the closest drinking water supplies, the Conowingo Dam (4L) and Chester Water Authority (13B). All samples were collected weekly by automatic sampling equipment or as grab samples. Weekly samples from each location were composited into two one-gallon monthly samples for analysis. A separate quarterly composite of the monthly samples was also collected.

Fish sample collection locations required by the ODCM are in an area close to the discharge of PBAPS (4) and a control location, unaffected by plant discharge (6). These samples were comprised of the flesh of commercially and recreationally important species specific to the environs around PBAPS. Fish samples were collected semiannually from two groups: Bottom Feeder (channel catfish, flathead catfish, and carp) and Predator (smallmouth and largemouth bass), as these are the types of fish commonly collected by the public from the river around PBAPS. The total weight of fish flesh was approximately 1000 grams. The samples were preserved on ice for shipping to the laboratory.

The ODCM requires one sediment sample to be collected downstream of the plant in an area with existing or potential recreational value. The REMP collects samples from three locations (4J, 4T and 6F; 6F is the control). Sediment samples, composed of recently deposited substrate, were collected semiannually. Multiple grab samples of the sediment were collected to obtain an approximately homogenous, representative sample totaling 1000 grams.

Terrestrial Environment

The terrestrial environment was evaluated by performing radiological analyses on milk and food product samples. The ODCM requires milk samples at three locations with the highest dose potential, within three miles of PBAPS and one sample at a control location. The REMP meets these requirements and samples extra locations. Milk samples were collected biweekly at five locations (J, R, S, U, X and V; V is the control) from April through November, when the cows were on pasture, and monthly from December through March, when the cows were primarily on feed. Six additional locations (C, D, E, L, P and W; C and E are the controls) were sampled quarterly. Two-gallon samples were collected directly from the bulk tank at each location, preserved with sodium bisulfite, and shipped promptly to the laboratory.

The ODCM requires food products to be collected from the area of highest dose impact and a control location, if milk sampling is unavailable in those locations. Milk sampling occurs in most every sector, but one, and a garden was established there for sampling. Food product samples, comprised of annual broad green leaf vegetation, were collected monthly at four locations (1C, 2Q, 3Q and 55; 55 is the control) from June through September. Typically, the 'planting' season starts late April/early May, with the plants gaining sufficient mass for collection in late June or July. Approximately 1000 g of unwashed samples were collected in plastic bags and shipped promptly to the laboratory, but sample size varied on garden production.

Airborne Environment

The airborne atmospheric environment was evaluated by performing radiological analyses on air particulate and radioiodine samples. The ODCM requires sampling from five locations, including three site boundary locations with greatest dose impact, one location within a local community with the highest dose impact, and one control location. Air particulate and radioiodine samples were collected and analyzed weekly from five locations (1B, 1C, 1Z/1A, 3A and 5H2; 5H2 is the control, 1A is the duplicate QA location). Airborne iodine and particulate samples were obtained at each location using a vacuum pump to pull air through a glass fiber filter and charcoal cartridge. The pumps were run continuously and sampled air at the rate of approximately 1 cubic foot per minute to obtain a minimum total volume of 280 cubic meters. The weekly filters were composited for a quarterly sample.

Ambient Gamma Radiation

The ambient gamma radiation in the areas surrounding PBAPS is measured using dosimeters, which are exposed to ambient radiation in the field and exchanged quarterly. The ODCM requires at least 40 routine monitoring stations with two or more dosimeters at each location for continuous monitoring. The REMP contains 48 dosimeter monitoring locations.

Optically-Stimulated Luminescent Dosimeters (OSLD) replaced the Thermo-Luminescent Dosimeter (TLD) starting in 2012. However, PBAPS continued using TLD in addition to OSLD to compare the two technologies. The primary data reported after 2012 is from OSLD. Additionally, only the "gross" OSLD exposure (i.e. no background or control subtraction) is reported; prior to 2012, "net' TLD exposures data were reported. This explains the increase in ambient radiation levels displayed in Figure C-6.

The OSLD locations were placed on and around the PBAPS site as follows:

Site boundary monitoring consists of 19 locations (1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1NN, 1P, 1Q, 1R, 2, and 40), near and within the site perimeter representing fence post doses (i.e., at locations where the doses will be potentially greater than maximum annual off-site doses).

Intermediate distance monitoring consists of 23 locations (14, 15, 17, 22, 23, 26, 27, 31A, 32, 3A, 42, 43, 44, 45, 46, 47, 48, 49, 4K, 5, 50, 51 and 6B), extending to approximately 5 miles from the site and designed to measure possible exposures to close-in population.

Six locations (16, 18, 19, 24, 2B and 1T) represent control and special interests areas such as population centers, schools, and nearest residents.

The specific dosimeter locations were determined by the following criteria:

1. The presence of relatively dense population, nearby residences, schools, and control locations;

2. Site meteorological data taking into account distance and elevation for each of the sixteen 22.5 degree sectors around the site, where estimated annual dose from PBAPS, if any, would be more significant;

3. And on hills free from local obstructions and within sight of the vents (where practical).

Each dosimetry location in the environment has 2 OSLD and 2 TLD dosimeters which were enclosed in plastic as a moisture barrier. Dosimeter housing are mesh plastic tubes, aligned horizontally and oriented such that dosimeter windows face the plant. Dosimeters themselves were placed vertically in the tubes so that no dosimeter was covered by another dosimeter and all dosimeters properly faced the plant.

B. Sample Analysis

This section describes the analytical methods used by TBE, EIS and GEL Labs to analyze the environmental samples for radioactivity. The analytical procedures used by the laboratories are listed in Table B-2, Appendix B.

The required OCDM analyses include:

1. Concentrations of beta emitters in drinking water and air particulates;
2. Concentrations of gamma-emitting nuclides in surface and drinking water, air particulates, milk, fish, sediment and food products;

3. Concentrations of tritium in surface and drinking water;
4. Concentrations of I-131 in air, milk, and food products. Although not required by the ODCM, I-131 is also analyzed in drinking and surface water;
5. Ambient gamma radiation levels at various site environs.

C. Data Interpretation

The radiological environmental and direct radiation data collected prior to PBAPS becoming operational was used as a baseline with which the 2018 operational data were compared. In addition, data were compared to previous years' operational data for consistency and trending. Several factors are important in the interpretation of the data.

1. Lower Limit of Detection and Minimum Detectable Concentration

The lower limit of detection (LLD) is defined as the smallest concentration of radioactive material in a sample that would yield a net count (above background) that would be detected with only a 5% probability of falsely concluding that a blank observation represents a "real" signal. The LLD is intended as a "before-the-fact" (*a priori*) estimate of a system (including instrumentation, procedure and sample type) and not as an "after-the-fact" (*a posteriori*) measurement. All analyses are designed to achieve the required detection limits for environmental samples, as described in the PBAPS ODCM.

The minimum detectable concentration or activity (MDC or MDA) is defined as the "after-the-fact" (*a posteriori*) estimate determined during the analysis of the sample.

2. Net Activity Calculation and Reporting of Results

Net activity for a sample is calculated by subtracting background activity from the sample activity. Since the REMP measures extremely small changes in radioactivity in the environment, background variations can result in sample activity being lower than the background activity causing a negative number. MDC is reported in all cases where positive activity was not detected. In previous years, when net activity was reported, a lower baseline is seen in trending when compared to 2018 results.

Gamma spectroscopy results for each type of sample were grouped as follows:

- For surface and drinking water, twelve nuclides, Manganese-54 (Mn-54), Cobalt-58 (Co-58), Iron-59 (Fe-59), Cobalt-60 (Co-60), Zinc-65 (Zn-65), Zirconium-95 (Zr-95), Niobium-95 (Nb-95), I-131, Cesium-134 (Cs-134), Cs-137, Barium-140 (Ba-140), and Lanthanum-140 (La-140) were reported.
- For fish, eight nuclides, K-40, Mn-54, Co-58, Fe-59, Co-60, Zn-65, Cs-134 and Cs-137 were reported.

- For sediment, seven nuclides, K-40, Mn-54, Co-58, Co-60, I-131, Cs-134 and Cs-137 were reported.
- For air particulates, six nuclides, Be-7, Mn-54, Co-58, Co-60, Cs-134 and Cs-137 were reported.
- For milk, six nuclides, K-40, I-131, Cs-134, Cs-137, Ba-140 and La-140 were reported.
- For food products, eight nuclides, Be-7, K-40, Mn-54, Co-58, Co-60, I-131, Cs-134 and Cs-137 were reported.

Positive activity values (greater than MDC) were recorded and the mean and two standard deviation of the results were calculated. The standard deviation represents the variability of measured results for different samples of the same media rather than a single analysis uncertainty.

D. Program Exceptions

For 2018, the PBAPS REMP had a sample collection recovery rate of > 99%. The exceptions to this program are listed below:

Table 2 LIST OF SAMPLE ANOMALIES

Sample Type	Location Code	Collection Date	Reason
Food Products	All Locations	June, 2018	Late planting season caused samples to only meet minimum volume requirement.
Food Products	All Locations	September, 2018	All locations had low production and 1C only collected 2 of 3 required species with one species at less than minimum required mass.
Surface Water	1MM	07/12 - 09/11 11/05 - 12/31	BVS sampler was out of service for 3 months.[1] (IR #02701975-03-02) Also it should be noted the sampling equipment was not returned to service before the following sampling period as stated in ODCMS 4.8.E.1.1-2.
AP/AI*	3A	11/08 - 11/16 11/22 - 11/29	Pump fuse blew in the middle of the week, but minimum volume for sample validity was met. Pump was replaced on 11/30 and one day of sampling was missed, but minimum volume was met.
Drinking Water	4L	December, 2018	BVS sampler was out of service due to maintenance at Conowingo Dam.[1] (IR #02701975-03)

**AP/AI = Air Particulates/Air Iodine*

[1]Sample was not missed, as compensatory sampling was performed, but sample did not meet Table 4.8.E.1 sample requirements (composited over a 2 hour period, IR #04154988)

Table 3 LIST OF MISSING SAMPLES

Sample Type	Location Code	Collection Date	Reason
Dosimetry	Deploy Control	1Q2018	Dosimeters were shipped with 4Q2017 samples and counted, therefore no control dosimeters for 1Q; transit dosimeters were used.
Dosimetry	4K	2Q2018	1 of 2 OSLD collected - one OSLD was lost and never recovered; data acceptable for 1 recovered OSLD, but no average value was produced.
AP/AI*	3A	03/01 - 03/10	Sample lost due to blown fuse and not enough volume collected to meet minimum volume requirements.
AP/AI*	5H2	07/02 - 07/09	Sample lost due to torn diaphragm pump; new pump installed 7/11/18.
AP/AI*	5H2	07/09 - 07/16	Sample lost due to electrical issue on new pump, another new pump installed on 7/14/18 (two samples missed in a row IR# 2701975-03-01).
Drinking Water	13B	07/18 - 07/25	Weekly sample lost due to pump malfunction at Chester Water Authority; monthly composite was not missed, but the sampling times are not continuous between July and August.

**AP/AI = Air Particulates/Air Iodine*

For the two weeks that location 5H2 missed air samples (IR# 2701975-03-01) the results from a co-located Limerick air sampling station were reviewed. These results did not show any abnormal results of concern; therefore, these missed samples are an acceptable deviation. Each program exception was reviewed to understand the causes of the program exception. Sampling and maintenance errors were reviewed with the personnel involved to prevent a recurrence. Occasional equipment breakdowns and power outages were unavoidable. Equipment with electrical issues were returned to manufacturer for repair or replacement.

IV. Program Changes

In 2018, PB upgraded the REMP air sampling equipment. Two restricted flow orifice pumps and four Hi-Q VS23 constant flow air sampler with gas totalizing meter and timer were replaced with Radeco AVS-28A portable constant air flow sampler with timer. This was done to improve equipment reliability. Also the sampling hoses and shrouds were replaced. The old shrouds were bell shaped and havens for wasps' nests. The new shrouds are more ring shaped and open and eliminated this environmental safety hazard.

V. Results and Discussion

Appendix A contains a summary of all 2018 PBAPS REMP results which meets the requirement of Table 3 of NUREG 1302 'Branch Technical Position Paper'[9]. Table A-1 lists results by each sample media and analyses performed. The total number of analyses performed, required LLD, the number of positive results for each indicator and control location are also listed. From the positive results identified (greater than the MDA) the mean value, range and station locations with highest annual mean are listed. Commonly identified nuclides are gross beta, K-40, and Be-7. A graphical representation is provided in Figure A-1.

A. Aquatic Environment

1. Surface Water

A summary of the 2018 analysis results for surface water samples from stations 1LL and 1MM are listed below:

Tritium

Quarterly samples were analyzed for tritium activity (Table C-I.1, Appendix C). No tritium activity was detected and the required LLD was met.

Iodine

Monthly samples were analyzed for low level I-131. All results were less than the MDC and the required LLD was met. (Table C-I.2, Appendix C).

Gamma Spectrometry

Monthly samples were analyzed for gamma-emitting nuclides (Table C-I.3, Appendix C). All nuclides were less than the MDC and all required LLDs were met.

2. Drinking Water

The results from the drinking water samples collected in 2018 from stations 13B, 4L and 6I are described below:

Gross Beta

Samples from all locations were analyzed monthly for concentrations of gross beta activity (Table C-II.1 and Figure C-1 Appendix C). Gross beta activity was detected in 18 of 36 samples. The values ranged from 1.8 to 4.0 pCi/L with a mean value of 2.7 ± 1.4 pCi/L. The mean detected gross beta activity was less than the required LLD (4 pCi/L) which indicates the sensitivity of the measurement technique. The detectable gross beta activity was well below the procedural investigation level (15 pCi/L). Concentrations detected were generally below those detected in previous years.

Tritium

Monthly samples were composited quarterly and analyzed for tritium activity (Table C-II.2, Appendix C). Tritium activity was not detected in any samples and the required LLD was met.

Iodine

Monthly samples were analyzed for low level I-131 (Table C-II.3, Appendix C). All results were less than the MDC and the required LLD was met.

Gamma Spectrometry

Samples from the three locations were analyzed monthly for gamma-emitting nuclides (Table C-II.4, Appendix C). All nuclides were less than the MDC and all required LLDs were met.

3. Fish

Results from fish samples collected at locations 4 and 6 in 2018 are described below:

Gamma Spectrometry

The edible portions of the collected fish samples were analyzed semiannually for gamma-emitting nuclides (Table C-III.1, Appendix C). Naturally occurring K-40 was found at all stations and ranged from 3,034 to 4,107 pCi/kg (wet), with a mean value of 3,620 ± 770 pCi/kg (wet), consistent with levels detected in previous years. No fission or activation products, due to plant operations were found in 2018 and all required LLDs were met. Figure C-2, Appendix C, displays the various gamma radionuclide MDC results for locations 4 and 6, based on the type of fish collected. All MDC results are less than the nuclide specific LLDs. The last 15-year average Cs-137 MDC is also shown to trend 2018 results with historical results. There have been no detectable levels of Cs-137 in fish since 1983.

4. Sediment

Sediment samples were collected at locations 6F, 4J, and 4T and the results are described below:

Gamma Spectrometry

Sediment samples were analyzed for gamma-emitting nuclides (Table C-IV.1, Appendix C). K-40 was found in all locations and ranged from 10,070 to 24,360 pCi/kg (dry) with a mean value of 16,675 ± 10,196 pCi/kg (dry). The fission product Cs-137 was detected in 1 of the 6 samples at a concentration of 158 pCi/kg ± 103 (dry), which is below the required LLD of 180 pCi/kg (dry). The positive result was also significantly less than the procedural investigation level of 1000 pCi/kg (dry), (IR #02701975-03-03).

2018 Cs-137 results are plotted against the average value from the last 15 years (Figure C-3, Appendix C). All values are significantly below the reporting level and there was not enough Cs-137 to indicate that the positive sample result was a consequence of plant operation. No other fission or activation products were found and all LLDs were met.

B. Atmospheric Environment

1. Airborne Particulates

Continuous air particulate samples were collected from five locations. The five locations were separated into three groups: Group I represents locations within the PBAPS site boundary (1B, 1C and 1Z/1A), Group II represents the location of the closest local community (3A) and Group III represents the control location at a remote distance from PBAPS (5H2). 1A results are discussed in Section H. The results from samples collected in 2018 are described below:

Gross Beta

Weekly samples were analyzed for concentrations of beta- emitters (Tables C-V.1, Appendix C). Detectable gross beta activity was observed at all locations. The results from Group I ranged from 6E-3 to 32E-3 pCi/m^3, with a mean of 14E-3 ± 10E-3 pCi/m^3. The results from Group II ranged from 6E-3 to 28E-3 pCi/m^3 with a mean of 14E-3 ± 10E-3 pCi/m^3. The results from the Group III ranged from 6E-3 to 28E-3 pCi/m^3 with a mean of 13E-3 ± 9E-3 pCi/m^3.

The mean value from all locations are the same within error, indicating the gross beta activity is not a result of the operation of PBAPS, as shown in Figure C-4, Appendix C. In addition, a comparison of the 2018 air particulate data with historical data indicates a decreasing trend in gross beta activity since initial operation of the plant (Figure C-4, Appendix C).

Gamma Spectrometry

Quarterly samples were analyzed for gamma-emitting nuclides (Table C-V.2, Appendix C). Naturally-occurring Be-7 activity, from cosmic rays, was detected in all 20 samples. The values ranged from 43E-3 to 90E-3 pCi/m^3, with a mean value of 66E-3 ± 30E-3pCi/m^3. All power production nuclides were less than the MDC and all required LLDs were met.

2. Airborne Iodine

Weekly samples were also analyzed for low level I-131 (Table C-VI.1, Appendix C). All results were less than the MDC for I-131 and the required LLD was met.

C. Terrestrial

1. Milk

During 2018, 156 milk samples were collected and analyzed from the following locations: D, J, R, L, P, S, U, W, X (indicators) and C, E, V (controls). The results are described below:

Iodine-131

Milk samples from all locations were analyzed for concentrations of I-131 (Tables C-VII.1, Appendix C). All results were less than the MDC for I-131 and all required LLDs were met. Figure C-5 displays the 2018 milk I-131 results for both indicator and control locations. All results are less than the LLD (1 pCi/L) and much less than the reporting level (3 pCi/L).

Gamma Spectrometry

Milk samples from all locations were analyzed for concentrations of gamma-emitting nuclides (Table C-VII.2, Appendix C). Naturally- occurring K-40 was found in all samples and ranged from 947 to 2,129 pCi/l, with a mean value of 1262 ± 283 pCi/L. All other nuclides were less than the MDC and all required LLDs were met.

2018 Cs-134 and Cs-137 MDC results are plotted in Figure C-5 with the required LLDs and Reporting Levels. All results are much less than the LLDs and reporting levels. The last 15-year average MDC of Cs-137 in milk is also plotted in Figure C-5, Appendix C. There is no statistical difference between the 2018 MDC Cs-137 results and the 15-year historical MDC.

2. Food Products

Throughout 2018, 47 samples of various green leafy vegetation (kale, cabbage, collard greens, broccoli, etc.) were collected and analyzed for concentrations of gamma-emitting nuclides (Table C-VIII.1, Appendix C). The results are discussed below:

Gamma Spectrometry

Naturally-occurring Be-7 activity was found in 33 of 47 samples and ranged from 262 to 26,950 pCi/kg (wet), with a mean of 2,062 ± 9,620 pCi/kg (wet). Also, naturally occurring K-40 activity was found in all samples and ranged from

905 to 9,595 pCi/kg (wet), with a mean of 3,845 ± 3,527 pCi/kg (wet). All power production nuclides were less than the MDC and all required LLDs were met.

D. Ambient Gamma Radiation

Results of OSLD measurements are listed in Tables C-IX.1 and C-IX.2 and Figure C-6, Appendix C.

The mean gross OSLD measurement for all indicator locations was 8.8 ± 2.6 mRem per standard month, with a range of 5.5 to 12.9 mRem per standard month. The period mean for the control locations (16, 18, 19 and 24) was 8.1 ± 2.1 mRem per standard month, with a range of 6.5 to 9.5 mRem per standard month, which is the same as the OSLDs located within the site boundary and intermediate distances. These results indicate PBAPS operation had no impact on the ambient gamma radiation levels in the areas surrounding PBAPS. This trend has occurred throughout the history of the plant and can be seen in Figure C-6, Appendix C. The 2012 increase in ambient radiation reading in 2012, seen in Figure C-6, was due to the change from TLD to OSLD monitoring and the reporting of gross rather than net measurement values.

E. Independent Spent Fuel Storage Installation (ISFSI)

ISFSI was initiated in June 2000. Six new casks were added to the ISFSI pad in 2018. Site boundary OSLDs which measure the ambient gamma radiation closest to ISFSI are locations 1A, 1D, 1M, 1P, 1Q, 1R, with 1R being the closest. Location 2B is the nearest real resident which could be impacted by ISFSI. Location 1R, showed a general increase of 1 to 3 mRem per standard month from pre-ISFSI loading (Figure C-7, Appendix C). Location 2B, follows closely with values from locations 1A, 1D, and controls, indicating no impact from ISFSI on nearest real resident. Data from location 2B is used to demonstrate compliance to both 40CFR190 and 10CFR72.104 limits. All radiation levels are well below regulatory limits.

The pre-operational (pre-op) ambient gamma radiation level is not a gross value, therefore, Figure C-7 displays a 'Pre-Op + Transit' value which adds an average transit dose to the pre-op value. Transit dose is any dose recorded by the OSLDs when they are not actively measuring ambient radiation in the field (e.g. during transportation and dosimeter change outs). Transit dose can be measured anywhere from 3 to 8 mrem per month. An average value of 5 mrem per month was added to show that even though an increased dose is observed due to ISFSI operations, ISFSI is not increasing ambient gamma radiation levels above background and pre-operation levels. Location 1R is approaching the pre-operational levels, but the other locations around ISFSI are still well below background levels.

The dosimetry system is undergoing an evaluation to align with the new methodology presented in ANSI 13.37, "Environmental Dosimetry".[10] This methodology is included in part of a revision to Regulatory Guide 4.13 (Draft Regulatory Guide DG-4019, "Environmental Dosimetry – Performance, Specifications, Testing, and Data Analysis").(11) The dosimetry results will be presented in the new methodology starting in 2019.

F. Land Use Census

A Land Use Survey, conducted during the fall of 2018, was performed by Exelon Industrial Services (EIS), to comply with Section 3.8.E.2 of PBAPS's ODCM Specifications. The survey documented the nearest milk-producing and meat animal, nearest residence, and garden larger than 500 square feet in each of the sixteen meteorological sectors out to five miles.

Also, because PBAPS is an elevated release facility, an additional requirement of identifying all gardens larger than 500 square feet and every dairy operation within three (3) miles was included in the survey. The distance and direction of all locations were positioned using Global Positioning System (GPS) technology. The results of this survey are summarized below.

There was no change in nearest residents compared to the 2017 report. There were gardens identified in all sectors except the NNW sector. Four (4) new gardens were located this year in SSE, SSW, WSW and W sectors. The garden in sector SSW was identified as the closest garden for that sector. Animals used for meat consumption were identified in 14 of the 16 sectors. Five new sites were identified this year in WNW, WSW, W, and E sectors, with the nearest meat animal updating in the WSW sector. Dairy sites were identified in 12 of 16 sectors with no changes in nearest milk-producing animal in any sector.

Location of the Nearest Residence, Garden, Milk, Meat, Animal within a Five-Mile Radius of PBASP Reactor Building Exhaust Vents

Sector		Residence Feet	Garden Feet	Milk Farm Feet	Meat Animal Feet
1	N	12,362	14,003	14,183	14,183
2	NNE	11,112	11,041	10,843	10,843
3	NE	10,080	10,004	10,492	10,492
4	ENE	10,495	11,554	10,925*	10,925
5	E	10,066	14,540	14,471	13,712
6	ESE	16,085	20,374	20,154	16,085
7	SE	10,772	10,772	19,134*	19,134
8	SSE	3,912	3,912	-	-
9	S	5,545	5,545	-	9,247
10	SSW	6,072	6,418	11,602	7,187
11	SW	4,755	4,865	4,860*	4,860
12	WSW	4,036	7,487	-	10,506
13	W	5,327	5,327	5,136*	5,136
14	WNW	2,928	4,192	22,124	3,926
15	NW	2,948	9,545	9,545	7,582
16	NNW	5,124	0-	-	-

G. Errata Data

In the 2017 AREOR, the location for Milk Farm C was incorrect in Table B-1, Appendix B (IR #04174541). Table B-1 has been incorrect since 2011 (the AREOR for 2010) when the units in that table changed from miles to feet. Review of previous AREORs identified that Milk Farm C was never included on a map until the 2017 AREOR. The distance is 9.54 miles or 50,400 ft. The corrected table is shown in Appendix F.

H. Secondary Laboratory Analysis

Appendix D of this report presents the results of data analyses performed by the QC laboratory, EIS and GEL. Duplicate samples were obtained from several locations and analyzed by both the primary and QC laboratories. GEL was only used for H-3 analyses of water samples because EIS could not perform those analyses. Comparisons of the results for all media were within expected ranges.

Figure D-2 shows the gross beta results for both TBE and EIS. These samples are from two separate air samplers co-located within a few feet of each other, but there is a distinct bias. Limerick Generating Station noticed similar results with their duplicate samples and performed in investigation tracked under IR # 4048258-02. During that investigation it was verified that each lab has passed their crosscheck program blind sample analyses. The only difference between each lab's calibration and sample analyses identified at this time is the sample count time. There does appear to be a slight low bias for TBE compared to EIS but based on cross check results the bias appears to be negligible compared to actual sample results. The fact that the samples being compared are not the same samples but different samples from the same location adds to the potential differences in reported values. The results between the labs do appear to trend together though with the slight bias identified.

In December of 2018, there were elevated gross beta results for 1A that were not seen in the 1Z filter. EIS did investigate by recounting samples and swapping the sample pumps, but not until over a month past sample collection. The filter deposition was noticeably darker than previous weeks, but sample results returned to normal ranges within the next month. No reportable or investigation limits were exceeded with the elevated results. There was no detectable gamma activity on the quarterly filter, therefore, these results were not a concern.

I. Summary of Results – Quality Control (QC) Laboratory Analysis

The primary and secondary laboratories analyzed Performance Evaluation (PE) samples of air particulate, air iodine, milk, soil, food products and water matrices (Appendix E). The PE samples, supplied by Eckert & Ziegler

Analytics, Inc., Environmental Resource Associates (ERA) and DOE's Mixed Analyte Performance Evaluation Program (MAPEP), were evaluated against a pre-set acceptance criteria described in Appendix E.

For the Teledyne Brown Engineering (TBE) laboratory, 166 out of 172 analyses performed met the specified acceptance criteria. Six analyses (Water - Sr-90, Milk – Fe-59 & I-131, Vegetation – Sr-90 (2) and Soil – Cr-51) did not meet the specified acceptance criteria and are documented in Appendix E. TBE has addressed each issue through the TBE Corrective Action Program.

For the EIS laboratory, 63 of 63 analyses met the specified acceptance criteria.

For the GEL laboratory, For the GEL laboratory, 345 of 352 analyses met the specified acceptance criteria. Tritium (water matrix) was the only nuclide analyzed for Peach Bottom REMP and all analyses met the specified acceptance criteria. Nuclides analyzed for Peach Bottom RGPP included H-3, Sr-89/90, Gross Alpha, Gross Beta, Gamma, and Alpha Spec (water matrix). One nuclide, Uranium did not meet the specified acceptance criteria and is documented in Appendix F. All failures were addressed through GEL's Corrective Action Program.

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

VI. References

1. Preoperational Environs Radioactivity Survey Summary Report, March 1960 through January 1966. (September 1967)

2. Interex Corporation, Peach Bottom Atomic Power Station Regional Environs Radiation Monitoring Program Preoperational Summary Report, Units 2 and 3, 5 February 1966 through 8 August 1973, June 1977, Natick, Massachusetts

3. Radiation Management Corporation Publication, Peach Bottom Atomic Power Station Preoperational Radiological Monitoring Report for Unit 2 and 3, January 1974, Philadelphia, Pennsylvania

4. Information from NCRP Reports 160 and 94

5. Primarily from airborne radon and its radioactive progeny

6. Includes CT (147 mrem), nuclear medicine (77 mrem), interventional fluoroscopy (43 mrem) and conventional radiography and fluoroscopy (33 mrem)

7. Primarily from cigarette smoking (4.6 mrem), commercial air travel (3.4 mrem), building materials (3.5 mrem), and mining and agriculture (0.8 mrem)

8. Industrial, security, medical, educational, and research

9. Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Boiling Water Reactors, Generic Letter 89-01, Supplement No. 1 (NUREG-1302), April 1991

10. American National Standards Institute/Health Physics Society, (ANSI/HPS) N13.37-2014, "Environmental Dosimetry – Criteria for System Design and Implementation"

11. U.S. Nuclear Regulatory Commission, draft regulatory guide (DG), DG-4019, "Environmental Dosimetry - Performance, Specifications, Testing, and Data Analysis", October, 2018

APPENDIX A

RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT SUMMARY

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FIGURE A-1
TOTAL REMP ANALYSES FOR 2018 AND SPECIFIC NUCLIDE ANALYSES WITH ACTIVITY GREATER THAN MDA

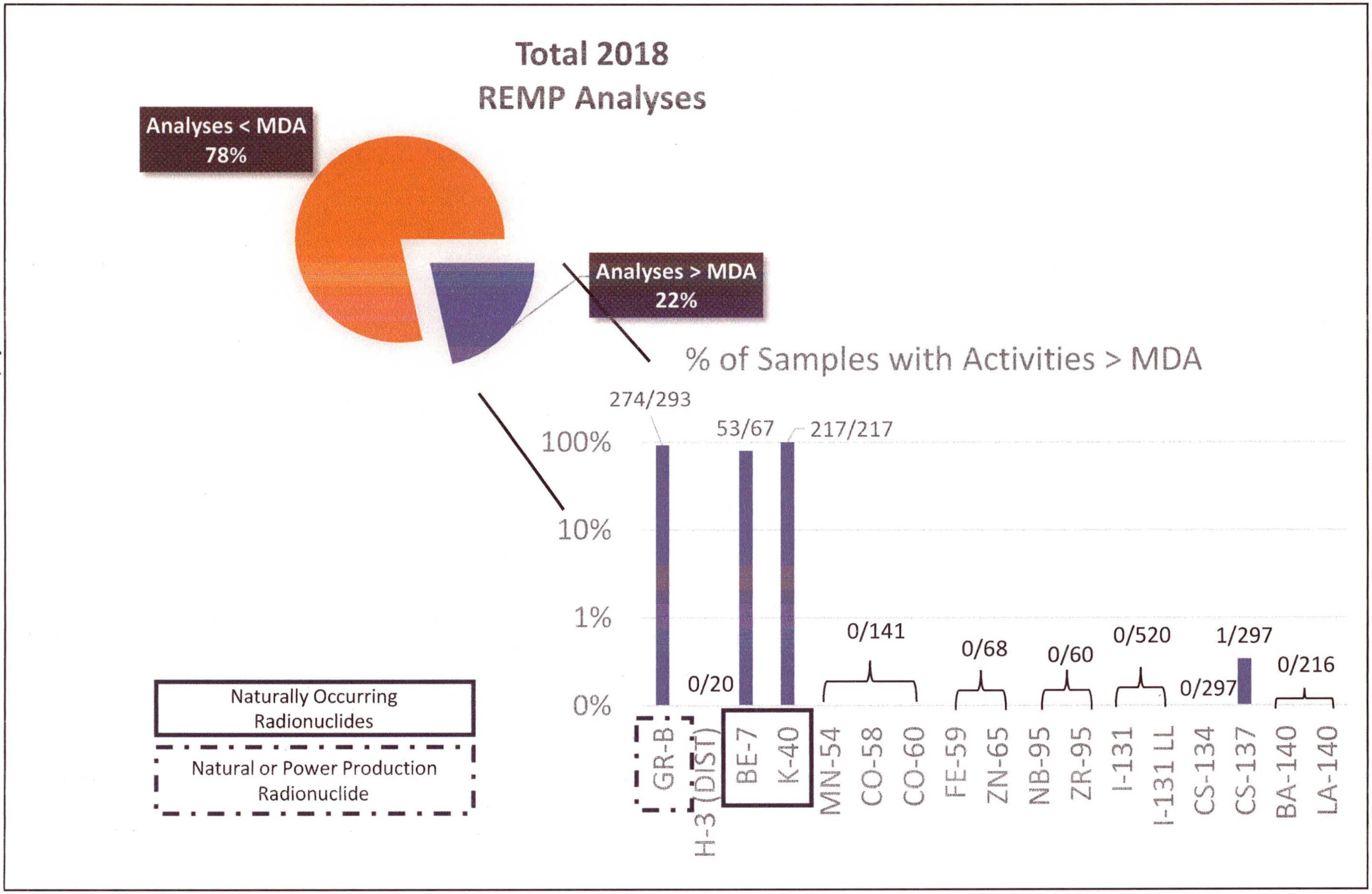

TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR PEACH BOTTOM ATOMIC POWER STATION, 2018

NAME OF FACILITY:	**PEACH BOTTOM ATOMIC POWER STATION**	**DOCKET NUMBER:**	**50-277 & 50-278**
LOCATION OF FACILITY:	**YORK COUNTY , PA**	**REPORTING PERIOD:**	**2018**

MEDIUM OR PATHWAY SAMPLED *(UNIT OF MEASUREMENT)*	TYPES OF ANALYSIS PERFORMED	NUMBER OF ANALYSIS PERFORMED	REQUIRED LOWER LIMIT OF DETECTION (LLD)	INDICATOR LOCATIONS MEAN (M) (F) *RANGE*	CONTROL LOCATION MEAN (M) (F) *RANGE*	LOCATION WITH HIGHEST ANNUAL MEAN (M): MEAN (M) (F) *RANGE*	LOCATION WITH HIGHEST ANNUAL MEAN (M): STATION # NAME DISTANCE AND DIRECTION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
SURFACE WATER *(PCI/LITER)*	**H-3**	8	200	<LLD	<LLD	-		0
	I-131	24	1	<LLD	<LLD	-		0
	GAMMA	24						
	Mn-54		15	<LLD	<LLD	-		0
	Co-58		15	<LLD	<LLD	-		0
	Fe-59		30	<LLD	<LLD	-		0
	Co-60		15	<LLD	<LLD	-		0
	Zn-65		30	<LLD	<LLD	-		0
	Nb-95		15	<LLD	<LLD	-		0
	Zr-95		30	<LLD	<LLD	-		0
	Cs-134		15	<LLD	<LLD	-		0
	Cs-137		18	<LLD	<LLD	-		0
	Ba-140		60	<LLD	<LLD	-		0
	La-140		15	<LLD	<LLD	-		0
DRINKING WATER *(PCI/LITER)*	**GR-B**	36	4	2.8 (11/24) *(1.8/4)*	2.6 (7/12) *(1.9/3.4)*	3.1 (6/12) *(1.8/4)*	4L INDICATOR CONOWINGO DAM EL 33' MSL 45900 FEET SE	0
	H-3	12	200	<LLD	<LLD	-		0
	I-131 (LOW LVL)	36	1	<LLD	<LLD	-		0
	GAMMA	36						
	MN-54		15	<LLD	<LLD	-		0
	CO-58		15	<LLD	<LLD	-		0
	FE-59		30	<LLD	<LLD	-		0
	CO-60		15	<LLD	<LLD	-		0
	ZN-65		30	<LLD	<LLD	-		0
	NB-95		15	<LLD	<LLD	-		0
	ZR-95		30	<LLD	<LLD	-		0
	CS-134		15	<LLD	<LLD	-		0
	CS-137		18	<LLD	<LLD	-		0
	BA-140		60	<LLD	<LLD	-		0
	LA-140		15	<LLD	<LLD	-		0

(M) The Mean Values are calculated using the positive values. (F) Fraction of detectable measurement are indicated in parentheses.

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LOCATION OF FACILITY:	**YORK COUNTY , PA**	**REPORTING PERIOD:**	**2018**

MEDIUM OR PATHWAY SAMPLED *(UNIT OF MEASUREMENT)*	TYPES OF ANALYSIS PERFORMED	NUMBER OF ANALYSIS PERFORMED	REQUIRED LOWER LIMIT OF DETECTION (LLD)	**INDICATOR LOCATIONS** MEAN (M) (F) *RANGE*	**CONTROL LOCATION** MEAN (M) (F) *RANGE*	**LOCATION WITH HIGHEST ANNUAL MEAN (M)** MEAN (M) (F) *RANGE*	**LOCATION WITH HIGHEST ANNUAL MEAN (M)** STATION # NAME DISTANCE AND DIRECTION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
BOTTOM FEEDER	**GAMMA**	4						
(PCI/KG WET)	*K-40*		NA	3434	3570	3570	6 CONTROL	0
				(2/2)	(2/2)	(2/2)	HOLTWOOD POND	
				(3034/3833)	*(3352/3787)*	*(3352/3787)*	50000 - 70000 FEET NW	
	MN-54		130	<LLD	<LLD	-		0
	CO-58		130	<LLD	<LLD	-		0
	FE-59		260	<LLD	<LLD	-		0
	CO-60		130	<LLD	<LLD	-		0
	ZN-65		260	<LLD	<LLD	-		0
	CS-134		130	<LLD	<LLD	-		0
	CS-137		150	<LLD	<LLD	-		0
PREDATOR	**GAMMA**	4						
(PCI/KG WET)	*K-40*		NA	3842	3636	3842	4 INDICATOR	0
				(2/2)	(2/2)	(2/2)	CONOWINGO POND	
				(3781/3903)	*(3165/4107)*	*(3781/3903)*	600-10000 FEET SE	
	MN-54		130	<LLD	<LLD	-		0
	CO-58		130	<LLD	<LLD	-		0
	FE-59		260	<LLD	<LLD	-		0
	CO-60		130	<LLD	<LLD	-		0
	ZN-65		260	<LLD	<LLD	-		0
	CS-134		130	<LLD	<LLD	-		0
	CS-137		150	<LLD	<LLD	-		0
SEDIMENT	**GAMMA**	6						
(PCI/KG DRY)	*K-40*		NA	16993	16040	22365	4T INDICATOR	0
				(4/4)	(2/2)	(2/2)	:ONOWINGO POND NEAR CONOWINGO DAM	
				(10070/24360)	*(15530/16550)*	*(20370/24360)*	41800 FEET SE	
	MN-54		NA	<LLD	<LLD	-		0
	CO-58		NA	<LLD	<LLD	-		0
	CO-60		NA	<LLD	<LLD	-		0
	CS-134		150	<LLD	<LLD	-		0
	CS-137		180	158	<LLD	158	4T INDICATOR	0
				(1/4)		(1/2)	:ONOWINGO POND NEAR CONOWINGO DAM	
							41800 FEET SE	

(M) The Mean Values are calculated using the positive values. (F) Fraction of detectable measurement are indicated in parentheses.

TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR PEACH BOTTOM ATOMIC POWER STATION, 2018

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LOCATION OF FACILITY:	**YORK COUNTY , PA**	**REPORTING PERIOD:**	**2018**

MEDIUM OR PATHWAY SAMPLED *(UNIT OF MEASUREMENT)*	TYPES OF ANALYSIS PERFORMED	NUMBER OF ANALYSIS PERFORMED	REQUIRED LOWER LIMIT OF DETECTION (LLD)	INDICATOR LOCATIONS MEAN (M) (F) *RANGE*	CONTROL LOCATION MEAN (M) (F) *RANGE*	LOCATION WITH HIGHEST ANNUAL MEAN (M): MEAN (M) (F) *RANGE*	LOCATION WITH HIGHEST ANNUAL MEAN (M): STATION # NAME DISTANCE AND DIRECTION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
AIR PARTICULATE *(E-3 PCI/CU.METER)*	**GR-B**	257	10	14 (206/207) *(6/32)*	13 (50/50) *(6/28)*	15 (51/51) *(6/28)*	3A INDICATOR DELTA PA SUBSTATION 19300 FEET SW	0
	GAMMA	20						
	BE-7		NA	66 (16/16) *(46/89)*	69 (4/4) *(43/90)*	72 (4/4) *(52/89)*	1B INDICATOR WEATHER STATION #2 2500 FEET NW	0
	MN-54		NA	<LLD	<LLD	-		0
	CO-58		NA	<LLD	<LLD	-		0
	CO-60		NA	<LLD	<LLD	-		0
	CS-134		50	<LLD	<LLD	-		0
	CS-137		60	<LLD	<LLD	-		0
AIR IODINE *(E-3 PCI/CU.METER)*	**GAMMA**	257						
	I-131		70	<LLD	<LLD	-		0
MILK *(PCI/LITER)*	**I-131 (LOW LVL)**	156	1	<LLD	<LLD	-		0
	GAMMA	156						
	K-40		NA	1263 (126/126) *(947/2129)*	1256 (30/30) *(1058/1607)*	1396 (4/4) *(1316/1506)*	W INDICATOR 89200 FEET S	0
	CS-134		15	<LLD	<LLD	-		0
	CS-137		18	<LLD	<LLD	-		0
	BA-140		60	<LLD	<LLD	-		0
	LA-140		15	<LLD	<LLD	-		0

(M) The Mean Values are calculated using the positive values. (F) Fraction of detectable measurement are indicated in parentheses.

TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR PEACH BOTTOM ATOMIC POWER STATION, 2018

NAME OF FACILITY:	**PEACH BOTTOM ATOMIC POWER STATION**	**DOCKET NUMBER:**	**50-277 & 50-278**
LOCATION OF FACILITY:	**YORK COUNTY , PA**	**REPORTING PERIOD:**	**2018**

MEDIUM OR PATHWAY SAMPLED *(UNIT OF MEASUREMENT)*	TYPES OF ANALYSIS PERFORMED	NUMBER OF ANALYSIS PERFORMED	REQUIRED LOWER LIMIT OF DETECTION (LLD)	**INDICATOR LOCATIONS** MEAN (M) (F) *RANGE*	**CONTROL LOCATION** MEAN (M) (F) *RANGE*	**LOCATION WITH HIGHEST ANNUAL MEAN (M)** MEAN (M) (F) *RANGE*	**LOCATION WITH HIGHEST ANNUAL MEAN (M)** STATION # NAME DISTANCE AND DIRECTION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
VEGETATION	**GAMMA**	47						
(PCI/KG WET)	*BE-7*		NA	1843 (26/35) *(262/26950)*	2873 (7/12) *(352/9441)*	4444 (7/11) *(262/26950)*	1C INDICATOR PEACH BOTTOM SOUTH SUB STATION 4700 FEET SSE	0
	K-40		NA	3402 (35/35) *(905/6557)*	5135 (12/12) *(3378/9595)*	5135 (12/12) *(3378/9595)*	55 CONTROL NE SECTOR 51900 FEET NE	0
	MN-54		NA	<LLD	<LLD	-		0
	CO-58		NA	<LLD	<LLD	-		0
	CO-60		NA	<LLD	<LLD	-		0
	I-131		60	<LLD	<LLD	-		0
	CS-134		60	<LLD	<LLD	-		0
	CS-137		80	<LLD	<LLD	-		0
DIRECT RADIATION *(MILLI-ROENTGEN/STD.MO.)*	**OSLD-QUARTERLY**	192	NA	8.8 (176/176) *(5.5/12.9)*	8.1 (16/16) *(6.5/9.5)*	12.6 (4/4) *(12.2/12.9)*	1R INDICATOR TRANSMISSION LINE HILL 2798 FEET SSE	0

(M) The Mean Values are calculated using the positive values. (F) Fraction of detectable measurement are indicated in parentheses.

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APPENDIX B

SAMPLE DESIGNATION AND LOCATIONS

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TABLE B-1 Radiological Environmental Monitoring Program – Sampling Locations, Distance and Direction from Reactor Buildings, Peach Bottom Atomic Power Station, 2018

Location	Location Description	Distance & Direction from Site per PBAPS ODCM
A. Surface Water		
1LL	Peach Bottom Units 2 and 3 Intake - Composite (Control)	1,200 feet ENE
1MM	Peach Bottom Canal Discharge -Composite	5,500 feet SE
B. Drinking (Potable) Water		
4L	Conowingo Dam EL 33' MSL - Composite	45,900 feet SE
6I	Holtwood Dam Hydroelectric Station - Composite (Control)	30,500 feet NW
13B	Chester Water Authority (CWA) Susquehanna Pumping Station- Composite	13,300 feet ESE
C. Fish		
4	Conowingo Pond	6,000 – 10,000 feet SE
6	Holtwood Pond (Control)	50,000 – 70,000 feet NNW
D. Sediment		
4J	Conowingo Pond near Berkin's Run	7,400 feet SE
4T	Conowingo Pond near Conowingo Dam	41,800 feet SE
6F	Holtwood Dam (Control)	31,500 feet NW
E. Air Particulate - Air Iodine		
1B	Weather Station #2	2,500 feet NW
1Z	Weather Station #1	1,500 feet SE
1A	Weather Station #1	1,500 feet SE
1C	Peach Bottom South Sub Station	4,700 feet SSE
3A	Delta, PA – Substation	19,300 feet SW
5H2	Manor Substation (Control)	162,400 feet NE
F. Milk – bi-weekly / monthly		
J		5,100 feet W
R		4,900 feet SW
S		19,100 feet SE
U		11,200 feet SSW
V	(Control)	32,600 feet W
X		9,500 feet NW
G. Milk – quarterly		
C	(Control)	50,400 feet NW
D		18,500 feet NE
E	(Control)	46,100 feet N
L		11,200 feet NE
P		11,000 feet ENE
W		89,200 feet S
H. Food Products – monthly when available		
1C		4,700 feet SSE
2Q		9,200 feet SW
3Q		9,500 feet W
55	(Control)	51,900 feet NE

TABLE B-1 Radiological Environmental Monitoring Program – Sampling Locations, Distance and Direction from Reactor Buildings, Peach Bottom Atomic Power Station, 2018

Location	Location Description	Distance & Direction from Site per PBAPS ODCM
J. Environmental Dosimetry - OSLD		
Site Boundary		
1L	Peach Bottom Unit 3 Intake	1,100 feet NE
1P	Tower B & C Fence	2,200 feet ESE
1A	Weather Station #1	1,500 feet SE
1Q	Tower D & E Fence	3,300 feet SE
1D	140 ° Sector	3,500 feet SSE
2	Peach Bottom 130° Sector Hill	4,700 feet SE
2B	Burk Property	3,900 feet SSE
1M	Discharge	5,400 feet SE
1R	Transmission Line Hill/ISFSI Pad	2,800 feet SSE
1I	Peach Bottom South Substation	2,900 feet S
1C	Peach Bottom South Substation	4,700 feet SSE
1J	Peach Bottom 180° Sector Hill	4,000 feet S
1K	Peach Bottom Site Area	4,700 feet SW
1F	Peach Bottom 200° Sector Hill	2,900 feet SSW
40	Peach Bottom Site Area	8,000 feet SW
1NN	Peach Bottom Site	2,700 feet WSW
1H	Peach Bottom 270° Sector Hill	3,200 feet W
1G	Peach Bottom North Substation	3,100 feet WNW
1B	Weather Station #2	2,500 feet NW
1E	Peach Bottom 350° Sector Hill	3,000 feet NNW
Intermediate Distance		
5	Wakefield, PA	24,400 feet E
15	Silver Spring Rd	19,300 feet N
22	Eagle Road	12,500 feet NNE
44	Goshen Mill Rd	26,700 feet NE
32	Slate Hill Rd	14,400 feet ENE
45	PB-Keeney Line	18,500 feet ENE
14	Peters Creek	10,300 feet E
17	Riverview Rd	21,500 feet ESE
31A	Eckman Rd	24,100 feet SE
4K	Conowingo Dam Power House Roof	45,900 feet SE
23	Peach Bottom 150° Sector Hill	5,500 feet SSE
27	N. Cooper Road	14,400 feet S
48	Macton Substation	26,500 feet SSW
3A	Delta, PA Substation	19,300 feet SW
49	PB-Conastone Line	21,500 feet WSW
50	TRANSCO Pumping Station	26,400 feet W
51	Fin Substation	21,000 feet WNW
26	Slab Road	21,800 feet NW
6B	Holtwood Dam Power House Roof	30,400 feet NW
42	Muddy Run Environ. Laboratory	21,600 feet NNW
43	Drumore Township School	26,200 feet NNE
46	Broad Creek	23,800 feet SSE
47	Broad Creek Scout Camp	22,700 feet S
1T	Lay Road/LLRWSF	3,100 feet WNW
Control		
16	Nottingham, PA Substation (Control)	67,100 feet E
24	Harrisville, MD Substation (Control)	58,200 feet ESE
18	Fawn Grove, PA (Control)	52,200 feet W
19	Red Lion, PA (Control)	124,000 feet WNW

TABLE B-2 Radiological Environmental Monitoring Program – Summary of Sample Collection and Analytical Methods, Peach Bottom Atomic Power Station, 2018

Sample Medium	Analysis	Sampling Method	Collection Procedure Number	Sample Size	Analytical Procedure Number
Surface Water	Gamma Spectroscopy	Monthly composite from a continuous water compositor	CY-ES-240 Surface, Drinking, and Effluent Water Sample Collection for Radiological Analysis ST-C-095-835-2 Circulating Water Intake and Discharge Composite Sampling	2 gallon	TBE, TBE-2007 Gamma emitting radioisotope analysis EIS, CY-ES-205 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
Surface Water	Tritium	Quarterly composite from a continuous water compositor	CY-ES-240 Surface, Drinking, and Effluent Water Sample Collection for Radiological Analysis ST-C-095-835-2 Circulating Water Intake and Discharge Composite Sampling	500 ml	TBE, TBE-2010 Tritium and carbon-14 analysis by liquid scintillation GEL, EPA906.0 Mod, for Tritium analysis by Liquid Scintillation
Surface Water	I-131	Monthly composite from a continuous water compositor	CY-ES-240 Surface, Drinking, and Effluent Water Sample Collection for Radiological Analysis ST-C-095-835-2 Circulating Water Intake and Discharge Composite Sampling	2 gallon	TBE, TBE-2012 Radioiodine in various matrices EIS, CY-ES-205 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
Drinking Water	Gross Beta	Monthly composite from a continuous water compositor	CY-ES-240 Surface, Drinking, and Effluent Water Sample Collection for Radiological Analysis	2 gallon	TBE, TBE-2008 Gross alpha and/or gross beta activity in various matrices CY-ES-206, Operation of the Tennelec S5E Proportional Counter
Drinking Water	I-131	Monthly composite from a continuous water compositor	CY-ES-240 Surface, Drinking, and Effluent Water Sample Collection for Radiological Analysis	2 gallon	TBE, TBE-2031 Radioiodine in drinking water EIS, CY-ES-205 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
Drinking Water	Gamma Spectroscopy	Monthly composite from a continuous water compositor	CY-ES-240 Surface, Drinking, and Effluent Water Sample Collection for Radiological Analysis	2 gallon	TBE, TBE-2007 Gamma emitting radioisotope analysis EIS, CY-ES-205 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
Drinking Water	Tritium	Quarterly composite from a continuous water compositor	CY-ES-240 Surface, Drinking, and Effluent Water Sample Collection for Radiological Analysis	500 ml	TBE, TBE-2010 Tritium and carbon-14 analysis by liquid scintillation GEL, EPA906.0 Mod, for Tritium analysis by Liquid scintillation
Fish	Gamma Spectroscopy	Semi-annual samples collected via electroshocking or other techniques	NAI-ER3 Collection of fish samples for radiological analysis (PBAPS)	1000 grams (wet)	TBE, TBE-2007 Gamma emitting radioisotope analysis EIS, CY-ES-205 Gamma Counting Using the HPGe Detector with the Genie PC Counting System

**Sampling specifics and locations are listed in CY-ES-244-F-02 "Peach Bottom REMP Sampling Locations and Site Content Information"*

TABLE B-2 Radiological Environmental Monitoring Program – Summary of Sample Collection and Analytical Methods, Peach Bottom Atomic Power Station, 2018

Sample Medium	Analysis	Sampling Method	Collection Procedure Number	Sample Size	Analytical Procedure Number
Sediment	Gamma Spectroscopy	Semi-annual grab samples	NAI-ER3 Collection of sediment samples for radiological analysis (PBAPS)	500 grams (dry)	TBE, TBE-2007 Gamma emitting radioisotope analysis EIS, CY-ES-205, Gamma Counting Using the HPGe Detector with the Genie PC Counting System
Air Particulates	Gross Beta	One-week composite of continuous air sampling through glass fiber filter paper	CY-ES-237 Air Iodine and Air Particulate Sample Collection for Radiological Analysis	1 filter (~ 280 cubic meters weekly)	TBE, TBE-2008 Gross alpha and/or gross beta activity in various matrices EIS, CY-ES-206, Operation of the Tennelec S5E Proportional Counter
Air Particulates	Gamma Spectroscopy	Quarterly composite of each station	TBE, TBE-2023 Compositing of samples CY-ES-204 Sample Preparation for Gamma and Beta Counting	13 filters (~ 3600 cubic meters)	TBE, TBE-2007 Gamma emitting radioisotope analysis EIS, CY-ES-205 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
Air Iodine	Gamma Spectroscopy	One-week composite of continuous air sampling through charcoal filter	CY-ES-237 Air Iodine and Air Particulate Sample Collection for Radiological Analysis	1 filter (~ 280 cubic meters weekly)	TBE, TBE-2007 Gamma emitting radioisotope analysis EIS, CY-ES-205 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
Milk	I-131	Bi-weekly grab sample when cows are on pasture. Monthly all other times	CY-ES-238 Milk Sample Collection for Radiological Analysis	2 gallon	TBE, TBE-2012 Radioiodine in various matrices EIS, CY-ES-205 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
Milk	Gamma Spectroscopy	Bi-weekly grab sample when cows are on pasture; Monthly all other times	CY-ES-238 Milk Sample Collection for Radiological Analysis	2 gallon	TBE, TBE-2007 Gamma emitting radioisotope analysis EIS, CY-ES-205 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
Food Products	Gamma Spectroscopy	Monthly when available	CY-ES-241 Vegetation Sample Collection for Radiological Analysis	1000 grams	TBE, TBE-2007 Gamma emitting radioisotope analysis EIS, CY-ES-205 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
OSLD	Optically Stimulated Luminescence Dosimetry	Quarterly OSLDs comprised of two Al_2O_3:C Landauer Incorporated elements.	CY-ES-239, Collection/Exchange of Field Dosimeters for Radiological Analysis	2 dosimeters	Landauer Incorporated

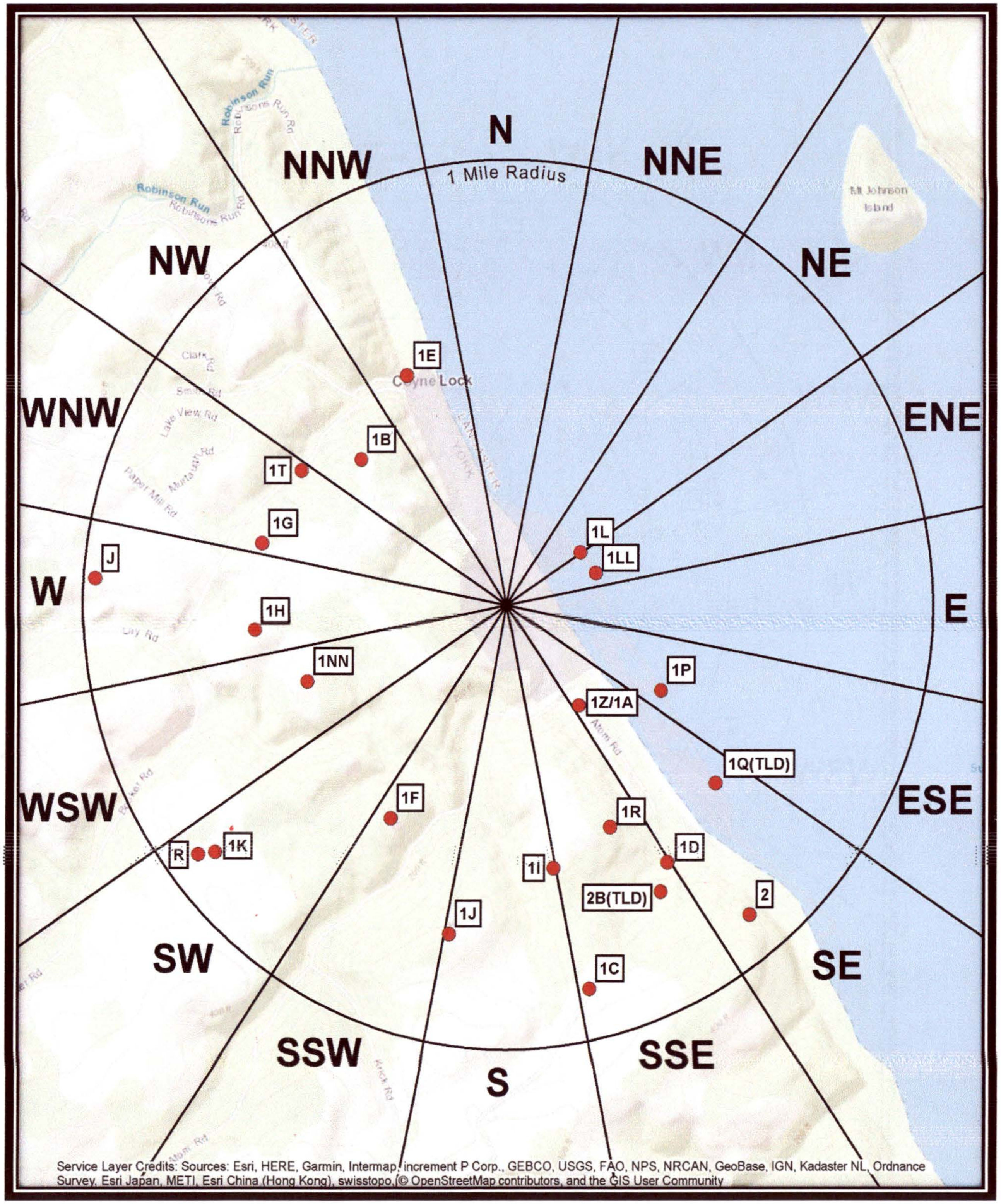

Figure B-1
Environmental Sampling Locations Within One Mile
of Peach Bottom Atomic Power Station, 2018

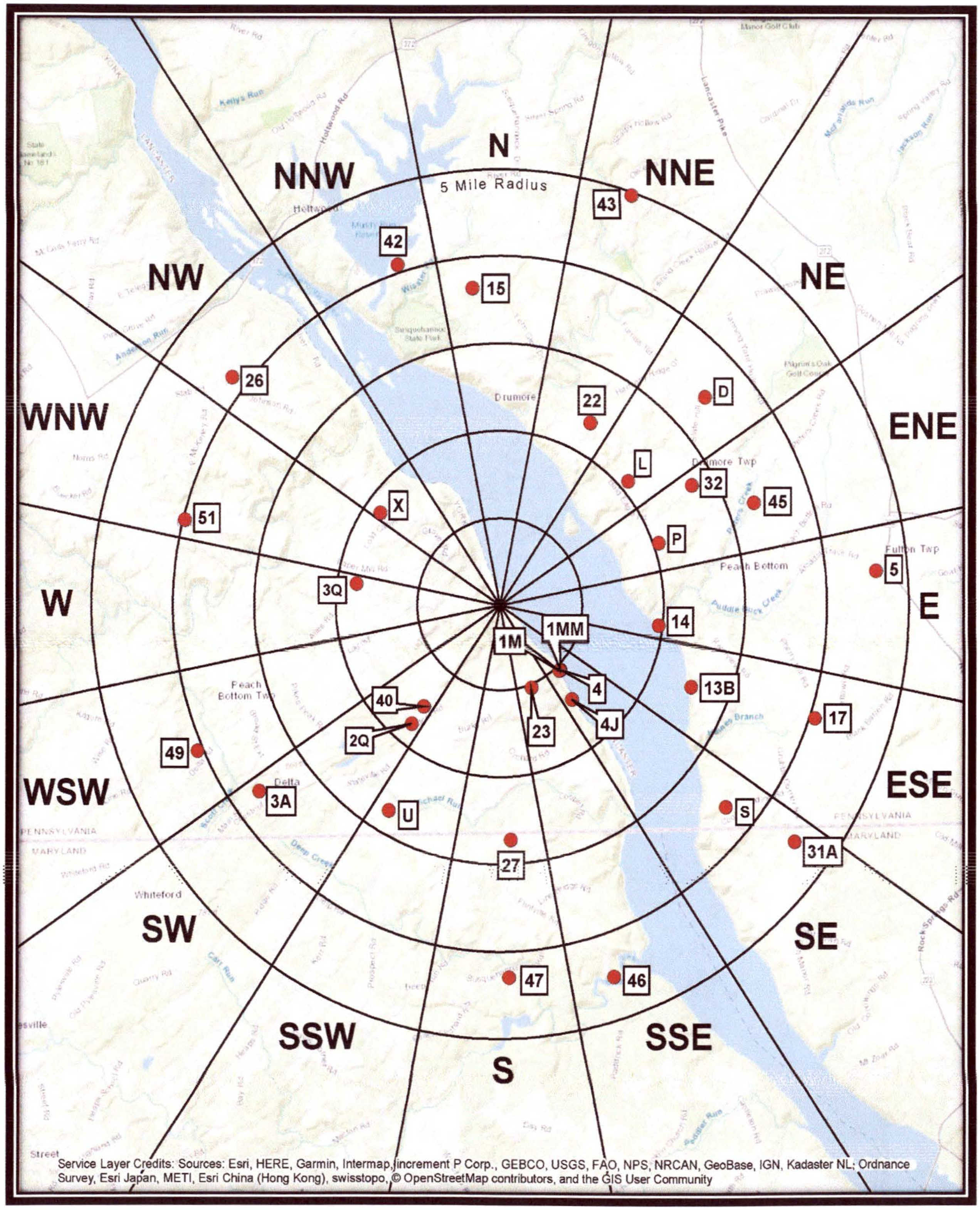

Figure B-2
Environmental Sampling Locations Between One and Approximately
Five Miles of Peach Bottom Atomic Power Station, 2018

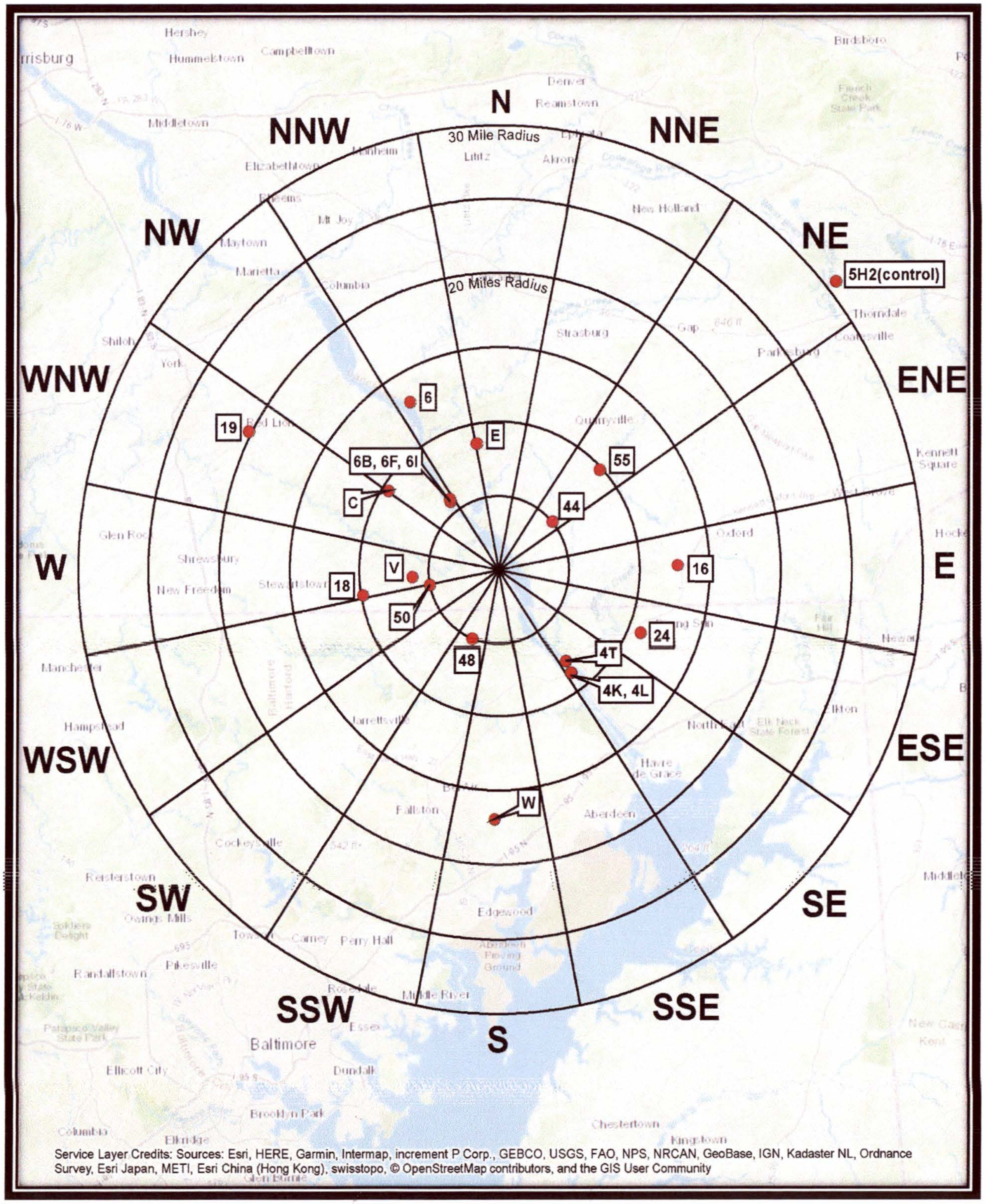

Figure B-3
Environmental Sampling Locations Greater Than
Five Miles from Peach Bottom Atomic Power Station, 2018

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APPENDIX C

DATA TABLES AND FIGURES
PRIMARY LABORATORY

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Table C-I.1 **CONCENTRATIONS OF TRITIUM IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018**

RESULTS IN UNITS OF PCI/LITER + 2 SIGMA

COLLECTION PERIOD	1LL	1MM
12/27/17 - 03/28/18	< 182	< 183
03/28/18 - 06/27/18	< 187	< 191
06/27/18 - 09/26/18	< 192	< 195
09/26/18 - 01/02/19	< 186	< 185
MEAN	-	-

Table C-I.2 **CONCENTRATIONS OF LOW LEVEL I-131 IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018**

RESULTS IN UNITS OF PCI/LITER + 2 SIGMA

COLLECTION PERIOD	1LL	1MM
12/27/17 - 01/31/18	< 0.6	< 0.5
01/31/18 - 02/28/18	< 0.7	< 0.7
02/28/18 - 03/28/18	< 0.5	< 0.8
03/28/18 - 04/25/18	< 0.5	< 0.4
04/25/18 - 05/30/18	< 0.5	< 0.6
05/30/18 - 06/27/18	< 0.7	< 0.8
06/27/18 - 07/25/18	< 0.8	< 0.8
07/25/18 - 08/29/18	< 0.7	< 0.6
08/29/18 - 09/26/18	< 0.8	< 0.4
09/26/18 - 10/31/18	< 0.9	< 0.8
10/31/18 - 11/28/18	< 0.7	< 1.0
11/28/18 - 01/02/19	< 0.8	< 0.3
MEAN	-	-

Table C-I.3 **CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140
1LL	12/27/17 - 01/31/18	< 6	< 6	< 14	< 7	< 13	< 6	< 10	< 5	< 8	< 34	< 11
	01/31/18 - 02/28/18	< 7	< 6	< 17	< 10	< 20	< 10	< 11	< 7	< 7	< 34	< 15
	02/28/18 - 03/28/18	< 7	< 7	< 18	< 7	< 17	< 9	< 10	< 10	< 7	< 37	< 15
	03/28/18 - 04/25/18	< 3	< 3	< 7	< 3	< 6	< 4	< 6	< 3	< 3	< 25	< 7
	04/25/18 - 05/30/18	< 3	< 5	< 10	< 5	< 10	< 4	< 9	< 5	< 5	< 29	< 8
	05/30/18 - 06/27/18	< 7	< 7	< 17	< 5	< 15	< 5	< 14	< 6	< 8	< 35	< 10
	06/27/18 - 07/25/18	< 8	< 9	< 18	< 8	< 15	< 8	< 15	< 10	< 8	< 37	< 12
	07/25/18 - 08/29/18	< 5	< 6	< 10	< 6	< 10	< 6	< 11	< 6	< 6	< 30	< 10
	08/29/18 - 09/26/18	< 6	< 6	< 13	< 5	< 10	< 7	< 11	< 7	< 7	< 36	< 9
	09/26/18 - 10/31/18	< 6	< 5	< 14	< 6	< 13	< 6	< 11	< 6	< 6	< 25	< 10
	10/31/18 - 11/28/18	< 7	< 7	< 14	< 9	< 13	< 6	< 12	< 7	< 7	< 34	< 9
	11/28/18 - 01/02/19	< 7	< 6	< 15	< 7	< 13	< 8	< 11	< 6	< 8	< 32	< 8
	MEAN	-	-	-	-	-	-	-	-	-	-	-
1MM	12/27/17 - 01/31/18	< 5	< 6	< 12	< 8	< 12	< 6	< 11	< 7	< 6	< 27	< 8
	01/31/18 - 02/28/18	< 8	< 7	< 18	< 6	< 10	< 9	< 14	< 8	< 8	< 37	< 9
	02/28/18 - 03/28/18	< 6	< 7	< 13	< 8	< 14	< 8	< 12	< 7	< 7	< 28	< 9
	03/28/18 - 04/25/18	< 3	< 3	< 9	< 3	< 7	< 4	< 8	< 4	< 3	< 28	< 12
	04/25/18 - 05/30/18	< 6	< 6	< 10	< 5	< 13	< 6	< 10	< 5	< 7	< 40	< 14
	05/30/18 - 06/27/18	< 7	< 7	< 14	< 5	< 14	< 6	< 12	< 7	< 7	< 27	< 9
	06/27/18 - 07/25/18	< 8	< 7	< 18	< 8	< 12	< 7	< 15	< 9	< 8	< 38	< 8
	07/25/18 - 08/29/18	< 8	< 8	< 14	< 10	< 11	< 8	< 10	< 8	< 7	< 36	< 14
	08/29/18 - 09/26/18	< 4	< 5	< 11	< 6	< 10	< 5	< 8	< 6	< 5	< 32	< 11
	09/26/18 - 10/31/18	< 5	< 5	< 12	< 6	< 10	< 4	< 8	< 5	< 6	< 24	< 9
	10/31/18 - 11/28/18	< 7	< 7	< 14	< 9	< 14	< 8	< 12	< 9	< 7	< 32	< 9
	11/28/18 - 01/02/19	< 5	< 7	< 12	< 7	< 15	< 7	< 10	< 7	< 6	< 26	< 7
	MEAN	-	-	-	-	-	-	-	-	-	-	-

Table C-II.1 CONCENTRATIONS OF GROSS BETA IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	13B	4L	6I
12/28/17 - 02/01/18	< 2.0	< 2.0	< 2.0
02/01/18 - 03/01/18	< 2.2	< 2.4	< 2.2
03/01/18 - 03/29/18	2.1 ± 1.0	3.6 ± 1.6	2.7 ± 1.3
03/29/18 - 04/26/18	< 2.0	< 2.0	< 2.0
04/26/18 - 05/31/18	< 2.1	< 2.0	< 2.0
05/31/18 - 06/28/18	3.4 ± 1.5	3.2 ± 1.5	3.4 ± 1.5
06/28/18 - 07/25/18	< 2.3	4.0 ± 1.5	2.6 ± 1.4
07/30/18 - 08/27/18	2.8 ± 1.6	< 2.1	2.5 ± 1.5
08/30/18 - 09/26/18	1.9 ± 1.3	2.3 ± 1.3	2.3 ± 1.3
09/26/18 - 10/31/18	2.3 ± 1.3	3.8 ± 1.4	2.5 ± 1.3
11/01/18 - 11/29/18	< 1.9	< 1.8	< 1.9
11/29/18 - 01/03/19	< 1.7	1.8 ± 1.2	1.9 ± 1.2
MEAN ± 2 STD DEV	2.5 ± 1.2	3.1 ± 1.7	2.6 ± 0.9

Table C-II.2 CONCENTRATIONS OF TRITIUM IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	13B	4L	6I
12/28/17 - 03/29/18	< 185	< 182	< 181
03/29/18 - 06/28/18	< 186	< 185	< 188
06/28/18 - 09/26/18	< 192	< 192	< 196
09/26/18 - 01/03/19	< 185	< 185	< 186
MEAN	-	-	-

Table C-II.3 CONCENTRATIONS OF LOW LEVEL I-131 IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	13B	4L	6I
12/28/17 - 02/01/18	< 0.4	< 0.7	< 0.3
02/01/18 - 03/01/18	< 0.7	< 0.5	< 0.5
03/01/18 - 03/29/18	< 0.8	< 0.7	< 0.9
03/29/18 - 04/26/18	< 0.9	< 0.7	< 0.7
04/26/18 - 05/31/18	< 0.6	< 0.5	< 0.5
05/31/18 - 06/28/18	< 0.7	< 0.5	< 0.7
06/28/18 - 07/25/18	< 0.9	< 0.6	< 0.7
07/30/18 - 08/27/18	< 0.6	< 0.9	< 0.5
08/30/18 - 09/26/18	< 0.5	< 0.7	< 0.5
09/26/18 - 10/31/18	< 1.0	< 0.9	< 0.8
11/01/18 - 11/29/18	< 0.6	< 0.8	< 0.9
11/29/18 - 01/03/19	< 0.6	< 0.4	< 0.4
MEAN	-	-	-

THE MEAN AND TWO STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUES

Table C-II.4

CONCENTRATIONS OF GAMMA EMITTERS IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140
13B	12/26/17 - 01/29/18	< 6	< 8	< 19	< 7	< 16	< 9	< 13	< 8	< 9	< 35	< 12
	01/29/18 - 02/26/18	< 9	< 8	< 15	< 8	< 13	< 6	< 12	< 8	< 8	< 34	< 15
	02/26/18 - 03/26/18	< 8	< 7	< 15	< 6	< 15	< 7	< 11	< 9	< 7	< 40	< 11
	03/26/18 - 04/23/18	< 3	< 3	< 6	< 3	< 6	< 3	< 5	< 3	< 3	< 21	< 6
	04/23/18 - 05/29/18	< 3	< 4	< 8	< 3	< 6	< 4	< 7	< 4	< 4	< 25	< 9
	05/29/18 - 06/25/18	< 6	< 6	< 10	< 7	< 12	< 6	< 8	< 5	< 6	< 30	< 10
	06/25/18 - 07/16/18	< 2	< 3	< 6	< 3	< 5	< 3	< 4	< 2	< 3	< 17	< 5
	07/30/18 - 08/27/18	< 8	< 7	< 15	< 7	< 14	< 8	< 13	< 8	< 8	< 36	< 13
	08/27/18 - 09/24/18	< 5	< 6	< 11	< 6	< 11	< 7	< 10	< 5	< 7	< 31	< 12
	09/24/18 - 10/29/18	< 5	< 5	< 10	< 6	< 11	< 6	< 10	< 5	< 5	< 24	< 9
	10/29/18 - 11/26/18	< 6	< 6	< 13	< 8	< 10	< 5	< 13	< 7	< 8	< 31	< 8
	11/26/18 - 12/31/18	< 6	< 7	< 13	< 7	< 14	< 7	< 12	< 7	< 6	< 27	< 13
	MEAN	-	-	-	-	-	-	-	-	-	-	-
4L	12/28/17 - 02/01/18	< 6	< 6	< 11	< 4	< 15	< 7	< 12	< 8	< 7	< 20	< 11
	02/01/18 - 03/01/18	< 8	< 9	< 15	< 9	< 18	< 6	< 14	< 10	< 9	< 38	< 10
	03/01/18 - 03/29/18	< 7	< 9	< 20	< 10	< 16	< 10	< 15	< 8	< 9	< 38	< 11
	03/29/18 - 04/25/18	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 18	< 7
	04/25/18 - 05/31/18	< 4	< 4	< 11	< 6	< 10	< 6	< 7	< 6	< 5	< 40	< 15
	05/31/18 - 06/28/18	< 7	< 7	< 15	< 8	< 11	< 8	< 14	< 7	< 8	< 33	< 11
	06/28/18 - 07/25/18	< 7	< 7	< 19	< 6	< 17	< 9	< 14	< 9	< 9	< 33	< 13
	07/25/18 - 08/30/18	< 5	< 7	< 14	< 8	< 15	< 7	< 12	< 5	< 6	< 40	< 9
	08/30/18 - 09/26/18	< 5	< 5	< 10	< 6	< 11	< 5	< 9	< 6	< 5	< 29	< 12
	09/26/18 - 11/01/18	< 6	< 5	< 11	< 4	< 13	< 6	< 9	< 7	< 6	< 27	< 8
	11/01/18 - 11/29/18	< 6	< 6	< 10	< 5	< 13	< 5	< 11	< 8	< 6	< 29	< 8
	11/29/18 - 01/03/19	< 9	< 8	< 16	< 7	< 18	< 9	< 15	< 8	< 9	< 40	< 10
	MEAN	-	-	-	-	-	-	-	-	-	-	-
6I	12/28/17 - 02/01/18	< 6	< 6	< 12	< 7	< 13	< 7	< 12	< 7	< 6	< 33	< 8
	02/01/18 - 03/01/18	< 6	< 7	< 20	< 9	< 17	< 10	< 13	< 9	< 8	< 36	< 12
	03/01/18 - 03/29/18	< 10	< 12	< 20	< 10	< 22	< 9	< 17	< 9	< 9	< 41	< 15
	03/29/18 - 04/26/18	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 19	< 6
	04/26/18 - 05/31/18	< 5	< 5	< 12	< 5	< 12	< 6	< 10	< 5	< 4	< 31	< 11
	05/31/18 - 06/28/18	< 8	< 7	< 15	< 6	< 18	< 9	< 15	< 9	< 7	< 36	< 13
	06/28/18 - 07/25/18	< 7	< 7	< 15	< 7	< 15	< 8	< 16	< 8	< 7	< 38	< 14
	07/25/18 - 08/30/18	< 8	< 7	< 15	< 7	< 16	< 7	< 13	< 7	< 9	< 32	< 14
	08/30/18 - 09/26/18	< 5	< 7	< 13	< 6	< 12	< 5	< 10	< 6	< 6	< 36	< 11
	09/26/18 - 10/31/18	< 4	< 4	< 9	< 5	< 8	< 5	< 6	< 6	< 4	< 20	< 6
	10/31/18 - 11/29/18	< 6	< 6	< 17	< 5	< 12	< 6	< 13	< 7	< 7	< 27	< 14
	11/29/18 - 01/03/19	< 5	< 5	< 11	< 8	< 10	< 6	< 13	< 6	< 7	< 38	< 12
	MEAN	-	-	-	-	-	-	-	-	-	-	-

Table C-III.1 **CONCENTRATIONS OF GAMMA EMITTERS IN PREDATOR AND BOTTOM FEEDER (FISH) SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018**

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

SITE	COLLECTION PERIOD	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Cs-134	Cs-137
4	06/04/18	3781 ± 950	< 48	< 55	< 92	< 44	< 106	< 40	< 52
PREDATOR	10/04/18	3903 ± 656	< 37	< 39	< 72	< 41	< 84	< 41	< 43
	MEAN ± 2 STD DEV	3842 ± 173	-	-	-	-	-	-	-
4	06/04/18	3034 ± 1061	< 55	< 73	< 123	< 89	< 142	< 81	< 69
BOTTOM FEEDER	10/04/18	3833 ± 667	< 36	< 41	< 89	< 31	< 91	< 38	< 40
	MEAN ± 2 STD DEV	3434 ± 1130	-	-	-	-	-	-	-
6	06/05/18	3165 ± 1480	< 69	< 85	< 183	< 69	< 161	< 72	< 83
PREDATOR	10/08/18	4107 ± 1232	< 82	< 82	< 172	< 73	< 159	< 85	< 74
	MEAN ± 2 STD DEV	3636 ± 1332	-	-	-	-	-	-	-
6	06/05/18	3787 ± 814	< 55	< 47	< 110	< 56	< 109	< 62	< 55
BOTTOM FEEDER	10/08/18	3352 ± 937	< 61	< 43	< 123	< 67	< 113	< 65	< 58
	MEAN ± 2 STD DEV	3570 ± 615	-	-	-	-	-	-	-

THE MEAN AND TWO STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUES

Table C-IV.1 CONCENTRATIONS OF GAMMA EMITTERS IN SEDIMENT SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018

RESULTS IN UNITS OF PCI/KG DRY ± 2 SIGMA

SITE	COLLECTION PERIOD	K-40	Mn-54	Co-58	Co-60	Cs-134	Cs-137
4J	06/08/18	13170 ± 1807	< 86	< 73	< 69	< 75	< 72
	11/20/18	10070 ± 2044	< 102	< 98	< 107	< 115	< 124
	MEAN ± 2 STD DEV	11620 ± 4384	-	-	-	-	-
4T	06/08/18	20370 ± 1910	< 112	< 111	< 107	< 130	158 ± 103
	11/20/18	24360 ± 2509	< 122	< 123	< 94	< 139	< 127
	MEAN ± 2 STD DEV	22365 ± 5643	-	-	-	-	158 ± 0
6F	06/08/18	16550 ± 2443	< 131	< 106	< 108	< 97	< 139
	11/20/18	15530 ± 2295	< 119	< 100	< 138	< 135	< 144
	MEAN ± 2 STD DEV	16040 ± 1442	-	-	-	-	-

Table C-V.1 **CONCENTRATIONS OF GROSS BETA IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018**

RESULTS IN UNITS OF E-3 PCI/CUBIC METER ± 2 SIGMA

COLLECTION	GROUP I			GROUP II	GROUP III
PERIOD	1B	1C	1Z	3A	5H2
12/28/17 - 01/04/18	20 ± 4	21 ± 5	26 ± 5	28 ± 5	
01/02/18 - 01/08/18					16 ± 5
01/04/18 - 01/10/18	12 ± 4	11 ± 4	13 ± 4	16 ± 4	
01/08/18 - 01/16/18					11 ± 4
01/10/18 - 01/18/18	15 ± 3	17 ± 3	17 ± 3	17 ± 3	
01/16/18 - 01/22/18					25 ± 5
01/18/18 - 01/25/18	22 ± 4	20 ± 4	23 ± 4	21 ± 4	
01/22/18 - 01/29/18					19 ± 4
01/25/18 - 02/01/18	13 ± 3	15 ± 3	14 ± 3	13 ± 3	
01/29/18 - 02/05/18					10 ± 4
02/01/18 - 02/08/18	15 ± 4	11 ± 4	12 ± 4	11 ± 4	
02/05/18 - 02/13/18					15 ± 3
02/08/18 - 02/15/18	10 ± 3	12 ± 5	14 ± 4	11 ± 4	
02/13/18 - 02/19/18					15 ± 5
02/15/18 - 02/22/18	9 ± 3	8 ± 4	12 ± 4	8 ± 4	
02/19/18 - 02/26/18					11 ± 3
02/22/18 - 03/01/18	9 ± 3	13 ± 4	14 ± 4	13 ± 4	
02/26/18 - 03/06/18					12 ± 4
03/01/18 - 03/08/18	10 ± 4	12 ± 4	11 ± 4	*(1)*	
03/06/18 - 03/12/18					6 ± 4
03/08/18 - 03/14/18	7 ± 4	8 ± 5	10 ± 4	11 ± 5	
03/12/18 - 03/20/18					14 ± 4
03/14/18 - 03/22/18	16 ± 4	15 ± 4	13 ± 3	17 ± 4	
03/20/18 - 03/26/18					9 ± 4
03/22/18 - 03/29/18	11 ± 4	13 ± 4	12 ± 4	15 ± 5	
03/26/18 - 04/02/18					13 ± 4
03/29/18 - 04/05/18	8 ± 4	10 ± 4	11 ± 4	10 ± 4	
04/02/18 - 04/09/18					13 ± 4
04/05/18 - 04/12/18	14 ± 4	13 ± 4	15 ± 4	16 ± 4	
04/09/18 - 04/16/18					10 ± 4
04/12/18 - 04/19/18	13 ± 4	12 ± 4	10 ± 3	13 ± 4	
04/16/18 - 04/23/18					6 ± 3
04/19/18 - 04/25/18	14 ± 4	10 ± 4	18 ± 4	19 ± 4	
04/23/18 - 04/30/18					11 ± 4
04/25/18 - 05/03/18	13 ± 4	14 ± 4	14 ± 4	15 ± 4	
04/30/18 - 05/07/18					20 ± 4
05/03/18 - 05/10/18	19 ± 4	19 ± 4	18 ± 4	19 ± 4	
05/07/18 - 05/14/18					11 ± 4
05/10/18 - 05/17/18	9 ± 4	13 ± 4	12 ± 3	11 ± 3	
05/14/18 - 05/21/18					7 ± 3
05/17/18 - 05/24/18	8 ± 3	9 ± 4	10 ± 3	9 ± 3	
05/21/18 - 05/29/18					15 ± 3
05/24/18 - 05/31/18	10 ± 3	10 ± 3	12 ± 3	8 ± 3	
05/29/18 - 06/05/18					8 ± 4
05/31/18 - 06/07/18	9 ± 4	10 ± 4	10 ± 4	10 ± 3	
06/05/18 - 06/11/18					14 ± 5
06/07/18 - 06/14/18	12 ± 4	15 ± 4	10 ± 4	15 ± 4	
06/11/18 - 06/18/18					11 ± 4
06/14/18 - 06/21/18	12 ± 4	16 ± 4	16 ± 5	12 ± 4	
06/18/18 - 06/25/18					12 ± 4
06/21/18 - 06/28/18	11 ± 4	10 ± 4	12 ± 3	10 ± 3	
06/25/18 - 07/02/18					13 ± 4
06/28/18 - 07/05/18	15 ± 4	17 ± 4	18 ± 4	18 ± 4	

THE MEAN AND TWO STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUES
(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

Table C-V.1 **CONCENTRATIONS OF GROSS BETA IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018**

RESULTS IN UNITS OF E-3 PCI/CUBIC METER ± 2 SIGMA

COLLECTION	GROUP I			GROUP II	GROUP III
PERIOD	1B	1C	1Z	3A	5H2
07/02/18 07/09/18					*(1)*
07/05/18 - 07/13/18	12 ± 4	12 ± 4	13 ± 3	15 ± 3	
07/09/18 07/17/18					*(1)*
07/13/18 - 07/19/18	15 ± 5	15 ± 4	17 ± 4	19 ± 4	
07/17/18 - 07/23/18					7 ± 4
07/19/18 - 07/25/18	8 ± 5	10 ± 4	< 6	6 ± 4	
07/23/18 - 07/30/18					8 ± 4
07/25/18 - 08/02/18	7 ± 4	14 ± 4	11 ± 4	12 ± 4	
07/30/18 - 08/06/18					10 ± 5
08/02/18 - 08/09/18	11 ± 4	19 ± 4	18 ± 5	21 ± 4	
08/06/18 - 08/13/18					20 ± 4
08/09/18 - 08/16/18	11 ± 5	16 ± 4	14 ± 4	17 ± 4	
08/13/18 - 08/20/18					19 ± 5
08/16/18 - 08/23/18	15 ± 4	15 ± 4	10 ± 4	13 ± 4	
08/20/18 - 08/28/18					13 ± 4
08/23/18 - 08/30/18	21 ± 4	27 ± 5	24 ± 4	26 ± 5	
08/28/18 - 09/04/18					17 ± 4
08/30/18 - 09/06/18	13 ± 4	15 ± 4	13 ± 4	18 ± 4	
09/04/18 - 09/11/18					15 ± 4
09/06/18 - 09/12/18	6 ± 4	9 ± 4	7 ± 4	11 ± 4	
09/11/18 - 09/18/18					28 ± 5
09/12/18 - 09/20/18	10 ± 3	8 ± 3	9 ± 3	7 ± 3	
09/18/18 - 09/24/18					11 ± 4
09/20/18 - 09/26/18	9 ± 4	12 ± 4	8 ± 4	9 ± 4	
09/24/18 - 10/01/18					12 ± 4
09/26/18 - 10/04/18	14 ± 4	19 ± 4	18 ± 4	20 ± 4	
10/01/18 - 10/09/18					20 ± 4
10/04/18 - 10/10/18	16 ± 4	18 ± 5	23 ± 5	21 ± 5	
10/09/18 - 10/15/18					10 ± 5
10/10/18 - 10/17/18	8 ± 3	12 ± 4	11 ± 3	10 ± 3	
10/15/18 - 10/22/18					14 ± 5
10/17/18 - 10/24/18	14 ± 4	16 ± 4	14 ± 4	13 ± 3	
10/22/18 - 10/31/18					8 ± 3
10/24/18 - 11/01/18	6 ± 3	11 ± 3	11 ± 3	9 ± 3	
10/31/18 - 11/05/18					14 ± 6
11/01/18 - 11/08/18	10 ± 3	9 ± 4	11 ± 4	11 ± 4	
11/05/18 - 11/12/18					12 ± 4
11/08/18 - 11/16/18	15 ± 4	11 ± 3	16 ± 4	12 ± 3	
11/12/18 - 11/19/18					14 ± 4
11/16/18 - 11/21/18	24 ± 7	23 ± 6	26 ± 6	22 ± 6	
11/19/18 - 11/26/18					18 ± 4
11/21/18 - 11/29/18	16 ± 4	13 ± 4	14 ± 4	20 ± 5	
11/26/18 - 12/05/18					9 ± 3
11/29/18 - 12/06/18	11 ± 4	14 ± 4	14 ± 4	14 ± 4	
12/05/18 - 12/11/18					17 ± 5
12/06/18 - 12/13/18	32 ± 5	26 ± 5	26 ± 5	24 ± 5	
12/11/18 - 12/18/18					21 ± 5
12/13/18 - 12/20/18	23 ± 4	18 ± 4	16 ± 4	16 ± 4	
12/18/18 - 12/26/18					10 ± 4
12/20/18 - 12/27/18	19 ± 4	16 ± 4	16 ± 4	15 ± 4	
12/26/18 - 01/02/19					19 ± 4
MEAN ± 2 STD DEV	13 ± 10	14 ± 9	14 ± 10	15 ± 10	13 ± 9

THE MEAN AND TWO STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUES
(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

Table C-V.2 **CONCENTRATIONS OF GAMMA EMITTERS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018**

RESULTS IN UNITS OF E-3 PCI/CUBIC METER ± 2 SIGMA

SITE	COLLECTION PERIOD	Be-7	Mn-54	Co-58	Co-60	Cs-134	Cs-137
1B	12/28/17 - 03/29/18	89 ± 23	< 4	< 3	< 5	< 3	< 3
	03/29/18 - 06/28/18	89 ± 25	< 2	< 3	< 2	< 3	< 2
	06/28/18 - 09/26/18	59 ± 22	< 2	< 3	< 3	< 2	< 2
	09/26/18 - 12/27/18	52 ± 19	< 3	< 2	< 3	< 3	< 3
	MEAN ± 2 STD DEV	72 ± 39	-	-	-	-	-
1C	12/28/17 - 03/29/18	54 ± 26	< 3	< 4	< 2	< 4	< 3
	03/29/18 - 06/28/18	79 ± 21	< 3	< 2	< 2	< 3	< 3
	06/28/18 - 09/26/18	67 ± 25	< 2	< 3	< 3	< 3	< 2
	09/26/18 - 12/27/18	55 ± 15	< 2	< 3	< 3	< 3	< 2
	MEAN ± 2 STD DEV	64 ± 24	-	-	-	-	-
1Z	12/28/17 - 03/29/18	53 ± 17	< 2	< 3	< 3	< 2	< 2
	03/29/18 - 06/28/18	71 ± 18	< 2	< 2	< 2	< 2	< 1
	06/28/18 - 09/26/18	77 ± 21	< 2	< 3	< 3	< 2	< 3
	09/26/18 - 12/27/18	46 ± 21	< 3	< 2	< 3	< 2	< 2
	MEAN ± 2 STD DEV	62 ± 29	-	-	-	-	-
3A	12/28/17 - 03/29/18	53 ± 22	< 2	< 2	< 2	< 2	< 2
	03/29/18 - 06/28/18	85 ± 21	< 2	< 3	< 3	< 3	< 2
	06/28/18 - 09/26/18	67 ± 24	< 2	< 3	< 3	< 3	< 2
	09/26/18 - 12/27/18	56 ± 17	< 3	< 2	< 2	< 3	< 2
	MEAN ± 2 STD DEV	65 ± 29	-	-	-	-	-
5H2	01/02/18 - 04/02/18	80 ± 26	< 3	< 3	< 2	< 2	< 1
	04/02/18 - 07/02/18	63 ± 21	< 2	< 2	< 2	< 2	< 2
	07/17/18 - 10/01/18	90 ± 26	< 2	< 3	< 2	< 3	< 4
	10/01/18 - 01/02/19	43 ± 16	< 3	< 3	< 4	< 4	< 3
	MEAN ± 2 STD DEV	69 ± 41	-	-	-	-	-

THE MEAN AND TWO STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUES

Table C-VI.1 CONCENTRATIONS OF I-131 IN AIR IODINE SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018

RESULTS IN UNITS OF E-3 PCI/CUBIC METER ± 2 SIGMA

COLLECTION	GROUP I			GROUP II	GROUP III
PERIOD	1B	1C	1Z	3A	5H2
12/28/17 - 01/04/18	< 4	< 40	< 39	< 37	
01/02/18 - 01/08/18					< 19
01/04/18 - 01/10/18	< 33	< 14	< 33	< 32	
01/08/18 - 01/16/18					< 15
01/10/18 - 01/18/18	< 17	< 14	< 17	< 16	
01/16/18 - 01/22/18					< 28
01/18/18 - 01/25/18	< 45	< 42	< 45	< 22	
01/22/18 - 01/29/18					< 29
01/25/18 - 02/01/18	< 52	< 22	< 52	< 51	
01/29/18 - 02/05/18					< 17
02/01/18 - 02/08/18	< 45	< 19	< 45	< 46	
02/05/18 - 02/13/18					< 12
02/08/18 - 02/15/18	< 33	< 50	< 40	< 40	
02/13/18 - 02/19/18					< 31
02/15/18 - 02/22/18	< 19	< 30	< 24	< 27	
02/19/18 - 02/26/18					< 25
02/22/18 - 03/01/18	< 25	< 56	< 50	< 50	
02/26/18 - 03/06/18					< 12
03/01/18 - 03/08/18	< 45	< 57	< 45	*(1)*	
03/06/18 - 03/12/18					< 23
03/08/18 - 03/14/18	< 53	< 66	< 53	< 59	
03/12/18 - 03/20/18					< 15
03/14/18 - 03/22/18	< 16	< 43	< 38	< 43	
03/20/18 - 03/26/18					< 14
03/22/18 - 03/29/18	< 24	< 37	< 29	< 37	
03/26/18 - 04/02/18					< 17
03/29/18 - 04/05/18	< 34	< 14	< 33	< 34	
04/02/18 - 04/09/18					< 46
04/05/18 - 04/12/18	< 50	< 21	< 50	< 49	
04/09/18 - 04/16/18					< 16
04/12/18 - 04/19/18	< 25	< 31	< 30	< 31	
04/16/18 - 04/23/18					< 32
04/19/18 - 04/25/18	< 41	< 42	< 41	< 35	
04/23/18 - 04/30/18					< 14
04/25/18 - 05/03/18	< 5	< 4	< 5	< 5	
04/30/18 - 05/07/18					< 13
05/03/18 - 05/10/18	< 45	< 45	< 40	< 20	
05/07/18 - 05/14/18					< 12
05/10/18 - 05/17/18	< 40	< 67	< 23	< 27	
05/14/18 - 05/21/18					< 22
05/17/18 - 05/24/18	< 51	< 57	< 39	< 46	
05/21/18 - 05/29/18					< 24
05/24/18 - 05/31/18	< 28	< 27	< 25	< 25	
05/29/18 - 06/05/18					< 17
05/31/18 - 06/07/18	< 70	< 63	< 62	< 58	
06/05/18 - 06/11/18					< 26
06/07/18 - 06/14/18	< 56	< 50	< 45	< 19	
06/11/18 - 06/18/18					< 16
06/14/18 - 06/21/18	< 46	< 42	< 50	< 38	
06/18/18 - 06/25/18					< 18
06/21/18 - 06/28/18	< 66	< 66	< 60	< 60	
06/25/18 - 07/02/18					< 34
06/28/18 - 07/05/18	< 37	< 37	< 42	< 28	

Table C-VI.1 CONCENTRATIONS OF I-131 IN AIR IODINE SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018

RESULTS IN UNITS OF E-3 PCI/CUBIC METER ± 2 SIGMA

COLLECTION	GROUP I			GROUP II	GROUP III
PERIOD	1B	1C	1Z	3A	5H2
07/02/18 07/09/18					*(1)*
07/05/18 - 07/13/18	< 28	< 28	< 25	< 11	
07/09/18 07/17/18					*(1)*
07/13/18 - 07/19/18	< 68	< 60	< 49	< 53	
07/17/18 - 07/23/18					< 26
07/19/18 - 07/25/18	< 38	< 31	< 34	< 34	
07/23/18 - 07/30/18					< 23
07/25/18 - 08/02/18	< 47	< 42	< 43	< 42	
07/30/18 - 08/06/18					< 11
08/02/18 - 08/09/18	< 37	< 34	< 48	< 34	
08/06/18 - 08/13/18					< 24
08/09/18 - 08/16/18	< 67	< 53	< 22	< 53	
08/13/18 - 08/20/18					< 16
08/16/18 - 08/23/18	< 27	< 33	< 52	< 22	
08/20/18 - 08/28/18					< 21
08/23/18 - 08/30/18	< 46	< 19	< 46	< 45	
08/28/18 - 09/04/18					< 34
08/30/18 - 09/06/18	< 39	< 40	< 39	< 40	
09/04/18 - 09/11/18					< 30
09/06/18 - 09/12/18	< 54	< 52	< 54	< 22	
09/11/18 - 09/18/18					< 33
09/12/18 - 09/20/18	< 17	< 41	< 46	< 42	
09/18/18 - 09/24/18					< 21
09/20/18 - 09/26/18	< 40	< 39	< 39	< 33	
09/24/18 - 10/01/18					< 11
09/26/18 - 10/04/18	< 34	< 34	< 34	< 34	
10/01/18 - 10/09/18					< 32
10/04/18 - 10/10/18	< 32	< 39	< 39	< 39	
10/09/18 - 10/15/18					< 48
10/10/18 - 10/17/18	< 53	< 53	< 53	< 53	
10/15/18 - 10/22/18					< 30
10/17/18 - 10/24/18	< 41	< 41	< 41	< 40	
10/22/18 - 10/31/18					< 17
10/24/18 - 11/01/18	< 23	< 20	< 20	< 23	
10/31/18 - 11/05/18					< 63
11/01/18 - 11/08/18	< 33	< 38	< 38	< 34	
11/05/18 - 11/12/18					< 15
11/08/18 - 11/16/18	< 26	< 17	< 22	< 24	
11/12/18 - 11/19/18					< 12
11/16/18 - 11/21/18	< 34	< 27	< 22	< 27	
11/19/18 - 11/26/18					< 17
11/21/18 - 11/29/18	< 46	< 45	< 45	< 53	
11/26/18 - 12/05/18					< 42
11/29/18 - 12/06/18	< 47	< 56	< 56	< 68	
12/05/18 - 12/11/18					< 12
12/06/18 - 12/13/18	< 24	< 58	< 58	< 58	
12/11/18 - 12/18/18					< 38
12/13/18 - 12/20/18	< 60	< 25	< 60	< 60	
12/18/18 - 12/26/18					< 44
12/20/18 - 12/27/18	< 44	< 44	< 24	< 44	
12/26/18 - 01/02/19					< 23
MEAN	-	-	-	-	-

(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

Table C-VII.1

CONCENTRATIONS OF LOW LEVEL I-131 IN MILK SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION	CONTROL FARMS			INDICATOR FARMS								
PERIOD	C	E	V	D	J	L	P	R	S	U	W	X
01/08/18			< 0.8		< 0.8			< 0.7	< 0.8	< 1.0		< 0.7
02/10/18	< 0.6	< 0.5	< 1.0	< 0.9	< 0.7	< 0.8	< 0.3	< 0.8	< 0.6	< 0.9	< 0.6	< 0.8
03/12/18			< 0.8		< 0.9			< 0.7	< 1.0	< 0.9		< 0.6
04/02/18			< 0.6		< 0.5			< 0.6	< 0.9	< 0.8		< 0.5
04/16/18			< 0.7		< 0.6			< 0.4	< 0.5	< 0.4		< 0.6
04/30/18			< 0.5		< 0.5			< 0.6	< 0.5	< 0.6		< 0.5
05/14/18	< 0.7	< 0.7	< 0.4	< 0.6	< 0.7	< 0.6	< 0.6	< 0.5	< 0.4	< 0.4	< 0.7	< 0.8
05/29/18			< 0.6		< 0.6			< 0.5	< 0.6	< 0.5		< 0.6
06/12/18			< 0.7		< 0.9			< 0.7	< 0.7	< 0.7		< 0.7
06/25/18			< 1.0		< 0.7			< 0.6	< 0.9	< 0.9		< 0.7
07/09/18			< 0.5		< 0.6			< 0.7	< 1.0	< 0.8		< 0.6
07/24/18			< 0.6		< 0.7			< 0.7	< 0.8	< 0.7		< 0.8
08/06/18	< 1.0	< 0.9	< 0.9	< 0.9	< 0.9	< 0.8	< 0.9	< 0.6	< 0.7	< 0.7	< 0.7	< 0.6
08/21/18			< 0.5		< 0.7			< 0.7	< 0.9	< 0.6		< 0.9
09/03/18			< 1.0		< 0.9			< 0.6	< 1.0	< 0.8		< 0.8
09/18/18			< 0.5		< 0.5			< 0.5	< 0.6	< 0.5		< 0.6
10/02/18			< 0.8		< 0.9			< 0.7	< 0.6	< 0.8		< 0.8
10/15/18			< 0.4		< 0.8			< 0.4	< 0.8	< 0.7		< 0.5
10/30/18			< 0.6		< 0.5			< 0.5	< 0.7	< 0.6		< 0.6
11/13/18	< 0.8	< 0.5	< 0.9	< 0.6	< 0.6	< 0.9	< 0.9	< 0.9	< 0.8	< 1.0	< 0.7	< 1.0
11/26/18			< 0.6		< 0.7			< 0.5	< 0.7	< 0.5		< 0.7
12/11/18			< 0.6		< 0.6			< 0.6	< 1.0	< 0.9		< 0.7
MEAN	-	-	-	-	-	-	-	-	-	-	-	-

Table C-VII.2 CONCENTRATIONS OF GAMMA EMITTERS IN MILK SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	K-40	Cs-134	Cs-137	Ba-140	La-140
C	02/13/18	1182 ± 189	< 10	< 9	< 44	< 11
	05/14/18	1169 ± 143	< 6	< 6	< 27	< 10
	08/06/18	1244 ± 162	< 10	< 8	< 34	< 9
	11/14/18	1493 ± 173	< 10	< 8	< 50	< 13
MEAN ± 2 STD DEV		1272 ± 302	-	-	-	-
E	02/13/18	1211 ± 183	< 10	< 9	< 40	< 12
	05/14/18	1237 ± 135	< 8	< 6	< 34	< 9
	08/06/18	1411 ± 178	< 9	< 10	< 29	< 9
	11/14/18	1269 ± 159	< 8	< 6	< 34	< 8
MEAN ± 2 STD DEV		1282 ± 178	-	-	-	-
V	01/08/18	1234 ± 172	< 9	< 7	< 29	< 7
	02/10/18	1101 ± 183	< 10	< 9	< 38	< 14
	03/12/18	1210 ± 199	< 8	< 7	< 27	< 12
	04/02/18	1058 ± 164	< 9	< 7	< 35	< 12
	04/16/18	1314 ± 174	< 8	< 9	< 28	< 8
	04/30/18	1208 ± 153	< 7	< 7	< 25	< 6
	05/15/18	1081 ± 144	< 6	< 6	< 29	< 10
	05/29/18	1137 ± 195	< 9	< 9	< 39	< 12
	06/12/18	1170 ± 135	< 7	< 7	< 30	< 6
	06/26/18	1232 ± 143	< 6	< 5	< 27	< 8
	07/09/18	1212 ± 170	< 7	< 8	< 32	< 14
	07/24/18	1244 ± 113	< 5	< 4	< 23	< 7
	08/07/18	1273 ± 201	< 9	< 10	< 39	< 8
	08/21/18	1485 ± 165	< 7	< 7	< 31	< 8
	09/03/18	1307 ± 129	< 6	< 6	< 31	< 12
	09/18/18	1607 ± 218	< 10	< 7	< 36	< 15
	10/02/18	1451 ± 172	< 8	< 8	< 37	< 11
	10/15/18	1310 ± 157	< 7	< 6	< 41	< 12
	10/30/18	1219 ± 164	< 8	< 8	< 37	< 13
	11/13/18	1166 ± 158	< 7	< 6	< 29	< 8
	11/26/18	1083 ± 133	< 6	< 5	< 22	< 4
	12/11/18	1369 ± 185	< 8	< 8	< 34	< 7
MEAN ± 2 STD DEV		1249 ± 275	-	-	-	-
D	02/12/18	1349 ± 169	< 8	< 9	< 37	< 12
	05/15/18	1082 ± 157	< 7	< 6	< 31	< 8
	08/07/18	1371 ± 179	< 10	< 9	< 38	< 10
	11/13/18	1457 ± 159	< 9	< 7	< 37	< 10
MEAN ± 2 STD DEV		1315 ± 324	-	-	-	-

THE MEAN AND TWO STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUES

Table C-VII.2 CONCENTRATIONS OF GAMMA EMITTERS IN MILK SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	K-40	Cs-134	Cs-137	Ba-140	La-140
J	01/09/18	1397 ± 159	< 7	< 7	< 21	< 9
	02/12/18	1246 ± 143	< 6	< 7	< 32	< 9
	03/12/18	1368 ± 164	< 11	< 11	< 36	< 10
	04/02/18	1314 ± 157	< 6	< 5	< 20	< 9
	04/16/18	1404 ± 184	< 7	< 8	< 29	< 11
	04/30/18	1234 ± 170	< 7	< 8	< 30	< 9
	05/15/18	1312 ± 97	< 5	< 4	< 20	< 5
	05/29/18	1227 ± 154	< 6	< 8	< 24	< 8
	06/12/18	1316 ± 152	< 7	< 6	< 31	< 9
	06/25/18	1317 ± 139	< 5	< 5	< 28	< 10
	07/09/18	1651 ± 184	< 8	< 9	< 42	< 7
	07/24/18	1168 ± 150	< 8	< 6	< 29	< 9
	08/07/18	1260 ± 187	< 7	< 8	< 34	< 7
	08/21/18	1331 ± 201	< 8	< 9	< 46	< 12
	09/04/18	1304 ± 134	< 6	< 6	< 28	< 9
	09/18/18	2129 ± 184	< 6	< 6	< 35	< 9
	10/02/18	1299 ± 120	< 7	< 5	< 23	< 8
	10/16/18	1145 ± 160	< 8	< 7	< 38	< 13
	10/30/18	1231 ± 184	< 7	< 6	< 29	< 10
	11/13/18	1335 ± 171	< 7	< 6	< 29	< 7
	11/26/18	1195 ± 192	< 8	< 9	< 28	< 12
	12/11/18	1079 ± 152	< 8	< 7	< 29	< 7
	MEAN ± 2 STD DEV	1330 ± 423	-	-	-	-
L	02/12/18	1287 ± 155	< 11	< 12	< 55	< 12
	05/15/18	1298 ± 123	< 7	< 6	< 29	< 6
	08/07/18	1264 ± 206	< 8	< 9	< 37	< 10
	11/13/18	1574 ± 157	< 7	< 7	< 43	< 13
	MEAN ± 2 STD DEV	1356 ± 292	-	-	-	-
P	02/13/18	1130 ± 153	< 8	< 6	< 30	< 7
	05/14/18	1113 ± 132	< 5	< 5	< 28	< 8
	08/06/18	1221 ± 204	< 9	< 8	< 36	< 12
	11/13/18	1217 ± 138	< 7	< 6	< 42	< 12
	MEAN ± 2 STD DEV	1170 ± 113	-	-	-	-

THE MEAN AND TWO STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUES

Table C-VII.2 CONCENTRATIONS OF GAMMA EMITTERS IN MILK SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	K-40	Cs-134	Cs-137	Ba-140	La-140
R	01/09/18	1179 ± 195	< 11	< 11	< 30	< 9
	02/12/18	1299 ± 158	< 6	< 6	< 34	< 14
	03/12/18	1420 ± 186	< 7	< 9	< 29	< 11
	04/04/18	1042 ± 178	< 9	< 7	< 30	< 11
	04/16/18	1182 ± 195	< 11	< 7	< 29	< 10
	04/30/18	1194 ± 150	< 7	< 6	< 32	< 8
	05/15/18	1180 ± 110	< 5	< 4	< 20	< 7
	05/29/18	1152 ± 145	< 5	< 5	< 21	< 7
	06/12/18	1326 ± 167	< 7	< 7	< 29	< 11
	06/25/18	1214 ± 128	< 7	< 6	< 38	< 9
	07/09/18	1415 ± 215	< 9	< 10	< 44	< 9
	07/24/18	1427 ± 168	< 7	< 6	< 30	< 14
	08/07/18	1638 ± 214	< 9	< 6	< 30	< 9
	08/21/18	1267 ± 163	< 7	< 9	< 32	< 11
	09/04/18	1382 ± 154	< 6	< 6	< 32	< 9
	09/18/18	1373 ± 131	< 7	< 7	< 31	< 10
	10/02/18	1291 ± 151	< 6	< 6	< 19	< 7
	10/16/18	1266 ± 186	< 7	< 9	< 42	< 12
	10/30/18	1236 ± 136	< 6	< 5	< 30	< 7
	11/13/18	1179 ± 158	< 7	< 7	< 29	< 11
	11/26/18	1339 ± 171	< 7	< 7	< 18	< 7
	12/11/18	1351 ± 196	< 10	< 8	< 38	< 8
	MEAN ± 2 STD DEV	1289 ± 256	-	-	-	-
S	01/09/18	1192 ± 192	< 10	< 6	< 23	< 9
	02/13/18	1419 ± 182	< 7	< 6	< 43	< 8
	03/12/18	1233 ± 202	< 10	< 9	< 31	< 10
	04/02/18	1256 ± 186	< 9	< 8	< 32	< 10
	04/16/18	1130 ± 166	< 8	< 7	< 28	< 6
	04/30/18	1331 ± 147	< 8	< 7	< 26	< 8
	05/14/18	1330 ± 135	< 6	< 4	< 28	< 9
	05/29/18	1291 ± 153	< 6	< 5	< 23	< 2
	06/12/18	1269 ± 178	< 9	< 6	< 34	< 10
	06/25/18	1334 ± 124	< 6	< 6	< 28	< 11
	07/09/18	1313 ± 207	< 10	< 10	< 39	< 13
	07/24/18	1271 ± 165	< 7	< 7	< 36	< 9
	08/07/18	1200 ± 183	< 8	< 9	< 34	< 10
	08/21/18	1180 ± 212	< 10	< 10	< 44	< 6
	09/04/18	1202 ± 166	< 6	< 7	< 38	< 8
	09/18/18	1273 ± 182	< 11	< 8	< 51	< 13
	10/02/18	1218 ± 130	< 6	< 7	< 20	< 6
	10/16/18	1393 ± 163	< 10	< 10	< 37	< 15
	10/30/18	1134 ± 139	< 8	< 6	< 32	< 9
	11/13/18	1438 ± 190	< 8	< 7	< 28	< 12
	11/26/18	1188 ± 140	< 8	< 7	< 26	< 8
	12/11/18	1159 ± 169	< 6	< 5	< 19	< 9
	MEAN ± 2 STD DEV	1262 ± 176	-	-	-	-

THE MEAN AND TWO STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUES

Table C-VII.2 CONCENTRATIONS OF GAMMA EMITTERS IN MILK SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	K-40	Cs-134	Cs-137	Ba-140	La-140
U	01/09/18	1137 ± 205	< 9	< 8	< 33	< 13
	02/10/18	1184 ± 151	< 7	< 8	< 40	< 14
	03/12/18	1227 ± 210	< 11	< 9	< 36	< 7
	04/04/18	1174 ± 183	< 10	< 9	< 31	< 6
	04/16/18	1167 ± 190	< 10	< 9	< 30	< 7
	04/30/18	1211 ± 154	< 8	< 9	< 31	< 7
	05/15/18	1308 ± 190	< 10	< 9	< 41	< 14
	05/29/18	1147 ± 177	< 9	< 9	< 40	< 13
	06/12/18	1174 ± 145	< 8	< 8	< 31	< 11
	06/25/18	986 ± 138	< 6	< 6	< 28	< 11
	07/09/18	1209 ± 159	< 9	< 7	< 34	< 11
	07/24/18	1283 ± 105	< 4	< 5	< 19	< 5
	08/07/18	1226 ± 154	< 7	< 6	< 32	< 6
	08/21/18	1242 ± 165	< 7	< 7	< 39	< 8
	09/04/18	1335 ± 162	< 9	< 7	< 30	< 9
	09/18/18	1284 ± 118	< 6	< 6	< 32	< 9
	10/02/18	1134 ± 131	< 7	< 7	< 28	< 9
	10/16/18	1265 ± 163	< 6	< 7	< 39	< 14
	10/30/18	1038 ± 151	< 7	< 7	< 31	< 11
	11/13/18	977 ± 185	< 9	< 8	< 39	< 12
	11/26/18	1171 ± 148	< 6	< 8	< 23	< 6
	12/11/18	1029 ± 160	< 8	< 8	< 34	< 15
MEAN ± 2 STD DEV		1178 ± 198	-	-	-	-
W	02/13/18	1368 ± 133	< 9	< 8	< 38	< 11
	05/14/18	1395 ± 137	< 6	< 5	< 30	< 12
	08/06/18	1316 ± 165	< 8	< 8	< 26	< 5
	11/13/18	1506 ± 155	< 6	< 7	< 41	< 11
MEAN ± 2 STD DEV		1396 ± 160	-	-	-	-
X	01/09/18	1209 ± 156	< 10	< 9	< 30	< 10
	02/12/18	1411 ± 225	< 10	< 11	< 45	< 10
	03/12/18	1314 ± 204	< 11	< 12	< 25	< 8
	04/02/18	1309 ± 182	< 8	< 9	< 32	< 9
	04/16/18	1156 ± 182	< 7	< 6	< 25	< 7
	04/30/18	1240 ± 156	< 7	< 6	< 26	< 9
	05/14/18	1358 ± 166	< 8	< 8	< 38	< 13
	05/29/18	1154 ± 156	< 7	< 5	< 26	< 9
	06/12/18	1216 ± 189	< 7	< 8	< 36	< 15
	06/25/18	1242 ± 113	< 5	< 5	< 31	< 6
	07/09/18	1250 ± 158	< 11	< 9	< 32	< 10
	07/24/18	1459 ± 224	< 10	< 9	< 39	< 11
	08/07/18	1393 ± 173	< 9	< 7	< 28	< 7
	08/21/18	1199 ± 177	< 10	< 9	< 40	< 13
	09/04/18	1167 ± 143	< 7	< 7	< 34	< 13
	09/18/18	1164 ± 132	< 7	< 5	< 29	< 10
	10/02/18	1320 ± 150	< 6	< 6	< 28	< 8
	10/16/18	1112 ± 162	< 8	< 9	< 35	< 12
	10/30/18	947 ± 139	< 8	< 7	< 39	< 10
	11/13/18	1054 ± 174	< 8	< 9	< 28	< 14
	11/26/18	1144 ± 166	< 7	< 6	< 22	< 7
	12/11/18	1102 ± 149	< 6	< 7	< 26	< 8
MEAN ± 2 STD DEV		1224 ± 247	-	-	-	-

THE MEAN AND TWO STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUES

Table C-VIII.1 **CONCENTRATIONS OF GAMMA EMITTERS IN FOOD PRODUCT SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018**

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

SITE	COLLECTION PERIOD	VEGETATION TYPE	Be-7	K-40	Mn-54	Co-58	Co-60	I-131	Cs-134	Cs-137
1C	06/20/18	*Kale*	< 266	2669 ± 615	< 35	< 26	< 38	< 43	< 29	< 33
	06/20/18	*Cabbage*	< 320	1775 ± 533	< 27	< 33	< 34	< 49	< 32	< 43
	06/20/18	*Collards*	< 260	2759 ± 536	< 26	< 28	< 23	< 48	< 31	< 29
	07/18/18	*Kale*	441 ± 234	964 ± 369	< 23	< 28	< 26	< 37	< 29	< 31
	07/18/18	*Cabbage*	262 ± 169	905 ± 361	< 22	< 23	< 25	< 34	< 21	< 29
	07/18/18	*Collards*	394 ± 246	1615 ± 419	< 21	< 25	< 25	< 35	< 24	< 32
	08/15/18	*Cabbage*	855 ± 211	1138 ± 237	< 17	< 17	< 19	< 26	< 19	< 18
	08/15/18	*Collards*	798 ± 273	2537 ± 560	< 21	< 34	< 18	< 52	< 29	< 26
	08/15/18	*Kale*	1410 ± 341	2236 ± 551	< 16	< 31	< 33	< 42	< 31	< 34
	09/19/18	*Cabbage*	< 127	1258 ± 231	< 13	< 12	< 12	< 38	< 14	< 14
	09/19/18	*Corn Leaves*	26950 ± 620	1288 ± 352	< 11	< 13	< 14	< 50	< 13	< 12
		MEAN ± 2 STD DEV	4444 ± 19863	1740 ± 1400	-	-	-	-	-	-
2Q	06/20/18	*Cabbage*	< 251	3341 ± 556	< 21	< 15	< 22	< 36	< 25	< 24
	06/20/18	*Broccoli Leaves*	927 ± 305	4219 ± 760	< 33	< 40	< 28	< 56	< 31	< 34
	06/20/18	*Brussels Sprouts*	< 275	4532 ± 559	< 27	< 28	< 29	< 39	< 27	< 25
	07/18/18	*Cabbage*	707 ± 214	5168 ± 660	< 29	< 23	< 34	< 38	< 35	< 31
	07/18/18	*Broccoli Leaves*	< 240	5002 ± 789	< 25	< 32	< 34	< 45	< 35	< 34
	07/18/18	*Collards*	323 ± 229	5457 ± 748	< 28	< 29	< 28	< 40	< 29	< 31
	08/15/18	*Cabbage*	328 ± 160	2553 ± 447	< 17	< 20	< 17	< 35	< 25	< 23
	08/15/18	*Collards*	279 ± 156	2255 ± 345	< 20	< 19	< 18	< 27	< 18	< 21
	08/15/18	*Brussels Sprouts*	< 313	3083 ± 441	< 25	< 26	< 29	< 38	< 30	< 27
	09/19/18	*Cabbage*	1037 ± 192	2086 ± 325	< 16	< 18	< 21	< 52	< 22	< 21
	09/19/18	*Broccoli Leaves*	486 ± 195	2146 ± 325	< 20	< 20	< 17	< 45	< 19	< 18
	09/19/18	*Collards*	464 ± 175	2897 ± 373	< 11	< 9	< 11	< 30	< 11	< 11
		MEAN ± 2 STD DEV	569 ± 579	3562 ± 2504	-	-	-	-	-	-
3Q	06/20/18	*Kale*	< 216	4054 ± 616	< 24	< 17	< 30	< 30	< 20	< 26
	06/20/18	*Cauliflower*	436 ± 241	3686 ± 608	< 22	< 23	< 28	< 33	< 25	< 24
	06/20/18	*Cabbage*	283 ± 77	5379 ± 246	< 10	< 10	< 10	< 14	< 11	< 9
	07/18/18	*Kale*	267 ± 139	5081 ± 436	< 17	< 14	< 15	< 22	< 20	< 20
	07/18/18	*Corn Leaves*	1955 ± 320	4914 ± 699	< 29	< 30	< 31	< 47	< 37	< 32
	07/18/18	*Cabbage*	676 ± 280	5268 ± 673	< 30	< 32	< 33	< 44	< 35	< 33
	08/15/18	*Cabbage*	1715 ± 366	4220 ± 601	< 22	< 26	< 33	< 46	< 34	< 26
	08/15/18	*Kale*	859 ± 208	4918 ± 505	< 21	< 17	< 21	< 30	< 24	< 19
	08/15/18	*Cauliflower Leaves*	373 ± 175	3783 ± 580	< 26	< 25	< 25	< 49	< 29	< 30
	09/19/18	*Broccoli Leaves*	1389 ± 143	5034 ± 323	< 8	< 8	< 7	< 28	< 9	< 8
	09/19/18	*Cauliflower Leaves*	1857 ± 180	6557 ± 434	< 19	< 19	< 20	< 59	< 21	< 20
	09/19/18	*Cabbage*	2453 ± 163	4308 ± 271	< 12	< 13	< 13	< 45	< 14	< 12
		MEAN ± 2 STD DEV	1115 ± 1570	4767 ± 1618	-	-	-	-	-	-
55	06/20/18	*Kale*	< 244	4549 ± 591	< 25	< 19	< 18	< 39	< 27	< 25
	06/20/18	*Cabbage*	< 268	4974 ± 650	< 28	< 28	< 22	< 39	< 35	< 29
	06/20/18	*Brussels Srputs*	< 291	4673 ± 716	< 26	< 34	< 27	< 48	< 41	< 32
	07/18/18	*Cabbage*	< 262	3924 ± 544	< 24	< 23	< 28	< 38	< 29	< 29
	07/18/18	*Kale*	352 ± 167	5179 ± 513	< 19	< 23	< 15	< 27	< 27	< 22
	07/18/18	*Brussels Srputs*	< 141	3378 ± 430	< 15	< 16	< 25	< 23	< 18	< 18
	08/15/18	*Cabbage*	892 ± 217	3681 ± 457	< 21	< 21	< 20	< 35	< 23	< 20
	08/15/18	*Collards*	637 ± 225	3488 ± 486	< 20	< 20	< 21	< 37	< 22	< 23
	08/15/18	*Kale*	846 ± 208	5066 ± 557	< 18	< 19	< 29	< 32	< 21	< 22
	09/19/18	*Eggplant Leaves*	5523 ± 265	6628 ± 415	< 15	< 17	< 15	< 60	< 16	< 15
	09/19/18	*Collards*	2420 ± 405	9595 ± 946	< 23	< 24	< 23	< 55	< 30	< 18
	09/19/18	*Corn Leaves*	9441 ± 266	6479 ± 317	< 14	< 15	< 14	< 59	< 17	< 15
		MEAN ± 2 STD DEV	2873 ± 6819	5135 ± 3511	-	-	-	-	-	-

THE MEAN AND TWO STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUES

Table C-IX.1 **QUARTERLY OSLD RESULTS FOR PEACH BOTTOM ATOMIC POWER STATION, 2018**

RESULTS IN UNITS OF MILLIREM/STD. MONTH ± 2 SIGMA

STATION CODE	MEAN ± 2 S.D.	JAN - MAR	APR - JUN	JUL - SEP	OCT - DEC
2	8.9 ± 0.5	9.3	8.9	8.7	8.8
5	8.5 ± 0.9	9.1	8.4	8.1	8.3
14	8.9 ± 1.2	9.3	9.2	9.0	8.0
15	9.1 ± 0.3	9.2	9.3	8.9	9.1
16	8.6 ± 0.9	9.1	8.7	8.7	8.0
17	10.4 ± 0.8	10.2	11.0	10.1	10.2
18	9.3 ± 0.6	9.5	9.4	9.5	8.9
19	7.7 ± 0.9	8.3	7.6	7.6	7.2
1A	9.6 ± 1.1	10.3	9.5	9.4	9.0
1B	7.9 ± 0.5	8.1	8.1	7.6	7.8
1C	9.0 ± 0.9	9.6	9.0	8.9	8.5
1D	8.5 ± 1.3	9.5	8.2	8.0	8.4
1E	8.6 ± 0.5	8.9	8.6	8.4	8.4
1F	10.3 ± 0.7	10.7	10.0	10.5	10.0
1G	6.3 ± 0.4	6.5	6.2	6.4	6.1
1H	9.1 ± 0.6	9.5	8.9	9.0	8.9
1I	8.3 ± 0.2	8.4	8.4	8.2	8.3
1J	10.0 ± 0.8	10.5	10.2	9.7	9.6
1K	10.1 ± 0.1	10.2	10.1	10.1	10.1
1L	8.1 ± 0.6	8.3	8.4	7.8	7.9
1M	5.8 ± 0.7	6.3	5.7	5.7	5.5
1P	6.7 ± 0.3	6.9	6.6	6.6	6.8
1Q	7.3 ± 0.4	7.6	7.1	7.2	7.4
1R	12.6 ± 0.6	12.7	12.2	12.9	12.4
1T	9.3 ± 0.8	9.8	9.4	9.0	9.0
22	9.3 ± 0.4	9.5	9.4	9.0	9.3
23	9.4 ± 0.7	9.4	9.4	9.9	9.0
24	6.8 ± 0.4	7.0	6.9	6.7	6.5
26	9.2 ± 0.3	9.3	9.3	9.0	9.1
27	9.2 ± 1.1	9.8	9.6	8.6	8.9
2B	8.6 ± 0.2	8.5	8.7	8.5	8.5
32	9.7 ± 0.4	9.6	9.5	10.0	9.6
3A	6.8 ± 0.5	7.1	6.8	6.9	6.5
40	10.2 ± 0.3	10.3	10.1	10.2	10.0
42	8.4 ± 0.7	8.9	8.2	8.2	8.1
43	9.8 ± 0.4	10.1	9.7	9.8	9.6
44	8.9 ± 0.5	9.1	9.1	8.6	8.7
45	9.4 ± 1.7	10.6	9.2	8.7	9.1
46	8.0 ± 0.3	8.1	8.1	7.8	7.8
47	9.9 ± 0.2	10.0	10.0	9.8	9.8
48	9.4 ± 0.7	9.8	9.5	9.0	9.1
49	9.1 ± 0.6	9.4	9.1	9.1	8.7
4K	6.3 ± 1.5	7.4	6.0	5.9	5.8
50	10.3 ± 0.6	10.3	10.3	10.6	9.9
51	8.9 ± 0.5	9.0	9.2	8.9	8.6
6B	7.7 ± 0.5	8.0	7.5	7.5	7.6
1NN	9.8 ± 0.5	10.1	9.8	9.9	9.5
31A	7.8 ± 0.3	7.8	8.0	7.7	7.8

SITE BOUNDARY STATIONS
1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1NN, 1P, 1Q, 1R, 1T, 2, 2B, 40

INTERMEDIATE STATIONS
14, 15, 17, 22, 23, 26, 27, 31A, 32, 3A, 42, 43, 44, 45, 46, 47, 48, 49, 4K, 5, 50, 51, 6B

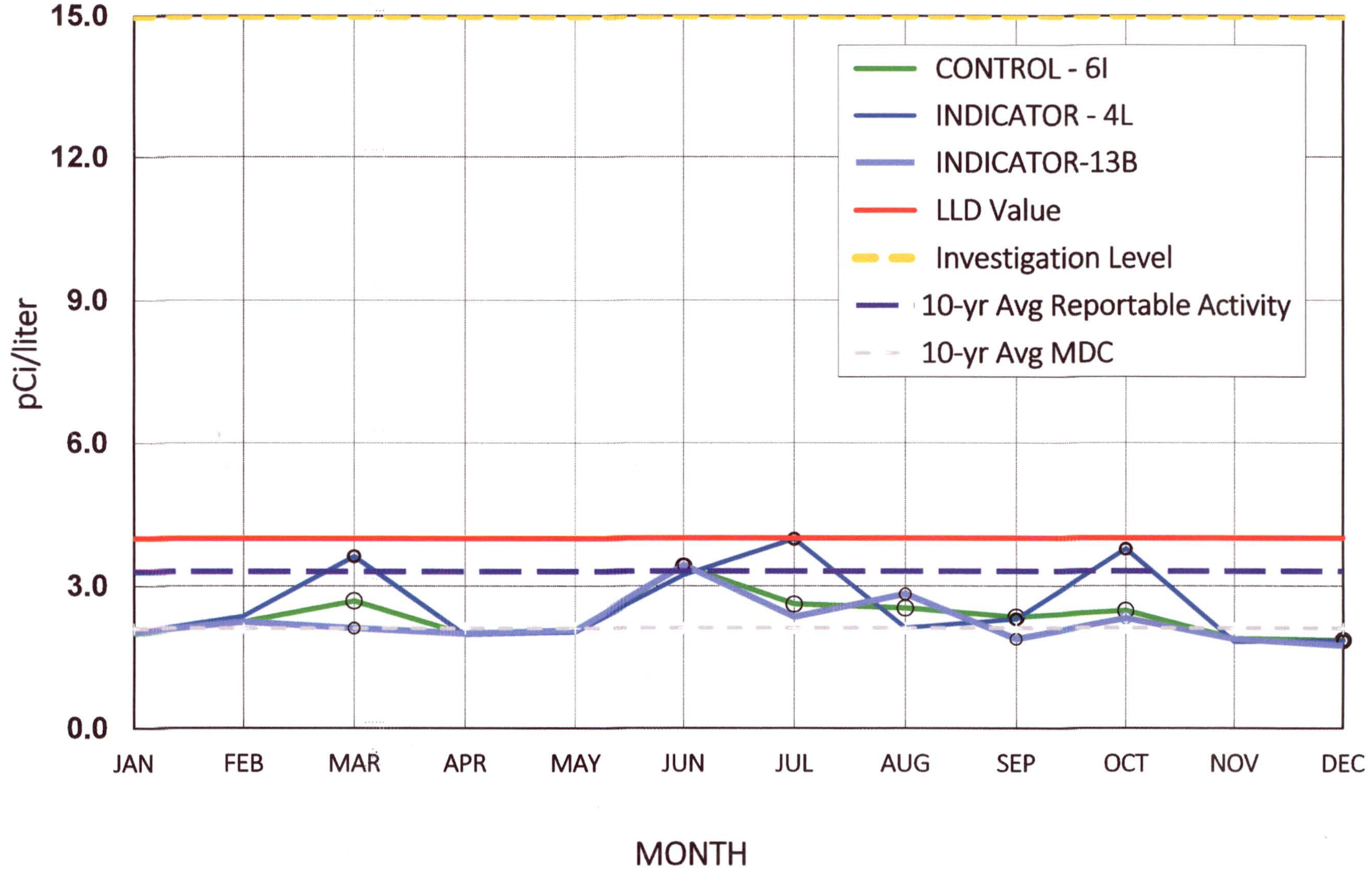
CONTROL STATIONS
16, 18, 19, 24

Table C-IX.2 **SUMMARY OF THE AMBIENT DOSIMETRY PROGRAM FOR PEACH BOTTOM ATOMIC POWER STATION, 2018**

RESULTS IN UNITS OF MILLI-REM/STD. MONTH

LOCATION	SAMPLES ANALYZED	PERIOD MINIMUM	PERIOD MAXIMUM	PERIOD MEAN ± 2 S.D.
SITE BOUNDARY	80	5.5	12.9	8.8 ± 3.1
INTERMEDIATE	96	5.8	11.0	8.9 ± 2.1
CONTROL	16	6.5	9.5	8.1 ± 2.1

FIGURE C-1
MONTHLY TOTAL GROSS BETA CONCENTRATIONS IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF PBAPS, 2018



Open data points are positive identification of gross beta activity

FIGURE C-2
MDC RESULTS FOR FISH SAMPLING COLLECTED IN THE VICINITY OF PBAPS, 2018

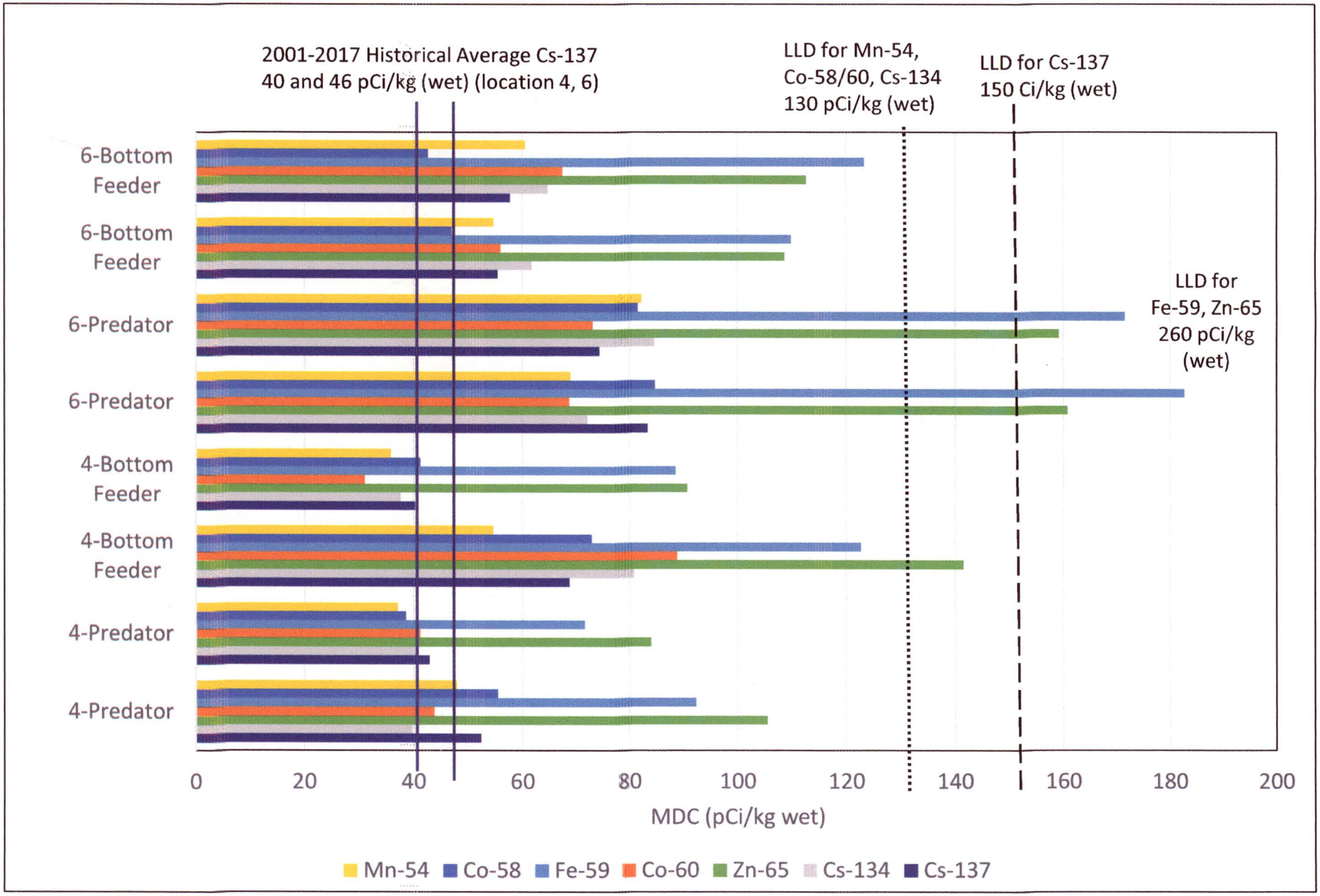


FIGURE C-3
SEMI-ANNUAL CS-137 CONCENTRATIONS IN SEDIMENT SAMPLES COLLECTED IN THE VICINITY OF PBAPS, 2018

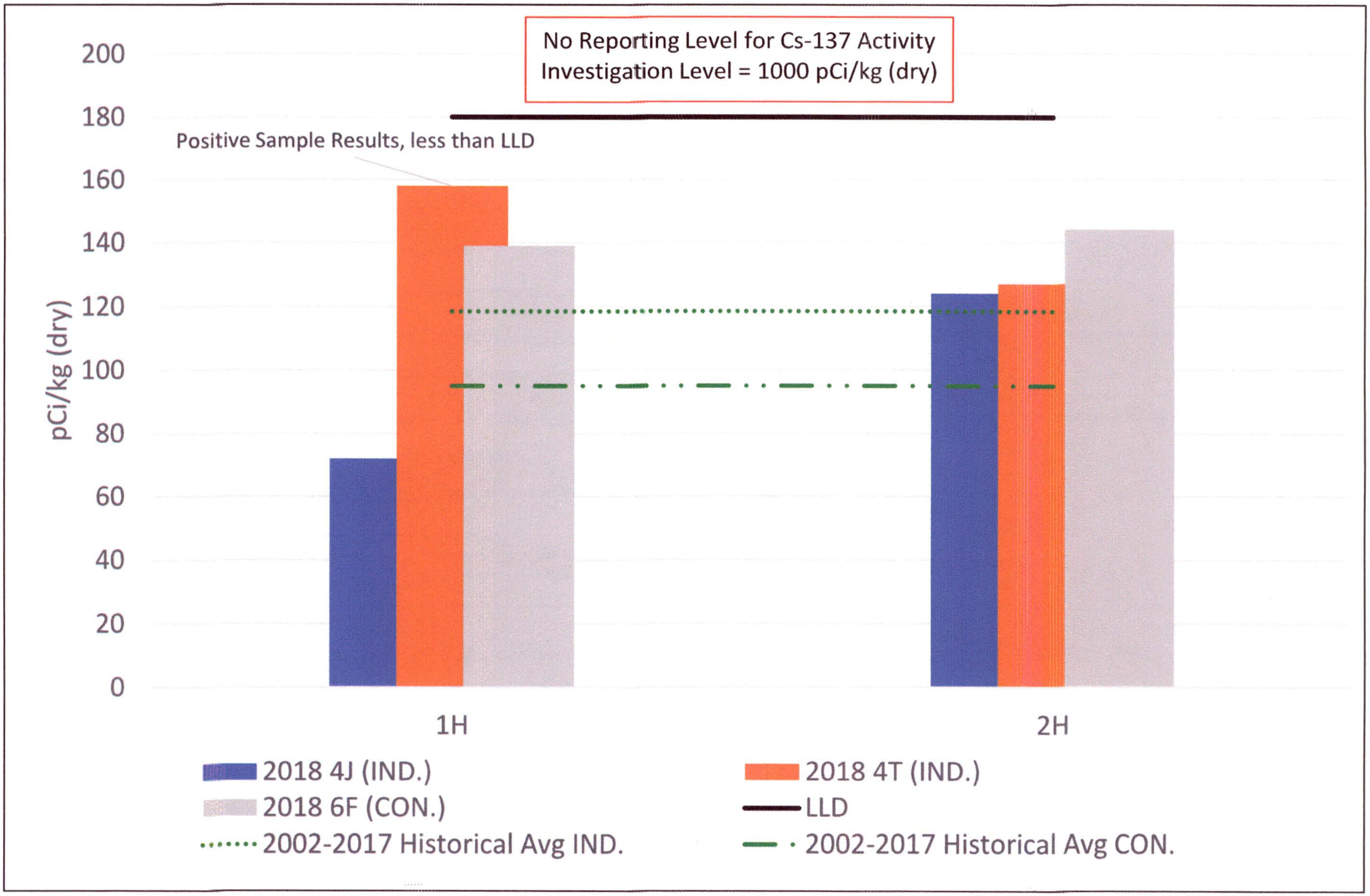
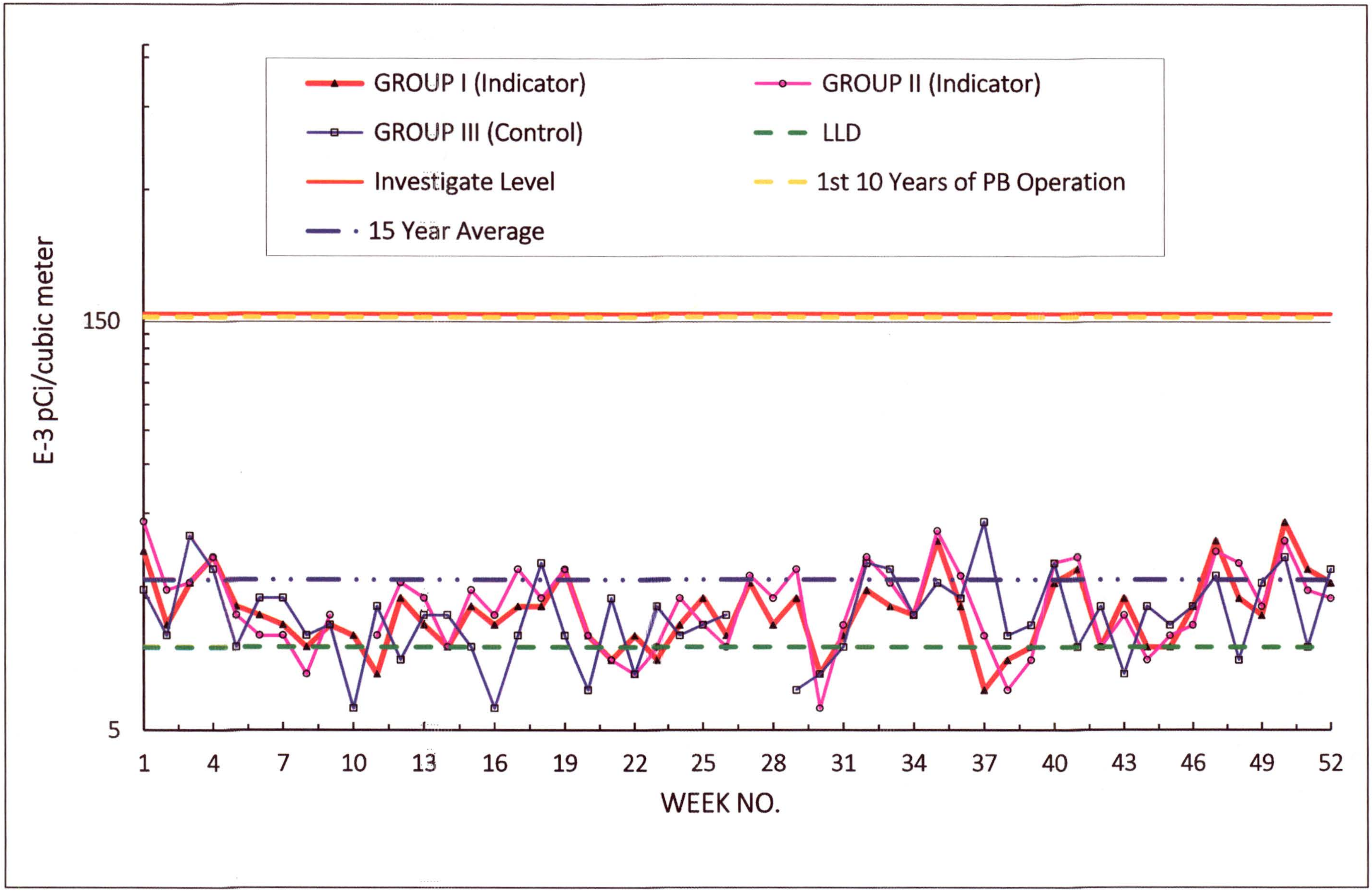


FIGURE C-4
MEAN WEEKLY GROSS BETA CONCENTRATIONS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF PBAPS, 2018



No Required Reporting Level for Gross Beta Activities

FIGURE C-5
AVERAGE MONTHLY MDC FOR REMP MILK SAMPLES COLLECTED IN THE VICINITY OF PBAPS, 2018

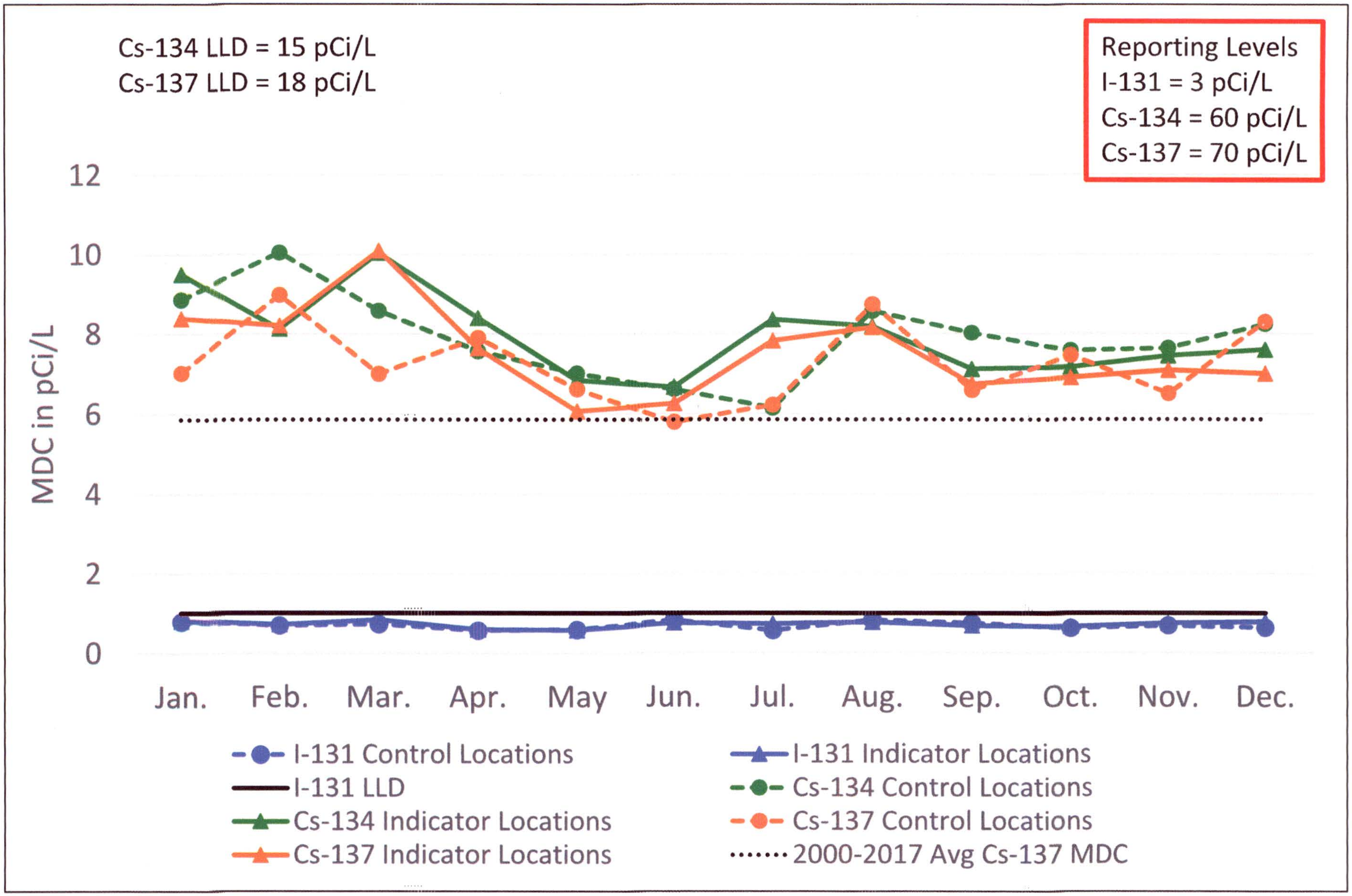
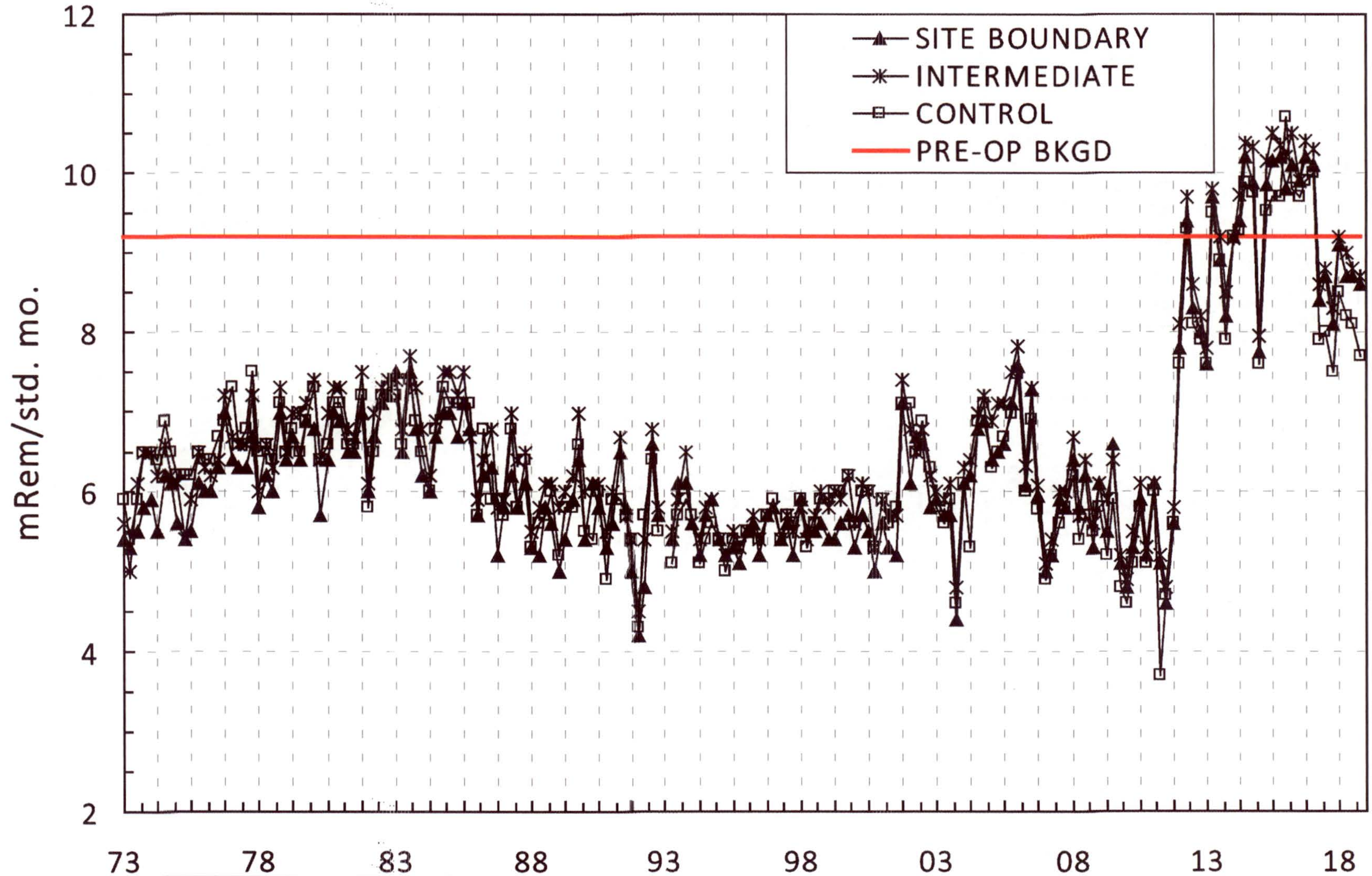
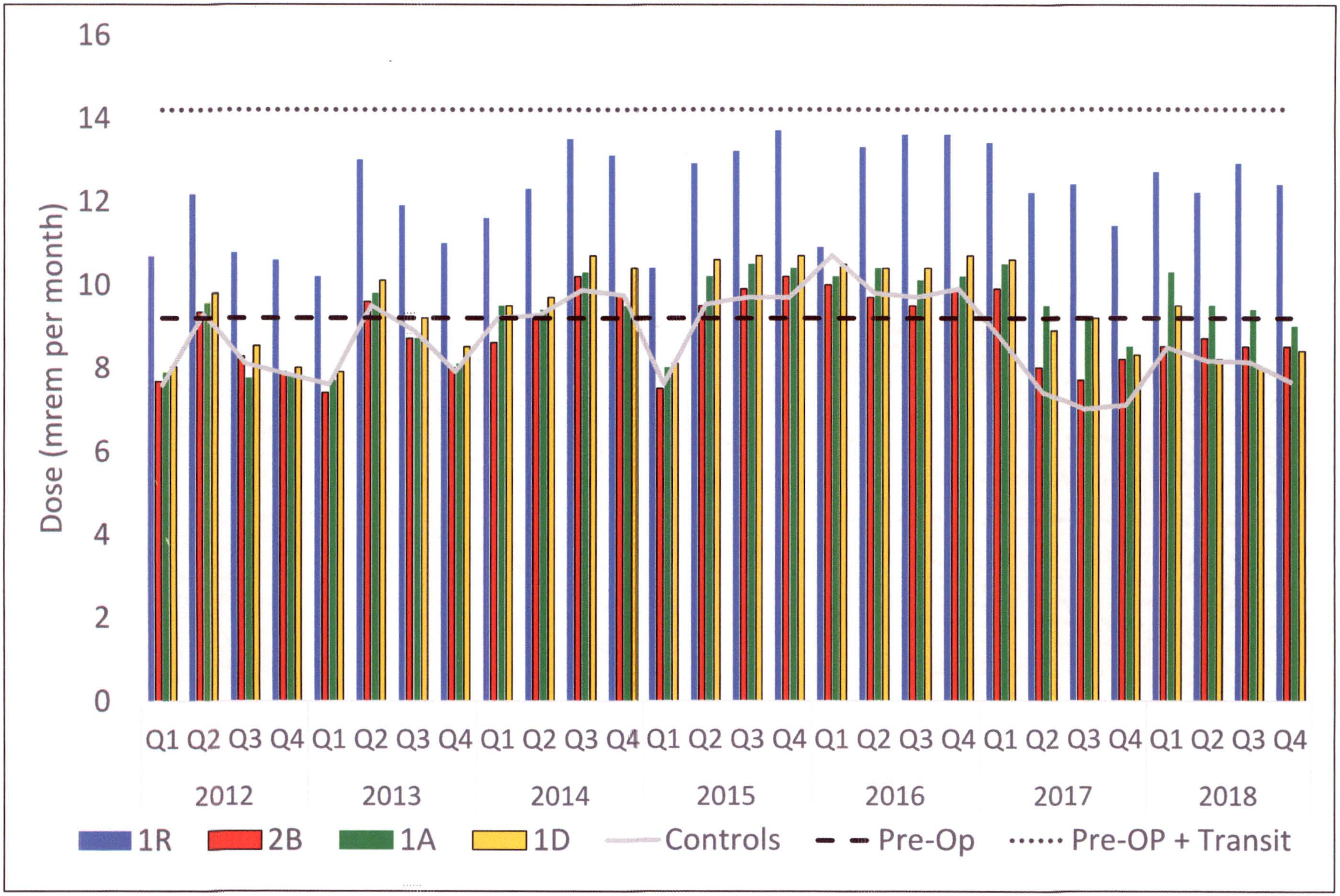


FIGURE C-6
MEAN QUARTERLY AMBIENT GAMMA RADIATION LEVELS IN THE VICINITY OF PBAPS, 1973 - 2018



OSLD technology use began January 2012, TLD technology ended December 2011. For only OSLD data, Gross mRem per standard month is reported.

FIGURE C-7
ISFSI AND CONTROL OSLD RESULTS COMPARED
TO PRE-OPERATION HISTORICAL VALUES



APPENDIX D

DATA TABLES AND FIGURES
QC LABORATORIES

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TABLE D-I.1

CONCENTRATIONS OF GROSS BETA IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	4L *	Lab
12/28/17 - 02/01/18	1.7 ± 0.6	EIS
02/01/18 - 03/01/18	1.8 ± 0.6	EIS
03/01/18 - 03/29/18	1.5 ± 0.6	EIS
03/29/18 - 04/25/18	1.5 ± 0.6	EIS
04/25/18 - 05/31/18	2.2 ± 0.6	EIS
05/31/18 - 06/28/18	3.3 ± 0.7	EIS
06/28/18 - 07/25/18	2.3 ± 0.7	EIS
07/25/18 - 08/30/18	1.8 ± 0.7	EIS
08/30/18 - 09/26/18	2.6 ± 0.7	EIS
09/26/18 - 11/01/18	1.9 ± 0.6	EIS
11/01/18 - 11/29/18	1.7 ± 0.7	EIS
11/29/18 - 01/03/19	1.4 ± 0.6	EIS
MEAN ± 2 STD DEV	2.0 ± 1.1	

TABLE D-I.2

CONCENTRATIONS OF TRITIUM IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	4L	Lab
12/28/17 - 03/29/18	< 123	GEL
03/29/18 - 06/26/18	< 117	GEL
06/26/18 - 09/26/18	< 102	GEL
09/26/18 - 01/03/19	< 141	GEL
MEAN	-	

TABLE D-I.3

CONCENTRATIONS OF I-131 IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	4L	Lab
12/28/17 - 02/01/18	< 0.5	EIS
02/01/18 - 03/01/18	< 0.7	EIS
03/01/18 - 03/29/18	< 0.6	EIS
03/29/18 - 04/25/18	< 0.7	EIS
04/25/18 - 05/31/18	< 0.7	EIS
05/31/18 - 06/28/18	< 0.5	EIS
06/28/18 - 07/25/18	< 0.7	EIS
07/25/18 - 08/30/18	< 0.5	EIS
08/30/18 - 09/26/18	< 0.9	EIS
09/26/18 - 11/01/18	< 0.5	EIS
11/01/18 - 11/29/18	< 0.7	EIS
11/29/18 - 01/03/19	< 0.9	EIS
MEAN	-	

*All detectable results were less than the required LLD

THE MEAN AND TWO STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUES

TABLE D-I.4 **CONCENTRATIONS OF GAMMA EMITTERS IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Zr-95	Nb-95	Cs-134	Cs-137	Ba-140	La-140	Lab
4L	12/28/17 - 02/01/18	< 4	< 9	< 5	< 5	< 9	< 7	< 5	< 4	< 5	< 18	< 8	EIS
	02/01/18 - 03/01/18	< 5	< 10	< 5	< 4	< 10	< 9	< 5	< 4	< 5	< 20	< 10	EIS
	03/01/18 - 03/29/18	< 4	< 11	< 5	< 6	< 10	< 8	< 5	< 4	< 5	< 21	< 10	EIS
	03/29/18 - 04/25/18	< 4	< 8	< 4	< 4	< 8	< 6	< 4	< 3	< 4	< 19	< 7	EIS
	04/25/18 - 05/31/18	< 5	< 12	< 5	< 5	< 9	< 8	< 5	< 4	< 4	< 30	< 14	EIS
	05/31/18 - 06/28/18	< 4	< 10	< 4	< 4	< 11	< 8	< 5	< 5	< 5	< 18	< 7	EIS
	06/28/18 - 07/25/18	< 4	< 9	< 4	< 4	< 7	< 7	< 4	< 3	< 4	< 27	< 10	EIS
	07/25/18 - 08/30/18	< 4	< 9	< 5	< 4	< 11	< 7	< 6	< 5	< 5	< 28	< 13	EIS
	08/30/18 - 09/26/18	< 3	< 8	< 3	< 4	< 7	< 6	< 3	< 3	< 4	< 13	< 5	EIS
	09/26/18 - 11/01/18	< 4	< 7	< 4	< 4	< 7	< 6	< 3	< 4	< 2	< 19	< 6	EIS
	11/01/18 - 11/29/18	< 4	< 8	< 4	< 4	< 8	< 6	< 4	< 3	< 4	< 16	< 7	EIS
	11/29/18 - 01/03/19	< 6	< 13	< 6	< 6	< 13	< 9	< 5	< 5	< 5	< 25	< 11	EIS
	MEAN	-	-	-	-	-	-	-	-	-	-	-	

TABLE D-II.1 CONCENTRATIONS OF GROSS BETA IN AIR PARTICULATE AND I-131 IN AIR IODINE SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018

RESULTS IN UNITS OF E-3 PCI/CU METER ± 2 SIGMA

COLLECTION PERIOD	1A GROSS BETA	1A I-131
12/28/17 - 01/04/18	24 ± 1	< 13
01/04/18 - 01/10/18	36 ± 1	< 22
01/10/18 - 01/18/18	23 ± 1	< 10
01/18/18 - 01/25/18	42 ± 1	< 11
01/25/18 - 02/01/18	27 ± 1	< 7
02/01/18 - 02/08/18	21 ± 1	< 19
02/08/18 - 02/15/18	27 ± 1	< 14
02/15/18 - 02/22/18	22 ± 1	< 18
02/22/18 - 03/01/18	24 ± 1	< 16
03/01/18 - 03/08/18	19 ± 1	< 12
03/08/18 - 03/14/18	17 ± 1	< 21
03/14/18 - 03/22/18	26 ± 1	< 18
03/22/18 - 03/29/18	24 ± 1	< 17
03/29/18 - 04/05/18	18 ± 1	< 14
04/05/18 - 04/12/18	28 ± 1	< 21
04/12/18 - 04/19/18	19 ± 1	< 14
04/19/18 - 04/25/18	22 ± 1	< 13
04/25/18 - 05/03/18	27 ± 1	< 18
05/03/18 - 05/10/18	27 ± 1	< 19
05/10/18 - 05/17/18	17 ± 1	< 16
05/17/18 - 05/24/18	13 ± 1	< 12
05/24/18 - 05/31/18	17 ± 1	< 16
05/31/18 - 06/07/18	14 ± 1	< 18
06/07/18 - 06/14/18	20 ± 1	< 14
06/14/18 - 06/21/18	25 ± 2	< 26
06/21/18 - 06/28/18	17 ± 1	< 24
06/28/18 - 07/05/18	25 ± 1	< 21
07/05/18 - 07/13/18	31 ± 1	< 21
07/13/18 - 07/19/18	26 ± 1	< 19
07/19/18 - 07/25/18	15 ± 1	< 22
07/25/18 - 08/02/18	23 ± 1	< 19
08/02/18 - 08/09/18	47 ± 2	< 35
08/09/18 - 08/16/18	30 ± 1	< 19
08/16/18 - 08/23/18	26 ± 1	< 16
08/23/18 - 08/30/18	39 ± 1	< 19
08/30/18 - 09/06/18	25 ± 1	< 20
09/06/18 - 09/12/18	13 ± 1	< 21
09/12/18 - 09/20/18	19 ± 1	< 14
09/20/18 - 09/26/18	19 ± 2	< 18
09/26/18 - 10/04/18	33 ± 1	< 19
10/04/18 - 10/10/18	36 ± 1	< 18
10/10/18 - 10/17/18	17 ± 1	< 18
10/17/18 - 10/24/18	23 ± 1	< 28
10/24/18 - 11/02/18	45 ± 1	< 14
11/02/18 - 11/08/18	14 ± 1	< 20
11/08/18 - 11/16/18	20 ± 1	< 17
11/16/18 - 11/21/18	37 ± 2	< 33
11/21/18 - 11/29/18	22 ± 1	< 14
11/29/18 - 12/06/18	23 ± 1	< 19
12/06/18 - 12/13/18	62 ± 1	< 18
12/13/18 - 12/20/18	46 ± 1	< 10
12/20/18 - 12/27/18	36 ± 1	< 12
12/27/18 - 01/03/19	34 ± 1	< 16
MEAN	26 ± 20	-

TABLE D-II.2 CONCENTRATIONS OF GAMMA EMITTERS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018

RESULTS IN UNITS OF E-3 PCI/CU METER ± 2 SIGMA

SITE	COLLECTION PERIOD	Be-7	Mn-54	Co-58	Co-60	Cs-134	Cs-137
1A	12/28/17 - 03/29/18	58 ± 8	< 1.1	< 1.2	< 0.9	< 0.9	< 1.1
	03/29/18 - 06/28/18	81 ± 14	< 1.4	< 1.6	< 1.5	< 1.3	< 1.3
	06/28/18 - 09/26/18	73 ± 12	< 1.3	< 1.5	< 1.3	< 1.3	< 1.2
	09/26/18 - 12/27/18	57 ± 11	< 1.3	< 1.3	< 1.2	< 1.2	< 1.3
	MEAN ± 2 STD DEV	67 ± 23	-	-	-	-	-

TABLE D-III.1 CONCENTRATIONS OF I-131 AND GAMMA EMITTERS IN MILK SAMPLES COLLECTED IN THE VICINITY OF PEACH BOTTOM ATOMIC POWER STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	I-131	K-40	Cs-134	Cs-137	Ba-140	La-140
J	02/12/18	< 0.5	1524 ± 92	< 4	< 4	< 32	< 10
	05/15/18	< 0.6	1431 ± 94	< 4	< 5	< 17	< 6
	08/07/18	< 0.9	1329 ± 115	< 6	< 6	< 33	< 12
	11/13/18	< 0.9	1396 ± 115	< 5	< 6	< 34	< 15
	MEAN ± 2 STD DEV	-	1420 ± 162	-	-	-	-
S	02/13/18	< 0.6	1486 ± 97	< 4	< 5	< 35	< 11
	05/14/18	< 0.5	1399 ± 117	< 5	< 6	< 28	< 9
	08/07/18	< 0.8	1430 ± 97	< 5	< 5	< 27	< 8
	11/13/18	< 0.8	1439 ± 89	< 3	< 4	< 27	< 9
	MEAN ± 2 STD DEV	-	1439 ± 72	-	-	-	-
V	02/10/18	< 0.5	1440 ± 118	< 5	< 5	< 30	< 10
	05/15/18	< 0.6	1327 ± 96	< 4	< 5	< 20	< 7
	08/07/18	< 0.7	1466 ± 89	< 4	< 4	< 27	< 7
	11/13/18	< 0.7	1395 ± 97	< 4	< 5	< 29	< 11
	MEAN ± 2 STD DEV	-	1407 ± 122	-	-	-	-

THE MEAN AND TWO STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUES

FIGURE D-1
COMPARISON OF MONTHLY TOTAL GROSS BETA CONCENTRATIONS IN DRINKING WATER SAMPLES FROM STATION 4L ANALYZED BY THE PRIMARY AND QC LABORATORIES, 2018

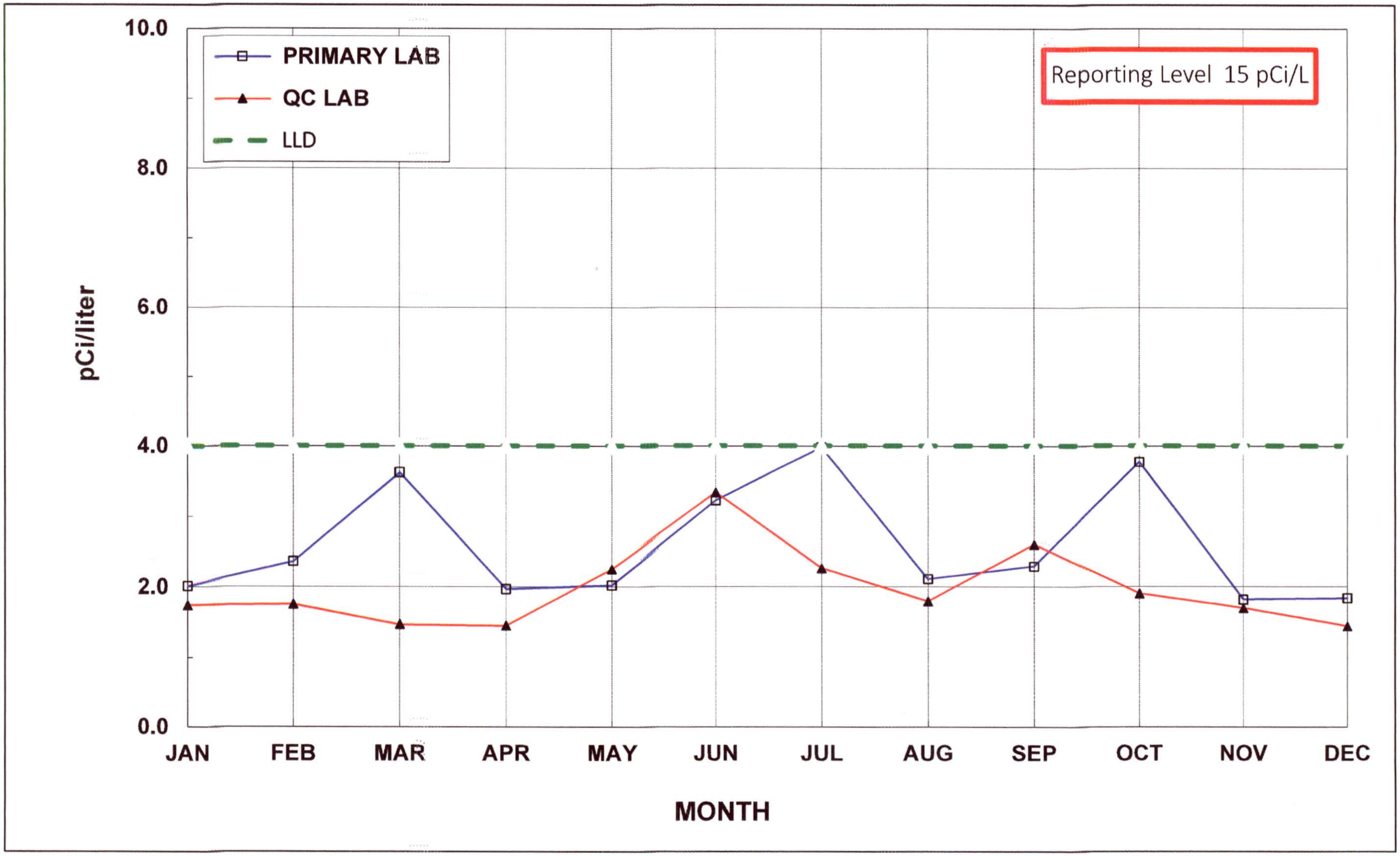
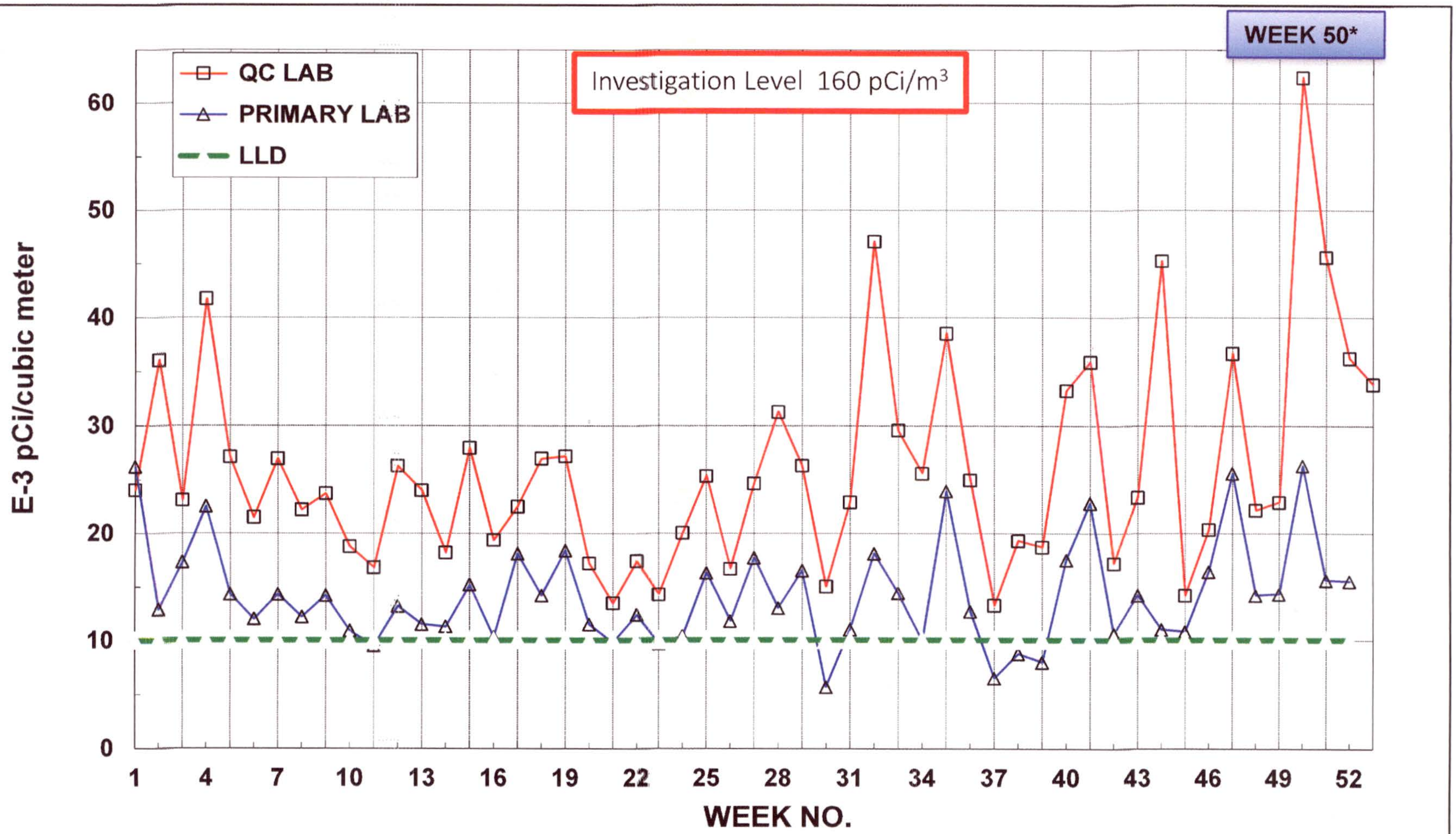


FIGURE D-2
COMPARISON OF WEEKLY GROSS BETA CONCENTRATIONS FROM CO-LOCATED AIR PARTICULATE LOCATIONS (1Z/1A) ANALYZED BY THE PRIMARY AND QC LABORATORIES, 2018



Week 50 *– Gross beta results increased slightly, but still well below the reportable and investigation levels for gross beta. There was no identified isotopic activity on the quarterly composite; therefore these results are not of concern.*

APPENDIX E

ERRATA DATA

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An error was found in the 2017 AREOR. Milk Farm C location in Appendix B is incorrect and has been incorrect since 2011 (AEROR for 2010), when units changed from miles to feet. Review of previous AREORs identified that Milk Farm C was never included on a map until the 2017 AEROR. The distance is 9.54 miles or 50,400 ft. (IR 04174541).

Corrected Table B-1, Page 1:

TABLE B-1 Radiological Environmental Monitoring Program – Sampling Locations, Distance and Direction from Reactor Buildings, Peach Bottom Atomic Power Station, 2018

Location	Location Description	Distance & Direction from Site per PBAPS ODCM
A. Surface Water		
1LL	Peach Bottom Units 2 and 3 Intake - Composite (Control)	1,200 feet ENE
1MM	Peach Bottom Canal Discharge -Composite	5,500 feet SE
B. Drinking (Potable) Water		
4L	Conowingo Dam EL 33' MSL - Composite	45,900 feet SE
6I	Holtwood Dam Hydroelectric Station - Composite (Control)	30,500 feet NW
13B	Chester Water Authority (CWA) Susquehanna Pumping Station- Composite	13,300 feet ESE
C. Fish		
4	Conowingo Pond	6,000 – 10,000 feet SE
6	Holtwood Pond (Control)	50,000 – 70,000 feet NNW
D. Sediment		
4J	Conowingo Pond near Berkin's Run	7,400 feet SE
4T	Conowingo Pond near Conowingo Dam	41,800 feet SE
6F	Holtwood Dam (Control)	31,500 feet NW
E. Air Particulate - Air Iodine		
1B	Weather Station #2	2,500 feet NW
1Z	Weather Station #1	1,500 feet SE
1A	Weather Station #1	1,500 feet SE
1C	Peach Bottom South Sub Station	4,700 feet SSE
3A	Delta, PA – Substation	19,300 feet SW
5H2	Manor Substation (Control)	162,400 feet NE
F. Milk – bi-weekly / monthly		
J		5,100 feet W
R		4,900 feet SW
S		19,100 feet SE
U		11,200 feet SSW
V	(Control)	32,600 feet W
X		9,500 feet NW
G. Milk – quarterly		
C*	(Control)	50,400 feet NW
D		18,500 feet NE
E	(Control)	46,100 feet N
L		11,200 feet NE
P		11,000 feet ENE
W		89,200 feet S
H. Food Products – monthly when available		
1C		4,700 feet SSE
2Q		9,200 feet SW
3Q		9,500 feet W
55	(Control)	51,900 feet NE
X		9,500 feet NW

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APPENDIX F

INTER-LABORATORY COMPARISON PROGRAM ACCEPTANCE CRITERIA AND RESULTS

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A. Pre-set Acceptance Criteria

1. Analytics Evaluation Criteria

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

2. ERA Evaluation Criteria

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

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

B. TBE PE Results and Discussion

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

2. The Analytics September 2018 milk Fe-59 result was evaluated as *Not Acceptable* (Ratio of TBE to known result at 132%). The reported value was 158 ± 17.6 pCi/L and the known value was 119 ± 19.9 pCi/L. No cause for the failure could be determined. TBE has passed 24 of the previous 27 milk cross-check results since 2012. This sample was run in duplicate on a different

detector with comparable results (162 +/- 16 pCi/L). *NOTE: TBE's 4th Qtr result passed at 105%* (NCR 18-20)

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

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

5. The MAPEP November vegetation Sr-90 result of 0.338 Bq/sample was evaluated as Not Acceptable (Lower acceptable range was 0.554 Bq/sample). It appears that there has been incomplete dissolution of Sr-90 due to the composition of the MAPEP vegetation "matrix". To resolve this issue, the TBE-2018 procedure has been modified to add H_2O_2 to assist in breaking down the organic material that comprises this "matrix". This corrective action will be monitored closely by QA.
   (NCR 18-25).

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

C. EIS Laboratory PE Results and Discussion

All analyses met the specified acceptance criteria.

D. GEL Labs PE Results and Discussion

1. The ERA February 2018 water Natural Uranium (and mass) results of 65.4 pCi/L and 97.6 µg/L were evaluated as *Not Acceptable*. No determination could be made as to a reason and all quality control criteria were met. The samples were re-analyzed and results fell in the acceptable range. (Corrective Action Request and Report, CARR 180226-1150). All other analyses done for Peach Bottom met the specified acceptance criteria.

TABLE F.1

Analytics Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services, 2018

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [(a)]	Ratio of TBE to Analytics Result	Evaluation [(b)]
March 2018	E12133	Milk	Sr-89	pCi/L	76.1	90.1	0.84	A
			Sr-90	pCi/L	12.2	12.5	0.98	A
	E12134	Milk	Ce-141	pCi/L	77.8	77.0	1.01	A
			Co-58	pCi/L	105	114	0.92	A
			Co-60	pCi/L	181	187	0.97	A
			Cr-51	pCi/L	298	326	0.92	A
			Cs-134	pCi/L	150	180	0.84	A
			Cs-137	pCi/L	164	172	0.95	A
			Fe-59	pCi/L	140	139	1.01	A
			I-131	pCi/L	105	108.0	0.97	A
			Mn-54	pCi/L	133	131	1.01	A
			Zn-65	pCi/L	242	244	0.99	A
	E12135	Charcoal	I-131	pCi	93.7	95.4	0.98	A
	E12136	AP	Ce-141	pCi	92.6	85.3	1.09	A
			Co-58	pCi	130	126	1.03	A
			Co-60	pCi	237	207	1.14	A
			Cr-51	pCi	411	361	1.14	A
			Cs-134	pCi	194	199	0.98	A
			Cs-137	pCi	200	191	1.05	A
			Fe-59	pCi	160	154	1.04	A
			Mn-54	pCi	152	145	1.05	A
			Zn-65	pCi	267	271	0.99	A
	E12137	Water	Fe-55	pCi/L	1990	1700	1.17	A
	E12138	Soil	Ce-141	pCi/g	0.148	0.118	1.26	W
			Co-58	pCi/g	0.171	0.174	0.98	A
			Co-60	pCi/g	0.297	0.286	1.04	A
			Cr-51	pCi/g	0.537	0.498	1.08	A
			Cs-134	pCi/g	0.274	0.275	1.00	A
			Cs-137	pCi/g	0.355	0.337	1.05	A
			Fe-59	pCi/g	0.243	0.212	1.15	A
			Mn-54	pCi/g	0.228	0.201	1.14	A
			Zn-65	pCi/g	0.395	0.374	1.06	A

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

(b) Analytics evaluation based on TBE internal QC limits:
- *A = Acceptable - reported result falls within ratio limits of 0.80-1.20*
- *W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30*
- *N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30*

TABLE F.1 **Analytics Environmental Radioactivity Cross Check Program**
Teledyne Brown Engineering Environmental Services, 2018

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [(a)]	Ratio of TBE to Analytics Result	Evaluation [(b)]
June 2018	E12205	Milk	Sr-89	pCi/L	74.9	84.6	0.89	A
			Sr-90	pCi/L	10.5	11.4	0.92	A
	E12206	Milk	Ce-141	pCi/L	89.2	82.2	1.08	A
			Co-58	pCi/L	94.8	89	1.07	A
			Co-60	pCi/L	125	113	1.10	A
			Cr-51	pCi/L	256	239	1.07	A
			Cs-134	pCi/L	112	114	0.99	A
			Cs-137	pCi/L	107	98.8	1.08	A
			Fe-59	pCi/L	95.9	86.0	1.12	A
			I-131	pCi/L	69.8	71.9	0.97	A
			Mn-54	pCi/L	138	130	1.06	A
			Zn-65	pCi/L	186	157	1.18	A
	E12207	Charcoal	I-131	pCi	69.6	72.2	0.96	A
	E12208	AP	Ce-141	pCi	151	165	0.92	A
			Co-58	pCi	174	178	0.98	A
			Co-60	pCi	290	227	1.28	W
			Cr-51	pCi	452	478	0.95	A
			Cs-134	pCi	215	227	0.95	A
			Cs-137	pCi	206	198	1.04	A
			Fe-59	pCi	180	172	1.05	A
			Mn-54	pCi	265	260	1.02	A
			Zn-65	pCi	280	315	0.89	A
	E12209	Water	Fe-55	pCi/L	1790	1740	1.03	A
	E12210	AP	Sr-89	pCi	77.8	90.3	0.86	A
			Sr-90	pCi	9.54	12.2	0.78	W

(a) The Analytics known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation
(b) Analytics evaluation based on TBE internal QC limits:
A = Acceptable - reported result falls within ratio limits of 0.80-1.20
W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30
N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

TABLE F.1

Analytics Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services, 2018

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

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

(b) Analytics evaluation based on TBE internal QC limits:
A = Acceptable - reported result falls within ratio limits of 0.80-1.20
W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30
N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

(1) See ***NCR 18-20***
(2) See ***NCR 18-24***
(3) See ***NCR 18-21***

TABLE F.1 **Analytics Environmental Radioactivity Cross Check Program**
Teledyne Brown Engineering Environmental Services, 2018

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

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

(b) Analytics evaluation based on TBE internal QC limits:
A = Acceptable - reported result falls within ratio limits of 0.80-1.20
W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30
N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

TABLE F.2

DOE's Mixed Analyte Performance Evaluation Program (MAPEP)
Teledyne Brown Engineering Environmental Services, 2018

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

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

(b) DOE/MAPEP evaluation:

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

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

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

(1) False positive test

(2) Sensitivity evaluation

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

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

TABLE F.3

ERA Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services, 2018

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

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

(b) ERA evaluation:

A = Acceptable - Reported value falls within the Acceptance Limits

N = Not Acceptable - Reported value falls outside of the Acceptance Limits

*(1) See **NCR 18-23***

TABLE F.4

Analytics Environmental Radioactivity Cross Check Program
Exelon Industrial Services, 2018

Month/Year	Identification Number	Matrix	Nuclide	Units	EIS Reported Value	Known Value [(a)]	Ratio of Analytics to EIS Result	Evaluation [(b)]
March 2018	E 12085	Water	Gr-B	pCi/L	272	275	98.9	Pass
	E 12086 D4	Charcoal	I-131	pCi	85.2	94.3	90.3	Pass
	E 12084 D3	Milk	I-131	pCi/L	106	108	98.1	Pass
			Ce-141	pCi/L	80.0	77.0	104	Pass
			Cr-51	pCi/L	317	326	97.2	Pass
			Cs-134	pCi/L	178	180	98.9	Pass
			Cs-137	pCi/L	176	172	102	Pass
			Co-58	pCi/L	118	114	104	Pass
			Mn-54	pCi/L	140	131	107	Pass
			Fe-59	pCi/L	148	139	106	Pass
			Zn-65	pCi/L	264	244	108	Pass
			Co-60	pCi/L	192	187	103	Pass
June 2018	E12177	AP	Ce-141	pCi/Filter	153	148	103	Pass
			Cr-51	pCi/Filter	437	429	102	Pass
			Cs-134	pCi/Filter	193	204	94.6	Pass
			Cs-137	pCi/Filter	179	178	101	Pass
			Co-58	pCi/Filter	158	160	98.8	Pass
			Mn-54	pCi/Filter	236	233	101	Pass
			Fe-59	pCi/Filter	173	155.0	112	Pass
			Zn-65	pCi/Filter	268	283	94.7	Pass
			Co-60	pCi/Filter	200	204	98.0	Pass
	E12176	Water	I-131	pCi/L	77	74	104	Pass
			Ce-141	pCi/L	90	86	105	Pass
			Cr-51	pCi/L	259	249	104	Pass
			Cs-134	pCi/L	101	119	84.9	Pass
			Cs-137	pCi/L	106	103	103	Pass
			Co-58	pCi/L	88	93	94.6	Pass
			Mn-54	pCi/L	132	135	97.8	Pass
			Fe-59	pCi/L	97	89.7	109	Pass
			Zn-65	pCi/L	171	164	104	Pass
			Co-60	pCi/L	112	118	94.9	Pass
	E12175	Water	Gr-B	pCi/L	215.9	251	86.0	Pass
September 2018	E12245	AP	Gr-B	pCi	220.3	211	104.4	Pass

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

(b) Analytics evaluation based on EIS internal QC limits in accordance with the NRC Resolution Test criteria

(Page 1 of 2)

TABLE F.4 **Analytics Environmental Radioactivity Cross Check Program**
Exelon Industrial Services, 2018

Month/Year	Identification Number	Matrix	Nuclide	Units	EIS Reported Value	Known Value [a]	Ratio of Analytics to EIS Result	Evaluation [b]
December 2018	E12343	Water	Gr-B	pCi/L	257	295	87.1	Pass
	E12344	Cartridge	I-131	pCi	86.2	89.7	96.1	Pass
	E12342A	AP	Ce-141	pCi/Filter	97.9	97.0	101	Pass
			Cr-51	pCi/Filter	226	217	104	Pass
			Cs-134	pCi/Filter	112.0	125.0	89.6	Pass
			Cs-137	pCi/Filter	98.8	88.2	112	Pass
			Co-58	pCi/Filter	85.7	86.5	99.1	Pass
			Mn-54	pCi/Filter	123	112.0	110	Pass
			Fe-59	pCi/Filter	97.9	83.4	117	Pass
			Zn-65	pCi/Filter	201	193	104	Pass
			Co-60	pCi/Filter	158	155	102	Pass
	E12345	Milk	I-131	pCi/L	95.8	93.3	103	Pass
			Ce-141	pCi/L	145	133.0	109	Pass
			Cr-51	pCi/L	372	298	125	Pass
			Cs-134	pCi/L	193	171	113	Pass
			Cs-137	pCi/L	141	121	117	Pass
			Co-58	pCi/L	123.0	119.0	103	Pass
			Mn-54	pCi/L	178	154	116	Pass
			Fe-59	pCi/L	127	114	111	Pass
			Zn-65	pCi/L	242	264	91.7	Pass
			Co-60	pCi/L	215	212	101	Pass

(a) The Analytics known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation
(b) Analytics evaluation based on EIS internal QC limits in accordance with the NRC Resolution Test criteria

(Page 2 of 2)

TABLE F.5 ERA Environmental Radioactivity Cross Check Program
Exelon Industrial Services, 2018

Month/Year	ID Number	Matrix	Nuclide	Units	EIS Reported Value	Known Value (a)	Acceptance Limits	Acceptance Ratio of ERA to EIS Result	Evaluation (b)
April 2018	RAD-113	Water	Ba-133	pCi/L	88.0	91.5		96.2	Pass
			Cs-134	pCi/L	81.1	75.9		107	Pass
			Cs-137	pCi/L	131	123		107	Pass
			Co-60	pCi/L	70.0	64.3		109	Pass
			Zn-65	pCi/L	95.9	86.7		111	Pass
			I-131	pCi/L	24.1	24.6		98.0	Pass
			GR-B	pCi/L	64.6	73.7		87.7	Pass
July 2018	RAD-114		H-3	pCi/L	215.9	251		86.0	Pass
September 2018	MRAD-29	AP	Am-241	pCi/Filter	52.3	64.1		81.6	Pass
			Cs-134	pCi/Filter	870	921		94.5	Pass
			Cs-137	pCi/Filter	403	373		108	Pass
			Co-60	pCi/Filter	1178	1130		104	Pass
			Zn-65	pCi/Filter	696	660		105	Pass
October 2018	RAD-115	Water	Ba-133	pCi/L	13.4	16.3		82.2	Pass
			Cs-134	pCi/L	87.9	93.0		94.5	Pass
			Cs-137	pCi/L	223.4	235.0		95.1	Pass
			Co-60	pCi/L	80.2	80.7		99.4	Pass
			Zn-65	pCi/L	317.8	336		94.6	Pass
			I-131	pCi/L	28.1	27.2		103	Pass

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

(b) Analytics evaluation based on EIS internal QC limits in accordance with the NRC Resolution Test criteria

TABLE F-6 **Analytics Environmental Radioactivity Cross Check Program**
GEL Laboratories (Relevant Nuclides), 2018

Quarter/Year	Identification Number	Matrix	Nuclide	Units	Reported Value	Known Value [(a)]	Acceptance Limits	Evaluation [(b)]
1st/2018	E12174	Water	Cs-134	pCi/L	161	171	94.2	A
			Cs-137	pCi/L	164	164	100	A
			Co-58	pCi/L	192	178	108	A
			Co-60	pCi/L	192	192	100	A
			Fe-59	pCi/L	148	148	100	A
			I-131	pCi/L	93.7	91.0	103	A
			Mn-54	pCi/L	136	125	109	A
			Zn-65	pCi/L	253	233	109	A
2nd/2018	E12174	Water	Cs-134	pCi/L	106	119	89.1	A
			Cs-137	pCi/L	98.6	103	95.7	A
			Co-58	pCi/L	97.6	92.9	105	A
			Co-60	pCi/L	122	118	103	A
			Fe-59	pCi/L	108	89.7	120	A
			I-131	pCi/L	73.1	74.4	98.3	A
			Mn-54	pCi/L	147	135	109	A
			Zn-65	pCi/L	197	164	120	A
3rd/2018	E12243	Water	Cs-134	pCi/L	120	128	93.8	A
			Cs-137	pCi/L	164.0	154	106	A
			Co-58	pCi/L	153.0	150	102	A
			Co-60	pCi/L	209	198	106	A
			Fe-59	pCi/L	139	124	112	A
			I-131	pCi/L	67.6	62.5	108	A
			Mn-54	pCi/L	191	174	110	A
			Zn-65	pCi/L	241	209	115	A
4th/2018	E12349	Water	Cs-134	pCi/L	141	160	88.1	A
			Cs-137	pCi/L	121	113	107	A
			Co-58	pCi/L	109	111	98.2	A
			Co-60	pCi/L	206	198	104	A
			Fe-59	pCi/L	116	107	108	A
			I-131	pCi/L	81.9	80.4	102	A
			Mn-54	pCi/L	151	144	105	A
			Zn-65	pCi/L	276	246	112	A

(a) The Analytics known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation.
(b) Analytics evaluation based on laboratory's internal acceptance criteria of 75% - 125%:
A = Acceptable - Reported value falls within the Acceptance Limits
N = Not Acceptable - Reported value falls outside of the Acceptance Limits

TABLE F-7

DOE's Mixed Analyte Performance Evaluation Program (MAPEP)
GEL Laboratories (Relevant Nuclides), 2018

Quarter/Year	Identification Number	Matrix	Nuclide	Units	Reported Value	Known Value [a]	Acceptance Range	Evaluation [b]
2nd/2018	18-MaW38	Water	Cs-134	Bq/L	9.1	10.2	7.1 - 13.3	A
			Cs-137	Bq/L	12.8	12.2	8.5 - 15.9	A
			Co-60	Bq/L	12.1	11.5	8.1 - 15.0	A
			Mn-54	Bq/L	9.35E-04		False Positive Test	A
			Zn-65	Bq/L	15.7	14.3	0.0 - 18.6	A
			H-3	Bq/L	1.14		False Positive Test	A
			Sr-90	Bq/L	10.7	11.4	8.0 - 14.8	A
			Am-241	Bq/L	0.685	0.709	0.496 - 0.922	A
			Pu-238	Bq/L	0.014	0.023	Sensitivity Evaluation	A
			Pu-239/240	Bq/L	0.586	0.600	0.420 - 0.780	A
			U-234/233	Bq/L	0.450	0.430	0.301 - 0.559	A
4th/2018	18-MaW39	Water	Cs-134	Bq/L	7.9	8.7	6.1 - 11.3	A
			Cs-137	Bq/L	7.41	6.9	4.8 - 9.0	A
			Co-60	Bq/L	0.0408		False Positive Test	A
			Mn-54	Bq/L	13.2	12.5	8.8 - 16.3	A
			Zn-65	Bq/L	8.52	7.53	5.27 - 9.79	A
			H-3	Bq/L	331	338	237 - 439	A
			Sr-90	Bq/L	8.24	9.41	6.59 - 12.23	A
			Am-241	Bq/L	0.007		False Positive Test	A
			Pu-238	Bq/L	0.591	0.670	0.472 - 0.876	A
			Pu-239/240	Bq/L	0.801	0.928	0.650 - 1.206	A
			U-234/233	Bq/L	2.13	2.11	1.48 - 2.74	A

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

(b) DOE/MAPEP evaluation:

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

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

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

(Page 1 of 1)

TABLE F.8 **ERA Environmental Radioactivity Cross Check Program**
GEL Laboratories (Relevant Nuclides)

Quarter/ Year	Identification Number	Matrix	Nuclide	Units	Reported Value	Known Value [(a)]	Acceptance Limits	Evaluation [(b)]
1st/2018	RAD-112	Water	Cs-134	pCi/L	64.9	66	80.2 - 105	A
			Cs-137	pCi/L	117	112	53.4 - 72.2	A
			Co-60	pCi/L	122	114	101 - 126	A
			I-131	pCi/L	25.3	28.1	23.4 - 33.0	A
			I-131	pCi/L	28.6	28.1	23.4 - 33.0	A
			Zn-65	pCi/L	320	277	249 - 324	A
			Gr-A	pCi/L	67.7	72.4	38.1 - 89.2	A
			Gr-A	pCi/L	66.4	72.4	38.1 - 89.2	A
			Gr-B	pCi/L	47.6	54.8	37.5 - 61.7	A
			H-3	pCi/L	20,200	21,200	18,600 - 23,000	A
			H-3	pCi/L	20,200	21,200	18,600 - 23,000	A
			Sr-89	pCi/L	59.7	65.2	52.9 - 73.2	A
			Sr-89	pCi/L	68.6	65.2	52.9 - 73.2	A
			Sr-90	pCi/L	36.1	39.2	28.8 - 45.1	A
			Sr-90	pCi/L	36.9	39.2	28.8 - 45.1	A
			U (Nat)	pCi/L	56.4	58.6	47.8 - 64.5	A
			U (Nat)	pCi/L	65.4	58.6	47.8 - 64.5	N[(1)]
			U (Nat) mass	µg/L	97.6	86.2	70.3 - 94.9	N[(1)]
			U (Nat) mass	µg/L	93.3	86.2	70.3 - 94.9	A
2nd/2018	MRAD-28	Water	Cs-134	pCi/L	2,380	2,510	1,840 - 2,880	A
			Cs-137	pCi/L	1,480	1,400	1,190 - 1,680	A
			Co-60	pCi/L	2,570	2,540	2,210 - 2,970	A
			Mn-54	pCi/L	<6.36	<100	0 - 100	A
			Zn-65	pCi/L	2,160	1,960	1,630 - 2,470	A
			H-3	pCi/L	18,900	19,400	13,000 - 27,700	A
			Gr-A	pCi/L	125	90	31.8 - 139	A
			Gr-B	pCi/L	59.6	61.0	34.9 - 90.4	A
			Sr-90	pCi/L	685	714	465 - 944	A
			Am-241	pCi/L	150	140	94.3 - 188	A
			Pu-238	pCi/L	108	128	94.7 - 159	A
			Pu-239	pCi/L	73.3	85.8	66.6 - 108	A
			U-234	pCi/L	82.1	90.3	67.8 - 116	A
			U-234	pCi/L	92.0	90.3	67.8 - 116	A
			U-234	pCi/L	87.1	90.3	67.8 - 116	A
			U (Total)	pCi/L	181	184	135 - 238	A
			U (Total)	pCi/L	173	184	135 - 238	A
			U (Total)	pCi/L	180	184	135 - 238	A
			U (Total)	pCi/L	185	184	135 - 238	A
			U (Nat) mass	µg/L	270	268	214 - 324	A
			U (Nat) mass	µg/L	260	268	214 - 324	A
			U (Nat) mass	µg/L	252	268	214 - 324	A
			U (Nat) mass	µg/L	276	268	214 - 324	A

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

(b) ERA evaluation:
A = Acceptable - Reported value falls within the Acceptance Limits
N = Not Acceptable - Reported value falls outside of the Acceptance Limits

(1) See **CARR180226-1150**

TABLE F-8

ERA Environmental Radioactivity Cross Check Program
GEL Laboratories (Relevant Nuclides), 2018

Quarter/ Year	Identification Number	Matrix	Nuclide	Units	Reported Value	Known Value [(a)]	Acceptance Limits	Evaluation [(b)]
3rd/2018	RAD-114	Water	Cs-134	pCi/L	15.9	15.7	11.4 - 18.2	A
			Cs-137	pCi/L	196	192	173 - 213	A
			Co-60	pCi/L	122	119	107 - 133	A
			I-131	pCi/L	25.6	28.1	23.4 - 33.0	A
			I-131	pCi/L	28.7	28.1	23.4 - 33.0	A
			Zn-65	pCi/L	196	277	159 - 208	A
			Gr-A	pCi/L	15.5	16.0	7.79 - 22.6	A
			Gr-A	pCi/L	18.2	16.0	7.79 - 22.6	A
			Gr-B	pCi/L	43.6	49.0	33.2 - 56.1	A
			H-3	pCi/L	19,900	20,400	17,900 - 22,400	A
			H-3	pCi/L	21,200	20,400	17,900 - 22,400	A
			Sr-89	pCi/L	61.5	62.7	50.7 - 70.6	A
			Sr-89	pCi/L	69.0	62.7	50.7 - 70.6	A
			Sr-90	pCi/L	34.4	40.1	29.5 - 46.1	A
			Sr-90	pCi/L	36.2	40.1	29.5 - 46.1	A
			U (Nat)	pCi/L	53.8	51.8	42.2 - 57.1	A
			U (Nat)	pCi/L	50.3	51.8	42.2 - 57.1	A
			U (Nat) mass	µg/L	80.3	75.5	61.5 - 83.2	A
			U (Nat) mass	µg/L	73.4	75.5	61.5 - 83.2	A
			U (Nat) mass	µg/L	77.8	75.5	61.5 - 83.2	A
4th/2018	MRAD-29	Water	Cs-134	pCi/L	2,200	2,310	1,740 - 2,540	A
			Cs-137	pCi/L	910	898	769 - 1,020	A
			Co-60	pCi/L	1,630	1,510	1,300 - 1,730	A
			Mn-54	pCi/L	<6.61	<100	0 - 100	A
			Zn-65	pCi/L	1,990	1,790	1,590 - 2,260	A
			H-3	pCi/L	3,030	3,020	2,280 - 3,680	A
			Gr-A	pCi/L	166	183	66.8 - 252	A
			Gr-B	pCi/L	91.0	99.4	49.7 - 137	A
			Sr-90	pCi/L	321	275	198 - 340	A
			Am-241	pCi/L	164	172	118 - 220	A
			Pu-238	pCi/L	108	141	84.8 - 183	A
			Pu-239	pCi/L	125	163	101 -201	A
			U-234	pCi/L	94.0	91.6	69.7 - 105	A
			U-234	pCi/L	95.8	91.6	69.7 - 105	A
			U-234	pCi/L	84.6	91.6	69.7 - 105	A
			U (Total)	pCi/L	184	187	146 - 213	A
			U (Total)	pCi/L	178	187	146 - 213	A
			U (Nat) mass	µg/L	265	273	221 - 310	A

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

(b) ERA evaluation:
A = Acceptable - Reported value falls within the Acceptance Limits
N = Not Acceptable - Reported value falls outside of the Acceptance Limits

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APPENDIX G

ANNUAL RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM REPORT (ARGPPR)

Docket No: 50-277
50-278

PEACH BOTTOM ATOMIC POWER STATION
UNITS 2 and 3

Annual Radiological Groundwater Protection Program Report (ARGPPR)

January 1 through December 31, 2018

Prepared By
Teledyne Brown Engineering
Environmental Services

Exelon Generation.

Peach Bottom Atomic Power Station
Delta, PA 17314

May 2019

Table of Contents

Appendices

I. Summary and Conclusions

This report on the Radiological Groundwater Protection Program (RGPP) conducted for the Peach Bottom Atomic Power Station (PBAPS) by Exelon Nuclear covers the period 01 January 2018 through 31 December 2018. This evaluation involved numerous station personnel and contractor support personnel. At PBAPS, there are 31 permanent groundwater monitoring wells. Installation of the wells began in 2006. Of these monitoring locations, none were assigned to the station's Radiological Environmental Monitoring Program (REMP). This report covers groundwater, surface water, seep water, and precipitation water samples collected from the environment on station property in 2018. During that time period, 437 analyses were performed on 238 samples from 39 locations. These 39 locations include 25 groundwater monitoring wells, 3 surface water sample points, 3 groundwater seeps, 2 yard drain sumps, and 6 precipitation water sampling points. Phase 1 of the monitoring was part of a comprehensive study initiated by Exelon to determine whether groundwater or surface water in the vicinity of PBAPS had been adversely impacted by any releases of radionuclides. Phase 1 was conducted by Conestoga Rovers and Associates (CRA) and the conclusions were made available to state and federal regulators as well as the public. Phase 2 of the RGPP was conducted by Exelon corporate and station personnel to initiate follow up of Phase 1 and begin long-term monitoring at groundwater and surface water locations selected during Phase 1. All analytical results from Phase 2 monitoring are reported herein.

Samples supporting the RGPP were analyzed for Tritium (H-3), Strontium-89 (Sr-89), Strontium-90 (Sr-90), gross alpha, gross beta, gamma-emitting radionuclides associated with licensed plant operations and isotopes known as 'hard to detects'.

In assessing all the data gathered for this report, it was concluded that the operation of PBAPS had no adverse radiological impact on the environment and there are currently no known active releases into the groundwater at PBAPS.

Tritium was not detected at any location in concentrations greater than the United States Environmental Protection Agency (USEPA) drinking water standard (and the Nuclear Regulatory Commission [NRC] Reporting Limit) of 20,000 pCi/L.

Tritium was not detected at concentrations greater than the minimum detectable concentration (MDC) in any surface water, seep water or precipitation water sample locations. Based on the sample data, tritium is not migrating off the station property at detectable concentrations.

II. Introduction

PBAPS is located along the Susquehanna River between Holtwood and Conowingo Dams in Peach Bottom Township, York County, Pennsylvania. The initial loading of fuel into Unit 1, a 40 MWe (net) high temperature gas-cooled reactor, began on 5 February 1966, and initial criticality was achieved on 3 March 1966. Shutdown of Peach Bottom Unit 1 for decommissioning was on 31 October 1974. For the purposes of the monitoring program, the beginning of the operational period for Unit 1 was considered to be 5 February 1966. A summary of the Unit 1 preoperational monitoring program was presented in a previous report (1). PBAPS Units 2 and 3 are boiling water reactors, each with a power output of approximately 1366 MWe. The first fuel was loaded into Peach Bottom Unit 2 on 9 August 1973. Criticality was achieved on 16 September 1973 and full power was reached on 16 June 1974. The first fuel was loaded into Peach Bottom Unit 3 on 5 July 1974. Criticality was achieved on 7 August 1974 and full power was first reached on 21 December 1974. Preoperational summary reports (2)(3) for Units 2 and 3 have been previously issued and summarize the results of all analyses performed on samples collected from 5 February 1966 through 8 August 1973.

This report covers those analyses performed by Teledyne Brown Engineering (TBE) on samples collected in 2018.

A. Objective of the RGPP

The objectives of the RGPP are as follows:

1. Ensure that the site characterization of geology and hydrology provides an understanding of predominant groundwater gradients based upon current site conditions.

2. Identify site risk based on plant design and work practices.

3. Establish an on-site groundwater monitoring program to ensure timely detection of inadvertent radiological releases to ground water.

4. Establish a remediation protocol to prevent migration of licensed material off-site and to minimize decommissioning impacts.

5. Ensure that records of leaks, spills, remediation efforts are retained and retrievable to meet the requirements of 10 CFR 50.75(g).

6. Conduct initial and periodic briefings of their site specific Groundwater Protection Initiative (GPI) program with the designated State/Local officials.

7. Make informal communication as soon as practicable to appropriate

State/Local officials, with follow-up notifications to the NRC, as appropriate, regarding significant on-site leaks/spills into groundwater and on-site or off-site water sample results exceeding the criteria in the REMP as described in the Offsite Dose Calculation Manual (ODCM).

8. Submit a written 30-day report to the NRC for any water sample result for on-site groundwater that is or may be used as a source of drinking water that exceeds any of the criteria in the licensee's existing REMP/ODCM for 30-day reporting of off-site water sample results.

9. Document all on-site groundwater sample results and a description of any significant on-site leaks/spills into groundwater for each calendar year in the Annual Radiological Environmental Operating Report (AREOR) for REMP or the Annual Radioactive Effluent Release Report (ARERR).

10. Perform a self-assessment of the GPI program.

11. Conduct a review of the GPI program, including at a minimum the licensee's self-assessments, under the auspices of the Nuclear Energy Institute (NEI).

B. Implementation of the Objectives

The objectives identified have been implemented at PBAPS via Corporate and Site specific procedures. These procedures include:

1. EN-AA-407, Response to Inadvertent Releases of Licensed Materials to Groundwater, Surface Water, Soil or Engineered Structures

2. EN-AA-408, Radiological Groundwater Protection Program

3. EN-AA-408-4000, Radiological Groundwater Protection Program Implementation

4. EN-PB-408-4160, RGPP Reference Material for Peach Bottom Atomic Power Station

C. Program Description

1. Sample Collection

Sample locations can be found in Table A–1 and Figures A–1 and A–2, Appendix A.

Groundwater, Surface Water and Precipitation Water

Samples of water are collected, managed, transported and analyzed in accordance with approved procedures. Sample locations, sample collection frequencies and analytical frequencies are controlled in accordance with approved station procedures. Contractor and/or station personnel are trained in the collection, preservation management and shipment of samples, as well as in documentation of sampling events. Analytical laboratories are subject to internal quality assurance programs, industry cross-check programs, as well as nuclear industry audits. Station personnel review and evaluate all analytical data deliverables as data are received.

Analytical data results are reviewed by both station personnel and an independent hydro geologist for adverse trends or changes to hydrogeologic conditions.

D. Characteristics of Tritium

Tritium is a radioactive isotope of hydrogen. The most common form of tritium is tritium oxide, which is also called "tritiated water." The chemical properties of tritium are essentially those of ordinary hydrogen.

Tritiated water behaves the same as ordinary water in both the environment and the body. Tritium can be taken into the body by drinking water, breathing air, eating food or absorption through skin. Once tritium enters the body it disperses quickly and is uniformly distributed throughout the body. Tritium is excreted primarily through urine with a clearance rate characterized by an effective biological half-life of about 14 days. Within one month or so after ingestion essentially all tritium is cleared. Organically bound tritium (tritium that is incorporated in organic compounds) can remain in the body for a longer period.

Tritium is produced naturally in the upper atmosphere when cosmic rays strike air molecules. Tritium is also produced during nuclear weapons explosions, as a by-product in reactors producing electricity and in special production reactors, where the isotopes Lithium-7 (Li-7) and/or Boron-10 (B-10) are activated to produce tritium. Like normal water, tritiated water is colorless and odorless. Tritiated water behaves chemically and physically like non-tritiated water in the subsurface and therefore tritiated water will travel at the same velocity as the average groundwater velocity.

Tritium has a half-life of approximately 12.3 years. It decays spontaneously to Helium-3 (He-3). This radioactive decay releases a beta particle (low-energy electron). The radioactive decay of tritium is the source of the health risk from exposure to tritium. Tritium emits a low energy beta particle and leaves the body relatively quickly. Since tritium is almost always found as water, it goes directly into soft tissues and organs. The associated dose to these tissues is generally uniform and is dependent on the water content of the specific tissue.

III. Program Description

A. Sample Analysis

This section describes the general analytical methodologies used by TBE and GEL Laboratories (GEL) to analyze the environmental samples for radioactivity for the PBAPS RGPP in 2018.

In order to achieve the stated objectives, the current program includes the following analyses:

1. Concentrations of gamma emitters in groundwater and surface water.

2. Concentrations of strontium in groundwater.

3. Concentrations of tritium in groundwater, surface water and precipitation water.

4. Concentrations of 'hard-to-detect' isotopes, Americium-241 (Am-241), Cerium-242/243/244 (Cm-242, Cm-243, Cm-244), Plutonium-238/239/240 (Pu-238, Pu-239, Pu-240), Uranium-233/234/235/238 (U-233, U-234, U-235, U-238), Iron-55 (Fe-55), and Nickel-63 (Ni-63) in groundwater. These analyses are required based on tritium results.

B. Data Interpretation

The radiological data collected prior to PBAPS becoming operational were used as a baseline for operational data comparison. For the purpose of this report, PBAPS was considered operational at initial criticality. Several factors were important in the interpretation of the data:

1. <u>Lower Limit of Detection</u>

   The lower limit of detection (LLD) is a minimum sensitivity value that must be achieved routinely by the analytical parameter.

2. Laboratory Measurements Uncertainty

The estimated uncertainty in measurement of tritium in environmental samples is frequently on the order of 50% of the measurement value.

Statistically, the exact value of a measurement is expressed as a range with a stated level of confidence. The convention is to report results with a 95% level of confidence. The uncertainty comes from factors such as calibration standards, sample volume or weight measurements, and sampling uncertainty. Exelon reports the uncertainty of a measurement created by statistical process (counting error) as well as all sources of error (Total Propagated Uncertainty or TPU). Each result has two values calculated. Exelon reports the TPU by following the result with plus or minus ± the estimated sample standard deviation.

Analytical uncertainties are reported at the 95% confidence level in this report for reporting consistency with the AREOR.

Gamma spectroscopy results for each type of sample were grouped as follows:

> For groundwater and surface water 12 nuclides, Manganese-54 (Mn-54), Colbalt-58/60 (Co-58, Co-60), Iron-59 (Fe-59), Zinc-65 (Zn-65), Niobium-95 (Nb-95), Zirconium-95 (Zr-95), Iodine-131 (I-131), Cesium-134/137 (Cs-134, Cs-137), Barium-140 (Ba-140) and Lanthanum-140 (La-140) are measured.

C. Background Analysis

A pre-operational REMP was conducted to establish background radioactivity levels prior to operation of the Station. The environmental media sampled and analyzed during the pre-operational REMP were atmospheric radiation, fall-out, domestic water, surface water, marine life and foodstuffs. The results of the monitoring were detailed in the report entitled PBAPS, Environs Radiation Monitoring Program, Preoperational Summary Report Units 2 and 3, September 1970- August 1973, January 1974 and PBAPS, Environs Radiation Monitoring Program, Preoperational Summary Report Units 2 and 3, June 1977. The pre-operational REMP contained analytical results from samples collected from the surface water, discharge, well and rain water.

1. Background Concentrations of Tritium

The purpose of the following discussion is to summarize background measurements of tritium in various media performed by others. Additional detail may be found by consulting references (CRA 2006)(1).

a. Tritium Production

Tritium is created in the environment from naturally occurring processes both cosmic and subterranean, as well as from anthropogenic (i.e., man-made) sources. In the upper atmosphere, "Cosmogenic" tritium is produced from the bombardment of stable nuclides and combines with oxygen to form tritiated water, which will then enter the hydrologic cycle. Below ground, "lithogenic" tritium is produced by the bombardment of natural Li present in crystalline rocks by neutrons produced by the radioactive decay of naturally abundant U and Th. Lithogenic production of tritium is usually negligible compared to other sources due to the limited abundance of Li in rock. The lithogenic tritium is introduced directly to groundwater.

A major anthropogenic source of tritium and Sr-90 comes from the former atmospheric testing of thermonuclear weapons. Levels of tritium in precipitation increased significantly during the 1950s and early 1960s and later with additional testing, resulting in the release of significant amounts of tritium to the atmosphere. The Canadian heavy water nuclear power reactors, other commercial power reactors, nuclear research and weapons production continue to influence tritium concentrations in the environment.

b. Precipitation Data

Precipitation samples are routinely collected at stations around the world for the analysis of tritium and other radionuclides. Two publicly available databases that provide tritium concentrations in precipitation are Global Network of Isotopes in Precipitation (GNIP) and USEPA's RadNet database. GNIP provides tritium precipitation concentration data for samples collected worldwide from 1960 to 2006. RadNet provides tritium precipitation concentration data for samples collected at stations throughout the U.S. from 1960 up to and including 2006. Based on GNIP data for sample stations located in the U.S. Midwest, tritium concentrations peaked around 1963. This peak, which approached 10,000 pCi/L for some stations, coincided with the atmospheric testing of thermonuclear weapons. Tritium concentrations in surface water showed a sharp decline until 1975. A gradual decline has followed since that time. Tritium concentrations have typically been below 100 pCi/L since around 1980. Tritium concentrations in wells may still be above the 200 pCi/L detection limit from the external causes described above. Water from previous years and decades is naturally captured in groundwater, so some well water sources today are affected by the surface water from the 1960s that was elevated in tritium.

c. Surface Water Data

Surface water level measurements were collected at the surface water monitoring locations during the groundwater level measurement event. The purpose of the surface water monitoring was to provide surface water elevation data to evaluate the groundwater/surface water interaction at the Station.

The USEPA RadNet surface water data typically has a reported 'Combined Standard Uncertainty' of 35 to 50 pCi/L. According to USEPA, this corresponds to a ± 70 to 100 pCi/L 95% confidence bound on each given measurement. Therefore, the typical background data provided may be subject to measurement uncertainty of approximately ± 70 to 100 pCi/L.

The radio-analytical laboratory is counting tritium results to an Exelon-specified LLD of 200 pCi/L. Typically, the lowest positive measurement will be reported within a range of 40 – 240 pCi/L or 140 ± 100 pCi/L. Clearly, these sample results cannot be distinguished as different from background at this concentration.

IV. Results and Discussion

A. Groundwater Results

Groundwater

Samples were collected from on-site wells throughout the year in accordance with the station radiological groundwater protection program. Analytical results and anomalies are discussed below:

Tritium

Samples from 33 locations were analyzed for tritium activity (Tables B-I.1 and B-II.1, Appendix B). Tritium values ranged from the detection limit to 14,300 pCi/L. Tritium was not detected in wells at or near the owner-controlled boundary. The location most representative of potential offsite user of drinking water is less than the MDC (Table B-I.1, Appendix B).

Low levels of tritium were detected at concentrations greater than the minimum detectable concentration (MDC) in 12 of 25 groundwater monitoring wells and the 2 yard drain locations. The tritium concentrations ranged from the detection limit to 14,300 pCi/L (Table B–I.1, Appendix B).

Tritium was detected in 2 surface water locations greater than the MDC. Tritium concentrations in 2 of 29 samples ranged from 243 to 309 pCi/L. (Table B–II.1, Appendix B)

Tritium was detected in 2 precipitation water locations. The concentrations for 3 of 61 samples ranged from 193 to 234 pCi/L. (Table B–III.1, Appendix B)

Strontium

Sr-89 and Sr-90 were not detected in any of the samples (Table B-I.1, Appendix B).

Gross Alpha and Gross Beta (dissolved and suspended)

Gross Alpha and Gross Beta analyses in the dissolved and suspended fractions were performed on groundwater samples during 2018.

Gross Alpha (dissolved) was detected in 6 of 19 groundwater locations analyzed. The concentrations ranged from 2.2 to 9.4 pCi/L.

Gross Alpha (suspended) was detected in 2 of 19 groundwater locations analyzed. The concentrations ranged from 1.8 to 2.1 pCi/L.

Gross Beta (dissolved) was detected in 19 of 19 groundwater locations analyzed. The concentrations ranged from 1.4 to 15.6 pCi/L.

Gross Beta (suspended) was detected in 3 of 19 groundwater locations analyzed. The concentrations ranged from 1.8 to 3.4 pCi/L.

The activity detected is consistent with historical levels. The activity detected is naturally occurring and the levels are considered to be background (Table B-I.1, Appendix B).

Hard-To-Detect

Hard-To-Detect analyses were performed on a select group of groundwater water locations to establish baseline levels. The analyses for groundwater included Fe-55, Ni-63, Am-241, Cm-242, Cm-243/244, Pu-238, Pu-239/240, U-234, U-235 and U-238.

U-234 was detected in 7 of 18 groundwater monitoring locations analyzed. The concentrations ranged from 0.56 to 5.44 pCi/L.

U-235 was detected in 2 of 18 groundwater monitoring locations analyzed. The concentrations ranged from 0.15 to 0.26 pCi/L.

U-238 was detected in 7 of 18 groundwater monitoring locations analyzed. The concentrations ranged from 0.41 to 4.21 pCi/L. No plant-produced radionuclides were detected.

The activity detected is naturally occurring and the levels are considered to be background (Table B–I.3, Appendix B).

Gamma Emitters

No power-production gamma emitters were detected in any of the samples (Table B–I.2, Appendix B).

B. Surface Water Results

Surface Water

Samples were collected from six surface water locations throughout the year in accordance with the station radiological groundwater protection program. Analytical results are discussed below.

Tritium

Samples from six locations were analyzed for tritium activity. Tritium was detected in 2 surface water locations greater than the MDC with concentrations in 2 of 29 samples ranged from 243 to 309 pCi/L. (Table B–II.1, Appendix B)

Gamma Emitters

No power-production gamma emitters were detected in any of the samples. No other gamma emitting nuclides were detected (Table B–II.2, Appendix B).

C. Precipitation Water Results

Samples were collected at six locations (1A, 1B, 1S, 1SSE, 1Z, and 4M) in accordance with the station radiological groundwater protection program. The following analysis was performed:

Tritium

Samples from six locations were analyzed for tritium activity. Tritium activity was detected in 2 locations with concentrations for 3 of 61 samples ranging from 193 to 234 pCi/L. (Table B–III.1, Appendix B)

D. Drinking Water Well Survey

A drinking water well survey was conducted during the summer 2006 by CRA (CRA 2006)[1] around PBAPS. The water well inventory was updated in 2012[4]. The updated water well database search indicated a new water well off Station property within a one mile radius of the Station. The well is described as a "test" well and its use is listed as "unused". In summary, there were no significant changes in off Station groundwater use from 2006-2012.

E. Summary of Results – Inter-Laboratory Comparison Program

Inter-Laboratory Comparison Program results for TBE and Environmental Inc. (Midwest Labs) are presented in the AREOR.

F. Leaks, Spills and Releases

There were no inadvertent leaks, spills or releases of water containing licensed material to the environment in 2018.

G. Trends

A tritium plume has been identified northeast of the Unit 3 Turbine Building. The plume extends eastward toward well MW-PB-4. The plume is bounded on the north by wells MW-PB-12 and MW-PB-22. The plume is bounded on the south by wells MW-PB-20 and MW-PB-21.

The tritium plume is a result of licensed material entering the groundwater through degraded floor seams and penetration seals in the Unit 3 Turbine Building. The activity currently detected in the Unit 3 Turbine Building monitoring wells, MW-PB-24, 25, 26 and 27, is the result of legacy licensed material under the turbine building being transported eastward by natural hydrogeologic groundwater flow.

Tritium activity in the Unit 3 Turbine Building monitoring wells are trended. Any adverse trend is captured in the Station's Corrective Action Program.

H. Investigations

MW-PB-4

In 2006, monitoring wells MW-PB-1 through MW-PB-14 were installed. Tritium activity was detected in MW-PB-4, located north of the Unit 3 Circulating Water Pump Structure and MW-PB-12, north of the Administration Building. Groundwater flow on site is from west to east. Monitoring wells were installed to the west, southwest and northwest of monitoring wells MW-PB-4 and MW-PB-12. The wells with the highest tritium activity are the wells installed directly east of and adjacent to the Unit 3 Turbine Building, wells MW-PB-24, 25, 26 and 27.

Investigation of potential sources identified that the likely source of groundwater contamination was due to degraded floor seams in the Unit 3 Turbine Building Moisture Separator area 116' elevation. Leaks internal to the building entered the groundwater through the degraded floor seams. The floor seams were repaired in August 2010. The floor in the Unit 3 Turbine Building Moisture Separator area 116' elevation was sealed and recoated in October 2011.

MW-PB-29, 30 and 31

An extent-of-condition inspection of the Unit 2 Turbine Building Moisture Separator area 116' elevation floor was performed in October 2010. Minor degradation of the floor seams was identified and repaired. In May 2011, monitoring wells MW-PB-29 and 30 were installed directly east of and adjacent to the Unit 2 Turbine Building; MW-PB-31 was installed southeast of and adjacent to the Unit 2 Turbine Building. These wells were installed to determine if a condition existed east of the Unit 2 Turbine Building that is similar to the condition east of the Unit 3 Turbine Building.

Tritium activity in these wells ranged from less than the MDC to 2,720 pCi/L. Samples from these wells were also analyzed for gamma-emitting isotopes and hard-to-detect radionuclides. All results are less than the MDC for each isotope.

The Unit 2 Turbine Building Moisture Separator floor 116' elevation floor was sealed and recoated in October 2012. Groundwater intrusion into a ventilation pit on the east side of the area was identified. The groundwater was removed and degraded seams in the ventilation pit were successfully repaired.

<u>MW-PB-24, 25, 26 and 27</u>
Wells MW-PB-24, 25, 26 and 27 are considered the wells of primary interest. These wells were sampled on a frequency ranging from weekly to quarterly. Below are 3 tables. The first lists the highest tritium activity of the wells of primary interest and the date of the sampling. The second table lists the highest tritium activity of the wells during 2018. The third table lists the activity of the wells from the last sampling of 2018. The tritium activity is in pCi/L.

Well #	Tritium Activity	Date
MW-PB-24	1,530	6/6/2018
MW-PB-25	161,000	3/8/2010
MW-PB-26	196,000	3/8/2010
MW-PB-27	71,800	2/22/2010

Well #	Tritium Activity	Date
MW-PB-24	2,250	4/3/2018
MW-PB-25	14,300	11/27/2018
MW-PB-26	330	2/6/2018
MW-PB-27	760	1/9/2018

Well #	Tritium Activity	Date
MW-PB-24	374	11/27/2018
MW-PB-25	14,300	11/27/2018
MW-PB-26	< 196	11/27/2018
MW-PB-27	377	11/27/2018

Potential sources of tritium in the groundwater are investigated via procedural processes and documented in the corrective action program. The most likely pathway for tritium to enter the groundwater has been determined to be leaks internal to the Unit 3 Turbine Building Moisture Separator 116', migrating through degraded floor seams or other unidentified openings in the floor.

I. Actions Taken

1. The Unit 3 Condensate storage tank moat, sump and valve pit were cleaned and recoated to eliminate a potential pathway for licensed material to enter the groundwater. These activities were completed under work order 04602739 and work request 01339203.

2. During P3R21, the Unit 3 Recombiner Jet Compressor room floor drains were found plugged. One plug was removed and the second plug was modified to allow water to drain to the radwaste system in the event of a licensed material leak. This was completed under work request 01369404.

3. Installation of Monitoring Wells

   No groundwater monitoring wells were installed in 2018.

4. Actions to Recover/Reverse Plumes

   There were no actions to recover the plume.

J. Deviations

The data tables show that duplicate samples were obtained at several wells during 2018. These duplicate samples were obtained and analyzed for quality control purposes.

Due to regional drought conditions, seep SP-PB-3, located west of the Low Level RadWaste Storage Facility was dry during the 4th quarter of 2018. No sample was obtained or analyzed.

V. References

1. Conestoga Rovers and Associates, Fleetwide Assessment, Peach Bottom Atomic Power Station, Delta, PA, Fleetwide Assessment, Rev. 1, September 1, 2006.

2. Peach Bottom Atomic Power Station, Environs Radiation Monitoring Program, Preoperational Summary Report Units 2 and 3, June 1977.

3. Peach Bottom Atomic Power Station, Environs Radiation Monitoring Program, Preoperational Summary Report Units 2 and 3, September 1970-August 1973, January 1974.

4. Conestoga Rovers and Associates, Hydrogeologic Investigation Report, Peach Bottom Atomic Power Station, November 2012.

5. AMO Environmental Decisions, 2018 RGPP Summary Monitoring Reports, April 2018, August 2018, October 2018 and February 2018.

APPENDIX A

SAMPLING LOCATIONS, DISTANCE AND DIRECTION

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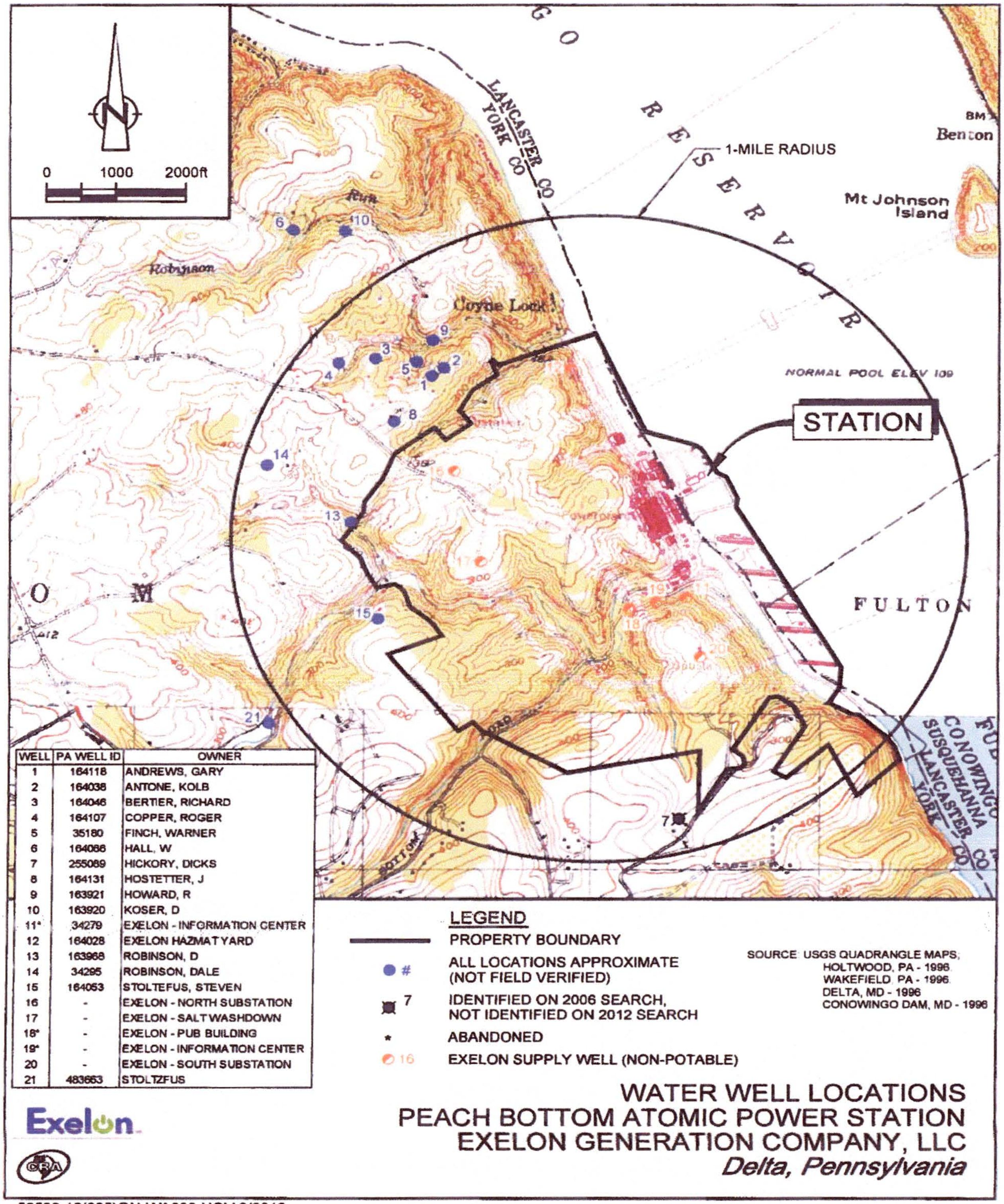
TABLE A-1: Radiological Groundwater Protection Program - Sampling Locations, Distance and Direction, Peach Bottom Atomic Power Station, 2018

Site	Site Type	Sector	Distance (ft.)
MW-PB-1	Groundwater Well	SW	1,166.6
MW-PB-2	Groundwater Well	WNW	309.0
MW-PB-3	Groundwater Well	SSE	709.7
MW-PB-4	Groundwater Well	ENE	350.2
MW-PB-5	Groundwater Well	NNW	1,146.1
MW-PB-6	Groundwater Well	NE	1,072.4
MW-PB-7	Groundwater Well	SE	813.9
MW-PB-8	Groundwater Well	SE	1,167.0
MW-PB-9	Groundwater Well	SE	2,816.9
MW-PB-10	Groundwater Well	SSE	1,125.1
MW-PB-11	Groundwater Well	SE	438.4
MW-PB-12	Groundwater Well	NNE	317.2
MW-PB-13	Groundwater Well	NW	329.4
MW-PB-14	Groundwater Well	S	1,231.2
MW-PB-15	Groundwater Well	SE	1,087.9
MW-PB-16	Groundwater Well	SE	1,101.6
MW-PB-17	Groundwater Well	SE	1,005.4
MW-PB-18	Groundwater Well	SE	1,010.0
MW-PB-19	Groundwater Well	NW	226.8
MW-PB-20	Groundwater Well	E	260.5
MW-PB-21	Groundwater Well	E	363.3
MW-PB-22	Groundwater Well	NE	315.4
MW-PB-24	Groundwater Well	N	185.9
MW-PB-25	Groundwater Well	N	159.7
MW-PB-26	Groundwater Well	NNE	121.1
MW-PB-27	Groundwater Well	NNE	139.1
MW-PB-28	Groundwater Well	NW	249.6
MW-PB-29	Groundwater Well	SE	325.0
MW-PB-30	Groundwater Well	SE	379.2
MW-PB-31	Groundwater Well	SE	450.1
SW-PB-1	Surface Water	NNW	2,850.5
SW-PB-5	Surface Water	SE	675.1
SW-PB-6	Surface Water	SE	1,305.9
SP-PB-1	Groundwater Seep	S	514.2
SP-PB-2	Groundwater Seep	WNW	311.6
SP-PB-3	Groundwater Seep	NNW	1,281.1
U/2 YARD DRAIN SUMP	Groundwater	SSE	498.7
U/3 YARD DRAIN SUMP	Groundwater	WSW	175.8
1A	Precipitation Water	ESE	1,271
1B	Precipitation Water	NW	2,587
1S	Precipitation Water	S	1,315
1SSE	Precipitation Water	SSE	1,312
1Z	Precipitation Water	SE	1,763
4M	Precipitation Water	SE	45,989



WELL	PA WELL ID	OWNER
1	164118	ANDREWS, GARY
2	164038	ANTONE, KOLB
3	164046	BERTIER, RICHARD
4	164107	COPPER, ROGER
5	35180	FINCH, WARNER
6	164066	HALL, W
7	255069	HICKORY, DICKS
8	164131	HOSTETTER, J
9	163921	HOWARD, R
10	163920	KOSER, D
11*	34279	EXELON - INFORMATION CENTER
12	164028	EXELON HAZMAT YARD
13	163968	ROBINSON, D
14	34295	ROBINSON, DALE
15	164053	STOLTEFUS, STEVEN
16	-	EXELON - NORTH SUBSTATION
17	-	EXELON - SALT WASHDOWN
18*	-	EXELON - PUB BUILDING
19*	-	EXELON - INFORMATION CENTER
20	-	EXELON - SOUTH SUBSTATION
21	483663	STOLTZFUS

53539-12(005)GN-WA008 NOV 6/2012

Figure A-1
Well Water Locations, Peach Bottom Atomic Power Station, 2018

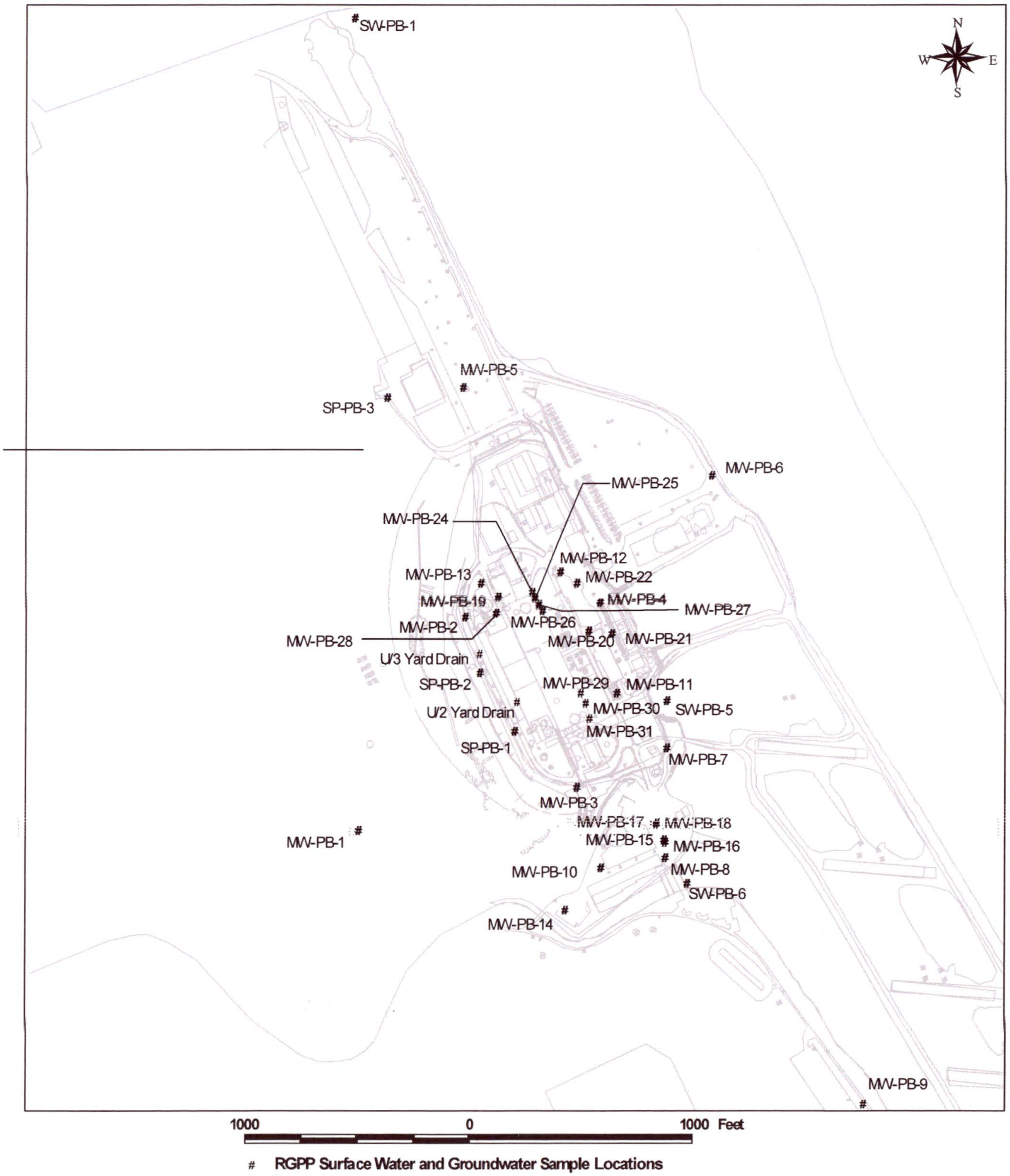


Figure A-2
RGPP Monitoring Locations, Peach Bottom Atomic Power Station, 2018

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APPENDIX B

DATA TABLES

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TABLE B-I.1 **CONCENTRATIONS OF TRITIUM, STRONTIUM, GROSS ALPHA AND GROSS BETA IN GROUNDWATER AND SEEP SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, PEACH BOTTOM ATOMIC POWER STATION, 2018**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE		H-3	Sr-89	Sr-90	Gr-A (Dis)	Gr-A (Sus)	Gr-B (Dis)	Gr-B (Sus)
MW-PB-1	09/10/18		< 185						
MW-PB-1	11/27/18		< 189						
MW-PB-2	03/05/18		< 179						
MW-PB-2	06/05/18		< 185	< 5.3	< 0.8	3.3 ± 0.8	< 0.8	6.2 ± 0.8	< 1.5
MW-PB-2	09/10/18		< 197						
MW-PB-2	11/27/18	TBE	< 188						
MW-PB-2	11/27/18	TBE	< 192						
MW-PB-2	11/27/18	GEL	< 154						
MW-PB-3	03/05/18		< 179						
MW-PB-3	06/05/18		< 184	< 5.7	< 0.7	< 1.3	< 0.8	1.9 ± 0.7	< 1.5
MW-PB-3	09/10/18		< 193						
MW-PB-3	11/27/18		< 188						
MW-PB-4	03/06/18		< 179						
MW-PB-4	06/06/18		< 179						
MW-PB-4	09/10/18	TBE	< 190						
MW-PB-4	09/10/18	TBE	< 184						
MW-PB-4	09/10/18	GEL	< 143						
MW-PB-4	11/28/18	TBE	189 ± 122						
MW-PB-4	11/28/18	TBE	195 ± 123						
MW-PB-4	11/27/18	GEL	< 149						
MW-PB-5	06/05/18		< 182						
MW-PB-6	06/04/18		254 ± 124						
MW-PB-7	03/06/18		< 180						
MW-PB-7	06/04/18		< 183	< 4.0	< 0.7	< 1.5	< 0.8	5.5 ± 1.2	< 1.5
MW-PB-7	09/11/18		< 189						
MW-PB-7	11/28/18		< 187						
MW-PB-8	03/06/18		< 177						
MW-PB-8	06/04/18		< 181	< 5.5	< 0.8	< 1.3	< 0.8	15.6 ± 1.5	< 1.5
MW-PB-8	09/11/18		< 194						
MW-PB-8	11/28/18		< 188						
MW-PB-10	03/06/18		< 181						
MW-PB-10	06/05/18		< 179	< 5.2	< 0.6	< 1.2	< 0.8	7.1 ± 1.2	< 1.5
MW-PB-10	09/11/18		< 193						
MW-PB-10	11/28/18		< 188						
MW-PB-12	03/06/18		< 182						
MW-PB-12	06/06/18	TBE	204 ± 122						
MW-PB-12	06/06/18	TBE	< 183						
MW-PB-12	06/06/18	GEL	142 ± 81						
MW-PB-12	09/10/18		< 190						
MW-PB-12	11/28/18		< 188						
MW-PB-12	11/28/18	TBE	< 184						
MW-PB-12	11/28/18	TBE	243 ± 126						
MW-PB-12	11/27/18	GEL	162 ± 107						
MW-PB-13	03/05/18		217 ± 127						
MW-PB-13	06/05/18		< 183	< 4.2	< 0.6	9.4 ± 2.7	< 0.8	12.7 ± 1.6	< 1.5
MW-PB-13	09/10/18		< 182						
MW-PB-13	11/27/18		< 188						
MW-PB-14	06/05/18		< 182						
MW-PB-15	03/06/18		< 179						
MW-PB-15	06/04/18		< 182	< 4.4	< 0.7	< 0.9	< 0.8	6.6 ± 1.1	< 1.5
MW-PB-15	09/11/18		< 196						
MW-PB-15	11/28/18		< 188						
MW-PB-16	03/06/18		< 182						
MW-PB-16	06/04/18	TBE	< 180	< 4.1	< 0.8	5.3 ± 1.1	< 0.8	8.7 ± 1.0	< 1.5
MW-PB-16	06/04/18	TBE	< 178	< 3.4	< 0.7	6.8 ± 1.2	1.8 ± 1.0	8.6 ± 1.0	1.8 ± 1.1
MW-PB-16	06/04/18	GEL	< 112	< 1.0	< 0.7	< 4.0 *(1)*		11.1 ± 2.0 *(1)*	

(1) Reported values are TOTAL (not Dissolved)

TABLE B-I.1 **CONCENTRATIONS OF TRITIUM, STRONTIUM, GROSS ALPHA AND GROSS BETA IN GROUNDWATER AND SEEP SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, PEACH BOTTOM ATOMIC POWER STATION, 2018**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE		H-3	Sr-89	Sr-90	Gr-A (Dis)	Gr-A (Sus)	Gr-B (Dis)	Gr-B (Sus)
MW-PB-16	09/11/18		< 192						
MW-PB-16	11/28/18		< 191						
MW-PB-19	03/05/18		< 179						
MW-PB-19	06/05/18		< 181	< 6.6	< 1.0	< 0.5	< 0.8	2.3 ± 0.7	< 1.5
MW-PB-19	09/10/18		< 194						
MW-PB-19	11/27/18		< 188						
MW-PB-20	03/06/18		< 180						
MW-PB-20	06/06/18		< 182						
MW-PB-20	09/10/18	TBE	< 189						
MW-PB-20	09/10/18	TBE	< 185						
MW-PB-20	09/10/18	GEL	< 151						
MW-PB-20	11/27/18		< 188						
MW-PB-20	11/27/18		< 185						
MW-PB-22	03/06/18		462 ± 132						
MW-PB-22	06/06/18	TBE	509 ± 135						
MW-PB-22	06/06/18	TBE	443 ± 133						
MW-PB-22	06/06/18	GEL	517 ± 105						
MW-PB-22	09/10/18		583 ± 145						
MW-PB-22	11/28/18		495 ± 138						
MW-PB-22	11/28/18		457 ± 128						
MW-PB-24	01/09/18		709 ± 144						
MW-PB-24	01/12/18		550 ± 137						
MW-PB-24	02/06/18		340 ± 128						
MW-PB-24	03/05/18		774 ± 149						
MW-PB-24	06/06/18		1530 ± 217	< 3.9	< 0.8	< 1.0	< 0.9	4.4 ± 1.0	1.8 ± 1.1
MW-PB-24	09/10/18		568 ± 145						
MW-PB-24	11/27/18		374 ± 139						
MW-PB-24	11/27/18		270 ± 120						
MW-PB-25	01/09/18		383 ± 126						
MW-PB-25	01/12/18		692 ± 144						
MW-PB-25	02/06/18		1910 ± 249						
MW-PB-25	02/20/18		5580 ± 614						
MW-PB-25	03/05/18		6200 ± 673						
MW-PB-25	04/18/18		5470 ± 607						
MW-PB-25	06/06/18		5850 ± 646	< 4.4	< 0.5	< 0.7	< 1.0	7.1 ± 0.9	< 1.5
MW-PB-25	09/10/18		531 ± 142						
MW-PB-25	11/27/18		14300 ± 1480						
MW-PB-25	11/27/18		10600 ± 1120						
MW-PB-26	01/09/18		188 ± 119						
MW-PB-26	01/12/18		306 ± 129						
MW-PB-26	02/06/18		330 ± 126						
MW-PB-26	03/05/18	TBE	214 ± 120						
MW-PB-26	03/05/18	TBE	213 ± 121						
MW-PB-26	03/05/18	GEL	170 ± 92						
MW-PB-26	06/06/18		213 ± 120	< 3.6	< 0.9	2.3 ± 0.8	< 1.0	4.2 ± 0.9	< 1.5
MW-PB-26	09/10/18		277 ± 132						
MW-PB-26	11/27/18		< 196						
MW-PB-26	11/27/18		< 182						
MW-PB-27	01/09/18		760 ± 147						
MW-PB-27	01/12/18		609 ± 140						
MW-PB-27	02/06/18		602 ± 140						
MW-PB-27	03/05/18		517 ± 135						
MW-PB-27	06/06/18		635 ± 142	< 4.1	< 0.6	2.2 ± 0.8	< 1.0	3.7 ± 0.8	< 1.5
MW-PB-27	09/10/18		666 ± 146						
MW-PB-27	11/27/18		352 ± 139						
MW-PB-27	11/27/18		377 ± 127						
MW-PB-28	03/05/18		< 174						
MW-PB-28	06/05/18		253 ± 124	< 5.1	< 0.5	< 0.9	2.1 ± 1.1	2.3 ± 1.0	3.4 ± 1.3
MW-PB-28	09/10/18		< 192						

TABLE B-I.1 **CONCENTRATIONS OF TRITIUM, STRONTIUM, GROSS ALPHA AND GROSS BETA IN GROUNDWATER AND SEEP SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, PEACH BOTTOM ATOMIC POWER STATION, 2018**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE		H-3	Sr-89	Sr-90	Gr-A (Dis)	Gr-A (Sus)	Gr-B (Dis)	Gr-B (Sus)
MW-PB-28	11/27/18		< 186						
MW-PB-28	11/27/18		< 176						
MW-PB-29	03/05/18		248 ± 122						
MW-PB-29	04/18/18		293 ± 129						
MW-PB-29	06/06/18		289 ± 127	< 3.0	< 0.6	< 0.6	< 1.0	2.4 ± 0.7	< 1.5
MW-PB-29	09/10/18		251 ± 127						
MW-PB-29	11/27/18		256 ± 129						
MW-PB-29	11/27/18		< 181						
MW-PB-30	03/05/18	TBE	414 ± 132						
MW-PB-30	03/05/18	TBE	320 ± 125						
MW-PB-30	03/05/18	GEL	353 ± 92						
MW-PB-30	04/18/18		< 190						
MW-PB-30	06/06/18		1610 ± 230	< 5.5	< 0.6	< 0.8	< 1.0	3.8 ± 0.8	< 1.5
MW-PB-30	09/10/18	TBE	1980 ± 265						
MW-PB-30	09/10/18	TBE	1920 ± 255						
MW-PB-30	09/10/18	GEL	1930 ± 209						
MW-PB-30	11/27/18		2140 ± 277						
MW-PB-30	11/27/18	TBE	2190 ± 288						
MW-PB-30	11/27/18	TBE	2040 ± 266						
MW-PB-30	11/27/18	GEL	2230 ± 232						
MW-PB-31	03/05/18		< 183						
MW-PB-31	04/18/18		< 187						
MW-PB-31	06/06/18		< 181	< 5.3	< 0.7	< 0.7	< 1.0	1.4 ± 0.7	< 1.5
MW-PB-31	09/10/18		< 188						
MW-PB-31	11/27/18		< 189						
U/2 YARD DRAIN	04/18/18		228 ± 127						
U/2 YARD DRAIN	01/11/18		< 185						
U/2 YARD DRAIN	09/11/18		< 190	< 4.9	< 0.6	< 1.0	< 0.5	2.8 ± 0.8	< 1.3
U/2 YARD DRAIN	11/30/18		< 193						
U/3 YARD DRAIN	03/08/18		< 187						
U/3 YARD DRAIN	06/06/18		257 ± 123	< 7.6	< 0.7	< 0.7	< 1.0	3.0 ± 0.8	< 1.5
U/3 YARD DRAIN	09/11/18		208 ± 126						
U/3 YARD DRAIN	11/30/18		< 189						

TABLE B-I.2 **CONCENTRATIONS OF GAMMA EMITTERS IN GROUNDWATER AND SEEP WATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, PEACH BOTTOM ATOMIC POWER STATION, 2018**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140
MW-PB-1	09/10/18	< 2	< 2	< 5	< 2	< 3	< 2	< 4	**< 33**	< 2	< 2	< 36	< 12
MW-PB-1	11/27/18	< 4	< 4	< 7	< 5	< 7	< 5	< 6	< 8	< 4	< 3	< 19	< 7
MW-PB-2	06/05/18	< 5	< 5	< 16	< 8	< 8	< 6	< 11	< 13	< 8	< 6	< 25	< 10
MW-PB-3	06/05/18	< 7	< 6	< 13	< 6	< 16	< 7	< 11	< 11	< 7	< 6	< 30	< 11
MW-PB-5	06/05/18	< 5	< 5	< 11	< 6	< 10	< 6	< 10	< 11	< 5	< 7	< 27	< 10
MW-PB-6	06/04/18	< 4	< 4	< 11	< 4	< 9	< 5	< 8	< 9	< 5	< 4	< 22	< 7
MW-PB-7	06/04/18	< 5	< 6	< 13	< 5	< 11	< 6	< 10	< 11	< 7	< 6	< 26	< 10
MW-PB-8	03/06/18	< 5	< 6	< 9	< 5	< 8	< 6	< 9	< 9	< 5	< 5	< 26	< 9
MW-PB-8	06/04/18	< 6	< 7	< 13	< 8	< 13	< 8	< 11	< 12	< 7	< 5	< 29	< 15
MW-PB-8	09/11/18	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 27	< 2	< 1	< 30	< 11
MW-PB-8	11/28/18	< 6	< 6	< 13	< 7	< 10	< 9	< 11	< 12	< 7	< 5	< 30	< 9
MW-PB-10	03/06/18	< 6	< 6	< 16	< 7	< 15	< 9	< 12	< 11	< 8	< 7	< 31	< 12
MW-PB-10	06/05/18	< 7	< 7	< 14	< 6	< 15	< 9	< 13	< 15	< 8	< 7	< 39	< 11
MW-PB-10	09/11/18	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 35	< 2	< 2	< 38	< 14
MW-PB-10	11/28/18	< 7	< 6	< 14	< 8	< 13	< 8	< 10	< 15	< 6	< 7	< 31	< 13
MW-PB-13	06/05/18	< 6	< 5	< 14	< 6	< 13	< 6	< 11	< 12	< 7	< 7	< 36	< 11
MW-PB-14	06/05/18	< 6	< 8	< 14	< 7	< 12	< 8	< 11	< 14	< 9	< 7	< 35	< 12
MW-PB-15	03/06/18	< 8	< 7	< 16	< 7	< 18	< 10	< 13	< 13	< 8	< 7	< 38	< 12
MW-PB-15	06/04/18	< 6	< 6	< 13	< 7	< 11	< 6	< 9	< 12	< 6	< 6	< 25	< 12
MW-PB-15	09/11/18	< 2	< 2	< 6	< 2	< 3	< 2	< 4	< 32	< 2	< 2	< 39	< 12
MW-PB-15	11/28/18	< 6	< 7	< 13	< 7	< 14	< 8	< 11	< 13	< 7	< 7	< 34	< 15
MW-PB-16	03/06/18	< 7	< 8	< 16	< 9	< 19	< 10	< 12	< 12	< 8	< 8	< 38	< 13
MW-PB-16	06/04/18 TBE	< 6	< 7	< 12	< 8	< 13	< 9	< 12	< 13	< 7	< 6	< 31	< 13
MW-PB-16	06/04/18 TBE	< 6	< 7	< 12	< 7	< 10	< 8	< 11	< 14	< 6	< 6	< 32	< 12
MW-PB-16	06/04/18 GEL	< 1	< 1	< 2	< 1	< 2	< 1	< 2	< 4	< 1	< 1	< 13	< 4
MW-PB-16	09/11/18	< 2	< 2	< 5	< 2	< 4	< 3	< 4	**< 32**	< 2	< 2	< 39	< 11
MW-PB-16	11/28/18	< 7	< 8	< 15	< 8	< 16	< 9	< 13	< 15	< 7	< 7	< 40	< 12
MW-PB-19	06/05/18	< 6	< 6	< 12	< 5	< 10	< 5	< 9	< 8	< 6	< 5	< 23	< 10
MW-PB-24	06/06/18	< 8	< 6	< 15	< 2	< 18	< 8	< 13	< 15	< 9	< 7	< 34	< 11
MW-PB-24	11/27/18	< 6	< 6	< 12	< 9	< 14	< 9	< 12	< 12	< 8	< 7	< 33	< 10
MW-PB-25	06/06/18	< 9	< 8	< 19	< 9	< 16	< 7	< 15	< 13	< 8	< 6	< 42	< 13
MW-PB-25	11/27/18	< 5	< 6	< 13	< 8	< 14	< 7	< 11	< 11	< 8	< 6	< 33	< 11
MW-PB-26	06/06/18	< 6	< 8	< 15	< 7	< 14	< 8	< 12	< 11	< 5	< 7	< 27	< 11
MW-PB-26	11/27/18	< 4	< 5	< 12	< 5	< 12	< 6	< 8	< 9	< 6	< 6	< 28	< 8
MW-PB-27	06/06/18	< 7	< 7	< 17	< 10	< 17	< 10	< 14	< 14	< 9	< 8	< 38	< 12
MW-PB-27	11/27/18	< 7	< 7	< 13	< 8	< 14	< 7	< 12	< 13	< 7	< 6	< 32	< 15
MW-PB-28	06/05/18	< 6	< 5	< 11	< 6	< 11	< 6	< 11	< 11	< 7	< 6	< 30	< 10
MW-PB-29	06/06/18	< 5	< 7	< 16	< 6	< 11	< 6	< 8	< 10	< 6	< 5	< 29	< 12
MW-PB-30	06/06/18	< 7	< 7	< 11	< 7	< 13	< 7	< 11	< 11	< 7	< 7	< 31	< 11
MW-PB-31	06/06/18	< 7	< 6	< 9	< 6	< 16	< 7	< 11	< 14	< 8	< 5	< 33	< 11
U/2 YARD DRAIN	09/11/18	< 2	< 2	< 6	< 2	< 4	< 3	< 4	**< 33**	< 2	< 2	< 37	< 13
U/2 YARD DRAIN	11/30/18	< 4	< 5	< 9	< 5	< 11	< 7	< 8	< 15	< 5	< 5	< 35	< 10
U/3 YARD DRAIN	06/06/18	< 6	< 7	< 13	< 9	< 11	< 7	< 10	< 13	< 7	< 7	< 32	< 11
U/3 YARD DRAIN	11/30/18	< 4	< 6	< 9	< 5	< 10	< 5	< 10	< 14	< 5	< 4	< 29	< 10

BOLD = Lab unable to meet detection limit due to the sample age at time of receipt/analysis

TABLE B-I.3 — CONCENTRATIONS OF HARD-TO-DETECTS IN GROUNDWATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROECTION PROGRAM, PEACH BOTTOM ATOMIC STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE		Am-241	Cm-242	Cm-243/244	Pu-238	Pu-239/240	U-234 *	U-235*	U-238	Fe-55	Ni-63
MW-PB-2	06/05/18		< 0.12	< 0.04	< 0.11	< 0.10	< 0.18	3.69 ± 0.75	< 0.09	2.32 ± 0.52		
MW-PB-3	06/05/18		< 0.11	< 0.06	< 0.09	< 0.16	< 0.10	0.93 ± 0.28	< 0.05	0.80 ± 0.25		
MW-PB-7	06/04/18		< 0.16	< 0.07	< 0.14	< 0.11	< 0.06	< 0.11	< 0.09	< 0.08		
MW-PB-8	06/04/18		< 0.14	< 0.10	< 0.12	< 0.13	< 0.04	< 0.03	< 0.14	< 0.11		
MW-PB-10	06/05/18		< 0.15	< 0.07	< 0.09	< 0.15	< 0.15	< 0.05	< 0.09	< 0.06		
MW-PB-13	06/05/18		< 0.12	< 0.06	< 0.15	< 0.12	< 0.08	4.65 ± 0.71	0.26 ± 0.16	4.21 ± 0.67		
MW-PB-15	06/04/18		< 0.16	< 0.08	< 0.11	< 0.17	< 0.15	< 0.08	< 0.12	< 0.07		
MW-PB-16	06/04/18	TBE	< 0.18	< 0.05	< 0.11	< 0.11	< 0.16	< 0.06	< 0.07	< 0.08		
MW-PB-16	06/04/18	TBE	< 0.16	< 0.08	< 0.11	< 0.20	< 0.14	< 0.12	< 0.08	< 0.12		
MW-PB-16	06/04/18	GEL	< 0.79	< 0.27	< 0.60	< 0.39	< 0.32	< 0.66	< 0.56	< 0.46		
MW-PB-19	06/05/18		< 0.15	< 0.03	< 0.08	< 0.15	< 0.13	< 0.07	< 0.15	< 0.12		
MW-PB-24	06/06/18		< 0.15	< 0.08	< 0.11	< 0.11	< 0.16	< 0.10	< 0.07	< 0.12		
MW-PB-24	09/10/18										< 196	< 4.8
MW-PB-25	06/06/18		< 0.03	< 0.08	< 0.03	< 0.15	< 0.15	0.95 ± 0.27	< 0.06	0.56 ± 0.19		
MW-PB-25	09/10/18										< 106	< 4.4
MW-PB-26	06/06/18		< 0.11	< 0.04	< 0.12	< 0.11	< 0.07	5.44 ± 1.03	< 0.09	2.42 ± 0.53		
MW-PB-26	09/10/18										< 197	< 4.5
MW-PB-27	06/06/18		< 0.17	< 0.09	< 0.15	< 0.17	< 0.17	4.68 ± 0.88	0.15 ± 0.10	1.63 ± 0.38		
MW-PB-27	09/10/18										< 102	< 3.5
MW-PB-28	06/05/18		< 0.18	< 0.08	< 0.16	< 0.16	< 0.12	0.56 ± 0.20	< 0.08	0.41 ± 0.16		
MW-PB-29	06/06/18		< 0.20	< 0.13	< 0.16	< 0.08	< 0.15	< 0.05	< 0.09	< 0.10		
MW-PB-30	06/06/18		< 0.16	< 0.08	< 0.10	< 0.03	< 0.15	< 0.06	< 0.11	< 0.08		
MW-PB-31	06/06/18		< 0.09	< 0.05	< 0.11	< 0.13	< 0.18	< 0.04	< 0.06	< 0.08		
U/3 YARD DRAIN	06/06/18		< 0.13	< 0.13	< 0.07	< 0.17	< 0.12	< 0.08	< 0.13	< 0.02		

*GEL Labs reports U-234 as U-234/235 and U-235 as U-235/236

TABLE B-II.1 CONCENTRATIONS OF TRITIUM IN SURFACE WATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, PEACH BOTTOM ATOMIC POWER STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE		H-3
SP-PB-1	03/05/18		< 182
SP-PB-1	06/05/18		< 181
SP-PB-1	09/10/18		< 188
SP-PB-1	11/27/18		< 189
SP-PB-2	06/05/18		243 ± 124
SP-PB-2	09/10/18		< 192
SP-PB-2	11/27/18		< 187
SP-PB-3	03/06/18		< 180
SP-PB-3	06/06/18		< 184
SP-PB-3	09/11/18		< 189
SP-PB-3	11/28/18		< 191
SW-PB-1	03/06/18	TBE	< 181
SW-PB-1	03/06/18	TBE	< 180
SW-PB-1	03/06/18	GEL	< 147
SW-PB-1	06/05/18	TBE	< 184
SW-PB-1	06/05/18	TBE	< 185
SW-PB-1	06/05/18	GEL	< 114
SW-PB-1	09/11/18		< 188
SW-PB-1	11/28/18		< 184
SW-PB-5	03/06/18		< 177
SW-PB-5	06/04/18		309 ± 128
SW-PB-5	09/11/18	TBE	< 189
SW-PB-5	09/11/18	TBE	< 186
SW-PB-5	09/11/18	GEL	< 153
SW-PB-5	11/28/18		< 186
SW-PB-6	03/06/18		< 180
SW-PB-6	06/04/18		< 182
SW-PB-6	09/11/18		< 193
SW-PB-6	11/28/18		< 185

TABLE B-II.2 CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, PEACH BOTTOM ATOMIC POWER STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE		Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140
SP-PB-1	06/05/18		< 7	< 6	< 11	< 7	< 13	< 6	< 12	< 11	< 7	< 7	< 36	< 13
SP-PB-2	06/05/18		< 6	< 7	< 10	< 7	< 12	< 6	< 11	< 11	< 6	< 6	< 24	< 12
SP-PB-3	06/06/18		< 8	< 6	< 13	< 6	< 12	< 6	< 10	< 10	< 6	< 7	< 30	< 11
SW-PB-1	06/05/18		< 5	< 4	< 11	< 6	< 10	< 5	< 9	< 10	< 7	< 7	< 31	< 11
SW-PB-1	06/05/18	TBE	< 5	< 5	< 11	< 5	< 8	< 5	< 9	< 9	< 5	< 5	< 32	< 10
SW-PB-5	06/04/18	TBE	< 5	< 6	< 13	< 5	< 13	< 6	< 9	< 9	< 6	< 6	< 22	< 8
SW-PB-5	06/04/18	GEL	< 1	< 1	< 2	< 1	< 2	< 1	< 2	< 5	< 1	< 1	< 9	< 2
SW-PB-6	06/04/18		< 5	< 5	< 9	< 4	< 10	< 5	< 9	< 10	< 5	< 5	< 24	< 9

TABLE B-III.1 CONCENTRATIONS OF TRITIUM IN PRECIPITATION WATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, PEACH BOTTOM ATOMIC POWER STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	H-3
1A	02/01/18	< 185
1A	03/01/18	234 ± 128
1A	03/29/18	< 180
1A	04/25/18	< 193
1A	05/31/18	< 195
1A	06/28/18	< 182
1A	07/25/18	< 184
1A	08/30/18	< 185
1A	09/26/18	< 180
1A	11/02/18	< 192
1B	02/01/18	< 180
1B	03/01/18	< 185
1B	03/29/18	< 176
1B	04/25/18	< 192
1B	05/31/18	< 192
1B	06/28/18	< 187
1B	07/25/18	193 ± 124
1B	07/25/18	213 ± 127
1B	08/30/18	< 184
1B	09/26/18	< 184
1B	11/01/18	< 195
1S	02/01/18	< 196
1S	03/01/18	< 183
1S	03/29/18	< 175
1S	04/25/18	< 191
1S	05/31/18	< 197
1S	06/28/18	< 180
1S	07/25/18	< 185
1S	08/30/18	< 178
1S	09/26/18	< 178
1S	11/01/18	< 190
1SSE	02/01/18	< 192
1SSE	03/01/18	< 184
1SSE	03/29/18	< 176
1SSE	04/25/18	< 192
1SSE	05/31/18	< 193
1SSE	06/28/18	< 187
1SSE	07/25/18	< 185
1SSE	08/30/18	< 182
1SSE	09/26/18	< 186
1SSE	11/01/18	< 190
1Z	02/01/18	< 183
1Z	03/01/18	< 184
1Z	03/29/18	< 181
1Z	04/25/18	< 193
1Z	05/31/18	< 198
1Z	06/28/18	< 184
1Z	07/25/18	< 186
1Z	08/30/18	< 180
1Z	09/26/18	< 179
1Z	11/01/18	< 187
4M	02/01/18	< 180
4M	03/01/18	< 184
4M	03/29/18	< 178
4M	04/25/18	< 194
4M	05/31/18	< 195
4M	06/28/18	< 182
4M	07/25/18	< 190
4M	08/30/18	< 178
4M	09/26/18	< 180
4M	11/01/18	< 188