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TMI-19-032

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Three Mile Island Nuclear Station Unit 1 and Unit 2
Renewed Facility Operating License No. DPR-50 and Possession Only License No. DPR 73
NRC Docket Nos. 50-289 and 50-320

SUBJECT: 2018 Annual Radiological Environmental Operating Report

In accordance with TMI-1 Technical Specification 6.9.3.1, TMI-2 Technical Specifications 6.8.1.1, enclosed is the Annual Radiological Environmental Operating Report covering the time period of January 1 through December 31, 2018, for the Three Mile Island Nuclear Station.

Please contact Dani Brookhart of TMI Chemistry at (717) 948-8017 if you have questions regarding this submittal.

Respectfully,

Joseph A. Dullinger
Plant Manager, Three Mile Island
Exelon Generation Co., LLC

Attachment/Enclosure

cc: Regional Administrator, NRC Region I
NRC Senior Resident Inspector – Three Mile Island Nuclear Station, Unit 1
NRC Project Manager, NRR – Three Mile Island Nuclear Station, Unit 1
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Docket No: 50-289
50-320

THREE MILE ISLAND NUCLEAR STATION
UNITS 1 AND 2

Annual Radiological
Environmental Operating Report

1 January through 31 December 2018

Prepared By
Teledyne Brown Engineering
Environmental Services

Three Mile Island Nuclear Station
Middletown, PA 17057

April 2019

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Appendices

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I. Summary and Conclusions

This report on the Radiological Environmental Monitoring Program conducted for the Three Mile Island Nuclear Station (TMINS) by Exelon covers the period 1 January 2018 through 31 December 2018. During that time period, 1,691 analyses were performed on 1,287 samples. In assessing all the data gathered for this report and comparing these results with preoperational data and operational REMP data, it was concluded that the operation of TMINS had no adverse radiological impact on the environment.

Surface, drinking and effluent water samples were analyzed for concentrations of tritium and gamma-emitting nuclides. Surface, drinking and effluent water samples were also analyzed for concentrations of Iodine-131 (I-131). Drinking and effluent water samples were also analyzed for concentrations of gross beta. Effluent water samples were analyzed for concentrations of Strontium-89 (Sr-89) and Strontium-90 (Sr-90). All groundwater, precipitation water, and storm water results are reported in the ARGPPR, Appendix F. No I-131, Sr-89 or Sr-90 activities were detected. Gross beta concentrations detected were consistent with those detected in previous years. Tritium activity in 9 surface water samples and 10 monthly effluent water samples was due to TMINS activities or releases. No other fission or activation products potentially attributed to TMI liquid releases were detected.

Fish (predator and bottom feeder) and sediment samples were analyzed for concentrations of gamma-emitting nuclides. Fish samples were also analyzed for concentrations of Sr-90. No Sr-90 activity was detected. No fission or activation products were detected in fish or sediment samples. Occasionally, Cs-137 is detected at very low levels (just above LLD) and is not distinguishable from background levels.

Air particulate samples were analyzed for concentrations of gross beta and gamma-emitting nuclides. Gross beta activity is consistent with data from previous years. Cosmogenic Beryllium-7 (Be-7) was detected at levels consistent with those detected in previous years. No other activation products were detected.

High sensitivity I-131 analyses were performed on weekly air samples. All results were less than the minimum detectable activity for I-131.

Cow milk samples were analyzed for concentrations of I-131, gamma-emitting nuclides, Sr-89, and Sr-90. Concentrations of naturally-occurring Potassium-40 (K-40) were consistent with those detected in previous years. No I-131 or Sr-89 activities were detected. Sr-90 activity was detected in one indicator sample. Occasionally Sr-90 activities are detected and are consistent with those detected in previous years and were attributed to fallout from nuclear weapons testing. No other fission or activation products were found.

Food Product samples were analyzed for concentrations of gamma-emitting nuclides including I-131 and Sr-90. Strontium-90 activity was detected in both indicator and control samples. This was a result of plant uptake of Sr-90 in soil

as a result of past nuclear weapons testing. Concentrations of naturally-occurring Be-7 and K-40 were consistent with those detected in previous years. No other fission or activation products were detected.

Beginning in 2012, Exelon changed the type of dosimetry used for the Radiological Environmental Monitoring Program (REMP). Optically Stimulated Luminescent Dosimetry (OSLD) were deployed and Thermo-luminescent Dosimetry (TLD) were discontinued. This change resulted in a slight change in process and reporting of quarterly results. The relative comparison to control locations remains valid. OSLD technology is different than that used in a TLD but has the same purpose (to measure direct radiation).

In conclusion, radioactive materials related to TMINS operations were detected in environmental samples, but the measured concentrations were low and consistent with measured effluents. The environmental sample results verified that the doses received by the public from TMINS effluents in 2018 were well below applicable dose limits and only a small fraction of the doses received from natural background radiation. Additionally, the results indicated that there was no permanent buildup of radioactive materials in the environment and no increase in background radiation levels.

Therefore, based on the results of the radiological environmental monitoring program (REMP) and the doses calculated from measured effluents, TMINS operations in 2018 did not have any adverse effects on the health of the public or on the environment.

II. Introduction

The Three Mile Island Nuclear Station (TMINS), consisting of two pressurized water reactors (PWR), is located on the northern end of Three Mile Island in the Susquehanna River approximately 2.5 miles south of Middletown in Londonderry Township, Dauphin County, Pennsylvania. TMI-1 is owned and operated by Exelon and became operational in 1974. TMI-2 is operated by GPU Nuclear, Inc. and owned by Metropolitan Edison (50%), Pennsylvania Electric (25%) and Jersey Central Power & Light (25%). TMI-2 became operational in 1978 and was shut down following the 1979 accident. At the end of 1993 TMI-2 was placed in a condition called Post-Defueling Monitored Storage. TMI-2 is maintained by Exelon under contract with GPU Nuclear.

A Radiological Environmental Monitoring Program (REMP) for TMINS was initiated in 1974. This report covers those analyses performed by Teledyne Brown Engineering (TBE), Landauer and Exelon Industrial Services (EIS)/GEL Laboratories on samples collected during the period 1 January 2018 through 31 December 2018.

A. Objectives of the REMP

The objectives of the REMP are to:

1. Evaluate the relationship between quantities of radioactive material released from the plant and resultant radiation doses to individuals from principal pathways of exposure.

2. Provide data on measurable levels of radiation and radioactive materials in the site environs.

3. To verify in-plant controls for the containment of radioactive materials.

4. To determine buildup of long-lived radionuclides in the environment and changes in background radiation levels.

5. To provide reassurance to the public that the program is capable of adequately assessing impacts and identifying noteworthy changes in the radiological status of the environment.

6. To fulfill the requirements of the TMI-1 and TMI-2 Technical Specifications.

B. Implementation of the Objectives

The 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 Station operation to assess Station radiological effects (if any) on man and the environment.

III. Program Description

A. Sample Collection

Samples for the TMINS REMP were collected for Exelon by Exelon Industrial Services, LLC (EIS) and Normandeau Associates, Inc. (NAI). This section describes the general collection methods used by EIS & NAI to obtain environmental samples for the TMINS REMP in 2018. Sample locations and descriptions can be found in Tables B-1 and B-2, and Figures B-1 through B-3, Appendix B. The collection procedures used by EIS & NAI are listed in Table B-3.

Aquatic Environment

The aquatic environment was evaluated by performing radiological analyses on samples of surface water, drinking water, effluent water, fish and sediment. Two gallon water samples were collected monthly from continuous samplers located at two surface water locations (J1-2 and Q9-1), three drinking water locations (G15-2, G15-3 and Q9-1), and one effluent water location (K1-1). A composite of weekly grab samples at one surface water location (A3-2) were collected. The control locations were A3-2 and Q9-1. All groundwater and storm water results are reported in the ARGPPR, Appendix F.

All water samples were collected in unused plastic bottles, which were rinsed at least twice with source water prior to collection. Fish samples comprising the flesh of two groups, bottom feeders and predators, were collected semiannually at an upstream control (BKG) and a downstream indicator (IND) location. Location IND could be affected by TMINS' effluent releases. Sediment samples composed of recently deposited substrate were collected semiannually at three locations (A1-3, J2-1 and K1-3). In addition, one sediment sample was collected annually at the East Dike Catch Basin (EDCB). Location A1-3 was the control.

Atmospheric Environment

The atmospheric environment was evaluated by performing radiological analyses on samples of air particulates and airborne iodine. Airborne iodine and particulate samples were collected and analyzed weekly at seven locations (A3-1, E1-2, F1-3, G2-1, H3-1, M2-1 and Q15-1). The control location was Q15-1. Airborne iodine and particulate samples were obtained at each location, using a vacuum pump with charcoal and glass fiber filters attached. The pumps were run continuously and sampled air at the rate of approximately one cubic foot per minute. The filters were replaced weekly and sent to the laboratory for analysis.

Terrestrial Environment

The terrestrial environment was evaluated by performing radiological analyses on samples of milk and food product. Milk samples were collected biweekly at five locations (E2-2, F4-1, G2-1, K15-3 and P4-1) from March through November, and monthly from December through February. The control location was K15-3. All samples were collected in new unused two gallon plastic bottles from the bulk tank at each location, preserved with sodium bisulfite and shipped promptly to the laboratory.

Food products were collected from June through October at three locations (B10-2, E1-2 and H1-2), in lieu of milk sampling and annually from the four food product groups at two locations (B10-2 and H1-2). B10-2 was the control location for both annual and monthly sampling. Six different kinds of vegetation samples and eight different kinds of vegetation leaves were collected, placed in new unused plastic bags, and sent to the laboratory for analysis.

Ambient Gamma Radiation

Beginning in 2012, Exelon changed the type of dosimetry used for the Radiological Environmental Monitoring Program (REMP). Optically Stimulated Luminescent Dosimetry (OSLD) were deployed and Thermo-luminescent Dosimetry (TLD) were discontinued. This change may result in a step change in readings, up or down, depending on site characteristics. The relative comparison to control locations remains valid. OSLD technology is different than that used in a TLD but has the same purpose (to measure direct radiation). The OSLDs were placed at locations on and around the TMINS site as follows:

A site boundary ring consisting of 19 locations (A1-4, B1-2, C1-2, D1-1, E1-4, F1-2, F1-4, G1-3, G1-5, G1-6, H1-1, J1-3, K1-4, L1-1, M1-1, N1-3, P1-2, Q1-2 and R1-1) 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) from TMINS release.

An indicator ring consisting of 60 locations (A3-1, A5-1, A9-3, B1-1, B2-1, B5-1, B10-1, C1-1, C2-1, C5-1, C8-1, D1-2, D2-2, D6-1, E1-2, E2-3, E5-1, E7-1, F1-1, F2-1, F5-1, F10-1, G1-2, G2-4, G5-1, H3-1, H5-1, H8-1, J1-1, J3-1, J5-1, J7-1 K2-1, K3-1, K5-1, K8-1, L1-2, L2-1, L5-1, L8-1, M1-2, M2-1, M5-1, M9-1, N1-1, N2-1, N5-1, N8-1, P1-1, P2-1, P5-1, P8-1, Q1-1, Q2-1, Q5-1, Q9-1, R1-2, R3-1, R5-1 and R9-1) extending to approximately 10 miles from the site, designed to measure possible exposures to close-in population.

The balance of 11 locations (D15-1, F25-1, G10-1, G15-1, H15-1, J15-1, K15-1, L15-1, N15-2, Q15-1 and R15-1) represent control areas.

The specific dosimeter locations were determined by the following criteria:

1. The presence of relatively dense population

2. Site meteorological data taking into account distance and elevation for each of the sixteen 22½ degree sectors around the site, where estimated annual dose from TMINS, if any, would be most significant

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

4. And near the closest dwelling to the vents in the prevailing downwind direction

Each station has two Al_2O_3:C Optically Stimulated Luminescence Dosimeters enclosed in plastic placed at each location in a frame located approximately 3-6 feet above ground level. Since each OSLD responds to radiation independently, this provides two independent detectors at each station.

B. Sample Analysis

This section describes the general analytical methods used by TBE and EIS to analyze the environmental samples for radioactivity for the TMINS REMP in 2018. The analytical procedures used by the laboratories are listed in Table B-3.

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

1. Concentrations of beta emitters in drinking and effluent water and air particulates

2. Concentrations of Gamma-Emitters in surface, drinking, and effluent water, air particulates, milk, fish, sediment and food products

3. Concentrations of tritium in surface, drinking and effluent water

4. Concentrations of I-131 in surface, drinking and effluent water, air, milk and food products

5. Concentrations of strontium in effluent water, fish, milk and food products

6. Ambient gamma radiation levels at various site environs

C. Data Interpretation

Data were compared to previous years' operational data for consistency and trending. In addition, comparison to pre-operational data is sometimes made. For the purpose of this report, TMINS was considered operational at initial criticality. Several factors were important in the interpretation of the data:

1. Lower Limit of Detection and Minimum Detectable Concentration

The lower limit of detection (LLD) was 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 was intended as a before the fact estimate of a system (including instrumentation, procedure and sample type) and not as an after the fact criteria for the presence of activity. All analyses were designed to achieve the required TMINS detection capabilities for environmental sample analysis.

The minimum detectable concentration (MDC) is defined above with the exception that the measurement is an after the fact estimate of the presence of activity.

2. Net Activity Calculation and Reporting of Results

Net activity for a sample was calculated by subtracting background activity from the sample activity. Since the REMP measures extremely small changes in radioactivity in the environment,

background variations may result in sample activity being lower than the background activity affecting a negative number. An MDC was reported in all cases where positive activity was not detected. Gamma spectroscopy results for each type of sample were grouped as follows:

For surface, drinking, and effluent water 11 nuclides, Mn-54, Co-58, Fe-59, Co-60, Zn-65, Nb-95, Zr-95, Cs-134, Cs-137, Ba-140 and La-140 MDC's were reported.

For fish eight nuclides, K-40, Mn-54, Co-58, Fe-59, Co-60, Zn-65, Cs-134 and Cs-137 MDC's were reported.

For sediment six nuclides, K-40, Mn-54, Co-58, Co-60, Cs-134 and Cs-137 MDC's were reported.

For air particulate eight nuclides, Be-7, Mn-54, Co-58, Co-60, Nb-95, Zn-95, Cs-134 and Cs-137 MDC's were reported.

For milk five nuclides, K-40, Cs-134, Cs-137, Ba-140 and La-140 MDC's were reported.

For food products five nuclides, Be-7, K-40, I-131, Cs-134 and Cs-137 MDC's were reported.

Means and standard deviations of the results were calculated. The standard deviations represent the variability of measured results for different samples rather than single analysis uncertainty.

D. Program Exceptions

For 2018, the TMINS REMP had a sample recovery rate of 99.7%. Issue Reports (IR) were initiated to document significant exceptions and missing samples. All exceptions are listed below:

Water

1. J1-2 (Surface Water)

   For the sampling periods 12/31/17 - 1/6/18 and 1/6/18 – 1/13/18, compensatory grab samples were required due to frozen sample line. (IR 4124985)

2. J1-2 (Surface Water)

   For the sampling periods 3/10/18 – 3/17/18 and 3/17/18 – 3/24/18,

compensatory grab samples were required due to the sample line being clogged. Tubing was replaced and calibration verified. (IR 4124985)

3. K1-1 (Effluent Water)

   For the sampling period 6/6/18 - 6/23/18, samples was missed due to hose being pinched, thus not allowing flow to sampler. Tubing could not be replaced at time of service. (IR 4153601)

Dosimetry

1. R1-2, K2-1, N1-1, Q1-1, P1-1, M1-2, L1-2

   OSLD stations above could not be exchanged on 12/20/17 due to ice pack on the river. Ice did not melt enough for the exchange to happen in the fourth quarter. OSLDs were exchanged during the exchange of OSDLs in First Quarter 2018 OSLDs on 03/19/18. (IR 04091766)

Air

1. G2-1

   For the 5/26/18 – 6/2/18 sampling period, sample was missed due to the tubing from the restricted orifice not being attached to the sample capsule. (IR 4153601)

2. E2-1

   For the sampling period 6/28/18 – 7/5/18, the sample was missed due to an insect being pulled through the filter and was left impacted on the iodine cartridge. (IR 4182844)

Milk

1. E2-2

   IR 04146690 addressed the deviation for this site (sampling period 4/18/18 – 12/1/18).

Vegetation

1. B10-2

   For the sampling period 8/19/18 - 8/26/18, the normal plants to be sampled were under water and no longer growing. Alternative plants

were sampled at the same site. (IR 4182844)

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 recurrence. Occasional equipment breakdowns and power outages were unavoidable.

The overall sample recovery rate (99%) indicates that the appropriate procedures and equipment are in place to assure reliable program implementation.

E. Program Changes

There were no changes to the program in 2018.

IV. Results and Discussion

A. Aquatic Environment

1. Surface Water

Samples were taken weekly from a continuous sampler at two locations (J1-2 and Q9-1) and weekly grab samples from one location (A3-2). Weekly samples were composited on a monthly schedule. Of these locations only J1-2 located downstream could be affected by TMINS' effluent releases. The following analyses were performed:

Tritium

Monthly samples from J1-2 and Q9-1 were analyzed for tritium activity (Table C–I.1, Appendix C). Positive tritium activity was detected in 5 of 12 samples at location J1-2, which is located immediately downstream of the TMINS effluent outfall. The concentrations ranged from 348 to 1,440 pCi/L. The increased tritium concentrations detected were a result of TMINS releasing radwaste treatment system effluent water under permitted discharges in accordance with NRC regulations. The indicator surface water sample is taken just downstream of the liquid discharge outfall where mixing of liquid effluents with the river water is incomplete. More complete mixing is not achieved until liquid effluents pass over the York Haven Dam. This water is normally not consumed by humans. The concentrations detected were well below any regulatory limits. (Figures C–1 and C–2, Appendix C)

Iodine

Monthly samples were taken from location A3-2. This is a control or background station sampled because known medical discharges of radiopharmaceuticals occur into the surface water upstream of TMI from a nearby hospital. Monthly samples were taken from A3-2 and analyzed for I-131. (Table C–I.2, Appendix C). I-131 activity was not detected in any samples.

Gamma Spectrometry

Locations J1-2 and Q9-1 were analyzed for gamma-emitting nuclides (Table C–I.3, Appendix C). All nuclides were less than the MDC.

2. Drinking Water

Monthly samples were collected from continuous water samplers at three locations (G15-2, G15-3 and Q9-1). Two locations (G15-2 and G15-3) could be affected by TMINS effluent releases. The following analyses were performed:

Gross Beta

Monthly samples from all locations were analyzed for concentrations of gross beta (Tables C–II.1, Appendix C). Gross beta activity was detected in 23 of 36 samples. The concentrations ranged from 2.1 to 5.2 pCi/L. Concentrations detected were consistent with those detected in previous years. (Figure C–3, Appendix C)

Iodine

Monthly samples from all locations were analyzed for concentrations of I-131. I-131 activity was not detected in any samples. (Table C–II.2, Appendix C)

Tritium

Monthly samples from all locations were analyzed for tritium activity (Table C–II.3, Appendix C). Tritium was not detected any of the 36 samples. (Figures C–4, Appendix C)

Gamma Spectrometry

Samples from all locations were analyzed for gamma-emitting nuclides. All nuclides were less than the MDC. (Table C–II.4,

Appendix C)

3. Effluent Water

Monthly samples were collected from a continuous water sampler at one location (K1-1). The following analyses were performed:

Gross Beta

Monthly samples from location K1-1 were analyzed for concentrations of gross beta (Tables C–III.1, Appendix C). Gross beta was detected in 12 of 12 samples. The concentrations ranged from 2.0 to 6.8 pCi/L. Concentrations detected were consistent with those detected in previous years.

Iodine-131

Monthly samples from location K1-1 were analyzed for concentrations of I-131 (Tables C–III.1, Appendix C). I-131 was not detected in any of the samples.

Tritium

Monthly samples from location K1-1 were analyzed for tritium activity (Table C–III.1, Appendix C). Tritium activity was detected in 5 of 12 samples. The concentrations ranged from 203 to 26,700 pCi/L. The elevated results were a result of TMI releasing radwaste treatment system effluent water under permitted discharges in accordance with NRC regulations. These results were from the liquid discharge mixing basin. The concentrations detected agree with those obtained from the TMINS Effluent Monitoring Program. (Figure C-4, Appendix C)

Strontium

Semiannual composite samples from location K1-1 were analyzed for Sr-89 and Sr-90 (Table C–III.1, Appendix C). No strontium activity was detected. The highest MDC was calculated at <4.0 pCi/L for Sr-89 and at <0.8 pCi/L for Sr-90.

Gamma Spectrometry

Samples from location K1-1 were analyzed for gamma-emitting nuclides (Table C–III.2, Appendix C). All nuclides were less than the MDC.

4. Storm Water

Storm water results are included in the Annual Radiological Groundwater Protection Program (ARGPPR), Appendix F.

5. Ground Water

Groundwater results are included in the Annual Radiological Groundwater Protection Program (ARGPPR), Appendix F.

6. Fish

Fish samples comprised of bottom feeders and predators were collected at two locations (IND and BKG) semiannually. Location IND could be affected by TMINS' effluent releases. The following analyses were performed:

Strontium

The edible portions of fish samples from both locations were analyzed for Sr-90 (Table C–IV.1, Appendix C). No strontium activity was detected. The highest MDC was calculated at <4.3 pCi/kg wet for Sr-90.

Gamma Spectrometry

The edible portions of fish samples from both locations were analyzed for gamma-emitting nuclides (Table C–IV.2, Appendix C). Naturally-occurring K-40 was found in all fish samples and ranged from 2,405 to 3,841 pCi/kg wet and was consistent with levels detected in previous years. No fission or activation products were detected.

7. Sediment

Aquatic sediment samples were collected at three locations (A1-3, J2-1 and K1-3) semiannually. Of these locations two (J2-1 and K1-3) could be affected by TMINS' effluent releases. The following analysis was performed:

Gamma Spectrometry

Sediment samples from all locations were analyzed for gamma-emitting nuclides (Table C–V.1, Appendix C). Potassium-40 was found in all sediment samples and ranged from 7,201 to 19,640 pCi/kg dry. No other fission or activation products were detected.

Cs-137 is occasionally found in sediment at very low levels (just above LLD) and is not distinguishable from background levels. (Figure C–5, Appendix C)

B. Atmospheric Environment

1. Airborne Particulates

a. Air Particulates

Continuous air particulate samples were collected from seven locations on a weekly basis. Six locations (A3-1, E1-2, F1-3, G2-1, H3-1 and M2-1) were indicator stations located in the highest D/Q sectors and the nearest communities to TMI. One sample (Q15-1) represents the control location at a remote distance from TMINS. The following analyses were performed:

Gross Beta

Weekly samples were analyzed for concentrations of beta emitters (Table C–VI.1 and C–VI.2, Appendix C). Detectable gross beta activity was observed at all locations. Comparison of results aid in determining the effects, if any, resulting from the operation of TMINS. The results from the closest to the site boundary locations (Group I) ranged from 5 to 28E–3 pCi/m^3 with a mean of 13E–3 pCi/m^3. The results from the intermediate offsite locations (Group II) ranged from 5 to 29E–3 pCi/m^3 with a mean of 13E–3 pCi/m^3. The results from the Control location (Group III) ranged from 6 to 26E–3 pCi/m^3 with a mean of 14E–3 pCi/m^3. Comparison of the 2018 air particulate data with previous years' data indicate no effects from the operation of TMINS (Figure C–6, Appendix C). In addition, a comparison of the weekly mean values for 2018 indicate no notable differences between indicator and control stations. (Figure C-7, Appendix C)

Gamma Spectrometry

Weekly samples were composited quarterly and analyzed for gamma-emitting nuclides (Table C–VI.3, Appendix C). Naturally-occurring Be-7 due to cosmic ray activity was detected in 24 of 28 samples. These concentrations ranged from 47 to 140E–3 pCi/m3. All other nuclides were less than MDC.

b. Airborne Iodine

Continuous air samples were collected from seven (A3-1, E1-2, F1-3, G2-1, H3-1, M2-1 and Q15-1) locations and analyzed weekly for I-131 (Table C–VII.1, Appendix C). All results were less than the MDC for I-131.

2. Terrestrial

a. Milk

Samples were collected from five locations (K15-3, E2-2, F4-1 G2-1 and P4-1) biweekly March through November and monthly December through February. The following analyses were performed:

Iodine–131

Milk samples from all locations were analyzed for concentrations of I-131 (Table C-VIII.1, Appendix C). All results were less than the MDC.

Strontium

Milk samples from all locations were composited quarterly and analyzed for Sr-89 and Sr-90 (Table C–VIII.2, Appendix C). No Sr-89 activity was detected. Sr-90 activity was detected in 1 sample with a concentration of 1.6 pCi/L. The results are consistent with those detected in the pre–operational years (Figure C-8, Appendix C).

Gamma Spectrometry

Milk samples from all locations were analyzed for concentrations of gamma-emitting nuclides. (Table C-VIII.3, Appendix C).

Naturally-occurring K-40 activity was found in all samples. The concentrations ranged from 834 to 1,535 pCi/L. All other nuclides were less than the MDC.

b. Food Products

Food products were collected monthly at three locations (B10-2, E1-2 and H1-2), in lieu of milk sampling, and annually from the four food product groups at two locations (B10-2 and E1-2). B10-2 was the control location for both

annual and monthly sampling. The following analyses were performed:

Strontium

Thirty-three food product samples were analyzed for concentrations of Sr-90 (Table C-IX.1, Appendix C). Sr-90 activity was detected in 20 of the 33 samples. The concentrations ranged from 1.2 to 38.0 pCi/kg wet.

Gamma Spectrometry

Each food product sample was analyzed for concentrations of gamma-emitting nuclides (Table C–IX.1, Appendix C). Naturally-occurring Be-7 due to cosmic ray activity was detected in 26 of 33 samples. These concentrations ranged from 297 to 5,490 pCi/kg. Naturally-occurring K-40 activity was found in all samples. The concentrations ranged from 1,946 to 7,286 pCi/kg. All other nuclides were less than the MDC.

C. Ambient Gamma Radiation

Ambient gamma radiation levels were measured utilizing Optically Stimulated Luminescence Dosimeter (OSLD). Ninety OSLD locations were established around the site. Results of OSLD measurements are listed in Tables C–X.1 to C–X.3, Appendix C

All of the OSLD measurements were below 31 mR/quarter, with a range of 9.1 to 30.4 mR/standard quarter. A comparison of the Site Boundary and Indicator data to the Control Location data, indicate that the ambient gamma radiation levels from the Control Locations D15-1, F25-1, G10-1, G15-1, H15-1, J15-1, K15-1, L15-1, N15-2, Q15-1 and R15-1 averaged higher than indicator stations. Locations D15-1, F25-1, G10-1, G15-1, H15-1, J15-1, K15-1, L15-1, N15-2, Q15-1 and R15-1 have a historical high bias, and this bias is most likely due to radon and other naturally-occurring nuclides, e.g. K-40, emanating from the ground.

D. Land Use Survey

A Land Use Survey conducted in the September - October 2018 growing season around the Three Mile Island Nuclear Station (TMINS) was performed by Exelon Industrial Services (EIS) for Exelon to comply with Sections 8.2 of the Plant's Offsite Dose Calculation Manual (ODCM). The purpose of the survey was to document the nearest resident, milk-producing animal and garden of greater than 500 ft^2 in each of the sixteen

22½ degree sectors around the site. The results of these surveys are summarized below:

Distance in Miles from the TMINS Reactor Buildings				
Sector		Residence Miles	Garden Miles	Milk Farm Miles
A	N	1.0	1.9	2.1
B	NNE	0.8	1.2	-
C	NE	0.5	1.1	4.2
D	ENE	0.5	0.5	4.5
E	E	0.4	0.5	1.1
F	ESE	1.1	1.2	3.2
G	SE	0.7	1.6	1.4
H	SSE	0.7	0.8	-
J	S	2.2	2.5	-
K	SSW	0.6	1.6	4.9, 14.4
L	SW	0.5	1.7	-
M	WSW	0.5	1.3	-
N	W	0.7	1.3	-
P	WNW	0.4	1.7	3.7
Q	NW	0.4	1.2	-
R	NNW	1.1	2.4	-

E. Radiological Impact of TMINS Operations

An assessment of potential radiological impact indicated that radiation doses to the public from 2018 operations at TMINS were well below all applicable regulatory limits and were significantly less than doses received from natural sources of radiation. The 2018 whole body dose potentially received by an assumed maximum exposed individual from TMI-1 and TMI-2 liquid and airborne effluents was conservatively calculated to be 0.12 mrem. This dose is equivalent to 0.06% of the dose that an individual living in the TMI area receives each year from natural background radiation.

1. Determination of Radiation Doses to the Public

Dose assessments can be performed by using either effluent data and an environmental transport model or environmental sample data. To the extent possible, doses to the public are based on the direct measurement of dose rates from external sources and the measurement of radionuclide concentrations in environmental media which may contribute to an internal dose of radiation. Optically Stimulated Luminescent Dosimetry (OSLDs) positioned in the

environment around TMINS provide measurements to determine external radiation doses to humans. Samples of air, water and food products are used to determine internal doses.

The quantity of radioactive materials released during normal operations are typically too small to be measured once distributed in the offsite environment. Therefore, the potential offsite doses are more effectively calculated for TMINS operations using a computerized model that predicts concentrations of radioactive materials in the environment and subsequent radiation doses based on measured effluents.

Doses are calculated using a model that incorporates the guidelines and methodology set forth by the USNRC in Regulatory Guide 1.109 and NUREG 0133. Due to the conservative assumptions that are used in the model, the calculated doses are generally higher than the doses based on actual environmental sample concentrations.

Therefore, the model predicts doses that are higher than actual doses received by people. The type and amount of radioactivity released from TMINS is calculated using measurements from effluent sample analyses.

Airborne releases are diluted and carried away from the site by atmospheric diffusion, which continuously acts to disperse radioactivity. Variables that affect atmospheric dispersion include wind speed, temperature at different elevations, terrain, and shift in wind direction. A weather station on the north end of TMI is linked to a data logger that records the meteorological data.

Computer models also are used to predict the downstream dilution and travel times for liquid releases into the Susquehanna River. Actual monthly Susquehanna River flows are obtained from the USGS Stream gauging station 01570500 located at Harrisburg, PA.

The human exposure pathways also are included in the model and are depicted in Figure 1. The exposure pathways that are considered for the discharge of TMINS liquid effluents are consumption of drinking water and fish. The exposure pathways considered for the discharge of TMINS airborne effluents are plume exposure, inhalation, cow milk consumption, fruit and vegetable consumption, and meat consumption.

When determining the dose to humans, it is necessary to consider all applicable pathways and all exposed tissues, summing the dose from each to provide the total dose for each organ as well as the

whole body from a given radionuclide. Dose calculations involve determining the energy absorbed per unit mass in the various tissues. Thus, for radionuclides taken into the body, the metabolism of the radionuclide in the body must be known along with the physical characteristics of the nuclide such as energies, types of radiations emitted and half-life. The dose assessment model also contains dose conversion factors for the radionuclides for each of four age groups (adults, teenagers, children and infants) and eight organs (total body, thyroid, liver, skin, kidney, lung, bone and GI tract).

2. Result of Dose Calculations

The maximum hypothetical doses due to 2018 TMI-1 and TMI-2 liquid and airborne effluents are summarized in Tables 1 and 2. Table 1 compares the calculated maximum hypothetical individual doses to the USNRC 10 CFR 50 App. I guidelines. This table also compares the calculated doses (to an individual of the public) from effluents and direct radiation to USEPA 40 CFR 190 dose limits. Table 2 presents the maximum hypothetical whole body doses to an individual. As shown in Table 1, the doses calculated for 2018 operations at TMINS were well below the Federal dose limits (USEPA 40 CFR 190) and the guidelines of USNRC 10 CFR 50 App. I. This conclusion was supported by radionuclide concentrations detected in actual environmental samples.

Doses from natural background radiation provide a baseline for assessing the potential public health significance of radioactive effluents. Natural background radiation from cosmic, terrestrial and natural radionuclides in the human body (not including radon), averages about 81 mrem/yr (Ref. 5). Additionally, the average individual living in the United States receives an annual dose of about 2,760 mrem to the lung from natural radon gas. This lung dose is considered to be equivalent to a whole (or total) body dose of 230 mrem (Ref. 5). Therefore, the average person in the United States receives a whole body dose of about 311 mrem/yr from natural background radiation sources.

As shown on Table 2, the maximum hypothetical whole body dose received by an individual from 2018 TMI-1 and TMI-2 liquid and airborne effluents combined was conservatively calculated to be 0.12 mrem. This dose is equivalent to 0.06% percent of the dose that an individual living in the TMI area receives each year from natural background radiation (311 mrem).

The low doses calculated for 2018 TMINS operations were the result

of efforts to maintain releases "as low as reasonably achievable" (ALARA).

In conclusion, radioactive materials related to 2018 TMINS operations were detected in environmental samples, but the measured concentrations were low and consistent with measured effluents. The environmental sample results verified that the doses received by the public from TMINS effluents in 2018 were well below applicable dose limits and only a small fraction of the doses received from natural background radiation. Additionally, the results indicated that there was no permanent buildup of radioactive materials in the environment and no increase in background radiation levels.

Therefore, based on the results of the radiological environmental monitoring program (REMP) and the doses calculated from measured effluents, TMINS operations in 2018 did not have any adverse effects on the health of the public or on the environment.

TABLE 1

Calculated Maximum Hypothetical Doses to an Individual from 2018 TMI-1 and TMI-2 Liquid and Airborne Effluents

	Maximum Hypothetical Doses To An Individual		
	USNRC 10 CFR 50 APP. I Guidelines (mrem/yr)	**Calculated Dose (mrem/yr)**	
		TMI-1	**TMI-2**
From Radionuclides In Liquid Releases	3 total body, or	1.42E-2	5.12E-4
	10 any organ	1.76E-2	8.13E-4
From Radionuclides In Airborne Releases (Noble Gases)	5 total body, or	3.14E-4	0*
	15 skin	4.61E-4	0*
From Radionuclides In Airborne Releases (Iodines, Tritium and Particulates)	15 any organ	4.07E-1	1.28E-5

*No noble gases were released from TMI-2.

	USEPA 40 CFR 190 Limits (mrem/yr)	**Calculated Dose (mrem/yr) TMI-1 and TMI-2 Combined****
Total from Site	75 thyroid	0.11
	25 total body or other organs	0.43

* *This sums together TMI-1 and TMI-2 maximum doses regardless of age group for different pathways. The combined doses include those due to radioactive effluents and direct radiation from TMINS. The direct radiation dose is calculated from environmental dosimeter data. For this calculation, exposure is assumed to be equal to dose.

The direct radiation dose from 2018 TMINS operations was less than detectable based on calculations from ANSI/HI Standard N13.37.

TABLE 2

Calculated Whole Body Doses to the Maximum Individual From 2018 TMI-1 and TMI-2 Liquid and Airborne Effluents

	Calculated Maximum Individual Whole Body Dose (mrem/yr)	
	TMI-1	TMI-2
From Radionuclides In Liquid Releases	1.42E-2	5.12E-4
From Radionuclides in Airborne Releases (Noble Gases)	3.14E-4	0*
From Radionuclides In Airborne Releases (Iodines, Tritium and Particulates)	1.02E-1	1.28E-5

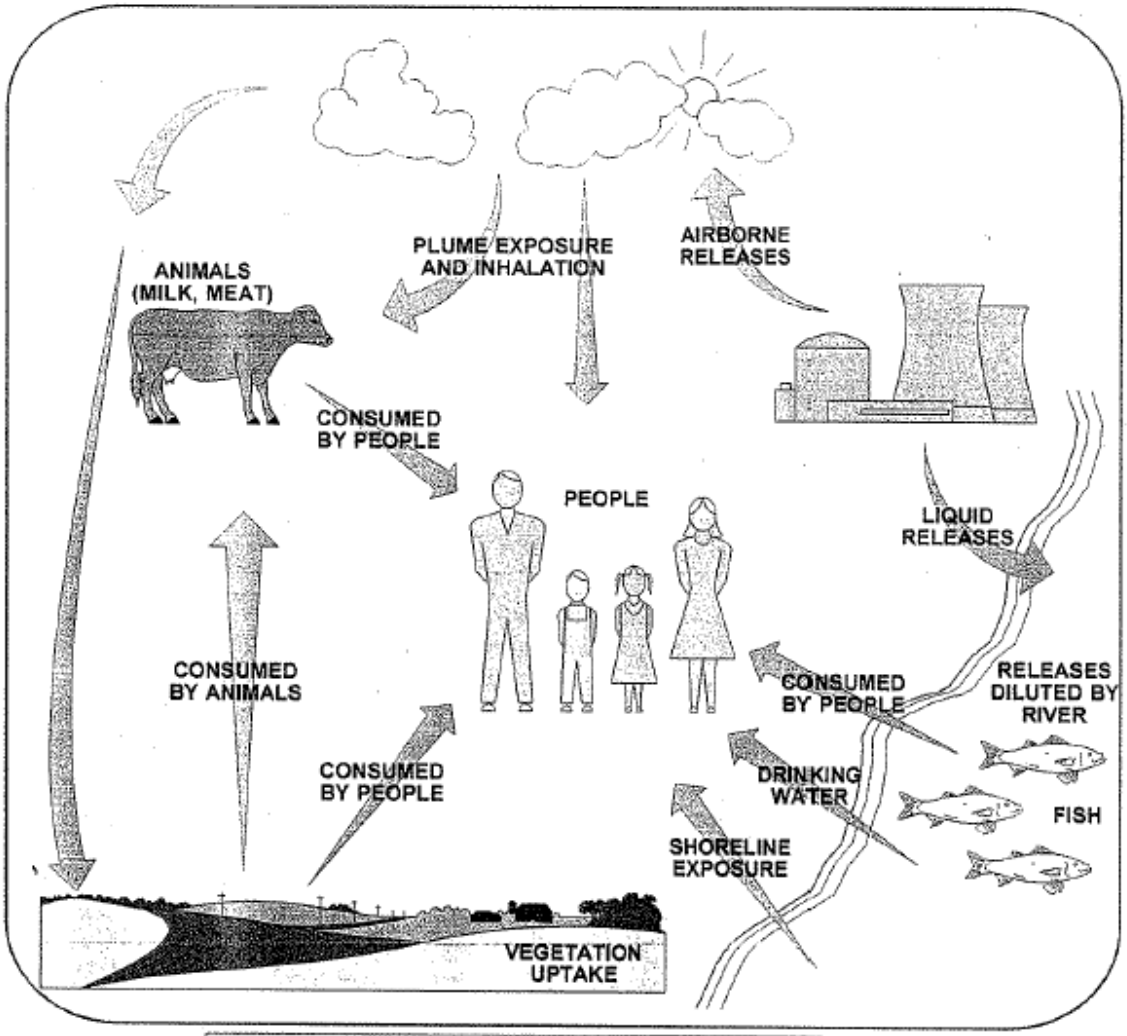
*No noble gases were released from TMI-2.

Individual Whole Body Dose Due to TMI-1 and TMI-2 Operations:	0.12 mrem/yr
Individual Whole Body Dose Due to Natural Background Radiation (1)	311 mrem/yr

(1) NCRP 160 – (2009)

Figure 1

Exposure Pathways For Radionuclides Routinely Released From TMINS



PREDOMINANT RADIONUCLIDES

NOBLE GASES (Xe,Kr)
Plume exposure

RADIOIODINES (I-131, I-133)
Inhalation and consumption of milk, water, fruits, and vegetables

RADIOSTRONTIUMS (Sr-89, Sr-90)
Consumption of milk, meat, fruits, and vegetables

ACTIVATION PRODUCTS (Co-60, Mn-54)
Shoreline exposure

RADIOCESIUMS (Cs-134, Cs-137)
Shoreline exposure and consumption of milk, meat, fish, water, fruits, and vegetables

TRITIUM (H-3)
Inhalation and consumption of water, milk, fruits, and vegetables

F. Errata Data

There is no errata data for 2018

G. Summary of Results – Inter-Laboratory Comparison Program

The primary and other secondary laboratories analyzed Performance Evaluation (PE) samples of air particulate, air iodine, milk, soil, vegetation and water matrices (Appendix E). The PE samples, supplied by Analytics Inc., Environmental Resource Associates (ERA) and DOE's MAPEP, were evaluated against the following pre-set acceptance criteria:

1. Analytics Evaluation Criteria

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

2. ERA Evaluation Criteria

   ERA's evaluation report provides an acceptance range for control and warning limits with associated flag values. ERA's acceptance limits are established per the USEPA, NELAC, state specific PT program requirements or ERA's SOP for the Generation of Performance Acceptance Limits, as applicable. The acceptance limits are either determined by a regression equation specific to each analyte or a fixed percentage limit promulgated under the appropriate regulatory document.

3. DOE Evaluation Criteria

   MAPEP's evaluation report provides an acceptance range with associated flag values.

   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.

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

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

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

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

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

5. The MAPEP November vegetation Sr-90 result of 0.338 Bq/sample was evaluated as Not Acceptable (Lower acceptable range was 0.554 Bq/sample). It appears that there has been incomplete dissolution of Sr-90 due to the composition of the MAPEP vegetation "matrix". To resolve this issue, the TBE-2018 procedure has been modified to add 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 November 2018 water Sr-90 sample was evaluated as *Not Acceptable*. TBE's initial reported result of 36.8 pCi/L exceeded the upper acceptance range (22.9 – 36.4 pCi/L). After reviewing the data for this sample, it was discovered that there was a typographical error at the time the results were entered at the ERA website. The correct result in LIMS of 36.2 should have been submitted instead. This result is within ERA's acceptance limits. In addition to the typo error, ERA's very stringent upper acceptance limit of 116% is not a reflection of TBE's ability to successfully perform this analysis. (NCR 18-23)

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

For the GEL laboratory, 545 of 552 met the specified acceptance criteria. Seven analyses did not meet the specified acceptance criteria. Of the 7, only 2 are analyses were performed for TMI during 2018 (vegetation sample for Co-60 and water sample for Fe-55). All failures were addressed through GEL's Corrective Action Program and the pertinent failures are described below:

1. The May ERA MRAD vegetation Co-60 result of 672 pCi/kg was higher than the acceptable upper limit (385 – 642 pCi/kg). The data was reviewed and no anomalies noted. The duplicate result of the original analysis met the acceptance criteria. The lab analyzed a separate aliquot of the sample and while the Co-60 was within limits, the result in general demonstrated a high bias.

2. The November 2018 ERA MRAD water Fe-55 result of 2610 pCi/L was higher than the acceptable upper limit (928 – 2300 pCi/L). The data was reviewed and no errors were noted. The lab analyzed a separate aliquot of the sample, which met the replication criteria within the analysis batch. All other QC criteria was met. Due to the high bias being nearly twice the reference value, it is suspected that the laboratory recorded an incorrect aliquot during the analysis process. The typical aliquot for this PT analysis is 20 mL and an aliquot of 10 mL was recorded as the aliquot used. A reanalysis was performed with results in the acceptable range.

The Inter-Laboratory Comparison Program provides evidence of "in control" counting systems and methods, and that the laboratories are producing accurate and reliable data. Interlaboratory Comparison results may be found in Appendix E.

V. References

1. Three Mile Island Nuclear Station, Unit 1, Technical Specifications, DPR 50.
2. Three Mile Island Nuclear Station, Unit 2, PDMS Technical Specifications, DPR 73.
3. Radiation Management Corporation. "Three Mile Island Nuclear Station, Preoperational Radiological Environmental Monitoring Program, January 1, 1974 – June 5, 1974." RMC-TR-75-17, January 1975.
4. Exelon. "Three Mile Island Nuclear Station Offsite Dose Calculation Manual (ODCM)."
5. National Council of Radiation Protection and Measurements Report No. 160. "Ionizing Radiation Exposure of the Population of the United States." 2009.

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APPENDIX A

RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT SUMMARY

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TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR THE THREE MILE ISLAND NUCLEAR STATION, 2018

NAME OF FACILITY: THREE MILE ISLAND NUCLEAR STATION **DOCKET NUMBER: 50-289 & 50-320**

LOCATION OF FACILITY: MIDDLETOWN 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**	24	**2000**	1047 (5/12) *(348/1440)*	<LLD	1047 (5/12) *(348/1440)*	J1-2 INDICATOR WEST SHORE; TMI 0.5 MILES S OF SITE	0
	I-131	12	**1**	NA	<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**	3.3 (16/24) *(2.1/5.2)*	2.8 (7/12) *(2.1/4.2)*	3.7 (10/12) *(2.6/5.2)*	G15-2 INDICATOR WRIGHTS WATER SUPPLY 13.3 MILES SE OF SITE	0
	I-131	36	**1**	<LLD	<LLD	-		0
	H-3	36	**2000**	<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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DRINKING WATER	**GAMMA**	36						
(PCI/LITER)	*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
EFFLUENT WATER *(PCI/LITER)*	**GR-B**	12	**4**	4.6 (12/12) *(2.0/6.8)*	NA	4.6 (12/12) *(2.0/6.8)*	K1-1 INDICATOR MAIN STATION LIQ. DISCHARGE ONSITE	0
	I-131 (LOW LVL)	12	**1**	<LLD	NA	-		0
	H-3	12	**2000**	19061 (6/13) *(203/26700)*	NA	19061 (6/13) *(203/26700)*	K1-1 INDICATOR MAIN STATION LIQ. DISCHARGE ONSITE	0
	SR-89	2	**5**	<LLD	NA	-		0
	SR-90	2	**2**	<LLD	NA	-		0

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EFFLUENT WATER	**GAMMA**		12						
(PCI/LITER)		*MN-54*		**15**	<LLD	NA	-		0
		CO-58		**15**	<LLD	NA	-		0
		FE-59		**30**	<LLD	NA	-		0
		CO-60		**15**	<LLD	NA	-		0
		ZN-65		**30**	<LLD	NA	-		0
		NB-95		**15**	<LLD	NA	-		0
		ZR-95		**30**	<LLD	NA	-		0
		CS-134		**15**	<LLD	NA	-		0
		CS-137		**18**	<LLD	NA	-		0
		BA-140		**60**	<LLD	NA	-		0
		LA-140		**15**	<LLD	NA	-		0
BOTTOM FEEDER	**SR-90**		4	**10**	<LLD	<LLD	-		0
(PCI/KGWET)									
	GAMMA		4						
		K-40		*NA*	3123 (2/2) *(2405/3841)*	2950 (2/2) *(2799/3101)*	3123 (2/2) *(2405/3841)*	INDB INDICATOR YORK HAVEN DAM DOWNSTREAM OF DISCHARGE	0
		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	**SR-90**		4	**10**	<LLD	<LLD	-		0
(PCI/KGWET)									

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PREDATOR	**GAMMA**		4						
(PCI/KGWET)		*K-40*		*NA*	2827	3004	3004	BKGP CONTROL	0
					(2/2)	(2/2)	(2/2)	CITY ISLAND	
					(2524/3129)	*(2970/3037)*	*(2970/3037)*	UPSTREAM OF DISCHARGE	
		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**		7						
(PCI/KG DRY)		*K-40*		*NA*	14180	12227	18675	J2-1 INDICATOR	0
					(5/5)	(2/2)	(2/2)	YORK HAVEN DAM	
					(7201/19640)	*(9874/14580)*	*(17710/19640)*	1.5 MILES S OF SITE	
		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**	<LLD	<LLD	-		0
AIR PARTICULATE	**GR-B**		355	**10**	13	14	14	Q15-1 CONTROL	0
(E-3 PCI/CU.METER)					(300/304)	(51/51)	(51/51)	WEST FAIRVIEW	
					(5/29)	*(6/26)*	*(6/26)*	13.5 MILES NW OF SITE	

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

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AIR PARTICULATE	**GAMMA**		28						
(E-3 PCI/CU.METER)		*BE-7*		*NA*	71	78	79	A3-1 INDICATOR	0
					(20/24)	(4/4)	(3/4)	MIDDLETOWN	
					(48/114)	*(47/140)*	*(54/114)*	2.6 MILES N OF SITE	
		MN-54		*NA*	<LLD	<LLD	-		0
		CO-58		*NA*	<LLD	<LLD	-		0
		CO-60		*NA*	<LLD	<LLD	-		0
		NB-95		*NA*	<LLD	<LLD	-		0
		ZR-95		*NA*	<LLD	<LLD	-		0
		CS-134		**50**	<LLD	<LLD	-		0
		CS-137		**60**	<LLD	<LLD	-		0
AIR IODINE	**GAMMA**		355						
(E-3 PCI/CU.METER)		*I-131*		**70**	<LLD	<LLD	-		0
MILK	**I-131**		97	**1**	<LLD	<LLD	-		0
(PCI/LITER)									
	SR-89		18	**5**	<LLD	<LLD	-		0
	SR-90		18	**2**	1.6	<LLD	1.6	E2-2 INDICATOR	0
					(1/14)		(1/2)	NISSLEY FARM	
								1.1 MILES E OF SITE	
	GAMMA		97						
		K-40		*NA*	1244	1251	1296	F4-1 INDICATOR	0
					(74/74)	(23/23)	(23/23)	TURNPIKE ROAD FARM	
					(834/1535)	*(1070/1410)*	*(834/1494)*	3.0 MILES ESE OF SITE	
		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 THE THREE MILE ISLAND NUCLEAR STATION, 2018

NAME OF FACILITY: THREE MILE ISLAND NUCLEAR STATION **DOCKET NUMBER: 50-289 & 50-320**

LOCATION OF FACILITY: MIDDLETOWN 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*	STATION # NAME DISTANCE AND DIRECTION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
VEGETATION	**SR-90**	33	**10**	14.4	12.9	19.4	H1-2 INDICATOR	0
(PCI/KG WET)				(12/21)	(8/12)	(8/9)	RED HILL MARKET	ALONG ROUTE 441
				(1.2/34.5)	*(4.8/38)*	*(2.5/34.5)*	1.0 MILES SSE OF SITE	
	GAMMA	33						
	BE-7		*NA*	1596	1453	2213	H1-2 INDICATOR	0
				(17/21)	(9/12)	(9/9)	RED HILL MARKET	
				(297/5490)	*(362/3476)*	*(716/5490)*	1.0 MILES SSE OF SITE	
	K-40		*NA*	3594	3927	3927	B10-2 CONTROL	0
				(21/21)	(12/12)	(12/12)	MILTON HERSHEY SCHOOL	
				(1946/5615)	*(2032/7286)*	*(2032/7286)*	10.1 MILES NNE OF SITE	
	I-131		**60**	<LLD	<LLD	-		0
	CS-134		**60**	<LLD	<LLD	-		0
	CS-137		**80**	<LLD	<LLD	-		0
DIRECT RADIATION	**OSLD - QUARTERLY**	360	*NA*	15.8	18	26.6	H8-1 INDICATOR	0
(MILLIREM/STD.MO.)				(316/316)	(44/44)	(4/4)	SAGINAW ROAD	STARVIEW
				(9.1/30.4)	*(13.2/27.3)*	*(23.9/30.4)*	7.4 MILES SSE OF SITE	

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

APPENDIX B

LOCATION DESIGNATION, DISTANCE & DIRECTION, AND SAMPLE COLLECTION & ANALYTICAL METHODS

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TABLE B-1: Location Designation and Identification System for the Three Mile Island Nuclear Station

XYY-Z- General code for identification of locations, where:

X - Angular Sector of Sampling Location. The compass is divided into 16 sectors of 22 1/2 degrees each with center at Three Mile Island's Units 1 and 2 off-gas vents. Sector A is centered due North, and others are alphabetical in a clockwise direction.

YY - Radial Zone of Sampling Location in miles.

Z - Station's Numerical Designation within sector and zone, using 1, 2, 3... in each sector and zone.

TABLE B-2: Radiological Environmental Monitoring Program - Sampling Locations, Distance and Direction, Three Mile Island Nuclear Station, 2018

Sample Medium	Station Code	Map Number	Distance (miles)	Azimuth	Description
AQS	A1-3	1	0.6	359°	N of site off north tip of TMI in Susquehanna River
ID	A1-4	1	0.3	6°	N of Reactor Building on W fence adjacent to North Weather Station, TMI
AP, AI, ID	A3-1	2	2.7	357°	N of site at Mill Street Substation
SW	A3-2	2	2.7	356°	N of site at Swatara Creek, Middletown
ID	A5-1	2	4.4	3°	N of site on Vine Street Exit off Route 283
ID	A9-3	3	8.0	2°	N of site at Duke Street Pumping Station, Hummelstown
ID	B1-1	1	0.6	25°	NNE of site on light pole in middle of North Bridge, TMI
ID	B1-2	1	0.4	24°	NNE of Reactor Building on top of dike, TMI
ID	B2-1	2	1.9	17°	NNE of site on Sunset Dr. (off Hillsdale Rd.)
ID	B5-1	2	4.9	19°	NNE of site at intersection of School House and Miller Roads
ID	B10-1	3	9.2	21°	NNE of site at intersection of West Areba Avenue and Mill Street, Hershey
FP	B10-2	3	10	31°	NNE of site at Milton Hershey School, Hershey
ID	C1-1	1	0.7	37°	NE of site along Route 441 N
ID	C1-2	1	0.3	50°	NE of Reactor Building on top of dike, TMI
ID	C2-1	2	1.5	44°	NE of site at Middletown Junction
ID	C5-1	2	4.7	43°	NE of site on Kennedy Lane
ID	C8-1	3	7.1	48°	NE of site at Schenk's Church on School House Road
AQF	Control	-	-	-	All locations where finfish are collected above Dock St. Dam, Harrisburg
ID	D1-1	1	0.2	76°	ENE of Reactor Building on top of dike, TMI
ID	D1-2	1	0.5	67°	ENE of site off Route 441 along lane between garden center and residence
ID	D2-2	2	1.6	74°	ENE of site along Hillsdale Rd. (S of Zion Rd.)
ID	D6-1	3	5.2	66°	ENE of site off Beagle Road
ID	D15-1	3	10.8	64°	ENE of site along Route 241, Lawn
AP, AI, ID, FP	E1-2	1	0.4	97°	E of site at TMI Visitor's Center
ID	E1-4	1	0.2	97°	E of Reactor Building on top of dike, TMI
M	E2-2	2	1.1	96°	E of site at farm on Pecks Road
ID	E2-3	2	2.0	97°	E of site along Hillsdale Rd. (N of Creek Rd.)
ID	E5-1	2	4.7	82°	E of site at intersection of North Market Street (Route 230) and Zeager Road
ID	E7-1	3	6.7	88°	E of site along Hummelstown Street, Elizabethtown
ID	F1-1	1	0.5	117°	ESE of site near entrance to 500 kV Substation
ID	F1-2	1	0.2	112°	ESE of Reactor Building on top of dike midway within ISWSF, TMI
AP, AI	F1-3	1	0.6	112°	ESE of site in 500 kV Substation
ID	F1-4	1	0.2	122°	ESE of Reactor Building on top of dike, TMI
ID	F2-1	2	1.3	119°	ESE of site along Engle Road
M	F4-1	2	3.2	104°	ESE of site at farm on Turnpike Road
ID	F5-1	2	4.7	109°	ESE of site along Amosite Road
ID	F10-1	3	9.4	112°	ESE of site along Donegal Springs Road, Donegal Springs
ID	F25-1	3	22	106°	ESE of site at intersection of Steel Way and Loop Roads, Lancaster
ID	G1-2	1	0.7	145°	SE of site along Route 441 S
ID	G1-3	1	0.2	130°	SE of Reactor Building on top of dike, TMI
ID	G1-5	1	0.3	143°	SE of Reactor Building on top of dike, TMI
ID	G1-6	1	0.3	139°	SE of Reactor Building on top of dike, TMI
AI, AP, M	G2-1	2	1.4	126°	SE of site at farm on Becker Road
ID	G2-4	2	1.7	138°	SE of site on Becker Road
ID	G5-1	2	4.8	131°	SE of site at intersection of Bainbridge and Risser Roads
ID	G10-1	3	9.7	128°	SE of site at farm along Engles Tollgate Road, Marietta
ID	G15-1	3	14.4	126°	SE of site at Columbia Water Treatment Plant
DW	G15-2	3	13.3	129°	SE of site at Wrightsville Water Treatment Plant
DW	G15-3	3	15.7	124°	SE of site at Lancaster Water Treatment Plant

TABLE B-2: Radiological Environmental Monitoring Program - Sampling Locations, Distance and Direction, Three Mile Island Nuclear Station, 2018

Sample Medium	Station Code	Map Number	Distance (miles)	Azimuth	Description
ID	H1-1	1	0.5	167°	SSE of site, TMI
FP	H1-2	1	1.0	151°	SSE of site along Route 441, Red Hill Market
AP, AI, ID	H3-1	2	2.2	160°	SSE of site in Falmouth-Collins Substation
ID	H5-1	2	4.1	158°	SSE of site by Guard Shack at Brunner Island Steam Electric Station
ID	H8-1	3	7.4	163°	SSE of site along Saginaw Road, Starview
ID	H15-1	3	13.2	157°	SSE of site at intersection of Orchard and Stonewood Roads, Wilshire Hills
AQF	Indicator	-	-	-	All locations where finfish are collected downstream of the TMINS liquid discharge outfall
ID	J1-1	1	0.8	176°	S of site, TMI
SW	J1-2	1	0.5	188°	S of site downstream of the TMINS liquid discharge outfall in Susquehanna River
ID	J1-3	1	0.3	189°	S of Reactor Building just S of SOB, TMI
AQS	J2-1	2	1.4	179°	S of site in Susquehanna River just upstream of the York Haven Dam
ID	J3-1	2	2.7	179°	S of site at York Haven/Cly
ID	J5-1	2	4.9	181°	S of site along Canal Road, Conewago Heights
ID	J7-1	3	6.5	176°	S of site off of Maple Street, Manchester
ID	J15-1	3	12.6	183°	S of site in Met-Ed York Load Dispatch Station
EW	K1-1	1	0.2	211°	On site at RML-7 Main Station Discharge Building
AQS	K1-3	1	0.2	213°	SSW of site downstream of the TMINS liquid discharge outfall in the Susquehanna River
ID	K1-4	1	0.2	209°	SSW of Reactor Building on top of dike behind Warehouse 2, TMI
ID	K2-1	2	1.2	200°	SSW of site on S Shelley Island
ID	K3-1	2	2.0	206°	SSW of site along Rt. 262, N of Cly
ID	K5-1	2	4.9	202°	SSW of site along Conewago Creek Road, Strinestown
ID	K8-1	3	7.5	196°	SSW of site at intersection of Coppenhaffer Road and Route 295, Zions View
ID	K15-1	3	12.8	203°	SSW of site behind McDonald's and next to child care center, Weiglestown
M	K15-3	3	14.4	205°	SSW of site at farm along S Salem Church Rd, Dover
ID	L1-1	1	0.1	236°	SW of site on top of dike W of Mech. Draft Cooling Tower, TMI
ID	L1-2	1	0.5	221°	SW of site on Beech Island
ID	L2-1	2	1.8	224°	SW of site along Route 262
ID	L5-1	2	4.1	228°	SW of site at intersection of Stevens and Wilson Roads
ID	L8-1	3	8.0	225°	SW of site along Rohlers Church Rd., Andersontown
ID	L15-1	3	11.8	226°	SW of site on W side of Route 74, rear of church, Mt. Royal
ID	M1-1	1	0.1	249°	WSW of Reactor Building on SE corner of U-2 Screenhouse fence, TMI
ID	M1-2	1	0.4	252°	WSW of site on E side of Shelley Island, Lot #157
AP, AI, ID	M2-1	2	1.3	256°	WSW of site along Route 262 and adjacent to Fishing Creek, Goldsboro
ID	M5-1	2	4.3	249°	WSW of site at intersection of Lewisberry and Roxberry Roads, Newberrytown
ID	M9-1	3	8.7	243°	WSW of site along Alpine Road, Maytown
ID	N1-1	1	0.7	274°	W of site on W side of Shelley Island, between lots #13 and #14
ID	N1-3	1	0.1	274°	W of Reactor Building on fence adjacent to Screenhouse entrance gate, TMI
ID	N2-1	2	1.2	261°	W of site at Goldsboro Marina
ID	N5-1	2	4.9	268°	W of site off of Old York Road along Robin Hood Drive
ID	N8-1	3	7.7	262°	W of site along Route 382, 1/2 mile north of Lewisberry
ID	N15-2	3	10.4	275°	W of site at intersection of Lisburn Road and Main Street, Lisburn
ID	P1-1	1	0.4	303°	WNW of site on Shelley Island

TABLE B-2: Radiological Environmental Monitoring Program - Sampling Locations, Distance and Direction, Three Mile Island Nuclear Station, 2018

Sample Medium	Station Code	Map Number	Distance (miles)	Azimuth	Description
ID	P1-2	1	0.1	292°	WNW of Reactor Building on fence N of Unit 1 Screenhouse, TMI
ID	P2-1	2	1.9	283°	WNW of site along Route 262
M	P4-1	2	3.6	295°	WNW of site at farm on Valley Road
ID	P5-1	2	5.0	284°	WNW of site at intersection of Valley Road (Route 262) and Beinhower Road
ID	P8-1	3	7.9	292°	WNW of site along Evergreen Road, Reesers Summit
ID	Q1-1	1	0.5	317°	NW of site on E side of Shelley Island
ID	Q1-2	1	0.2	321°	NW of Reactor Building on fence W of Warehouse 1, TMI
ID	Q2-1	2	1.9	310°	NW of site along access road along river
ID	Q5-1	2	5.0	317°	NW of site along Lumber Street, Highspire
SW, DW, ID	Q9-1	3	8.5	310°	NW of site at the Steelton Water Company
AP, AI, ID	Q15-1	3	13.4	309°	NW of site behind West Fairview Fire Dept. Social Hall (abandoned)
ID	R1-1	1	0.2	335°	NNW of Reactor Building along W fence, TMI
ID	R1-2	1	0.7	334°	NNW of site on central Henry Island
ID	R3-1	2	2.6	341°	NNW of site at Crawford Station, Middletown
ID	R5-1	2	4.9	339°	NNW of site at intersection of Spring Garden Drive and Route 441
ID	R9-1	3	8.0	341°	NNW of site at intersection of Derry and 66th Streets, Rutherford Heights
ID	R15-1	3	11.2	332°	NNW of site at intersection of Route 22 and Colonial Road, Colonial Park

IDENTIFICATION KEY

ID = Immersion Dose (OSLD)
SW = Surface Water
AI = Air Iodine
AP = Air Particulate
FP = Food Products (Green Leafy Vegetation, Fruits, Vegetables)
EW = Effluent Water
DW = Drinking Water
M = Milk (Cow)
AQF = Finfish
AQS = Aquatic Sediment

TABLE B-3: Radiological Environmental Monitoring Program – Summary of Sample Collection and Analytical Methods, Three Mile Island Nuclear 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-221, Rev. 000 EIS Collection of Surface-Drinking-Effluent Water Samples for Radiological Analysis (TMI)	2 gallon	TBE, TBE-2007 Gamma-emitting radioisotope analysis EIS, CY-ES-205, Rev. 001 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
Surface Water	Gross Beta	Monthly composite from a continuous water compositor	CY-ES-221, Rev. 000 EIS Collection of Surface-Drinking-Effluent Water Samples for Radiological Analysis (TMI)	2 gallon	TBE, TBE-2008 Gross alpha and/or gross beta activity in various matrices EIS, CY-ES-206, Rev. 001 Operation of the Tennelec S5E Proportional Counter
Surface Water	Tritium	Monthly composite from a continuous water compositor	CY-ES-221, Rev. 000 EIS Collection of Surface-Drinking-Effluent Water Samples for Radiological Analysis (TMI)	2 gallon	TBE, TBE-2010 Tritium and carbon-14 analysis by liquid scintillation GEL, EPA906.0 Mod, for Tritium analysis by Liquid scintillation
Surface Water	Iodine-131	Monthly composite from a continuous water compositor	CY-ES-221, Rev. 000 EIS Collection of Surface-Drinking-Effluent Water Samples for Radiological Analysis (TMI)	2 gallon	TBE, TBE-2012 Radioiodine in various matrices EIS, CY-ES-205, Rev. 001 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-221, Rev. 000 EIS Collection of Surface-Drinking-Effluent Water Samples for Radiological Analysis (TMI)	2 gallon	TBE, TBE-2008 Gross alpha and/or gross beta activity in various matrices
Drinking Water	Gamma Spectroscopy	Monthly composite from a continuous water compositor	CY-ES-221, Rev. 000 EIS Collection of Surface-Drinking-Effluent Water Samples for Radiological Analysis (TMI)	2 gallon	TBE, TBE-2007 Gamma-emitting radioisotope analysis
Drinking Water	Iodine-131	Monthly composite from a continuous water compositor	CY-ES-221, Rev. 000 EIS Collection of Surface-Drinking-Effluent Water Samples for Radiological Analysis (TMI)	2 gallon	TBE, TBE-2012 Radioiodine in various matrices
Drinking Water	Tritium	Monthly composite from a continuous water compositor	CY-ES-221, Rev. 000 EIS Collection of Surface-Drinking-Effluent Water Samples for Radiological Analysis (TMI)	2 gallon	TBE, TBE-2010 Tritium and carbon-14 analysis by liquid scintillation
Effluent Water	Iodine-131	Monthly composite from a continuous water compositor	CY-ES-221, Rev. 000 EIS Collection of Surface-Drinking-Effluent Water Samples for Radiological Analysis (TMI)	2 gallon	TBE, TBE-2012 Radioiodine in various matrices
Effluent Water	Gamma Spectroscopy	Monthly composite from a continuous water compositor	CY-ES-221, Rev. 000 EIS Collection of Surface-Drinking-Effluent Water Samples for Radiological Analysis (TMI)	2 gallon	TBE, TBE-2007 Gamma-emitting radioisotope analysis

TABLE B-3: Radiological Environmental Monitoring Program – Summary of Sample Collection and Analytical Methods, Three Mile Island Nuclear Station, 2018

Sample Medium	Analysis	Sampling Method	Collection Procedure Number	Sample Size	Analytical Procedure Number
Effluent Water	Tritium	Monthly composite from a continuous water compositor	CY-ES-221, Rev. 000 EIS Collection of Surface-Drinking-Effluent Water Samples for Radiological Analysis (TMI)	2 gallon	TBE, TBE-2010 Tritium and carbon-14 analysis by liquid scintillation
Effluent Water	Strontium-89/90	Semi-annual composite from monthly samples	TBE, TBE-2023 Compositing of samples	2 gallon	TBE, TBE-2019 Radiostrontium analysis by ion exchange
Storm Water	Gamma Spectroscopy	Quarterly composite of monthly grab samples	CY-ES-221, Rev. 000 EIS Collection of Surface-Drinking-Effluent Water Samples for Radiological Analysis (TMI)	1 gallon	TBE, TBE-2007 Gamma-emitting radioisotope analysis
Storm Water	Tritium	Quarterly composite of monthly grab samples	CY-ES-221, Rev. 000 EIS Collection of Surface-Drinking-Effluent Water Samples for Radiological Analysis (TMI)	1 gallon	TBE, TBE-2010 Tritium and carbon-14 analysis by liquid scintillation
Fish	Gamma Spectroscopy	Semi-annual samples collected via electroshocking or other techniques	ER-TMI-13 Collection of fish samples for radiological analysis (TMINS)	1000 grams (wet)	TBE, TBE-2007 Gamma-emitting radioisotope analysis EIS, CY-ES-205, Rev. 001 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
Fish	Strontium-90	Semi-annual samples collected via electroshocking or other techniques	ER-TMI-13 Collection of fish samples for radiological analysis (TMINS)	1000 grams (wet)	TBE, TBE-2019 Radiostrontium analysis by ion exchange GEL, EPA 905.0 Mod/DOE RP501 Rev. 1 Mod
Sediment	Gamma Spectroscopy	Semi-annual grab samples	ER-TMI-03 Collection of sediment samples for radiological analysis (TMINS)	500 grams (dry)	TBE, TBE-2007 Gamma-emitting radioisotope analysis EIS, CY-ES-205, Rev. 001 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
Air Particulates	Gamma Spectroscopy	Quarterly composite of each station	TBE, TBE-2023 Compositing of samples CY-ES-204, Rev. 001 Sample Preparation for Gamma and Beta Counting	13 filters (approx.. 3600 cubic meters)	TBE, TBE-2007 Gamma-emitting radioisotope analysis EIS, CY-ES-205, Rev. 001 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-219, Rev. 001 Collection of Air Iodine & Air Particulate for Radiological Analysis - TMI	1 filter (approx.. 280 cubic meters weekly)	TBE, TBE-2008 Gross alpha and/or gross beta activity in various matrices CY-ES-206, Rev. 001 Operation of the Tennelec S5E Proportional Counter

TABLE B-3: Radiological Environmental Monitoring Program – Summary of Sample Collection and Analytical Methods, Three Mile Island Nuclear Station, 2018

Sample Medium	Analysis	Sampling Method	Collection Procedure Number	Sample Size	Analytical Procedure Number
Air Iodine	Gamma Spectroscopy	One-week composite of continuous air sampling through charcoal filter	CY-ES-219, Rev. 001 Collection of Air Iodine & Air Particulate for Radiological Analysis - TMI	1 filter (approx.. 280 cubic meters weekly)	TBE, TBE-2007 Gamma-emitting radioisotope analysis EIS, CY-ES-205, Rev. 001 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-220, Rev. 000 EIS Sample Collection for Gamma Counting - Milk (TMI)	2 gallon	TBE, TBE-2012 Radioiodine in various matrices EIS, CY-ES-205, Rev. 001 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
Milk	Sr-89/90	Quarterly composite of Bi-weekly and monthly grab samples	TBE, TBE-2023 Compositing of samples CY-ES-227, Rev. 000 Compositing Milk Samples for Radiological Analysis - TMI	2 gallon	TBE, TBE-2019 Radiostrontium analysis by ion exchange GEL, EPA 905.0 Mod/DOE RP501 Rev. 1 Mod
Milk	Gamma Spectroscopy	Bi-weekly grab sample when cows are on pasture. Monthly all other times	CY-ES-220, Rev. 000 EIS Sample Collection for Gamma Counting - Milk (TMI)	2 gallon	TBE, TBE-2007 Gamma-emitting radioisotope analysis EIS, CY-ES-205, Rev. 001 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
Vegetation	Gamma Spectroscopy	Monthly and annual grab sample	CY-ES-217, Rev. 000 Sample Collection for Gamma Counting - Vegetation (TMI)	1000 grams	TBE, TBE-2007 Gamma-emitting radioisotope analysis EIS, CY-ES-205, Rev. 001 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
Vegetation	Strontium-89/90	Monthly and annual grab sample	CY-ES-217, Rev. 000 Sample Collection for Gamma Counting - Vegetation (TMI)	1000 grams	TBE, TBE-2019 Radiostrontium analysis by ion exchange GEL, EPA 905.0 Mod/DOE RP501 Rev. 1 Mod
OSLD	Optically Stimulated Luminescence Dosimetry	Quarterly OSLDs comprised of two Al_2O_3:C Landauer Incorporated elements.	ER-TMI-02 Collection of OSLD samples for radiological analysis (TMINS)	2 badges with 3 dosimeters	Landauer Incorporated

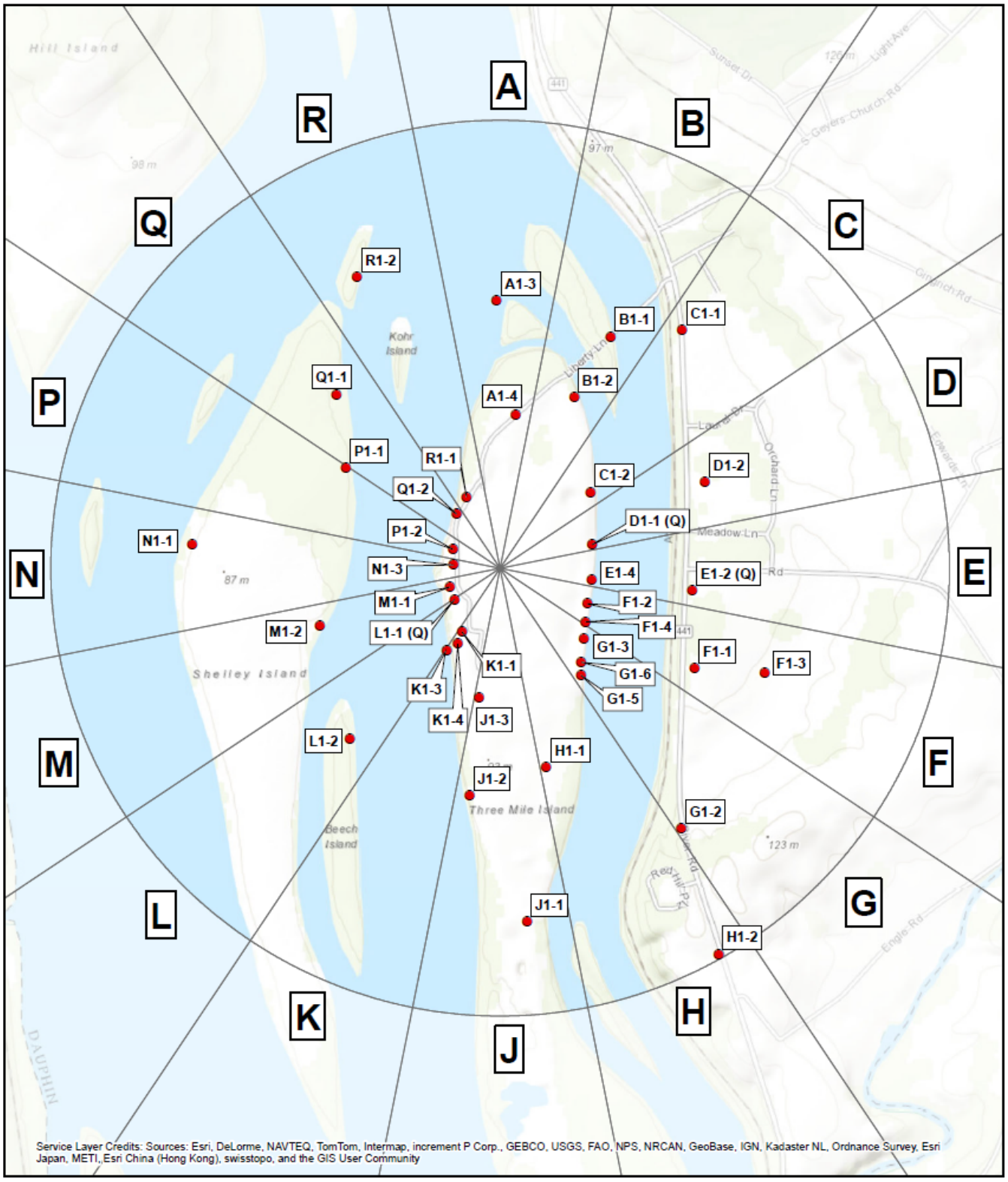

Figure B-1
Environmental Sampling Locations Within One Mile of the Three Mile Island Nuclear Station, 2018

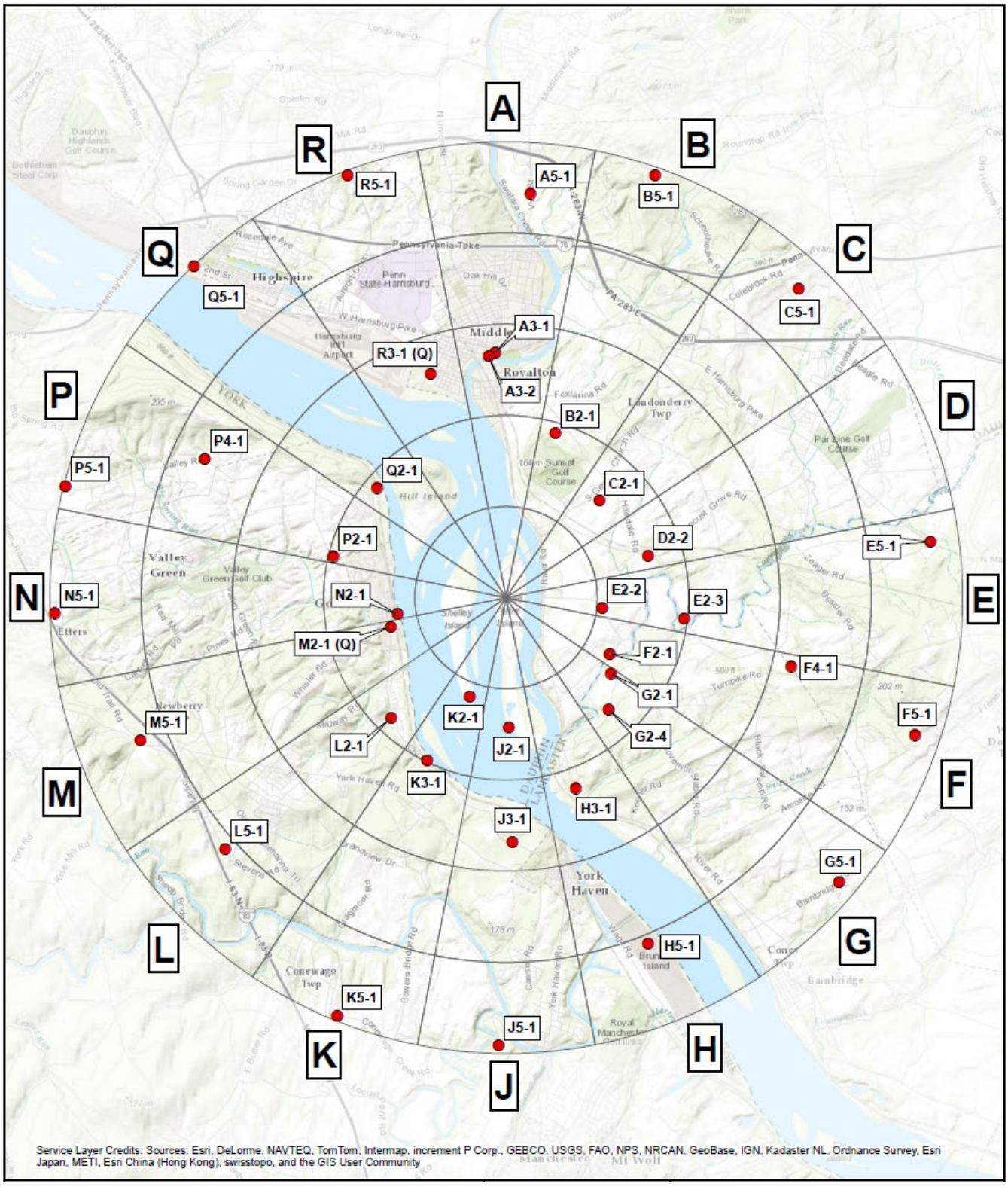

Figure B-2
Environmental Sampling Locations Between One and Five Miles of the Three Mile Island Nuclear Station, 2018

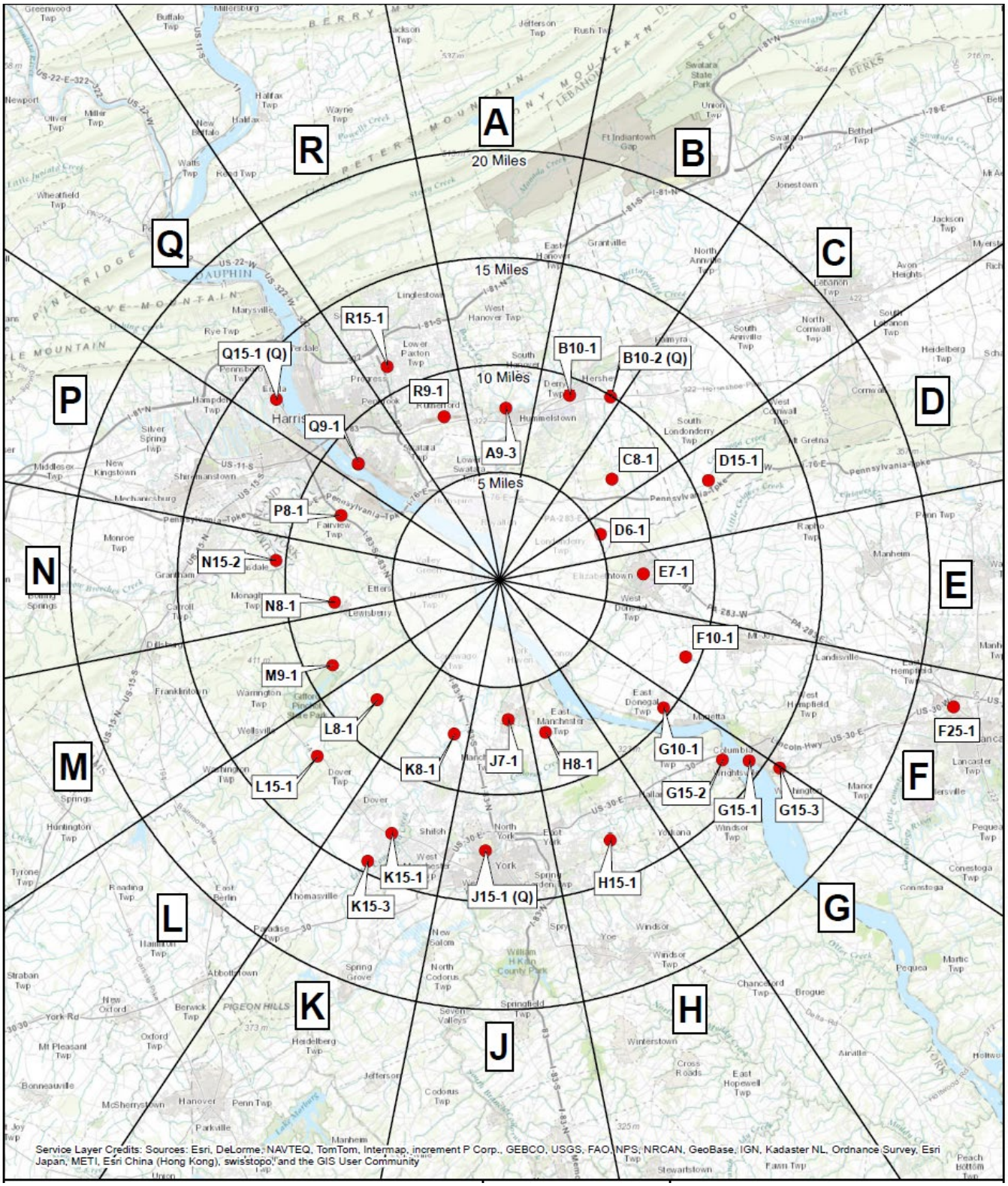

Figure B-3
Environmental Sampling Locations Greater than Five Miles of the Three Mile Island Nuclear Station, 2018

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 THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	J1-2	Q9-1
01/03/18 - 01/30/18	< 193	< 195
01/30/18 - 02/27/18	< 187	< 186
03/08/18 - 03/27/18	< 179	< 186
03/27/18 - 05/01/18	348 ± 132	< 180
05/01/18 - 05/31/18	1390 ± 212	< 192
05/31/18 - 06/26/18	868 ± 150	< 182
06/26/18 - 07/31/18	1440 ± 209	< 190
07/31/18 - 08/29/18	1190 ± 190	< 193
08/29/18 - 09/25/18	< 195	< 194
09/25/18 - 10/31/18	< 177	< 183
10/31/18 - 11/29/18	< 190	< 198
11/29/18 - 01/03/19	< 188	< 191
MEAN ± 2 STD DEV	1047 ± 902	-

Table C-I.2 CONCENTRATIONS OF I-131 IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	A3-2
01/03/18 - 01/30/18	< 0.4
01/30/18 - 02/27/18	< 0.8
03/08/18 - 03/27/18	< 0.6
03/27/18 - 05/01/18	< 0.7
05/01/18 - 05/31/18	< 0.7
05/31/18 - 06/26/18	< 0.5
06/26/18 - 07/31/18	< 0.5
07/31/18 - 08/29/18	< 0.8
08/29/18 - 09/25/18	< 0.4
09/25/18 - 10/31/18	< 0.6
10/31/18 - 11/29/18	< 0.7
11/29/18 - 01/03/19	< 0.9
MEAN	-

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

Table C-I.3 **CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR 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
J1-2	01/03/18 - 01/30/18	< 6	< 8	< 16	< 5	< 19	< 8	< 12	< 9	< 7	< 33	< 9
	01/30/18 - 02/27/18	< 7	< 8	< 16	< 8	< 15	< 7	< 13	< 9	< 8	< 38	< 13
	03/08/18 - 03/27/18	< 8	< 8	< 13	< 10	< 14	< 11	< 17	< 9	< 9	< 37	< 13
	03/27/18 - 05/01/18	< 4	< 6	< 12	< 4	< 9	< 5	< 8	< 5	< 4	< 31	< 10
	05/01/18 - 05/31/18	< 5	< 7	< 14	< 6	< 10	< 6	< 11	< 7	< 6	< 35	< 13
	05/31/18 - 06/26/18	< 6	< 7	< 14	< 6	< 11	< 6	< 8	< 7	< 6	< 31	< 15
	06/26/18 - 07/31/18	< 5	< 5	< 13	< 7	< 13	< 9	< 13	< 7	< 6	< 34	< 13
	07/31/18 - 08/29/18	< 7	< 5	< 15	< 8	< 13	< 7	< 12	< 8	< 7	< 35	< 9
	08/29/18 - 09/25/18	< 5	< 5	< 11	< 5	< 9	< 5	< 9	< 5	< 4	< 36	< 10
	09/25/18 - 10/31/18	< 4	< 4	< 12	< 7	< 12	< 8	< 12	< 7	< 6	< 29	< 11
	10/31/18 - 11/29/18	< 8	< 5	< 15	< 9	< 9	< 5	< 7	< 7	< 8	< 35	< 10
	11/29/18 - 01/03/19	< 9	< 8	< 19	< 8	< 16	< 9	< 14	< 9	< 9	< 33	< 11
	MEAN	-	-	-	-	-	-	-	-	-	-	-
Q9-1	01/03/18 - 01/30/18	< 7	< 7	< 14	< 7	< 15	< 6	< 12	< 7	< 8	< 33	< 9
	01/30/18 - 02/27/18	< 6	< 5	< 15	< 7	< 9	< 6	< 9	< 6	< 7	< 36	< 10
	03/08/18 - 03/27/18	< 8	< 8	< 16	< 10	< 17	< 7	< 15	< 8	< 7	< 34	< 11
	03/27/18 - 05/01/18	< 4	< 5	< 12	< 6	< 8	< 6	< 9	< 6	< 5	< 32	< 10
	05/01/18 - 05/31/18	< 5	< 4	< 10	< 5	< 10	< 6	< 9	< 5	< 5	< 32	< 10
	05/31/18 - 06/26/18	< 6	< 7	< 12	< 7	< 13	< 7	< 8	< 6	< 6	< 37	< 15
	06/26/18 - 07/31/18	< 6	< 7	< 14	< 7	< 13	< 6	< 10	< 7	< 8	< 33	< 10
	07/31/18 - 08/29/18	< 5	< 6	< 12	< 7	< 11	< 6	< 10	< 6	< 6	< 32	< 8
	08/29/18 - 09/25/18	< 5	< 4	< 11	< 5	< 9	< 6	< 11	< 4	< 5	< 36	< 13
	09/25/18 - 10/31/18	< 6	< 8	< 13	< 7	< 10	< 6	< 13	< 8	< 7	< 42	< 14
	10/31/18 - 11/29/18	< 6	< 7	< 13	< 6	< 14	< 6	< 12	< 7	< 6	< 31	< 9
	11/29/18 - 01/03/19	< 6	< 6	< 11	< 6	< 10	< 7	< 9	< 6	< 6	< 25	< 6
	MEAN	-	-	-	-	-	-	-	-	-	-	-

Table C-II.1 **CONCENTRATIONS OF GROSS BETA IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	G15-2	G15-3	Q9-1
01/03/18 - 01/30/18	2.7 ± 1.6	2.1 ± 1.4	2.3 ± 1.4
01/30/18 - 02/27/18	4.8 ± 1.8	< 2.1	< 2.0
03/08/18 - 03/27/18	5.2 ± 1.7	3.0 ± 1.5	3.4 ± 1.5
03/27/18 - 05/01/18	2.9 ± 1.5	< 1.9	4.2 ± 1.5
05/01/18 - 05/31/18	< 2.1	2.2 ± 1.4	< 1.9
05/31/18 - 06/26/18	4.2 ± 1.5	2.1 ± 1.3	2.8 ± 1.4
06/26/18 - 07/31/18	2.6 ± 1.4	< 1.9	< 1.9
07/31/18 - 08/29/18	4.1 ± 1.7	3.9 ± 1.6	2.1 ± 1.4
08/29/18 - 09/25/18	3.8 ± 1.5	2.3 ± 1.3	2.2 ± 1.2
09/25/18 - 10/31/18	3.0 ± 1.4	< 1.9	2.4 ± 1.4
10/31/18 - 11/29/18	3.5 ± 1.5	< 1.9	< 1.9
11/29/18 - 01/03/19	< 1.8	< 1.7	< 1.7
MEAN ± 2 STD DEV	3.7 ± 1.8	2.6 ± 1.5	2.8 ± 1.6

Table C-II.2 **CONCENTRATIONS OF I-131 IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	G15-2	G15-3	Q9-1
01/03/18 - 01/30/18	< 0.4	< 0.6	< 0.7
01/30/18 - 02/27/18	< 0.6	< 0.6	< 0.6
03/08/18 - 03/27/18	< 0.8	< 0.7	< 0.7
03/27/18 - 05/01/18	< 0.7	< 0.6	< 0.8
05/01/18 - 05/31/18	< 0.4	< 0.4	< 0.4
05/31/18 - 06/26/18	< 0.6	< 0.6	< 0.5
06/26/18 - 07/31/18	< 0.4	< 0.4	< 0.4
07/31/18 - 08/29/18	< 0.4	< 0.5	< 0.5
08/29/18 - 09/25/18	< 0.6	< 0.6	< 0.4
09/25/18 - 10/31/18	< 0.9	< 0.6	< 0.6
10/31/18 - 11/29/18	< 0.7	< 0.8	< 0.7
11/29/18 - 01/03/19	< 0.7	< 0.6	< 0.6
MEAN	-	-	-

Table C-II.3 **CONCENTRATIONS OF TRITIUM IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	G15-2	G15-3	Q9-1
01/03/18 - 01/30/18	< 192	< 194	< 197
01/30/18 - 02/27/18	< 185	< 187	< 185
03/08/18 - 03/27/18	< 182	< 180	< 183
03/27/18 - 05/01/18	< 189	< 186	< 190
05/01/18 - 05/31/18	< 192	< 194	< 194
05/31/18 - 06/26/18	< 181	< 177	< 180
06/26/18 - 07/31/18	< 195	< 190	< 188
07/31/18 - 08/29/18	< 193	< 192	< 197
08/29/18 - 09/25/18	< 197	< 192	< 194
09/25/18 - 10/31/18	< 179	< 179	< 176
10/31/18 - 11/29/18	< 193	< 196	< 194
11/29/18 - 01/03/19	< 192	< 187	< 192
MEAN ± 2 STD DEV	-	-	-

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 COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR 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
TM-DW-G15-2	01/03/18 - 01/30/18	< 8	< 11	< 23	< 10	< 19	< 9	< 19	< 8	< 12	< 43	< 12
	01/30/18 - 02/27/18	< 5	< 8	< 13	< 8	< 13	< 7	< 10	< 8	< 6	< 34	< 12
	03/08/18 - 03/27/18	< 6	< 5	< 10	< 7	< 9	< 7	< 11	< 7	< 5	< 20	< 7
	03/27/18 - 05/01/18	< 1	< 1	< 3	< 1	< 3	< 2	< 2	< 1	< 1	< 10	< 3
	05/01/18 - 05/31/18	< 4	< 5	< 10	< 6	< 11	< 6	< 7	< 6	< 5	< 29	< 9
	05/31/18 - 06/26/18	< 6	< 5	< 17	< 6	< 13	< 7	< 9	< 7	< 6	< 35	< 10
	06/26/18 - 07/31/18	< 7	< 7	< 15	< 10	< 17	< 7	< 10	< 8	< 7	< 36	< 15
	07/31/18 - 08/29/18	< 8	< 6	< 15	< 6	< 17	< 10	< 13	< 7	< 7	< 41	< 15
	08/29/18 - 09/25/18	< 4	< 6	< 9	< 5	< 8	< 5	< 10	< 5	< 5	< 36	< 13
	09/25/18 - 10/31/18	< 6	< 6	< 15	< 9	< 13	< 7	< 14	< 9	< 8	< 33	< 11
	10/31/18 - 11/29/18	< 6	< 8	< 12	< 7	< 9	< 5	< 11	< 5	< 8	< 29	< 13
	11/29/18 - 01/03/19	< 4	< 5	< 11	< 6	< 11	< 5	< 9	< 6	< 4	< 21	< 8
	MEAN	-	-	-	-	-	-	-	-	-	-	-
TM-DW-G15-3	01/03/18 - 01/30/18	< 5	< 6	< 15	< 10	< 16	< 7	< 12	< 7	< 8	< 35	< 12
	01/30/18 - 02/27/18	< 6	< 7	< 15	< 6	< 11	< 7	< 8	< 6	< 5	< 33	< 14
	03/08/18 - 03/27/18	< 6	< 6	< 14	< 8	< 14	< 7	< 11	< 7	< 7	< 25	< 10
	03/27/18 - 05/01/18	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 14	< 4
	05/01/18 - 05/31/18	< 5	< 5	< 12	< 6	< 12	< 5	< 10	< 6	< 6	< 27	< 12
	05/31/18 - 06/26/18	< 5	< 6	< 13	< 6	< 11	< 6	< 12	< 7	< 6	< 31	< 8
	06/26/18 - 07/31/18	< 9	< 8	< 16	< 7	< 15	< 7	< 14	< 7	< 9	< 42	< 12
	07/31/18 - 08/29/18	< 4	< 4	< 12	< 3	< 13	< 6	< 11	< 7	< 5	< 34	< 10
	08/29/18 - 09/25/18	< 4	< 4	< 8	< 4	< 8	< 4	< 8	< 5	< 4	< 24	< 9
	09/25/18 - 10/31/18	< 5	< 6	< 14	< 6	< 14	< 7	< 10	< 7	< 6	< 32	< 13
	10/31/18 - 11/29/18	< 6	< 6	< 13	< 7	< 13	< 6	< 11	< 6	< 6	< 27	< 11
	11/29/18 - 01/03/19	< 4	< 4	< 8	< 6	< 9	< 5	< 8	< 6	< 6	< 24	< 8
	MEAN	-	-	-	-	-	-	-	-	-	-	-
TM-DW-Q9-1	01/03/18 - 01/30/18	< 8	< 8	< 18	< 10	< 13	< 8	< 13	< 10	< 9	< 43	< 15
	01/30/18 - 02/27/18	< 7	< 8	< 16	< 6	< 16	< 10	< 13	< 8	< 8	< 37	< 15
	03/08/18 - 03/27/18	< 8	< 8	< 17	< 9	< 22	< 12	< 19	< 10	< 9	< 42	< 10
	03/27/18 - 05/01/18	< 4	< 3	< 9	< 3	< 8	< 4	< 6	< 5	< 4	< 26	< 8
	05/01/18 - 05/31/18	< 5	< 5	< 10	< 6	< 10	< 5	< 9	< 5	< 5	< 34	< 11
	05/31/18 - 06/26/18	< 7	< 8	< 17	< 9	< 14	< 8	< 8	< 7	< 8	< 38	< 14
	06/26/18 - 07/31/18	< 6	< 6	< 12	< 5	< 12	< 7	< 10	< 6	< 7	< 33	< 12
	07/31/18 - 08/29/18	< 6	< 6	< 13	< 5	< 10	< 6	< 10	< 6	< 7	< 39	< 8
	08/29/18 - 09/25/18	< 5	< 6	< 11	< 5	< 12	< 5	< 10	< 6	< 5	< 32	< 11
	09/25/18 - 10/31/18	< 8	< 7	< 13	< 5	< 14	< 6	< 11	< 7	< 8	< 35	< 9
	10/31/18 - 11/29/18	< 7	< 5	< 14	< 8	< 16	< 6	< 12	< 7	< 7	< 27	< 9
	11/29/18 - 01/03/19	< 7	< 7	< 13	< 6	< 14	< 6	< 12	< 7	< 7	< 31	< 9
	MEAN	-	-	-	-	-	-	-	-	-	-	-

Table C-III.1 **CONCENTRATIONS OF GROSS BETA, IODINE-131, TRITIUM, AND STRONTIUM IN EFFLUENT WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD		GR-B	I-131	H-3	SR-89	SR-90
K1-1	01/03/18 - 01/30/18		5.2 ± 1.8	< 0.5	< 198		
	01/30/18 - 02/27/18		5.3 ± 1.8	< 0.6	< 186		
	03/08/18 - 03/27/18		4.0 ± 1.6	< 0.9	< 183		
	03/27/18 - 05/01/18		2.0 ± 1.4	< 0.6	< 179		
	05/01/18 - 05/31/18		4.3 ± 1.6	< 0.9	22600 ± 2310		
	05/31/18 - 06/26/18		5.1 ± 1.7	< 0.8	24200 ± 2460		
	05/31/18 - 06/26/18	*Reanalysis*			25900 ± 2640		
	01/03/18 - 06/26/18					< 4.0	< 0.8
	06/26/18 - 07/31/18		5.4 ± 1.8	< 0.4	21600 ± 2210		
	07/31/18 - 08/29/18		4.8 ± 1.7	< 0.4	26700 ± 2720		
	08/29/18 - 09/25/18		6.8 ± 1.8	< 0.7	203 ± 130		
	09/25/18 - 10/31/18		5.3 ± 1.7	< 0.6	< 181		
	10/31/18 - 11/29/18		3.9 ± 1.5	< 0.7	< 190		
	11/29/18 - 01/03/19		3.0 ± 1.4	< 0.9	< 189		
	06/26/18 - 01/03/19					< 3.7	< 0.7
	MEAN ± 2 STD DEV		4.6 ± 2.5	-	19061 ± 21433	-	-

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

Table C-III.2

CONCENTRATIONS OF GAMMA EMITTERS IN EFFLUENT WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR 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
K1-1	01/03/18 - 01/30/18	< 7	< 8	< 15	< 7	< 17	< 8	< 14	< 8	< 8	< 34	< 11
	01/30/18 - 02/27/18	< 4	< 4	< 10	< 5	< 10	< 5	< 9	< 5	< 5	< 23	< 8
	03/08/18 - 03/27/18	< 6	< 5	< 9	< 7	< 13	< 6	< 11	< 7	< 6	< 20	< 7
	03/27/18 - 05/01/18	< 4	< 4	< 11	< 5	< 8	< 4	< 8	< 5	< 5	< 31	< 9
	05/01/18 - 05/31/18	< 5	< 5	< 14	< 6	< 10	< 5	< 10	< 6	< 4	< 37	< 7
	05/31/18 - 06/26/18	< 7	< 7	< 16	< 8	< 13	< 5	< 14	< 8	< 7	< 38	< 10
	06/26/18 - 07/31/18	< 8	< 6	< 14	< 6	< 8	< 7	< 10	< 8	< 7	< 29	< 15
	07/31/18 - 08/29/18	< 5	< 6	< 13	< 7	< 11	< 5	< 13	< 6	< 7	< 31	< 9
	08/29/18 - 09/25/18	< 4	< 4	< 8	< 4	< 8	< 5	< 7	< 4	< 4	< 32	< 9
	09/25/18 - 10/31/18	< 5	< 6	< 12	< 5	< 11	< 6	< 10	< 5	< 7	< 25	< 12
	10/31/18 - 11/29/18	< 3	< 4	< 13	< 5	< 13	< 6	< 12	< 5	< 4	< 29	< 12
	11/29/18 - 01/03/19	< 7	< 6	< 13	< 9	< 15	< 6	< 10	< 9	< 6	< 22	< 5
	MEAN	-	-	-	-	-	-	-	-	-	-	-

Table C-IV.1 CONCENTRATIONS OF STRONTIUM IN PREDATOR AND BOTTOM FEEDER (FISH) SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

SITE		Sr-90
BKGB	06/06/18	< 2.2
BOTTOM FEEDER	10/24/18	< 4.3
	MEAN	-
BKGP	06/06/18	< 3.1
PREDATOR	10/24/18	< 2.8
	MEAN	-
INDB	05/25/18	< 1.2
BOTTOM FEEDER	10/05/18	< 4.2
	MEAN	-
INDP	05/25/18	< 3.0
PREDATOR	10/05/18	< 3.4
	MEAN	-

Table C-IV.2 **CONCENTRATIONS OF GAMMA EMITTERS IN PREDATOR AND BOTTOM FEEDER (FISH) SAMPLES COLLECTED IN THE VICINTY OF THREE MILE ISLAND NUCLEAR 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
BKGB	06/06/18	3101 ± 847	< 64	< 46	< 76	< 53	< 99	< 66	< 48
BOTTOM FEEDER	10/24/18	2799 ± 1000	< 57	< 59	< 157	< 83	< 142	< 62	< 56
	MEAN ± 2 STD DEV	2950 + 427	-	-	-	-	-	-	-
BKGP	06/06/18	3037 ± 990	< 52	< 54	< 99	< 54	< 145	< 71	< 49
PREDATOR	10/24/18	2970 ± 1119	< 82	< 73	< 217	< 96	< 173	< 85	< 82
	MEAN ± 2 STD DEV	3004 + 94.8	-	-	-	-	-	-	-
INDB	05/25/18	2405 ± 1208	< 45	< 72	< 184	< 81	< 154	< 98	< 90
BOTTOM FEEDER	10/05/18	3841 ± 782	< 54	< 50	< 131	< 57	< 119	< 60	< 58
	MEAN ± 2 STD DEV	3123 + 2031	-	-	-	-	-	-	-
INDP	05/25/18	3129 ± 1057	< 51	< 43	< 118	< 70	< 164	< 79	< 83
PREDATOR	10/05/18	2524 ± 1296	< 57	< 56	< 155	< 100	< 129	< 89	< 72
	MEAN ± 2 STD DEV	2827 ± 856	-	-	-	-	-	-	-

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

Table C-V.1 CONCENTRATIONS OF GAMMA EMITTERS IN SEDIMENT SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR 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
A1-3	06/11/18	14580 ± 1921	< 97	< 82	< 95	< 118	< 107
	10/25/18	9874 ± 1716	< 92	< 83	< 111	< 124	< 112
	MEAN ± 2 STD DEV	12227 ± 6655	-	-	-	-	-
EDCB	10/25/18	12930 ± 2191	< 111	< 132	< 129	< 145	< 138
	MEAN ± 2 STD DEV	12930 ± 0	-	-	-	-	-
J2-1	06/11/18	17710 ± 1982	< 90	< 73	< 103	< 123	< 103
	10/25/18	19640 ± 2558	< 100	< 100	< 160	< 145	< 132
	MEAN ± 2 STD DEV	18675 ± 2729	-	-	-	-	-
K1-3	06/11/18	7201 ± 1400	< 76	< 64	< 80	< 76	< 86
	10/25/18	13420 ± 2195	< 108	< 111	< 140	< 145	< 161
	MEAN ± 2 STD DEV	10311 ± 8795	-	-	-	-	-

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

Table C-VI.1 **CONCENTRATIONS OF GROSS BETA IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018**

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

COLLECTION	GROUP I		GROUP II				GROUP III
PERIOD	E1-2	F1-3	A3-1	G2-1	H3-1	M2-1	Q15-1
01/04/18 - 01/11/18	17 ± 4	14 ± 4	8 ± 4	14 ± 4	14 ± 4	11 ± 4	14 ± 4
01/11/18 - 01/18/18	15 ± 4	14 ± 4	13 ± 4	13 ± 4	14 ± 4	14 ± 4	16 ± 4
01/18/18 - 01/25/18	19 ± 4	21 ± 4	20 ± 4	21 ± 4	21 ± 4	14 ± 4	23 ± 5
01/25/18 - 02/01/18	13 ± 4	13 ± 4	11 ± 4	9 ± 4	11 ± 4	10 ± 4	15 ± 4
02/01/18 - 02/08/18	10 ± 4	11 ± 4	9 ± 4	9 ± 4	16 ± 4	13 ± 4	12 ± 4
02/08/18 - 02/15/18	17 ± 4	16 ± 4	13 ± 4	12 ± 4	19 ± 5	19 ± 5	13 ± 4
02/15/18 - 02/22/18	15 ± 4	17 ± 4	10 ± 3	12 ± 4	14 ± 4	15 ± 4	17 ± 4
02/22/18 - 03/01/18	13 ± 4	18 ± 4	9 ± 3	9 ± 3	14 ± 4	11 ± 4	16 ± 4
03/01/18 - 03/08/18	8 ± 4	9 ± 4	6 ± 4	6 ± 4	12 ± 4	10 ± 4	11 ± 4
03/08/18 - 03/15/18	14 ± 4	8 ± 3	13 ± 4	9 ± 3	9 ± 3	12 ± 4	11 ± 4
03/15/18 - 03/23/18	13 ± 4	13 ± 4	9 ± 3	5 ± 3	11 ± 4	14 ± 4	14 ± 4
03/23/18 - 03/29/18	11 ± 4	16 ± 5	12 ± 5	9 ± 4	11 ± 5	8 ± 4	10 ± 4
03/29/18 - 04/05/18	11 ± 4	14 ± 4	16 ± 4	9 ± 4	8 ± 4	10 ± 4	12 ± 4
04/05/18 - 04/12/18	15 ± 4	14 ± 4	8 ± 4	8 ± 4	12 ± 4	9 ± 4	14 ± 4
04/12/18 - 04/19/18	13 ± 4	11 ± 4	8 ± 4	6 ± 3	11 ± 4	9 ± 4	13 ± 4
04/19/18 - 04/26/18	15 ± 4	15 ± 4	10 ± 4	8 ± 4	11 ± 4	10 ± 4	15 ± 4
04/26/18 - 05/03/18	19 ± 5	13 ± 4	11 ± 4	9 ± 4	14 ± 4	16 ± 5	19 ± 5
05/03/18 - 05/10/18	21 ± 5	17 ± 5	19 ± 5	12 ± 4	22 ± 5	23 ± 5	19 ± 5
05/10/18 - 05/17/18	9 ± 4	9 ± 4	6 ± 4	< 5	9 ± 4	9 ± 4	8 ± 4
05/17/18 - 05/24/18	11 ± 4	10 ± 4	8 ± 3	8 ± 4	9 ± 4	7 ± 3	7 ± 3
05/24/18 - 05/31/18	12 ± 4	9 ± 3	9 ± 3	*(1)*	10 ± 4	14 ± 4	15 ± 4
05/31/18 - 06/06/18	5 ± 3	6 ± 3	8 ± 3	7 ± 3	8 ± 4	8 ± 4	6 ± 3
06/06/18 - 06/13/18	10 ± 5	9 ± 4	9 ± 4	11 ± 5	11 ± 5	8 ± 4	10 ± 5
06/13/18 - 06/21/18	13 ± 3	15 ± 3	11 ± 3	14 ± 3	12 ± 3	13 ± 3	17 ± 4
06/21/18 - 06/28/18	8 ± 3	11 ± 3	11 ± 3	10 ± 3	10 ± 3	12 ± 4	11 ± 4
06/28/18 - 07/05/18	*(1)*	14 ± 4	16 ± 4	16 ± 5	16 ± 4	18 ± 4	18 ± 4
07/05/18 - 07/12/18	12 ± 4	11 ± 4	14 ± 4	14 ± 4	< 5	15 ± 4	12 ± 4
07/12/18 - 07/19/18	14 ± 4	11 ± 4	13 ± 4	16 ± 4	< 4	13 ± 4	18 ± 4
07/19/18 - 07/26/18	< 4	8 ± 3	5 ± 3	9 ± 4	6 ± 3	5 ± 3	7 ± 3
07/26/18 - 08/02/18	10 ± 4	12 ± 4	5 ± 3	13 ± 4	11 ± 4	11 ± 4	16 ± 4
08/02/18 - 08/09/18	23 ± 5	21 ± 4	20 ± 4	23 ± 5	23 ± 5	22 ± 5	26 ± 5
08/09/18 - 08/16/18	15 ± 4	17 ± 4	16 ± 4	19 ± 4	16 ± 4	18 ± 4	16 ± 4
08/16/18 - 08/23/18	13 ± 4	14 ± 4	14 ± 4	12 ± 4	10 ± 4	15 ± 4	17 ± 4
08/23/18 - 08/29/18	25 ± 5	23 ± 5	23 ± 5	23 ± 5	24 ± 5	22 ± 5	25 ± 5
08/29/18 - 09/06/18	14 ± 4	13 ± 4	12 ± 3	13 ± 4	12 ± 4	13 ± 4	11 ± 4
09/06/18 - 09/13/18	11 ± 4	11 ± 4	8 ± 3	12 ± 4	12 ± 4	8 ± 3	12 ± 4
09/13/18 - 09/19/18	6 ± 4	8 ± 4	9 ± 4	10 ± 4	6 ± 4	7 ± 4	8 ± 4
09/19/18 - 09/27/18	6 ± 3	10 ± 3	8 ± 3	10 ± 4	12 ± 4	10 ± 3	10 ± 4
09/27/18 - 10/04/18	13 ± 4	13 ± 4	15 ± 4	17 ± 4	14 ± 4	15 ± 4	16 ± 4
10/04/18 - 10/12/18	16 ± 4	16 ± 4	16 ± 4	15 ± 4	15 ± 4	13 ± 4	15 ± 4
10/12/18 - 10/18/18	15 ± 4	17 ± 4	12 ± 4	12 ± 4	16 ± 4	16 ± 4	14 ± 4
10/18/18 - 10/25/18	9 ± 4	9 ± 4	9 ± 4	7 ± 4	7 ± 4	10 ± 4	11 ± 4
10/25/18 - 10/31/18	11 ± 4	6 ± 4	14 ± 4	11 ± 4	9 ± 4	7 ± 4	9 ± 4
10/31/18 - 11/08/18	16 ± 4	14 ± 3	15 ± 3	15 ± 3	15 ± 3	15 ± 4	16 ± 4
11/08/18 - 11/15/18	14 ± 4	13 ± 4	9 ± 3	15 ± 4	12 ± 4	14 ± 4	17 ± 4
11/15/18 - 11/21/18	18 ± 5	18 ± 5	13 ± 4	21 ± 5	14 ± 4	15 ± 5	22 ± 5
11/21/18 - 11/29/18	14 ± 4	11 ± 3	13 ± 3	13 ± 4	10 ± 3	13 ± 4	11 ± 3
11/29/18 - 12/06/18	14 ± 4	11 ± 4	10 ± 3	13 ± 4	11 ± 4	11 ± 4	12 ± 4
12/06/18 - 12/13/18	28 ± 5	27 ± 5	23 ± 4	29 ± 5	25 ± 5	25 ± 5	26 ± 5
12/13/18 - 12/20/18	13 ± 4	15 ± 4	13 ± 4	18 ± 5	13 ± 4	17 ± 4	13 ± 4
12/20/18 - 12/27/18	17 ± 4	13 ± 4	13 ± 4	17 ± 4	15 ± 4	16 ± 4	15 ± 4
MEAN ± 2 STD DEV	14 ± 9	13 ± 8	12 ± 8	13 ± 10	13 ± 9	13 ± 9	14 ± 9

(1) SEE PROGRAM EXCEPTIONS SECTION FOR INFORMATION

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

Table C-VI.2

MONTHLY AND YEARLY MEAN VALUES OF GROSS BETA CONCENTRATIONS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018

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

GROUP I - CLOSEST TO THE SITE BOUNDARY				GROUP II - INTERMEDIATE OFFSITE				GROUP III - CONTROL LOCATIONS			
COLLECTION PERIOD		MIN	MAX	MEAN ± 2SD	COLLECTION PERIOD	MIN	MAX	MEAN ± 2SD	COLLECTION PERIOD	MIN	MAX	MEAN ± 2SD
01/04/18	02/01/18	13	21	16 ± 6	01/04/18 - 02/01/18	8	21	14 ± 8	01/04/18 - 02/01/18	14	23	17 ± 8
02/01/18	03/01/18	10	18	15 ± 6	02/01/18 - 03/01/18	9	19	13 ± 7	02/01/18 - 03/01/18	12	17	15 ± 4
03/01/18	03/29/18	8	16	12 ± 6	03/01/18 - 03/29/18	5	14	10 ± 5	03/01/18 - 03/29/18	10	14	11 ± 3
03/29/18	05/03/18	11	19	14 ± 5	03/29/18 - 05/03/18	6	16	10 ± 5	03/29/18 - 05/03/18	12	19	14 ± 5
05/03/18	05/31/18	9	21	12 ± 9	05/03/18 - 05/31/18	6	23	12 ± 11	05/03/18 - 05/31/18	7	19	12 ± 11
05/31/18	06/28/18	5	15	10 ± 6	05/31/18 - 06/28/18	7	14	10 ± 4	05/31/18 - 06/28/18	6	17	11 ± 9
06/28/18	08/02/18	8	14	11 ± 4	06/28/18 - 08/02/18	5	18	12 ± 8	06/28/18 - 08/02/18	7	18	14 ± 10
08/02/18	08/29/18	13	25	19 ± 9	08/02/18 - 08/29/18	10	24	19 ± 9	08/02/18 - 08/29/18	16	26	21 ± 11
08/29/18	10/04/18	6	14	10 ± 6	08/29/18 - 10/04/18	6	17	11 ± 6	08/29/18 - 10/04/18	8	16	11 ± 6
10/04/18	10/31/18	6	17	12 ± 8	10/04/18 - 10/31/18	7	16	12 ± 6	10/04/18 - 10/31/18	9	15	12 ± 6
10/31/18	11/29/18	11	18	15 ± 5	10/31/18 - 11/29/18	9	21	14 ± 5	10/31/18 - 11/29/18	11	22	17 ± 9
11/29/18	12/27/18	11	28	17 ± 13	11/29/18 - 12/27/18	10	29	17 ± 11	11/29/18 - 12/27/18	12	26	17 ± 13
01/04/18	12/27/18	5	28	13 ± 9	01/04/18 - 12/27/18	5	29	13 ± 9	01/04/18 - 12/27/18	6	26	14 ± 9

Table C-VI.3 CONCENTRATIONS OF GAMMA EMITTERS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018

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

SITE	COLLECTION PERIOD	Be-7	Mn-54	Co-58	Co-60	Nb-95	Zr-95	Cs-134	Cs-137
A3-1	01/04/18 - 03/29/18	< 56	< 4	< 6	< 4	< 6	< 10	< 4	< 4
	03/29/18 - 06/28/18	68 ± 20	< 1	< 2	< 1	< 1	< 3	< 2	< 2
	06/28/18 - 09/27/18	114 ± 40	< 3	< 5	< 2	< 7	< 10	< 2	< 2
	09/27/18 - 12/27/18	54 ± 16	< 3	< 3	< 3	< 3	< 5	< 3	< 3
	MEAN ± 2 STD DEV	79 ± 63	-	-	-	-	-	-	-
E1-2	01/04/18 - 03/29/18	77 ± 22	< 3	< 3	< 3	< 4	< 7	< 3	< 3
	03/29/18 - 06/28/18	64 ± 22	< 1	< 1	< 3	< 1	< 4	< 1	< 2
	06/28/18 - 09/27/18	85 ± 40	< 4	< 8	< 2	< 7	< 11	< 3	< 2
	09/27/18 - 12/27/18	72 ± 22	< 3	< 2	< 3	< 2	< 5	< 2	< 2
	MEAN ± 2 STD DEV	75 ± 18	-	-	-	-	-	-	-
F1-3	01/04/18 - 03/29/18	71 ± 30	< 3	< 3	< 3	< 4	< 7	< 3	< 3
	03/29/18 - 06/28/18	86 ± 24	< 2	< 2	< 3	< 3	< 5	< 2	< 3
	06/28/18 - 09/27/18	< 71	< 3	< 7	< 2	< 7	< 11	< 3	< 2
	09/27/18 - 12/27/18	68 ± 18	< 1	< 3	< 2	< 2	< 5	< 2	< 2
	MEAN ± 2 STD DEV	75 ± 19	-	-	-	-	-	-	-
G2-1	01/04/18 - 03/29/18	54 ± 26	< 3	< 4	< 3	< 4	< 8	< 3	< 3
	03/29/18 - 06/28/18	48 ± 26	< 2	< 2	< 3	< 2	< 5	< 3	< 2
	06/28/18 - 09/27/18	86 ± 45	< 3	< 6	< 3	< 8	< 14	< 2	< 3
	09/27/18 - 12/27/18	53 ± 22	< 3	< 3	< 4	< 4	< 7	< 3	< 3
	MEAN ± 2 STD DEV	60 ± 34	-	-	-	-	-	-	-
H3-1	01/04/18 - 03/29/18	69 ± 31	< 3	< 4	< 3	< 4	< 7	< 3	< 2
	03/29/18 - 06/28/18	78 ± 24	< 2	< 2	< 2	< 3	< 4	< 3	< 3
	06/28/18 - 09/27/18	< 96	< 4	< 9	< 3	< 9	< 18	< 4	< 3
	09/27/18 - 12/27/18	57 ± 18	< 3	< 2	< 3	< 3	< 3	< 2	< 2
	MEAN ± 2 STD DEV	68 ± 21	-	-	-	-	-	-	-
M2-1	01/04/18 - 03/29/18	84 ± 23	< 3	< 4	< 4	< 3	< 6	< 3	< 2
	03/29/18 - 06/28/18	80 ± 21	< 2	< 2	< 2	< 2	< 3	< 2	< 1
	06/28/18 - 09/27/18	< 66	< 3	< 5	< 2	< 7	< 12	< 1	< 2
	09/27/18 - 12/27/18	59 ± 21	< 3	< 2	< 3	< 3	< 5	< 2	< 3
	MEAN ± 2 STD DEV	74 ± 27	-	-	-	-	-	-	-
Q15-1	01/04/18 - 03/29/18	56 ± 27	< 3	< 3	< 4	< 5	< 7	< 3	< 2
	03/29/18 - 06/28/18	71 ± 21	< 2	< 2	< 2	< 2	< 4	< 1	< 1
	06/28/18 - 09/27/18	140 ± 43	< 3	< 7	< 3	< 7	< 13	< 3	< 2
	09/27/18 - 12/27/18	47 ± 15	< 3	< 3	< 3	< 2	< 5	< 3	< 2
	MEAN ± 2 STD DEV	78 ± 84	-	-	-	-	-	-	-

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

Table C-VII.1 **CONCENTRATIONS OF I-131 IN AIR IODINE SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018**

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

COLLECTION PERIOD	GROUP I		GROUP II				GROUP III
	E1-2	F1-3	A3-1	G2-1	H3-1	M2-1	Q15-1
01/04/18 - 01/11/18	< 43	< 44	< 35	< 44	< 36	< 34	< 34
01/11/18 - 01/18/18	< 55	< 56	< 39	< 56	< 40	< 39	< 39
01/18/18 - 01/25/18	< 50	< 51	< 35	< 51	< 36	< 35	< 35
01/25/18 - 02/01/18	< 24	< 56	< 56	< 56	< 56	< 58	< 58
02/01/18 - 02/08/18	< 33	< 34	< 43	< 34	< 44	< 42	< 42
02/08/18 - 02/15/18	< 46	< 46	< 32	< 47	< 33	< 32	< 31
02/15/18 - 02/22/18	< 48	< 49	< 24	< 49	< 24	< 24	< 24
02/22/18 - 03/01/18	< 41	< 42	< 28	< 42	< 29	< 28	< 29
03/01/18 - 03/08/18	< 63	< 61	< 30	< 64	< 31	< 30	< 25
03/08/18 - 03/15/18	< 38	< 39	< 26	< 39	< 25	< 25	< 26
03/15/18 - 03/23/18	< 41	< 42	< 16	< 42	< 20	< 20	< 20
03/23/18 - 03/29/18	< 47	< 48	< 46	< 48	< 47	< 47	< 47
03/29/18 - 04/05/18	< 39	< 40	< 27	< 40	< 28	< 27	< 27
04/05/18 - 04/12/18	< 56	< 57	< 31	< 57	< 31	< 31	< 31
04/12/18 - 04/19/18	< 55	< 55	< 30	< 56	< 25	< 31	< 31
04/19/18 - 04/26/18	< 30	< 25	< 48	< 30	< 31	< 20	< 47
04/26/18 - 05/03/18	< 38	< 32	< 35	< 38	< 39	< 15	< 36
05/03/18 - 05/10/18	< 59	< 21	< 56	< 60	< 61	< 24	< 56
05/10/18 - 05/17/18	< 29	< 30	< 44	< 30	< 30	< 45	< 44
05/17/18 - 05/24/18	< 54	< 51	< 26	< 54	< 65	< 66	< 67
05/24/18 - 05/31/18	< 21	< 17	< 30	*(1)*	< 20	< 33	< 34
05/31/18 - 06/06/18	< 33	< 32	< 18	< 33	< 33	< 49	< 50
06/06/18 - 06/13/18	< 27	< 26	< 26	< 27	< 27	< 67	< 69
06/13/18 - 06/21/18	< 20	< 19	< 40	< 20	< 20	< 44	< 45
06/21/18 - 06/28/18	< 52	< 50	< 23	< 52	< 30	< 30	< 30
06/28/18 - 07/05/18	*(1)*	< 44	< 24	< 49	< 46	< 60	< 62
07/05/18 - 07/12/18	< 58	< 56	< 24	< 59	< 58	< 62	< 64
07/12/18 - 07/19/18	< 43	< 41	< 51	< 43	< 42	< 58	< 58
07/19/18 - 07/26/18	< 45	< 43	< 52	< 45	< 45	< 57	< 58
07/26/18 - 08/02/18	< 63	< 60	< 52	< 63	< 62	< 57	< 57
08/02/18 - 08/09/18	< 44	< 43	< 18	< 44	< 43	< 47	< 48
08/09/18 - 08/16/18	< 33	< 27	< 24	< 34	< 33	< 32	< 32
08/16/18 - 08/23/18	< 40	< 38	< 49	< 40	< 39	< 54	< 55
08/23/18 - 08/29/18	< 50	< 47	< 61	< 50	< 49	< 63	< 65
08/29/18 - 09/06/18	< 45	< 44	< 33	< 45	< *45*	< 37	< 38
09/06/18 - 09/13/18	< 54	< 52	< 49	< 54	< *53*	< 52	< 53
09/13/18 - 09/19/18	< 56	< 53	< 36	< 57	< 56	< 42	< 43
09/19/18 - 09/27/18	< 31	< 30	< 17	< 31	< 42	< 43	< 43
09/27/18 - 10/04/18	< 41	< 40	< 21	< 42	< 41	< 39	< 41
10/04/18 - 10/12/18	< 36	< 34	< 16	< 36	< 35	< 32	< 33
10/12/18 - 10/18/18	< 63	< 61	< 38	< 63	< 62	< 43	< 44
10/18/18 - 10/25/18	< 40	< 39	< 23	< 40	< 30	< 29	< 30
10/25/18 - 10/31/18	< 39	< 38	< 42	< *40*	< 40	< 45	< 46
10/31/18 - 11/08/18	< 20	< 19	< 10	< 20	< 19	< 27	< 27
11/08/18 - 11/15/18	< 53	< 51	< 32	< 54	< 53	< 41	< 42
11/15/18 - 11/21/18	< 67	< 64	< 30	< 67	< 66	< 60	< 61
11/21/18 - 11/29/18	< 36	< 35	< 20	< 37	< 36	< 22	< 22
11/29/18 - 12/06/18	< 48	< 46	< 50	< 48	< 48	< 55	< 56
12/06/18 - 12/13/18	< 53	< 51	< 21	< 53	< 52	< 55	< 56
12/13/18 - 12/20/18	< 42	< 40	< 52	< 42	< 41	< 58	< 59
12/20/18 - 12/27/18	< 46	< 44	< 20	< 46	< 45	< 51	< 52
MEAN	-	-	-	-	-	-	-

(1) SEE PROGRAM EXCEPTIONS SECTION FOR INFORMATION

TABLE C-VIII.1 CONCENTRATIONS OF I-131 IN MILK SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION	CONTROL FARM	INDICATOR FARMS			
PERIOD	K15-3	E2-2	F4-1	G2-1	P4-1
01/10/18	< 0.8	< 0.7	< 0.9	< 0.8	< 0.7
02/07/18	< 0.9	< 0.5	< 0.9	< 0.5	< 0.6
03/07/18	< 0.5	< 0.8	< 0.6	< 0.6	< 0.7
03/23/18	< 0.7	< 0.9	< 0.7	< 0.8	< 0.9
04/04/18	< 0.8	< 0.5	< 0.6	< 0.7	< 0.5
04/18/18	< 0.5	*(1)*	< 0.4	< 0.8	< 0.5
05/02/18	< 0.6	*(1)*	< 0.6	< 0.5	< 0.5
05/16/18	< 0.9	*(1)*	< 0.8	< 0.8	< 0.9
05/31/18	< 0.5	*(1)*	< 0.4	< 0.5	< 0.5
06/14/18	< 0.8	*(1)*	< 0.6	< 0.6	< 0.5
06/27/18	< 0.5	*(1)*	< 0.5	< 0.4	< 1.0
07/11/18	< 0.5	*(1)*	< 0.6	< 0.5	< 0.9
07/25/18	< 0.7	*(1)*	< 0.7	< 0.7	< 0.6
08/08/18	< 0.7	*(1)*	< 0.9	< 0.5	< 0.5
08/22/18	< 0.9	*(1)*	< 0.6	< 0.6	< 0.9
09/05/18	< 0.8	*(1)*	< 0.6	< 0.8	< 0.7
09/19/18	< 0.5	*(1)*	< 0.5	< 0.5	< 0.5
10/03/18	< 0.6	*(1)*	< 0.5	< 0.5	< 0.5
10/17/18	< 0.8	*(1)*	< 0.8	< 0.7	< 0.5
10/31/18	< 0.4	*(1)*	< 0.5	< 0.9	< 0.8
11/14/18	< 0.9	*(1)*	< 0.7	< 0.8	< 0.7
11/29/18	< 0.6	*(1)*	< 0.6	< 0.5	< 0.8
12/12/18	< 0.5	*(1)*	< 0.4	< 0.7	< 0.8
MEAN	-	-	-	-	-

(1) SEE PROGRAM EXCEPTIONS SECTION FOR INFORMATION

Table C-VIII.2

CONCENTRATIONS OF STRONTIUM IN MILK SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION	CONTROL FARM		INDICATOR FARMS							
	K15-3		E2-2		F4-1		G2-1		P4-1	
PERIOD	Sr-89	Sr-90	Sr-89	Sr-90	Sr-89	Sr-90	Sr-89	Sr-90	Sr-89	Sr-90
01/10/18 - 03/21/18	< 1.5	< 0.8	< 1.9	< 0.8	< 2.1	< 0.6	< 4.0	< 0.8	< 3.6	< 0.7
04/04/18 - 06/27/18	< 2.9	< 0.6	< 12.5	1.6 ± 0.6	< 4.3	< 1.0	< 4.5	< 0.8	< 2.7	< 0.7
07/11/18 - 09/19/18	< 3.7	< 0.8	*(1)*	*(1)*	< 4.4	< 0.9	< 3.3	< 0.9	< 4.2	< 0.8
10/03/18 - 12/12/18	< 3.7	< 0.8	*(1)*	*(1)*	< 3.3	< 0.9	< 3.6	< 0.8	< 4.2	< 0.6
MEAN ± 2 STD DEV	-	-	-	1.6 ± 0	-	-	-	-	-	-

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

Table C-VIII.3 CONCENTRATIONS OF GAMMA EMITTERS IN MILK SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	K-40	Cs-134	Cs-137	Ba-140	La-140
K15-3	01/10/18	1187 ± 197	< 7	< 8	< 27	< 10
	02/07/18	1349 ± 202	< 10	< 8	< 35	< 8
	3/7/2018	1263 ± 166	< 7	< 6	< 31	< 7
	03/23/18	1357 ± 175	< 8	< 8	< 28	< 7
	04/04/18	1160 ± 206	< 11	< 10	< 30	< 9
	04/18/18	1223 ± 143	< 8	< 9	< 32	< 9
	05/02/18	1188 ± 172	< 8	< 7	< 47	< 13
	05/16/18	1199 ± 139	< 7	< 7	< 29	< 6
	05/30/18	1226 ± 149	< 8	< 6	< 45	< 14
	06/13/18	1315 ± 168	< 8	< 8	< 37	< 6
	06/27/18	1377 ± 188	< 11	< 8	< 34	< 13
	07/11/18	1311 ± 178	< 9	< 9	< 37	< 11
	07/25/18	1410 ± 153	< 7	< 7	< 30	< 6
	08/08/18	1382 ± 164	< 8	< 9	< 38	< 8
	08/22/18	1315 ± 213	< 9	< 8	< 49	< 14
	09/05/18	1070 ± 178	< 9	< 9	< 42	< 13
	09/19/18	1158 ± 172	< 8	< 8	< 40	< 8
	10/03/18	1273 ± 172	< 8	< 7	< 53	< 10
	10/17/18	1245 ± 162	< 8	< 7	< 50	< 14
	10/31/18	1174 ± 152	< 7	< 7	< 35	< 8
	11/14/18	1135 ± 149	< 8	< 8	< 46	< 12
	11/28/18	1273 ± 151	< 8	< 7	< 44	< 11
	12/12/18	1176 ± 181	< 7	< 6	< 24	< 8
	MEAN ± 2 STD DEV	1251 ± 180	-	-	-	-
E2-2[(1)]	01/10/18	1188 ± 215	< 10	< 9	< 38	< 15
	02/07/18	1253 ± 214	< 8	< 7	< 39	< 13
	03/07/18	1171 ± 169	< 8	< 7	< 31	< 11
	03/23/18	1368 ± 143	< 7	< 6	< 24	< 5
	04/04/18	1031 ± 124	< 6	< 5	< 18	< 3
	MEAN ± 2 STD DEV	1202 ± 246	-	-	-	-
F4-1	01/10/18	1127 ± 166	< 9	< 8	< 38	< 8
	02/07/18	1321 ± 184	< 9	< 8	< 26	< 9
	03/07/18	1310 ± 169	< 12	< 11	< 45	< 11
	03/23/18	1297 ± 216	< 9	< 8	< 36	< 10
	04/04/18	1281 ± 152	< 7	< 8	< 17	< 5
	04/18/18	1257 ± 139	< 6	< 6	< 28	< 7
	05/02/18	1486 ± 192	< 7	< 9	< 54	< 13
	05/16/18	1156 ± 156	< 6	< 7	< 30	< 8
	05/30/18	1491 ± 225	< 7	< 9	< 43	< 10
	06/13/18	1138 ± 167	< 8	< 7	< 31	< 11
	06/27/18	1289 ± 196	< 10	< 9	< 44	< 10
	07/11/18	1464 ± 191	< 9	< 8	< 38	< 8
	07/25/18	1324 ± 140	< 9	< 8	< 33	< 11
	08/08/18	1418 ± 171	< 8	< 8	< 35	< 8
	08/22/18	1286 ± 198	< 11	< 9	< 47	< 11
	09/05/18	1267 ± 210	< 8	< 7	< 37	< 8
	09/19/18	1462 ± 182	< 3	< 4	< 26	< 5
	10/03/18	1494 ± 174	< 8	< 7	< 52	< 14
	10/17/18	1369 ± 145	< 6	< 6	< 41	< 14
	10/31/18	834 ± 86	< 3	< 3	< 14	< 6
	11/14/18	1254 ± 192	< 8	< 7	< 45	< 13
	11/29/18	1379 ± 159	< 6	< 7	< 42	< 13
	12/12/18	1104 ± 133	< 7	< 7	< 24	< 6
	MEAN ± 2 STD DEV	1296 ± 309	-	-	-	-

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

Table C-VIII.3 CONCENTRATIONS OF GAMMA EMITTERS IN MILK SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	K-40	Cs-134	Cs-137	Ba-140	La-140
G2-1	1/10/2018	1034 ± 206	< 10	< 10	< 45	< 12
	02/07/18	994 ± 258	< 15	< 10	< 44	< 13
	03/07/18	1335 ± 210	< 8	< 9	< 36	< 14
	03/21/18	1207 ± 186	< 9	< 7	< 39	< 12
	04/04/18	1262 ± 177	< 8	< 7	< 20	< 10
	04/18/18	1259 ± 147	< 7	< 8	< 26	< 8
	05/02/18	1096 ± 133	< 6	< 6	< 41	< 13
	05/16/18	1326 ± 138	< 6	< 5	< 27	< 8
	05/30/18	1221 ± 146	< 6	< 6	< 40	< 11
	06/13/18	1279 ± 170	< 8	< 7	< 38	< 11
	06/27/18	1181 ± 153	< 8	< 8	< 31	< 9
	07/11/18	1361 ± 201	< 8	< 7	< 29	< 11
	07/25/18	964 ± 142	< 8	< 8	< 30	< 10
	08/08/18	1262 ± 196	< 10	< 9	< 32	< 8
	08/22/18	1165 ± 196	< 12	< 10	< 39	< 10
	09/05/18	1296 ± 203	< 9	< 8	< 34	< 11
	09/19/18	1324 ± 153	< 7	< 6	< 33	< 7
	10/03/18	1147 ± 125	< 6	< 6	< 39	< 11
	10/17/18	1000 ± 151	< 8	< 7	< 51	< 12
	10/31/18	1328 ± 183	< 8	< 9	< 42	< 10
	11/14/18	1089 ± 137	< 7	< 6	< 41	< 11
	11/29/18	1105 ± 143	< 6	< 6	< 39	< 11
	12/12/18	1149 ± 149	< 7	< 6	< 23	< 8
	MEAN ± 2 STD DEV	1191 ± 242	-	-	-	-
P4-1	01/10/18	1286 ± 168	< 10	< 10	< 44	< 9
	02/07/18	1255 ± 181	< 8	< 9	< 30	< 10
	03/07/18	1424 ± 204	< 6	< 11	< 34	< 10
	03/23/18	1397 ± 189	< 8	< 7	< 25	< 12
	04/04/18	939 ± 171	< 10	< 8	< 30	< 11
	04/18/18	1266 ± 186	< 7	< 8	< 35	< 7
	05/02/18	1041 ± 113	< 6	< 6	< 41	< 12
	05/16/18	887 ± 133	< 6	< 7	< 35	< 9
	05/31/18	1224 ± 218	< 10	< 9	< 46	< 14
	06/14/18	1098 ± 195	< 10	< 8	< 47	< 13
	06/27/18	1354 ± 187	< 7	< 8	< 33	< 8
	07/11/18	1374 ± 201	< 9	< 8	< 33	< 11
	07/25/18	1388 ± 222	< 10	< 8	< 47	< 11
	08/08/18	1535 ± 202	< 9	< 6	< 33	< 12
	08/22/18	1524 ± 216	< 10	< 8	< 37	< 8
	09/05/18	1259 ± 179	< 9	< 10	< 31	< 12
	09/19/18	1323 ± 204	< 9	< 8	< 39	< 8
	10/03/18	936 ± 149	< 7	< 6	< 45	< 13
	10/17/18	1272 ± 121	< 6	< 5	< 39	< 12
	10/31/18	1240 ± 150	< 8	< 8	< 38	< 7
	11/14/18	1168 ± 167	< 7	< 7	< 37	< 11
	11/29/18	1347 ± 155	< 7	< 8	< 37	< 14
	12/12/18	1288 ± 152	< 7	< 6	< 22	< 5
	MEAN ± 2 STD DEV	1253 ± 350	-	-	-	-

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

Table C-IX.1 CONCENTRATIONS OF STRONTIUM AND GAMMA EMITTERS IN FOOD PRODUCT SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

SITE	COLLECTION PERIOD	Sr-90	Be-7	K-40	I-131	Cs-134	Cs-137
B10-2							
Kale	06/28/18	< 4.0	653 ± 303	3686 ± 550	< 57	< 36	< 32
Cabbage	06/28/18	4.8 ± 0.7	362 ± 222	3189 ± 589	< 57	< 39	< 27
Brussels Sprouts	06/28/18	8.3 ± 0.9	697 ± 207	3749 ± 432	< 56	< 22	< 21
Kale	07/25/18	5.0 ± 1.2	3476 ± 213	3038 ± 323	< 27	< 16	< 17
Cabbage	07/25/18	12.8 ± 1.7	733 ± 349	4177 ± 677	< 46	< 38	< 34
Brussels Sprouts	07/25/18	9.4 ± 1.4	814 ± 169	4684 ± 366	< 31	< 21	< 19
Corn	08/09/18	< 2.9	< 204	3489 ± 457	< 37	< 29	< 26
Tomato	08/09/18	< 4.0	< 169	2032 ± 435	< 32	< 21	< 20
Watermelon	08/22/18	38.0 ± 2.2	3431 ± 370	4088 ± 556	< 40	< 38	< 30
Pumpkin	08/22/18	17.4 ± 2.1	1001 ± 293	3535 ± 482	< 33	< 19	< 23
Suflower	08/22/18	7.9 ± 1.8	1914 ± 165	7286 ± 382	< 19	< 14	< 13
Sweet Potato	10/16/18	< 2.3	< 148	4173 ± 386	< 34	< 18	< 17
	MEAN ± 2 STD DEV	12.9 ± 21.9	1453 ± 2424	3927 ± 2513	-	-	-
E1-2							
Kale	06/28/18	1.6 ± 0.6	297 ± 86	5615 ± 241	< 18	< 11	< 10
Cabbage	06/28/18	8.9 ± 1.9	< 231	4851 ± 674	< 44	< 35	< 31
Collards	06/28/18	1.2 ± 0.6	398 ± 234	4997 ± 800	< 53	< 38	< 35
Kale	07/25/18	< 1.5	1074 ± 330	2733 ± 556	< 53	< 34	< 28
Cabbage	07/25/18	< 1.6	1253 ± 302	4529 ± 594	< 45	< 29	< 29
Brussels Spouts	07/25/18	6.1 ± 1.4	1094 ± 313	2837 ± 546	< 45	< 34	< 23
Corn	08/09/18	< 3.7	< 158	3800 ± 527	< 37	< 26	< 18
Tomato	08/09/18	< 3.5	< 170	1946 ± 343	< 33	< 21	< 19
Kale	08/22/18	< 1.1	1087 ± 172	1993 ± 242	< 21	< 15	< 14
Cabbage	08/22/18	< 2.6	1327 ± 283	4500 ± 582	< 37	< 30	< 29
Collards	08/22/18	< 2.5	682 ± 243	2828 ± 439	< 33	< 21	< 21
Sweet Potato	10/16/18	< 3.2	< 102	4306 ± 383	< 26	< 14	< 13
	MEAN ± 2 STD DEV	4.4 ± 7.4	902 ± 783	3745 ± 2471	-	-	-
H1-2							
Squash	06/28/18	11.3 ± 1.4	716 ± 87	3406 ± 206	< 15	< 9	< 9
Zucchini	06/28/18	< 3.1	1313 ± 326	4499 ± 587	< 44	< 28	< 25
Cucumber	06/28/18	2.5 ± 1.1	1714 ± 133	4502 ± 247	< 21	< 12	< 12
Squash	07/25/18	29.2 ± 4.0	5490 ± 507	2326 ± 552	< 55	< 34	< 30
Zucchini	07/25/18	16.3 ± 1.8	2397 ± 455	3569 ± 674	< 47	< 37	< 34
Cucumber	07/25/18	34.5 ± 3.1	2513 ± 382	3441 ± 642	< 43	< 32	< 30
Squash	08/22/18	18.3 ± 2.1	2305 ± 496	2905 ± 628	< 49	< 31	< 35
Pumpkin	08/22/18	27.5 ± 3.6	2250 ± 317	2465 ± 513	< 41	< 31	< 28
Cucumber	08/22/18	15.7 ± 1.6	1222 ± 243	3423 ± 496	< 38	< 23	< 27
	MEAN ± 2 STD DEV	19.4 ± 20.9	2213 ± 2753	3393 ± 1537	-	-	-

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

Table C-X.1 QUARTERLY OSLD RESULTS FOR THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF MILLIREM/QUARTER

STATION CODE	MEAN ± 2 S.D.	JAN - MAR	APR - JUN	JUL - SEP	OCT - DEC
A1-4	13.7 ± 4.6	13.1	17.0	12.9	11.7
A3-1	13.3 ± 4.3	11.9	16.3	13.2	11.6
A5-1	16.6 ± 4.0	14.9	19.4	*16.5*	15.6
A9-3	14.3 ± 3.5	14.1	16.5	14.2	12.2
B1-1	14.4 ± 4.1	13.6	17.3	14.3	12.5
B1-2	13.9 ± 3.6	13.4	16.4	13.6	12.1
B2-1	14.6 ± 4.4	13.5	17.6	14.8	12.6
B5-1	16.3 ± 4.4	14.2	19.0	17.0	14.8
C1-1	16.0 ± 3.6	15.5	18.5	15.8	14.2
C1-2	13.7 ± 4.9	11.9	17.2	13.5	12.1
C2-1	15.7 ± 4.8	15.8	18.6	15.6	12.7
C5-1	17.2 ± 3.2	17.1	19.4	16.2	15.9
C8-1	18.0 ± 4.2	19.6	19.7	17.1	15.4
D1-1	14.4 ± 3.8	13.9	17.2	13.4	13.1
D1-2	15.7 ± 4.7	14.7	19.0	15.6	13.5
D2-2	19.7 ± 4.1	18.6	22.3	20.3	17.7
D6-1	19.1 ± 3.3	19.6	21.2	18.4	17.3
E1-2	14.7 ± 4.6	15.1	17.0	15.1	11.5
E1-4	14.1 ± 4.0	13.8	16.9	13.5	12.2
E2-3	17.1 ± 6.2	14.4	20.8	18.6	14.7
E5-1	18.5 ± 5.1	17.1	22.1	18.6	16.3
E7-1	17.0 ± 4.7	18.9	19.0	15.4	14.5
F1-1	16.2 ± 3.8	17.5	17.9	15.3	13.9
F1-2	15.3 ± 4.4	14.3	18.4	15.0	13.4
F1-4	14.3 ± 4.6	13.4	17.5	13.9	12.2
F2-1	18.8 ± 4.6	20.4	21.0	17.4	16.2
F5-1	18.9 ± 5.2	17.7	22.6	18.4	16.7
G1-2	17.6 ± 4.3	19.3	19.2	17.1	14.7
G1-3	13.7 ± 3.8	13.5	15.9	13.9	11.3
G1-5	14.4 ± 6.6	12.5	19.3	13.6	12.3
G1-6	14.6 ± 3.5	13.9	17.1	14.1	13.1
G2-4	21.5 ± 5.2	24.9	22.0	19.9	19.0
G5-1	17.6 ± 6.6	22.4	16.3	16.5	15.1
H1-1	15.7 ± 5.1	14.4	18.9	16.4	13.0
H3-1	12.9 ± 3.7	12.8	15.3	12.8	10.8
H5-1	11.7 ± 5.2	10.8	15.3	11.4	9.1
H8-1	26.6 ± 6.3	23.9	30.4	27.9	24.1
J1-1	14.9 ± 3.9	14.9	17.1	15.2	12.4
J1-3	12.0 ± 3.8	11.7	14.3	12.1	9.7
J3-1	16.2 ± 4.0	14.7	19.1	15.8	15.0
J5-1	17.7 ± 4.5	15.9	20.9	17.6	16.4
J7-1	19.4 ± 4.6	18.4	22.8	18.9	17.6
K1-4	14.8 ± 3.5	14.7	17.1	14.3	12.9
K2-1	18.9 ± 3.1	17.8	20.8	17.5	*19.6*
K3-1	14.3 ± 5.2	12.5	17.9	14.5	12.2
K5-1	17.1 ± 4.8	14.3	20.0	17.6	16.4
K8-1	16.2 ± 5.2	14.4	19.6	16.9	14.0

(1) SEE PROGRAM EXCEPTIONS SECTION FOR INFORMATION

Table C-X.1 QUARTERLY OSLD RESULTS FOR THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF MILLIREM/QUARTER

STATION CODE	MEAN ± 2 S.D.	JAN - MAR	APR - JUN	JUL - SEP	OCT - DEC
L1-1	14.4 ± 4.3	14.6	16.8	14.4	11.6
L1-2	14.1 ± 3.3	13.9	16.5	13.0	*13.1*
L2-1	15.3 ± 4.8	13.9	18.1	16.3	12.7
L5-1	14.0 ± 4.6	12.9	17.3	13.7	12.1
L8-1	15.5 ± 4.8	14.5	18.6	15.9	13.0
M1-1	14.3 ± 4.1	13.0	17.3	13.9	12.9
M1-2	15.5 ± 3.0	15.5	17.5	14.8	*14*
M2-1	13.8 ± 4.9	12.4	17.4	13.3	12.1
M5-1	15.6 ± 5.5	14.1	18.7	16.8	12.6
M9-1	20.1 ± 6.0	18.6	24.3	20.2	17.4
N1-1	15.1 ± 3.1	14.9	17.3	14.4	*13.8*
N1-3	14.1 ± 4.0	13.4	16.6	14.4	11.8
N2-1	16.6 ± 4.2	14.4	19.3	17.1	15.7
N5-1	13.3 ± 4.3	12.6	16.4	12.7	11.4
N8-1	16.9 ± 3.5	16.3	19.0	17.4	14.8
P1-1	15.1 ± 2.6	14.9	16.8	13.7	*15*
P1-2	14.5 ± 5.2	16.9	16.1	13.9	11.1
P2-1	18.9 ± 5.1	17.1	22.6	18.6	17.4
P5-1	15.7 ± 4.0	14.3	18.5	15.9	14.2
P8-1	13.4 ± 3.8	12.6	16.2	11.9	13.0
Q1-1	15.4 ± 3.2	15.2	17.6	14.8	*13.8*
Q1-2	12.9 ± 3.9	13.3	15.3	12.2	10.7
Q2-1	13.5 ± 5.7	11.3	17.4	13.9	11.4
Q5-1	14.2 ± 4.0	13.2	17.0	14.0	12.5
Q9-1	15.7 ± 4.8	13.8	18.9	16.0	13.9
R1-1	14.4 ± 4.2	14.9	16.8	13.9	11.8
R1-2	13.8 ± 2.8	13.4	15.9	12.8	*13.2*
R3-1	18.0 ± 3.4	18.0	20.1	18.1	15.9
R5-1	17.9 ± 3.9	16.5	20.8	17.3	17.0
R9-1	16.6 ± 3.4	17.6	15.9	18.2	14.5
B10-1	15.8 ± 3.2	16.1	17.9	15.2	14.1
D15-1	16.3 ± 4.0	15.6	19.0	16.3	14.2
F10-1	19.3 ± 5.3	16.2	22.7	19.3	19.0
F25-1	18.4 ± 5.1	18.5	21.9	17.5	15.8
G10-1	22.5 ± 8.5	17.1	27.3	23.8	21.9
G15-1	22.1 ± 3.2	23.8	22.8	21.7	20.1
H15-1	16.1 ± 5.3	13.2	19.6	15.9	15.5
J15-1	19.5 ± 4.8	17.3	22.9	19.0	18.6
K15-1	15.7 ± 3.4	13.7	17.8	15.8	15.6
L15-1	16.9 ± 5.5	14.6	20.6	17.3	15.1
N15-2	18.3 ± 3.3	16.7	20.4	18.8	17.3
Q15-1	17.7 ± 4.7	15.9	20.5	18.8	15.6
R15-1	15.1 ± 2.3	15.7	15.9	15.3	13.4

(1) SEE PROGRAM EXCEPTIONS SECTION FOR INFORMATION

TABLE C-X.2 MEAN QUARTERLY OSLD RESULTS FOR THE SITE BOUNDARY, INDICATOR CONTROL LOCATIONS FOR THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF MILLIREM/QUARTER
± 2 STANDARD DEVIATIONS OF THE STATION DATA

COLLECTION PERIOD	SITE BOUNDARY ± 2 STD DEV	INDICATOR	CONTROL
JAN-MAR	13.7 ± 2.3	15.8 ± 5.8	16.6 ± 5.7
APR-JUN	17.0 ± 2.3	19.0 ± 5.2	20.8 ± 6.0
JUL-SEP	13.8 ± 1.9	16.2 ± 5.2	18.2 ± 5.3
OCT-DEC	12.1 ± 1.9	14.6 ± 5.0	16.6 ± 5.2

TABLE C-X.3 SUMMARY OF THE AMBIENT DOSIMETRY PROGRAM FOR THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF MILLIREMQUARTER

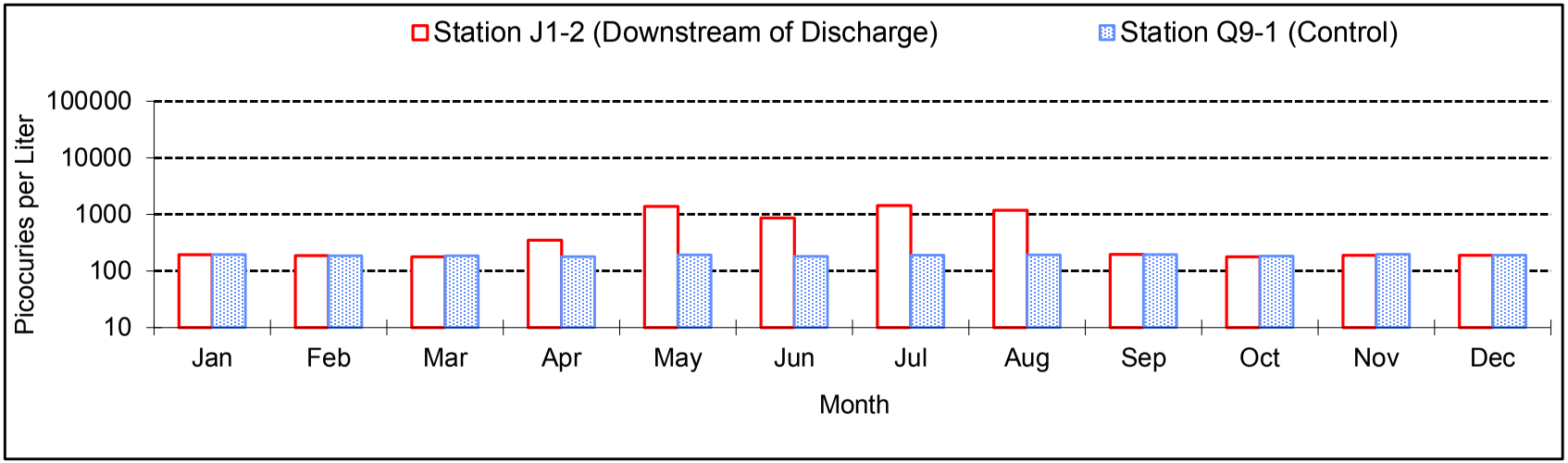
LOCATION	SAMPLES ANALYZED	PERIOD MINIMUM	PERIOD MAXIMUM	PERIOD MEAN ± 2 STD DEV
SITE BOUNDARY	76	9.7	19.3	14.1 ± 4.1
INDICATOR	240	9.1	30.4	16.4 ± 6.2
CONTROL	44	13.2	27.3	18.0 ± 6.4

SITE BOUNDARY STATIONS - A1-4, B1-2, C1-2, D1-1, E1-4, F1-2, F1-4, G1-3, G1-5, G1-6, H1-1, J1-3, K1-4, L1-1, M1-1, N1-3, P1-2, Q1-2, R1-1

INDICATOR STATIONS - A3-1, A5-1, A9-3, B1-1, B10-1, B2-1, B5-1, C1-1, C2-1, C5-1, C8-1, D1-2, D2-2, D6-1, E1-2, E2-3, E5-1, E7-1, F1-1, F10-1, F2-1, F5-1, G1-2, G2-4, G5-1, H3-1, H5-1, H8-1, J1-1, J3-1, J5-1, J7-1, K2-1, K3-1, K5-1, K8-1, L1-2, L2-1, L5-1, L8-1, M1-2, M2-1, M5-1, M9-1, N1-1, N2-1, N5-1, N8-1, P1-1, P2-1, P5-1, Q1-1, Q2-1, Q5-1, Q9-1, R1-2, R3-1, R5-1, R9-1

CONTROL STATIONS - D15-1, F25-1, G10-1, G15-1, H15-1, J15-1, K15-1, L15-1, N15-1, Q15-1, R15-1

FIGURE C-1
Monthly Tritium Concentrations in Surface Water and Effluent Water
Three Mile Island Nuclear Station, 2018



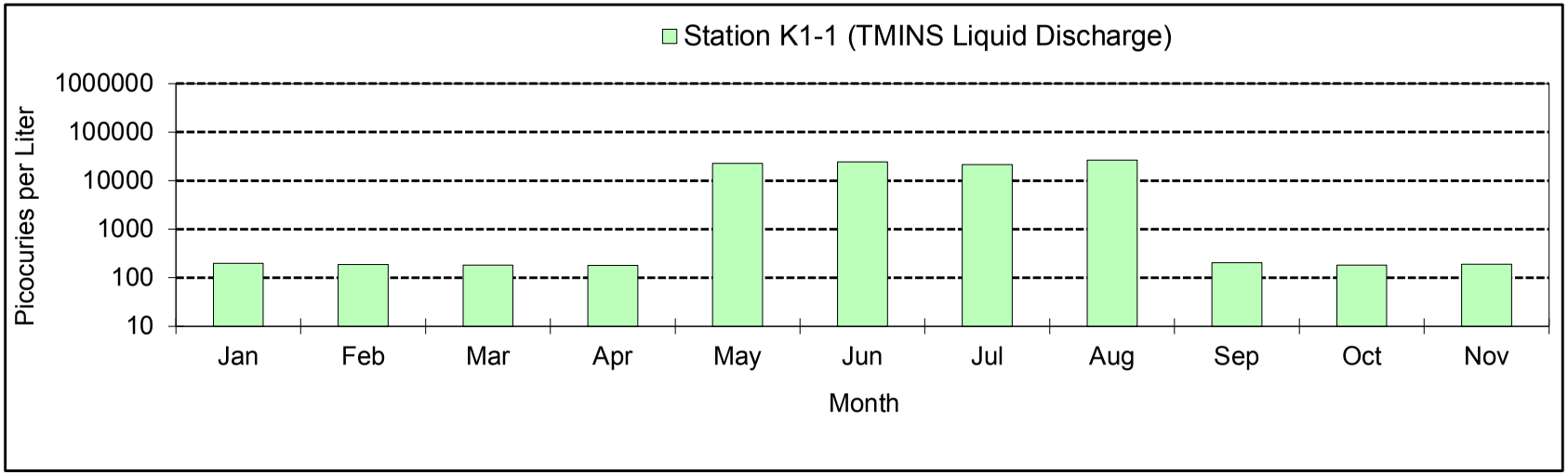


FIGURE C-2
Mean Quarterly Tritium Concentrations in Surface Water
Three Mile Island Nuclear Station, 1974 - 2018

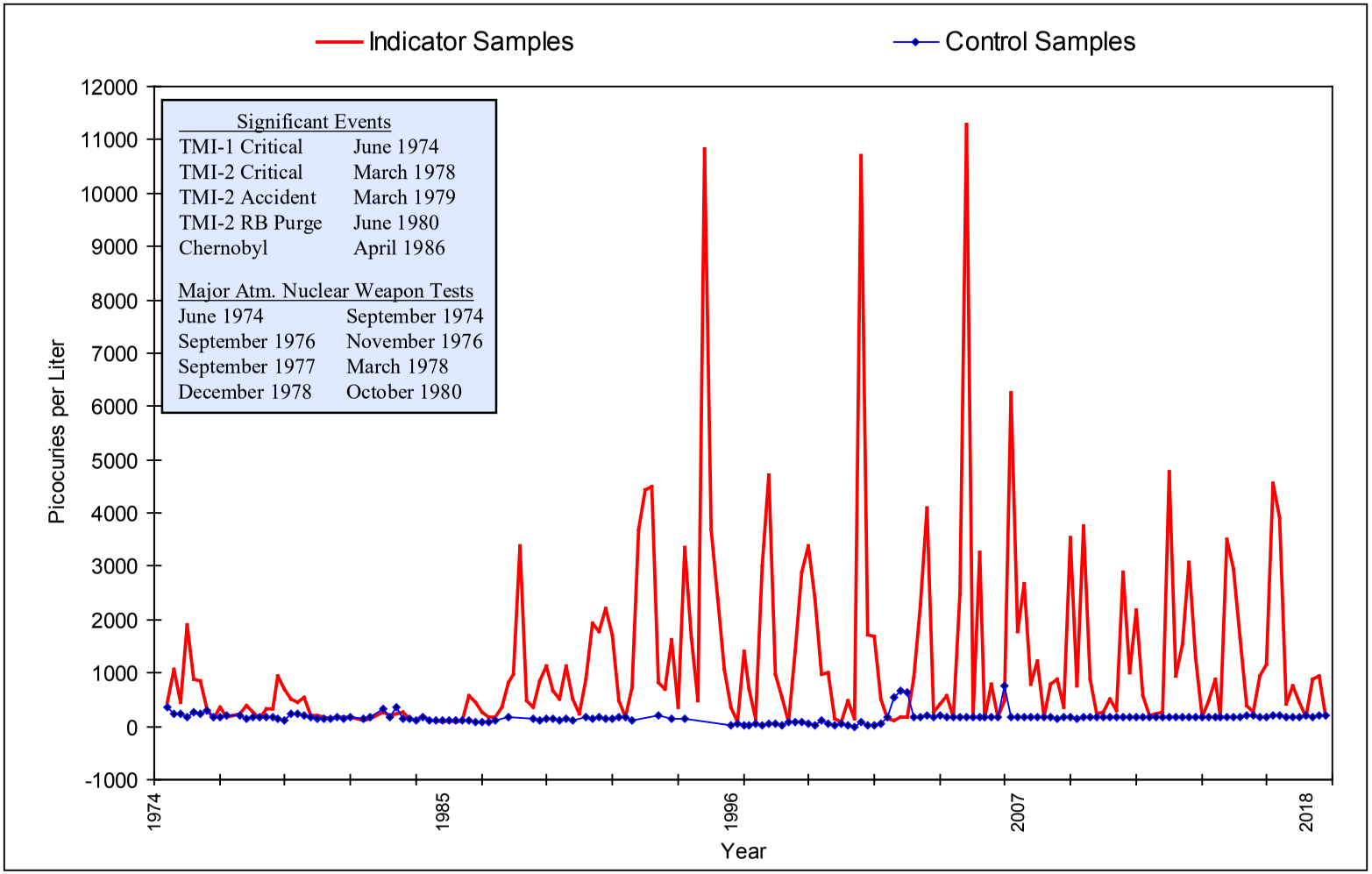


FIGURE C-3
Mean Monthly Gross Beta Concentrations in Drinking Water
Three Mile Island Nuclear Station, 2018

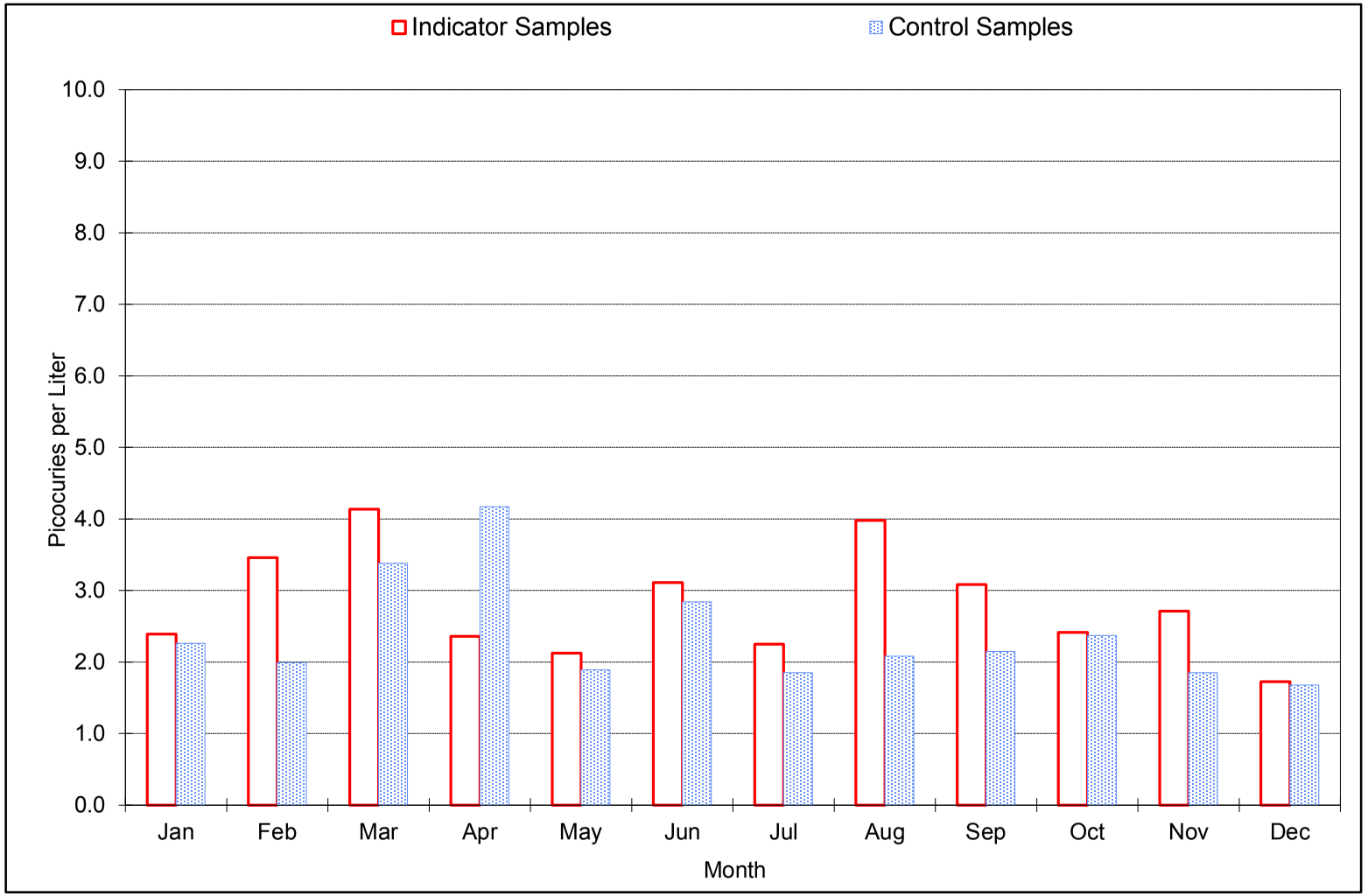
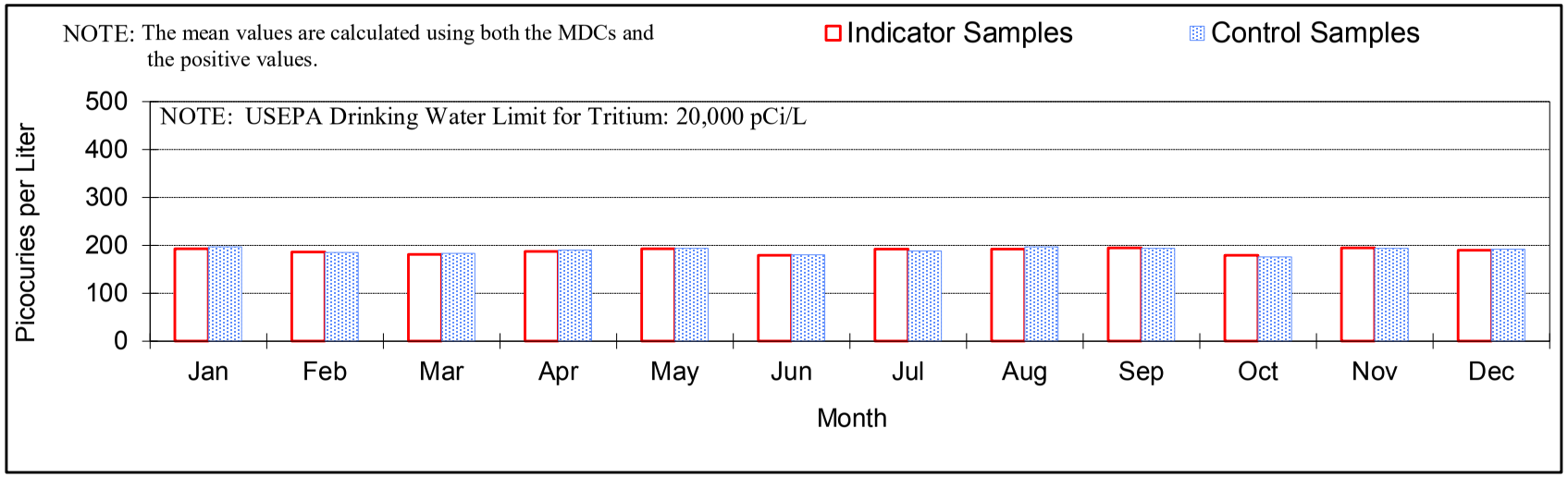


FIGURE C-4
Mean Monthly Tritium Concentrations in Drinking Water and Effluent Water
Three Mile Island Nuclear Station, 2018



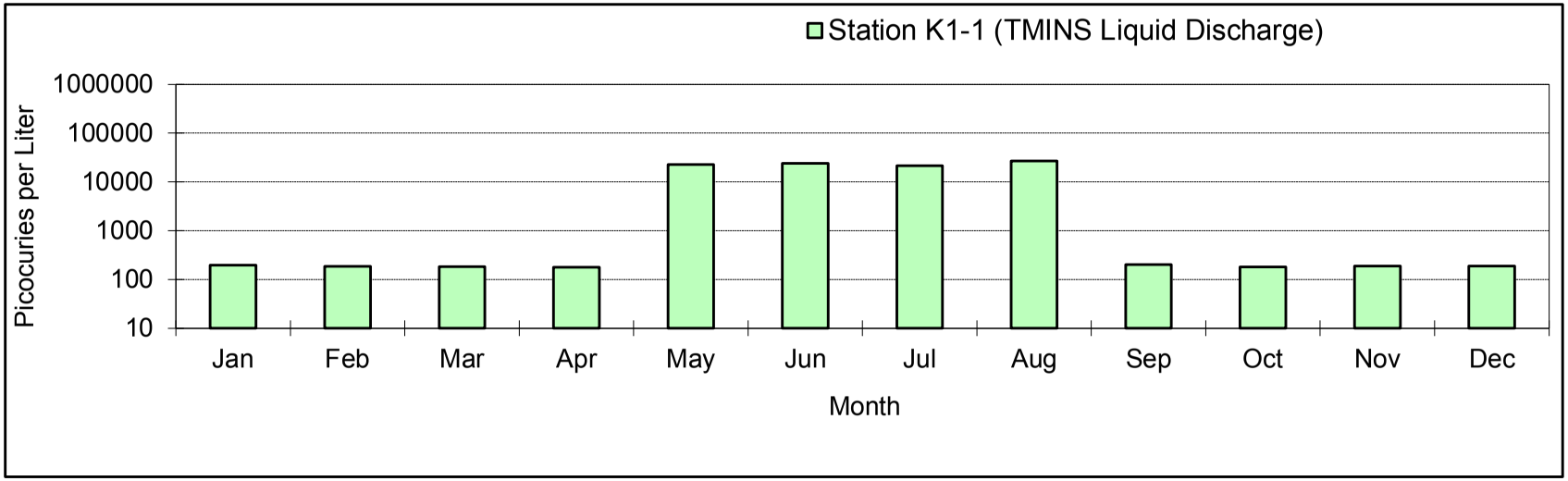


FIGURE C-5
Mean Cesium-137 Concentrations in Aquatic Sediments
Three Mile Island Nuclear Station, 1984 – 2018

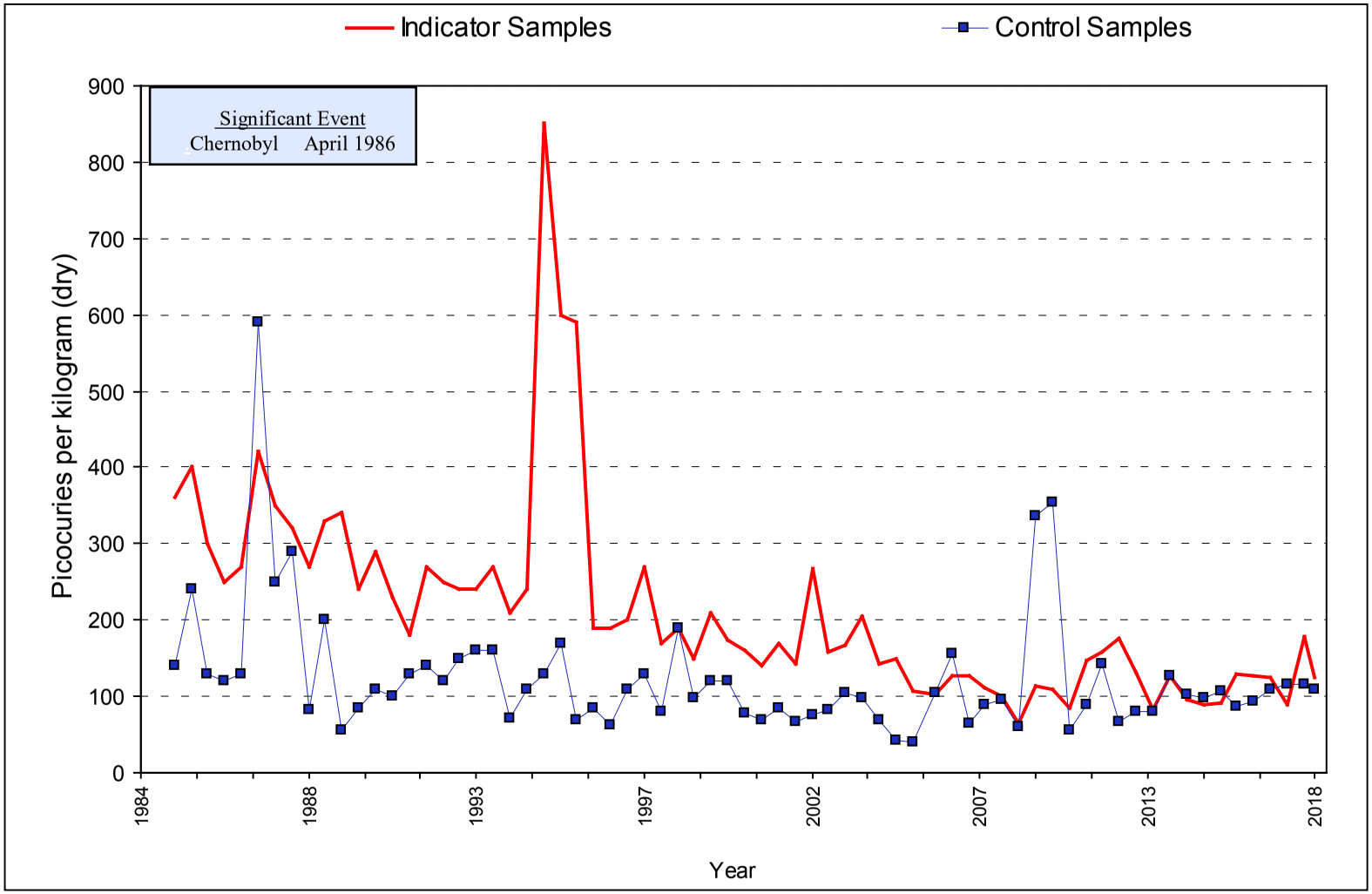


FIGURE C-6
Mean Quarterly Gross Beta Concentrations in Air Particulates
Three Mile Island Nuclear Station, 1972 - 2018

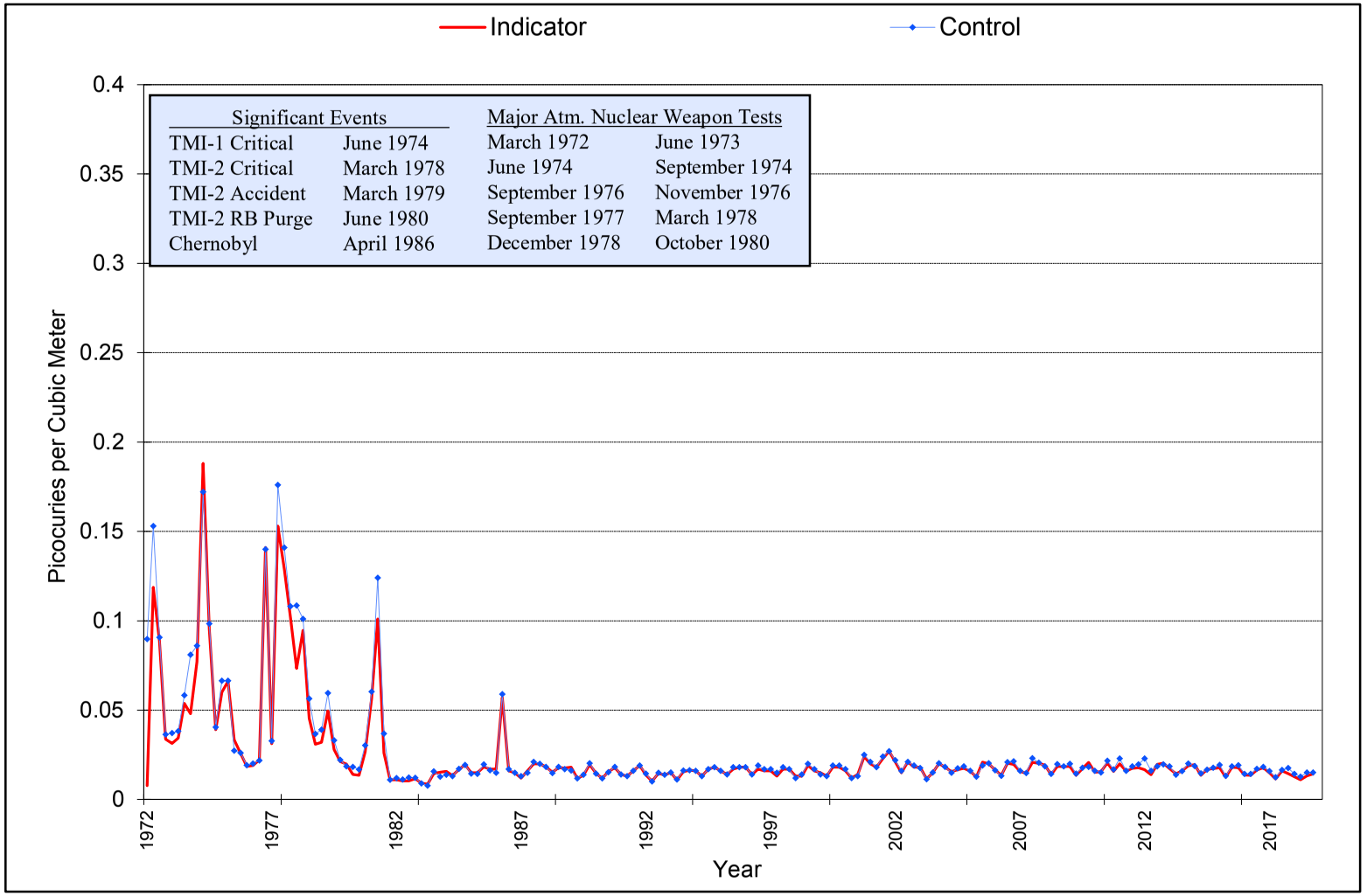
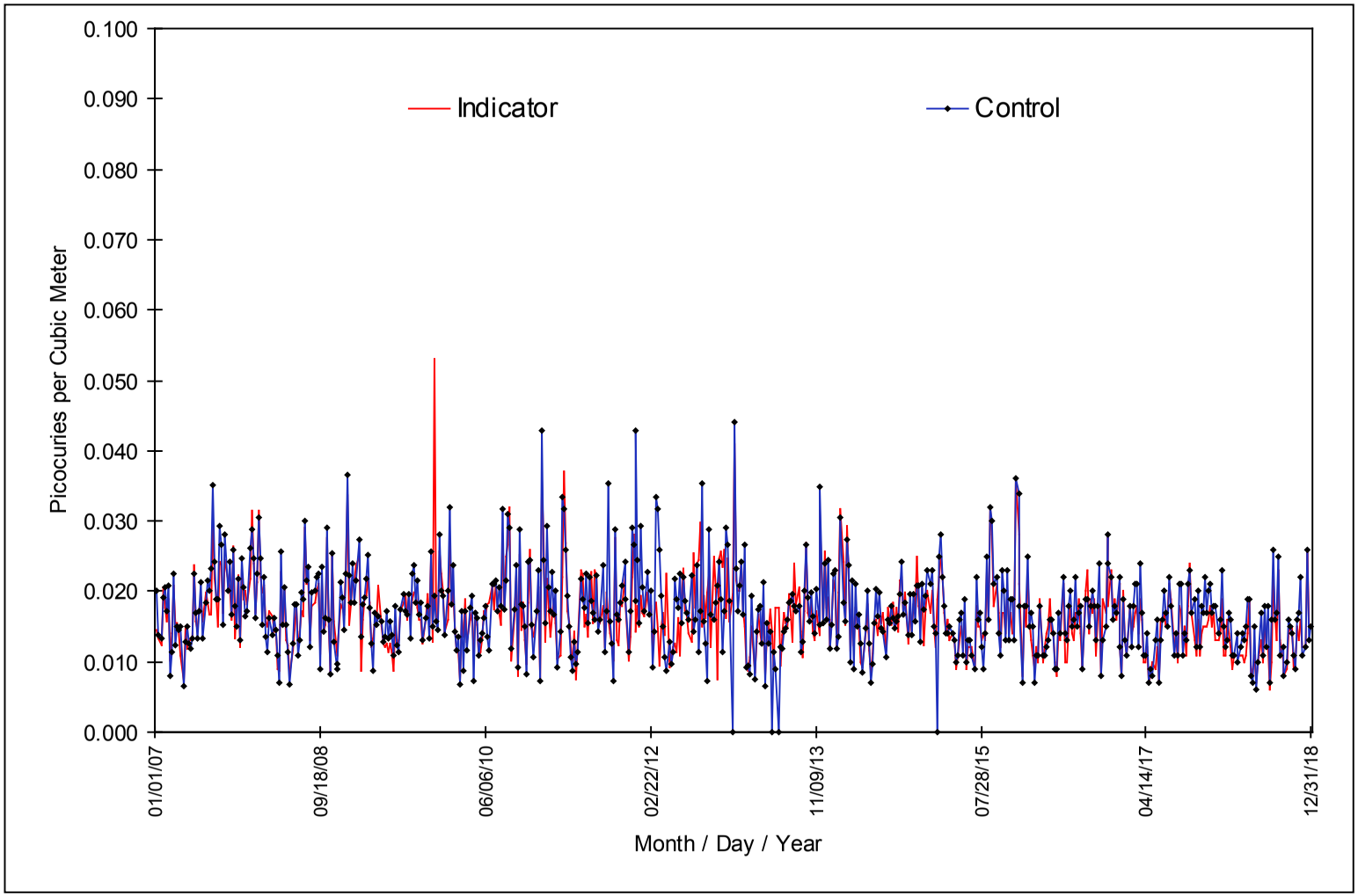
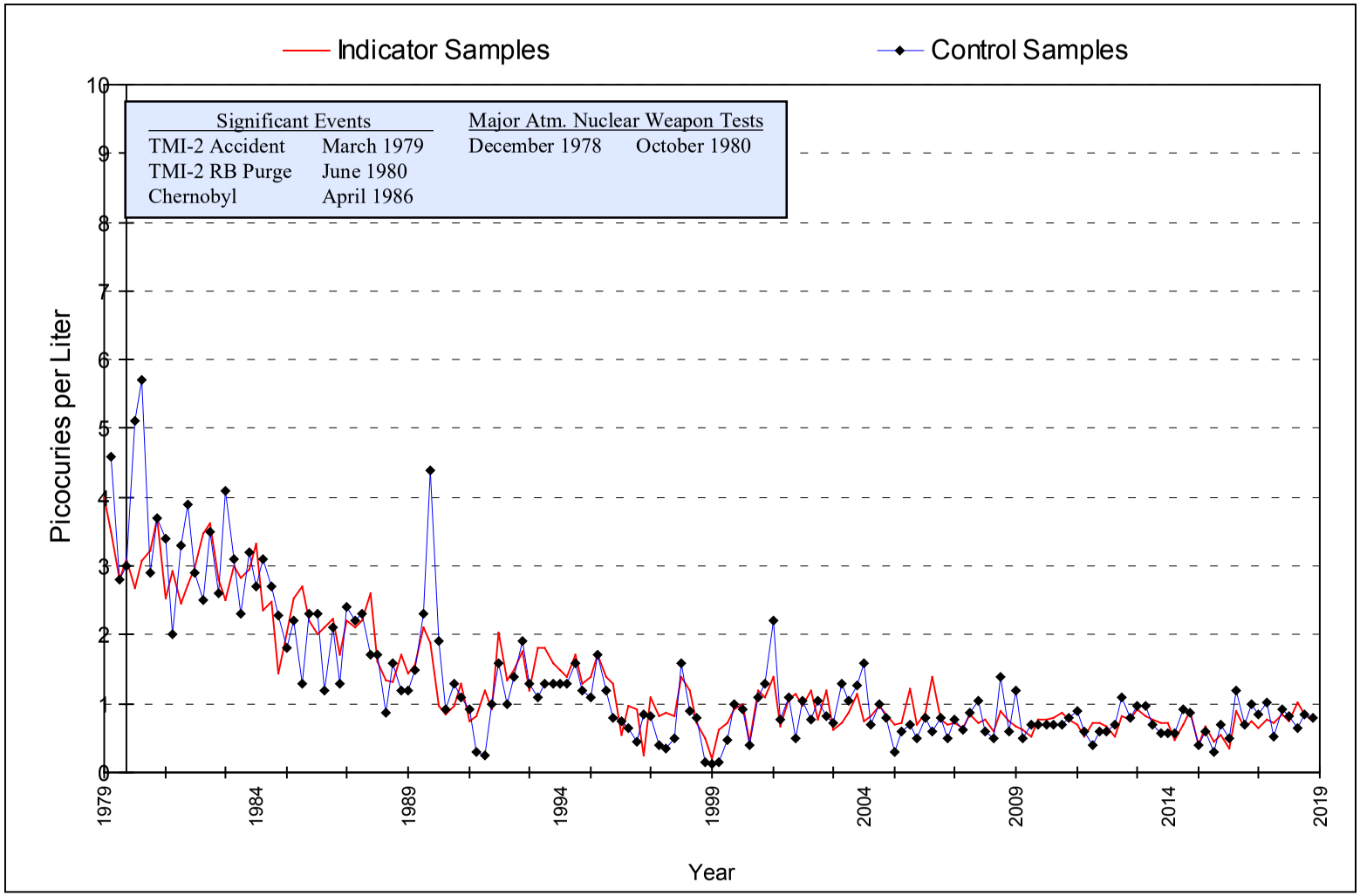


FIGURE C-7
Mean Weekly Gross Beta Concentrations in Air Particulates
Three Mile Island Nuclear Station, 2007 - 2018



The high value on 11/24/2009 was caused by an airborne release on 11/21/2009

FIGURE C-8
Mean Quarterly Strontium-90 Concentrations in Cow Milk
Three Mile Island Nuclear Station, 1979 - 2018



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APPENDIX D

DATA TABLES AND FIGURES
COMPARISON LABORATORIES

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The following section presents the results of data analysis performed by the QC laboratories, Exelon Industrial Services (EIS) and GEL Laboratories (GEL). Duplicate samples were obtained from several locations and media and were split with the primary laboratory, Teledyne Brown Engineering (TBE). Comparison of the results for most media were within expected ranges.

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TABLE D-I.1 CONCENTRATIONS OF GROSS BETA IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

LAB	COLLECTION PERIOD	Q9-1Q
EIS	01/03/18 - 01/30/18	2.0 ± 0.6
	01/30/18 - 02/27/18	1.9 ± 0.6
	02/27/18 - 03/27/18	1.1 ± 0.6
	03/27/18 - 05/01/18	1.3 ± 0.6
	05/01/18 - 05/31/18	2.4 ± 0.7
	05/31/18 - 06/26/18	2.6 ± 0.7
	06/26/18 - 07/31/18	2.1 ± 0.6
	07/31/18 - 08/29/18	1.7 ± 0.7
	08/29/18 - 09/25/18	1.9 ± 0.7
	09/25/18 - 10/31/18	1.5 ± 0.6
	10/31/18 - 11/29/18	1.5 ± 0.7
	11/29/18 - 01/03/19	0.8 ± 0.6
	MEAN ± 2 STD DEV	1.7 ± 1.1

TABLE D-I.2 CONCENTRATIONS OF TRITIUM IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

LAB	COLLECTION PERIOD	Q9-1Q
GEL	01/03/18 - 03/27/18	< 123
	03/27/18 - 06/06/18	< 112
	06/06/18 - 09/25/18	< 102
	09/25/18 - 01/03/19	< 141
	MEAN	-

TABLE D-I.3 CONCENTRATIONS OF IODINE-131 IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

LAB	COLLECTION PERIOD	Q9-1Q
EIS	01/03/18 - 01/30/18	< 0.4
	01/30/18 - 02/27/18	< 0.6
	02/27/18 - 03/27/18	< 0.7
	03/27/18 - 05/01/18	< 0.5
	05/01/18 - 05/31/18	< 0.6
	05/31/18 - 06/26/18	< 0.9
	06/26/18 - 07/31/18	< 0.6
	07/31/18 - 08/29/18	< 0.7
	08/29/18 - 09/25/18	< 0.6
	09/25/18 - 10/31/18	< 0.5
	10/31/18 - 11/29/18	< 0.7
	11/29/18 - 01/03/09	< 0.8
	MEAN	-

THE MEAN AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUES

TABLE D-I.4

CONCENTRATIONS OF GAMMA EMITTERS IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

LAB	SITE	COLLECTION PERIOD	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140
EIS	Q9-1Q	01/03/18 - 01/30/18	< 4	< 10	< 5	< 5	< 10	< 5	< 7	< 5	< 4	< 19	< 8
		01/30/18 - 02/27/18	< 4	< 12	< 5	< 4	< 11	< 5	< 8	< 4	< 4	< 20	< 8
		02/27/18 - 03/27/18	< 4	< 8	< 4	< 3	< 9	< 5	< 7	< 4	< 5	< 21	< 9
		03/27/18 - 05/01/18	< 4	< 9	< 4	< 5	< 9	< 4	< 6	< 4	< 5	< 16	< 7
		05/01/18 - 05/31/18	< 5	< 12	< 4	< 5	< 10	< 6	< 9	< 4	< 4	< 35	< 13
		05/31/18 - 06/26/18	< 4	< 8	< 4	< 4	< 8	< 4	< 6	< 3	< 4	< 17	< 6
		06/26/18 - 07/31/18	< 4	< 10	< 4	< 4	< 8	< 5	< 7	< 4	< 4	< 19	< 10
		07/31/18 - 08/29/18	< 5	< 10	< 4	< 4	< 9	< 5	< 7	< 4	< 4	< 22	< 11
		08/29/18 - 09/25/18	< 4	< 7	< 4	< 4	< 7	< 4	< 7	< 3	< 4	< 19	< 7
		09/25/18 - 10/31/18	< 6	< 10	< 5	< 6	< 14	< 5	< 7	< 5	< 5	< 20	< 7
		10/31/18 - 11/29/18	< 3	< 7	< 3	< 3	< 7	< 3	< 5	< 3	< 3	< 15	< 5
		11/29/18 - 01/03/19	< 4	< 8	< 4	< 4	< 7	< 4	< 6	< 4	< 4	< 19	< 7
		MEAN	-	-	-	-	-	-	-	-	-	-	-

TABLE D-II.1

CONCENTRATIONS OF STRONTIUM AND GAMMA EMITTERS IN FISH SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

LAB	SITE	COLLECTION PERIOD	Sr-89	Sr-90	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Cs-134	Cs-137
EIS	INDP	10/12/18			2890 ± 375	< 25	< 23	< 50	< 25	< 64	< 21	< 20

TABLE D-III.1 CONCENTRATIONS OF GAMMA EMITTERS IN SEDIMENT SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018

LAB	SITE	COLLECTION PERIOD	K-40	Cs-134	Cs-137
EIS	J2-1	10/25/18	16028 ± 1594	< 96	< 120

TABLE D-IV.1 CONCENTRATIONS OF GAMMA EMITTERS AND STRONTIUM IN FOOD PRODUCT SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

LAB	SITE	TYPE	COLLECTION PERIOD	Be-7	K-40	I-131	Cs-134	Cs-137	Sr-89	Sr-90
EIS	B10-2Q	Cabbage Leaves	06/28/18	379 ± 86	3728 ± 266	< 47	< 12	< 12		
GEL	B10-2Q	Cabbage Leaves	06/28/18						< 3.0	< 0.7
EIS	H1-2Q	Yellow Squash Leaves	06/28/18	701 ± 106	4164 ± 263	< 48	< 11	< 12		
GEL	H1-2Q	Yellow Squash Leaves	06/28/18						< 0.2	< 0.2
EIS	H1-2Q	Yellow Squash Leaves	07/25/18	5394 ± 250	2276 ± 227	< 28	< 15	< 18		
GEL	H1-2Q	Yellow Squash Leaves	07/25/18						< 0.3	< 0.1
EIS	H1-2Q	Yellow Squash Leaves	08/22/18	2587 ± 179	2381 ± 232	< 29	< 14	< 15		
GEL	H1-2Q	Yellow Squash Leaves	08/22/18						< 0.1	< 0.2

TABLE D-V.1 CONCENTRATIONS OF GROSS BETA IN AIR PARTICULATE AND I-131 IN AIR IODINE SAMPLES COLLECED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018

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

LAB	COLLECTION PERIOD	E1-2Q GROSS BETA	E1-2Q I-131
EIS	12/28/17 - 01/04/18	25 ± 2	< 16
	01/04/18 - 01/11/18	26 ± 2	< 20
	01/11/18 - 01/18/18	22 ± 2	< 17
	01/18/18 - 01/25/18	29 ± 3	< 10
	01/25/18 - 02/01/18	19 ± 2	< 16
	02/01/18 - 02/08/18	19 ± 2	< 13
	02/08/18 - 02/15/18	28 ± 2	< 19
	02/15/18 - 02/22/18	22 ± 2	< 18
	02/22/18 - 03/01/18	20 ± 2	< 12
	03/01/18 - 03/08/18	17 ± 2	< 9
	03/08/18 - 03/15/18	15 ± 2	< 13
	03/15/18 - 03/23/18	19 ± 2	< 10
	03/23/18 - 03/29/18	19 ± 2	< 22
	03/29/18 - 04/05/18	17 ± 2	< 24
	04/05/18 - 04/12/18	22 ± 2	< 20
	04/12/18 - 04/19/18	15 ± 2	< 16
	04/19/18 - 04/26/18	18 ± 2	< 24
	04/26/18 - 05/03/18	24 ± 2	< 14
	05/03/18 - 05/10/18	25 ± 2	< 15
	05/10/18 - 05/17/18	16 ± 2	< 22
	05/17/18 - 05/24/18	15 ± 2	< 22
	05/24/18 - 05/31/18	18 ± 2	< 24
	05/31/18 - 06/07/18	13 ± 2	< 12
	06/07/18 - 06/13/18	19 ± 2	< 25
	06/13/18 - 06/21/18	20 ± 2	< 21
	06/21/18 - 06/28/18	16 ± 2	< 22
	06/28/18 - 07/05/18	26 ± 2	< 15
	07/05/18 - 07/12/18	19 ± 2	< 15
	07/12/18 - 07/19/18	24 ± 2	< 14
	07/19/18 - 07/26/18	12 ± 2	< 20
	07/26/18 - 08/02/18	22 ± 2	< 21
	08/02/18 - 08/09/18	34 ± 3	< 20
	08/09/18 - 08/16/18	30 ± 3	< 17
	08/16/18 - 08/23/18	23 ± 2	< 11
	08/23/18 - 08/29/18	37 ± 3	< 19
	08/29/18 - 09/06/18	25 ± 2	< 15
	09/06/18 - 09/13/18	15 ± 2	< 11
	09/13/18 - 09/19/18	15 ± 2	< 12
	09/19/18 - 09/27/18	18 ± 2	< 18
	09/27/18 - 10/04/18	28 ± 2	< 19
	10/04/18 - 10/12/18	29 ± 2	< 17
	10/12/18 - 10/18/18	17 ± 2	< 15
	10/18/18 - 10/25/18	18 ± 2	< 18
	10/25/18 - 10/31/18	15 ± 2	< 31
	10/31/18 - 11/08/18	20 ± 2	< 13
	11/08/18 - 11/15/18	16 ± 2	< 21
	11/15/18 - 11/21/18	28 ± 3	< 18
	11/21/18 - 11/29/18	20 ± 2	< 17
	11/29/18 - 12/06/18	14 ± 2	< 20
	12/06/18 - 12/13/18	34 ± 3	< 16
	12/13/18 - 12/20/18	26 ± 2	< 26
	12/20/18 - 12/27/18	23 ± 2	< 15
	MEAN ± 2 STD DEV	21 ± 11	-

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

TABLE D-V.2 CONCENTRATIONS OF GAMMA EMITTERS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018

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

LAB	SITE	COLLECTION PERIOD	Be-7	Cs-134	Cs-137
EIS	E1-2Q	12/28/17 - 03/29/18	61 ± 11	< 1.0	< 1.2
		03/29/18 - 06/28/18	76 ± 10	< 0.9	< 0.9
		06/28/18 - 09/27/18	78 ± 11	< 1.0	< 1.0
		09/27/18 - 12/27/18	58 ± 10	< 1.0	< 1.1
		MEAN ± 2 STD DEV	68 ± 21	-	-

TABLE D-VI.1 CONCENTRATIONS OF I-131 BY CHEMICAL SEPARATION, GAMMA EMITTERS, AND STRONTIUM IN MILK SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

LAB	SITE	COLLECTION DATE	I-131	K-40	Cs-134	Cs-137	Ba-140	La-140	Sr-89	Sr-90
EIS	G2-1Q	01/10/18	< 0.8	1246 ± 111	< 7	< 8	< 32	< 12		
EIS		02/07/18	< 0.8	1218 ± 64	< 3	< 3	< 40	< 14		
EIS		03/07/18	< 0.9	1477 ± 86	< 3	< 3	< 24	< 8		
EIS		03/21/18	< 0.8	1284 ± 113	< 6	< 7	< 31	< 11		
GEL		01/10/18 - 03/21/18								< 0.8
EIS		04/04/18	< 0.7	1405 ± 120	< 4	< 6	< 21	< 8		
EIS		04/18/18	< 0.8	1199 ± 80	< 3	< 4	< 24	< 8		
EIS		05/02/18	< 0.8	1231 ± 83	< 5	< 4	< 21	< 7		
EIS		05/16/18	< 0.8	1640 ± 94	< 4	< 4	< 19	< 6		
EIS		05/30/18	< 0.7	1402 ± 89	< 4	< 4	< 25	< 9		
EIS		06/13/18	< 0.7	1394 ± 86	< 3	< 4	< 23	< 7		
EIS		06/27/18	< 0.7	1307 ± 92	< 4	< 5	< 19	< 7		
GEL		04/04/18 - 06/27/18								< 1.0
EIS		07/11/18	< 0.8	1447 ± 97	< 4	< 5	< 24	< 8		
EIS		07/25/18	< 1.0	1126 ± 77	< 4	< 4	< 32	< 10		
EIS		08/08/18	< 0.9	1423 ± 88	< 4	< 4	< 22	< 6		
EIS		08/22/18	< 0.8	1261 ± 112	< 7	< 7	< 29	< 11		
EIS		09/19/18	< 0.7	1562 ± 122	< 6	< 6	< 23	< 8		
GEL		07/01/18 - 09/19/18							< 4.1	< 0.8
EIS		10/03/18	< 0.9	1108 ± 87	< 5	< 5	< 24	< 9		
EIS		10/17/18	< 0.6	1028 ± 68	< 3	< 3	< 25	< 9		
EIS		10/31/18	< 0.4	1113 ± 77	< 4	< 5	< 19	< 6		
EIS		11/14/18	< 0.8	1189 ± 107	< 6	< 5	< 33	< 11		
EIS		11/29/18	< 0.5	1284 ± 92	< 5	< 6	< 21	< 7		
EIS		12/12/18	< 0.6	1118 ± 85	< 5	< 6	< 25	< 10		
GEL		09/25/18 - 01/03/19							< 0.9	< 0.8
		MEAN ± 2 STD DEV		1294 ± 318	-	-	-	-	-	-

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

APPENDIX E

INTER-LABORATORY COMPARISON PROGRAM

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TABLE E.1 **Analytics Environmental Radioactivity Cross Check Program**
Teledyne Brown Engineering Environmental Services

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

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

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

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

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

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

TABLE E.1 **Analytics Environmental Radioactivity Cross Check Program**
Teledyne Brown Engineering Environmental Services

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

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

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

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

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

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

TABLE E.1 **Analytics Environmental Radioactivity Cross Check Program**
Teledyne Brown Engineering Environmental Services

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

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

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

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

TABLE E.1 **Analytics Environmental Radioactivity Cross Check Program**
Teledyne Brown Engineering Environmental Services

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

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

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

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

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

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

TABLE E.2 **DOE's Mixed Analyte Performance Evaluation Program (MAPEP)**
Teledyne Brown Engineering Environmental Services

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

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

(b) DOE/MAPEP evaluation:

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

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

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

(1) False positive test

(2) Sensitivity evaluation

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

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

TABLE E.3

ERA Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Acceptance Limits	Evaluation [b]
March 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 E.4 Analytics Environmental Radioactivity Cross Check Program
Exelon Industrial Services

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

TABLE E.4 **Analytics Environmental Radioactivity Cross Check Program**
Exelon Industrial Services

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

TABLE E.5 **ERA Environmental Radioactivity Cross Check Program**
Exelon Industrial Services

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 E.6

2018 DEPARTMENT OF ENERGY MIXED ANALYTE PERFORMANCE EVALUATION PROGRAM (MAPEP) RESULTS
GEL LABORATORIES

PT Provider	Quarter / Year	Report Received Date	Sample Number	Sample Media	Unit	Analyte / Nuclide	GEL Value	Known value	Acceptance Range/ Ratio	Evaluation
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaS38	Soil	Bq/Kg	Americium-241	1.84		False Pos Test	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaS38	Soil	Bq/Kg	Cesium-134	1.85		False Pos Test	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaS38	Soil	Bq/Kg	Cesium-137	4.85	4.6	Sens. Eval.	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaS38	Soil	Bq/Kg	Cobalt-57	798	826	578-1074	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaS38	Soil	Bq/Kg	Cobalt-60	581	560	392-728	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaS38	Soil	Bq/Kg	Iron-55	67		False Pos Test	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaS38	Soil	Bq/Kg	Manganese-54	1060	1010	707-1313	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaS38	Soil	Bq/Kg	Nickel-63	1.05		False Pos Test	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaS38	Soil	Bq/Kg	Plutonium-238	42.7	45.2	31.6-58.8	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaS38	Soil	Bq/Kg	Plutonium-239/240	46.9	50.8	35.6-66.0	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaS38	Soil	Bq/Kg	Potassium-40	649	577	404-750	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaS38	Soil	Bq/Kg	Strontium-90	-1.08		False Pos Test	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaS38	Soil	Bq/Kg	Technetium-99	890	980	686-1274	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaS38	Soil	Bq/Kg	U-234/233	58.9	52.9	37.0-68.8	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaS38	Soil	Bq/Kg	Uranium-238	134	141	99-183	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaS38	Soil	Bq/Kg	Zinc-65	1060	960	672-1248	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaW38	Water	Bq/L	Americium-241	0.685	0.709	0.496-0.922	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaW38	Water	Bq/L	Cesium-134	9.140	10.2	7.1-13.3	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaW38	Water	Bq/L	Cesium-137	12.8	12.2	8.5-15.9	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaW38	Water	Bq/L	Cobalt-57	-0.042		False Pos Test	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaW38	Water	Bq/L	Cobalt-60	12.1	11.5	8.1-15.0	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaW38	Water	Bq/L	Hydrogen-3	1.14		False Pos Test	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaW38	Water	Bq/L	Iron-55	11.90	11.1	7.8-14.1	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaW38	Water	Bq/L	Manganese-54	9.35E-04		False Pos Test	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaW38	Water	Bq/L	Nickel-63	14.5	14.0	9.8-18.2	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaW38	Water	Bq/L	Plutonium-238	0.014	0.023	Sens. Eval.	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaW38	Water	Bq/L	Plutonium-239/240	0.586	0.600	0.420-0.780	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaW38	Water	Bq/L	Potassium-40	-0.23		False Pos Test	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaW38	Water	Bq/L	Radium-226	0.249	0.257	0.180-0.334	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaW38	Water	Bq/L	Strontium-90	10.70	11.400	8.0-14.8	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaW38	Water	Bq/L	Technetium-99	3.84	4.4	3.06-5.68	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaW38	Water	Bq/L	Uranium-234/233	0.45	0.43	0.301-0.559	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaW38	Water	Bq/L	Uranium-238	0.48	0.44	0.306-0.568	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-MaW38	Water	Bq/L	Zinc-65	15.7	14.30	0.0-18.6	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-RdF38	Filter	ug/sample	Uranium-235	0.076	0.0739	0.0517-0.0961	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-RdF38	Filter	ug/sample	Uranium-238	10.60	10.4	7.3-13.5	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-RdF38	Filter	ug/sample	Uranium-Total	10.68	10.5	7.4-13.7	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-RdF38	Filter	Bq/sample	Americium-241	0.0646	0.0670	0.047-0.087	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-RdF38	Filter	Bq/sample	Cesium-134	0.72	0.675	0.473-0.878	Acceptable

MAPEP	2nd/2018	05/31/18	MAPEP-18-RdF38	Filter	Bq/sample	Cesium-137	-0.023		False Pos Test	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-RdF38	Filter	Bq/sample	Cobalt-57	1.22	1.18	0.83-1.53	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-RdF38	Filter	Bq/sample	Cobalt-60	0.010		False Pos Test	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-RdF38	Filter	Bq/sample	Manganese-54	1.08	1.03	0.72-1.34	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-RdF38	Filter	Bq/sample	Plutonium-238	0.0440	0.0445	0.0312-0.0579	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-RdF38	Filter	Bq/sample	Plutonium-239/240	0.0010		False Pos Test	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-RdF38	Filter	Bq/sample	Strontium-90	0.840	1.010	0.71-1.31	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-RdF38	Filter	Bq/sample	Uranium-234/233	0.121	0.124	0.087-0.161	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-RdF38	Filter	Bq/sample	Uranium-238	0.126	0.128	0.090-0.166	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-RdF38	Filter	Bq/sample	Zinc-65	1.54	1.33	0.93-1.73	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-RdV38	Vegetation	Bq/sample	Americium-241	0.107	0.106	0.074-0.138	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-RdV38	Vegetation	Bq/sample	Cesium-134	3.17	3.23	2.26-4.2	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-RdV38	Vegetation	Bq/sample	Cesium-137	4.03	3.67	2.57-4.77	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-RdV38	Vegetation	Bq/sample	Cobalt-57	4.76	4.42	3.09-5.75	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-RdV38	Vegetation	Bq/sample	Cobalt-60	2.49	2.3	1.60-2.98	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-RdV38	Vegetation	Bq/sample	Manganese-54	3.02	2.66	1.86-3.46	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-RdV38	Vegetation	Bq/sample	Plutonium-238	0.0005		False Pos Test	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-RdV38	Vegetation	Bq/sample	Plutonium-239/240	0.0679	0.0770	0.054-0.1	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-RdV38	Vegetation	Bq/sample	Strontium-90	0.61	0.675	0.473-0.878	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-RdV38	Vegetation	Bq/sample	Uranium-234/233	0.21	0.179	0.125-0.233	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-RdV38	Vegetation	Bq/sample	Uranium-238	0.197	0.186	0.130-0.242	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-RdV38	Vegetation	Bq/sample	Zinc-65	0.02		False Pos Test	Acceptable
MAPEP	2nd/2018	05/31/18	MAPEP-18-XaW38	Water	Bq/L	Iodine-129	2.00	1.93	1.35-2.51	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaS39	Soil	Bq/Kg	Americium-241	55.4	55.5	38.9-72.2	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaS39	Soil	Bq/Kg	Cesium-134	693.00	781	547-1015	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaS39	Soil	Bq/Kg	Cesium-137	598	572	400-744	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaS39	Soil	Bq/Kg	Cobalt-57	1080	958	671-1245	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaS39	Soil	Bq/Kg	Cobalt-60	595.000	608	426-790	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaS39	Soil	Bq/Kg	Iron-55	434	512	358-666	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaS39	Soil	Bq/Kg	Manganese-54	0.24		False Pos Test	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaS39	Soil	Bq/Kg	Nickel-63	793	765	536-995	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaS39	Soil	Bq/Kg	Plutonium-238	55.2	57.0	39.9-74.1	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaS39	Soil	Bq/Kg	Plutonium-239/240	-0.33	0.34	Sens. Eval	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaS39	Soil	Bq/Kg	Potassium-40	556	566	396-736	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaS39	Soil	Bq/Kg	Strontium-90	162	193	135-251	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaS39	Soil	Bq/Kg	Technetium-99	239	252	176-328	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaS39	Soil	Bq/Kg	U-234/233	113	160	112-208	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaS39	Soil	Bq/Kg	Uranium-238	224	276	193-359	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaS39	Soil	Bq/Kg	Zinc-65	537.0	500	350-650	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaW39	Water	Bq/L	Americium-241	0.007		False Pos Test	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaW39	Water	Bq/L	Cesium-134	7.94	8.7	6.1-11.3	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaW39	Water	Bq/L	Cesium-137	7.41	6.9	4.8-9.0	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaW39	Water	Bq/L	Cobalt-57	15.1	14.9	10.4-19.4	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaW39	Water	Bq/L	Cobalt-60	0.0408		False Pos Test	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaW39	Water	Bq/L	Hydrogen-3	331	338	237-439	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaW39	Water	Bq/L	Iron-55	8.41	9.0	6.3-11.7	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaW39	Water	Bq/L	Manganese-54	13.2	12.5	8.8-16.3	Acceptable

MAPEP	4th/2018	12/03/18	MAPEP-18-MaW39	Water	Bq/L	Nickel-63	6.14	7.0	4.9-9.1	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaW39	Water	Bq/L	Plutonium-238	0.591	0.67	0.472-0.876	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaW39	Water	Bq/L	Plutonium-239/240	0.801	0.928	0.650-1.206	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaW39	Water	Bq/L	Potassium-40	0.884		False Pos Test	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaW39	Water	Bq/L	Radium-226	0.566	0.44	0.309-0.575	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaW39	Water	Bq/L	Strontium-90	8.24	9.41	6.59-12.23	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaW39	Water	Bq/L	Technetium-99	3.87	3.39	2.73-4.41	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaW39	Water	Bq/L	Uranium-234/233	2.13	2.11	1.48-2.74	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaW39	Water	Bq/L	Uranium-238	2.170	2.180	1.53-2.83	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-MaW39	Water	Bq/L	Zinc-65	8.52	7.53	5.27-9.79	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdF38	Filter	ug/sample	Uranium-235	0.0936	0.0913	0.0650 - 0.1208	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdF38	Filter	ug/sample	Uranium-238	13.4	12.7	8.9 - 16.5	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdF38	Filter	ug/sample	Uranium-Total	13.5	12.8	9.0 - 16.6	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdF38	Filter	Bq/sample	Americium-241	0.0919	0.0913	0.0639 - 0.1187	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdF38	Filter	Bq/sample	Cesium-134	0.431	0.444	0.311 - 0.577	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdF38	Filter	Bq/sample	Cesium-137	0.338	0.345	0.242 - 0.449	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdF38	Filter	Bq/sample	Cobalt-57	0.598	0.592	0.414 - 0.770	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdF38	Filter	Bq/sample	Cobalt-60	0.338	0.294	0.206 - 0.382	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdF38	Filter	Bq/sample	Manganese-54	0.326	0.266	0.186 - 0.346	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdF38	Filter	Bq/sample	Plutonium-238	0.000398	0.0011	Sens. Evaluation	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdF38	Filter	Bq/sample	Plutonium-239/240	0.0672	0.0698	0.0489 - 0.0907	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdF38	Filter	Bq/sample	Strontium-90	-0.026		False Pos Test	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdF38	Filter	Bq/sample	Uranium-234/233	0.148	0.152	0.106 - 0.198	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdF38	Filter	Bq/sample	Uranium-238	0.150	0.158	0.111 - 0.205	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdF38	Filter	Bq/sample	Zinc-65	0.229	0.201	Sens. Evaluation	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdV38	Vegetation	Bq/sample	Americium-241	0.0851	0.0930	0.065-0.121	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdV38	Vegetation	Bq/sample	Cesium-134	1.74	1.94	1.36-2.52	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdV38	Vegetation	Bq/sample	Cesium-137	2.42	2.36	1.65-3.07	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdV38	Vegetation	Bq/sample	Cobalt-57	3.24	3.31	2.32-4.30	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdV38	Vegetation	Bq/sample	Cobalt-60	1.69	1.68	1.18-2.18	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdV38	Vegetation	Bq/sample	Manganese-54	2.59	2.53	1.77-3.29	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdV38	Vegetation	Bq/sample	Plutonium-238	0.0680	0.070	0.049-0.091	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdV38	Vegetation	Bq/sample	Plutonium-239/240	0.0605	0.0620	0.043-0.081	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdV38	Vegetation	Bq/sample	Strontium-90	0.718	0.791	0.554-1.028	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdV38	Vegetation	Bq/sample	Uranium-234/233	0.136	0.138	0.097-0.179	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdV38	Vegetation	Bq/sample	Uranium-238	0.140	0.143	0.100-0.186	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-RdV38	Vegetation	Bq/sample	Zinc-65	1.51	1.37	0.96-1.78	Acceptable
MAPEP	4th/2018	12/03/18	MAPEP-18-XaW39	Alk. Water	Bq/L	Iodine-129	1.63	1.62	1.13-2.11	Acceptable

TABLE E.7

2018 ERA (RAD) PROGRAM PERFORMANCE EVALUATION

RESULTS GEL LABORATORIES

PT Provider	Quarter / Year	Report Received Date	Sample Number	Sample Media	Unit	Analyte / Nuclide	GEL Value	Known value	Acceptance Range	Evaluation
ERA	1st/2018	2//27/17	RAD-108	Water	pCi/L	Barium-133	86.7	85.6	72.0 - 94.2	Acceptable
ERA	1st/2018	2//27/17	RAD-108	Water	pCi/L	Cesium-134	51.2	52.6	42.4 - 57.9	Acceptable
ERA	1st/2018	2//27/17	RAD-108	Water	pCi/L	Cesium-137	118	112	101 - 126	Acceptable
ERA	1st/2018	2//27/17	RAD-108	Water	pCi/L	Cobalt-60	118	113	102 - 126	Acceptable
ERA	1st/2018	2//27/17	RAD-108	Water	pCi/L	Zinc-65	202	189	170 - 222	Acceptable
ERA	1st/2018	2//27/17	RAD-108	Water	pCi/L	Gross Alpha	71.6	52.3	27.3 - 65.5	Not Acceptable
ERA	1st/2018	2//27/17	RAD-108	Water	pCi/L	Gross Alpha	69.6	52.3	27.3 - 65.5	Not Acceptable
ERA	1st/2018	2//27/17	RAD-108	Water	pCi/L	Gross Beta	37.6	41.6	27.7 - 49.0	Acceptable
ERA	1st/2018	2//27/17	RAD-108	Water	pCi/L	Radium-226	12.3	12.7	9.48 - 14.7	Acceptable
ERA	1st/2018	2//27/17	RAD-108	Water	pCi/L	Radium-226	13.1	12.7	9.48 - 14.7	Acceptable
ERA	1st/2018	2//27/17	RAD-108	Water	pCi/L	Radium-226	14.2	12.7	9.48 - 14.7	Acceptable
ERA	1st/2018	2//27/17	RAD-108	Water	pCi/L	Radium-228	6.31	6.2	3.83 - 8.08	Acceptable
ERA	1st/2018	2//27/17	RAD-108	Water	pCi/L	Radium-228	6.36	6.2	3.83 - 8.08	Acceptable
ERA	1st/2018	2//27/17	RAD-108	Water	pCi/L	Uranium (Nat)	12.2	12.6	9.91 - 14.4	Acceptable
ERA	1st/2018	2//27/17	RAD-108	Water	µg/L	Uranium (Nat) mass	19.7	18.4	14.5 - 21.1	Acceptable
ERA	1st/2018	2//27/17	RAD-108	Water	µg/L	Uranium (Nat) mass	18.9	18.4	14.5 - 21.1	Acceptable
ERA	1st/2018	2//27/17	RAD-108	Water	pCi/L	Tritium	11300	12500	10900 - 13800	Acceptable
ERA	1st/2018	2//27/17	RAD-108	Water	pCi/L	Tritium	11600	12500	10900 - 13800	Acceptable
ERA	1st/2018	2//27/17	RAD-108	Water	pCi/L	Strontium-89	60.2	55.5	44.3 - 63.2	Acceptable
ERA	1st/2018	2//27/17	RAD-108	Water	pCi/L	Strontium-89	54.5	55.5	44.3 - 63.2	Acceptable
ERA	1st/2018	2//27/17	RAD-108	Water	pCi/L	Strontium-90	35.9	43.1	31.8 - 49.5	Acceptable
ERA	1st/2018	2//27/17	RAD-108	Water	pCi/L	Strontium-90	37.7	43.1	31.8 - 49.5	Acceptable
ERA	2nd/2018	05/30/17	RAD-109	Water	pCi/L	Gross Alpha	79.7	75	39.5 - 92.3	Acceptable
ERA	2nd/2018	05/30/17	RAD-109	Water	pCi/L	Gross Alpha	72.9	75	39.5 - 92.3	Acceptable
ERA	2nd/2018	05/30/17	RAD-109	Water	pCi/L	Gross Alpha	72.9	75	39.5 - 92.3	Acceptable
ERA	3rd/2018	08/28/17	RAD - 110	Water	pCi/L	Barium-133	68.8	66.3	55.2 - 72.9	Acceptable
ERA	3rd/2018	08/28/17	RAD - 110	Water	pCi/L	Cesium-134	24.7	24.4	18.7 - 27.2	Acceptable
ERA	3rd/2018	08/28/17	RAD - 110	Water	pCi/L	Cesium-137	51.7	51.6	46.4 - 59.6	Acceptable
ERA	3rd/2018	08/28/17	RAD - 110	Water	pCi/L	Cobalt-60	97	88.6	79.7 - 99.8	Acceptable
ERA	3rd/2018	08/28/17	RAD - 110	Water	pCi/L	Zinc-65	39.7	32.7	27.3 - 41.6	Acceptable
ERA	3rd/2018	08/28/17	RAD - 110	Water	pCi/L	Gross Alpha	26.3	25.7	13.0 - 34.1	Acceptable
ERA	3rd/2018	08/28/17	RAD - 110	Water	pCi/L	Gross Alpha	31.9	25.7	13.0 - 34.1	Acceptable
ERA	3rd/2018	08/28/17	RAD - 110	Water	pCi/L	Gross Beta	54.4	63	43.5 - 69.6	Acceptable
ERA	3rd/2018	08/28/17	RAD - 110	Water	pCi/L	Radium-226	1.6	1.29	1.07 - 1.95	Acceptable
ERA	3rd/2018	08/28/17	RAD - 110	Water	pCi/L	Radium-226	1.21	1.29	1.07 - 1.95	Acceptable
ERA	3rd/2018	08/28/17	RAD - 110	Water	pCi/L	Radium-228	6.49	5.66	3.45 - 7.47	Acceptable
ERA	3rd/2018	08/28/17	RAD - 110	Water	pCi/L	Radium-228	5.59	5.66	3.45 - 7.47	Acceptable
ERA	3rd/2018	08/28/17	RAD - 110	Water	pCi/L	Uranium (Nat)	65	66.7	54.3 - 73.9	Acceptable
ERA	3rd/2018	08/28/17	RAD - 110	Water	pCi/L	Uranium (Nat)	66.2	66.7	54.3 - 73.9	Acceptable
ERA	3rd/2018	08/28/17	RAD - 110	Water	µg/L	Uranium (Nat) mass	97	98.1	79.8 - 109	Acceptable
ERA	3rd/2018	08/28/17	RAD - 110	Water	µg/L	Uranium (Nat) mass	104.7	98.1	79.8 - 109	Acceptable
ERA	3rd/2018	08/28/17	RAD - 110	Water	pCi/L	Tritium	5120	5060	4340 - 5570	Acceptable
ERA	3rd/2018	08/28/17	RAD - 110	Water	pCi/L	Tritium	4620	5060	4340 - 5570	Acceptable

ERA	3rd/2018	08/28/17	RAD - 110	Water	pCi/L	Strontium-89	29.9	26.4	18.4 - 32.9	Acceptable
ERA	3rd/2018	08/28/17	RAD - 110	Water	pCi/L	Strontium-89	28.2	26.4	18.4 - 32.9	Acceptable
ERA	3rd/2018	08/28/17	RAD - 110	Water	pCi/L	Strontium-90	37.8	36	26.4 - 41.5	Acceptable
ERA	3rd/2018	08/28/17	RAD - 110	Water	pCi/L	Strontium-90	34	36	26.4 - 41.5	Acceptable
ERA	3rd/2018	08/28/17	RAD - 110	Water	pCi/L	Iodine-131	28	25.5	21.2 - 30.1	Acceptable
ERA	3rd/2018	08/28/17	RAD - 110	Water	pCi/L	Iodine-131	33	25.5	21.2 - 30.1	Not Acceptable

2018 ERA PROGRAM (MRAD) PERFORMANCE EVALUATION RESULTS

GEL LABORATORIES

PT Provider	Quarter / Year	Report Received Date	Sample Number	Sample Media	Unit	Analyte / Nuclide	GEL Value	Known value	Acceptance Range	Evaluation
ERA	1st / 2018	2/26/18	RAD-112	Water	pCi/L	Barium-133	97.6	95.1	80.2 - 105	Acceptable
ERA	1st / 2018	2/26/18	RAD-112	Water	pCi/L	Cesium-134	64.9	65.6	53.4 - 72.2	Acceptable
ERA	1st / 2018	2/26/18	RAD-112	Water	pCi/L	Cesium-137	117	112	101 - 126	Acceptable
ERA	1st / 2018	2/26/18	RAD-112	Water	pCi/L	Cobalt-60	122	114	103 - 128	Acceptable
ERA	1st / 2018	2/26/18	RAD-112	Water	pCi/L	Zinc-65	320	277	249 - 324	Acceptable
ERA	1st / 2018	2/26/18	RAD-112	Water	pCi/L	Gross Alpha	67.7	72.4	38.1 - 89.2	Acceptable
ERA	1st / 2018	2/26/18	RAD-112	Water	pCi/L	Gross Alpha	66.4	72.4	38.1 - 89.2	Acceptable
ERA	1st / 2018	2/26/18	RAD-112	Water	pCi/L	Gross Beta	47.6	54.8	37.5 - 61.7	Acceptable
ERA	1st / 2018	2/26/18	RAD-112	Water	pCi/L	Radium-226	16.2	14.2	10.6 - 16.3	Acceptable
ERA	1st / 2018	2/26/18	RAD-112	Water	pCi/L	Radium-226	16.3	14.2	10.6 - 16.3	Acceptable
ERA	1st / 2018	2/26/18	RAD-112	Water	pCi/L	Radium-226	5	4.21	2.43 - 5.81	Acceptable
ERA	1st / 2018	2/26/18	RAD-112	Water	pCi/L	Radium-228	4.44	4.21	2.43 - 5.81	Acceptable
ERA	1st / 2018	2/26/18	RAD-112	Water	pCi/L	Radium-228	65.4	58.6	47.8 - 64.5	Acceptable
ERA	1st / 2018	2/26/18	RAD-112	Water	pCi/L	Uranium (Nat)	56.4	58.6	47.8-64.5	Acceptable
ERA	1st / 2018	2/26/18	RAD-112	Water	pCi/L	Uranium (Nat)	65.4	58.6	47.8 - 64.5	Not Acceptable
ERA	1st / 2018	2/26/18	RAD-112	Water	µg/L	Uranium (Nat) mass	97.6	86.2	70.3 - 94.9	Not Acceptable
ERA	1st / 2018	2/26/18	RAD-112	Water	µg/L	Uranium (Nat) mass	93.3	86.2	70.3 - 94.9	Acceptable
ERA	1st / 2018	2/26/18	RAD-112	Water	pCi/L	Tritium	20000	21200	18600 - 23300	Acceptable
ERA	1st / 2018	2/26/18	RAD-112	Water	pCi/L	Tritium	20200	21200	18600 - 23300	Acceptable
ERA	1st / 2018	2/26/18	RAD-112	Water	pCi/L	Strontium-89	59.7	65.2	52.9 - 73.2	Acceptable
ERA	1st / 2018	2/26/18	RAD-112	Water	pCi/L	Strontium-89	68.6	65.2	52.9 - 73.2	Acceptable
ERA	1st / 2018	2/26/18	RAD-112	Water	pCi/L	Strontium-90	36.1	39.2	28.8 - 45.1	Acceptable
ERA	1st / 2018	2/26/18	RAD-112	Water	pCi/L	Strontium-90	36.9	39.2	28.8 - 45.1	Acceptable
ERA	1st / 2018	2/26/18	RAD-112	Water	pCi/L	Iodine-131	25.3	28.1	23.4 - 33.0	Acceptable
ERA	1st / 2018	2/26/18	RAD-112	Water	pCi/L	Iodine-131	28.6	28.1	23.4 - 33.0	Acceptable
ERA	3rd / 2018	08/23/18	RAD-114	Water	pCi/L	Barium-133	28.5	25.6	19.9 - 29.4	Acceptable
ERA	3rd / 2018	08/23/18	RAD-114	Water	pCi/L	Cesium-134	15.9	15.7	11.4 - 18.2	Acceptable
ERA	3rd / 2018	08/23/18	RAD-114	Water	pCi/L	Cesium-137	196	192	173 - 213	Acceptable
ERA	3rd / 2018	08/23/18	RAD-114	Water	pCi/L	Cobalt-60	122	119	107 - 133	Acceptable
ERA	3rd / 2018	08/23/18	RAD-114	Water	pCi/L	Zinc-65	196	177	159 - 208	Acceptable
ERA	3rd / 2018	08/23/18	RAD-114	Water	pCi/L	Gross Alpha	15.5	16	7.79 - 22.6	Acceptable
ERA	3rd / 2018	08/23/18	RAD-114	Water	pCi/L	Gross Alpha	18.2	16	7.79 - 22.6	Acceptable
ERA	3rd / 2018	08/23/18	RAD-114	Water	pCi/L	Gross Beta	43.6	49	33.2 - 56.1	Acceptable
ERA	3rd / 2018	08/23/18	RAD-114	Water	pCi/L	Radium-226	8.44	9.08	6.81 - 10.6	Acceptable
ERA	3rd / 2018	08/23/18	RAD-114	Water	pCi/L	Radium-228	2.72	2.28	1.07 - 3.60	Acceptable
ERA	3rd / 2018	08/23/18	RAD-114	Water	pCi/L	Radium-228	3.3	2.28	1.07 - 3.60	Acceptable
ERA	3rd / 2018	08/23/18	RAD-114	Water	pCi/L	Uranium (Nat)	53.8	51.8	42.2 - 57.1	Acceptable
ERA	3rd / 2018	08/23/18	RAD-114	Water	pCi/L	Uranium (Nat)	50.3	51.8	42.2 - 57.1	Acceptable
ERA	3rd / 2018	08/23/18	RAD-114	Water	µg/L	Uranium (Nat) mass	80.3	75.5	61.5 - 83.2	Acceptable
ERA	3rd / 2018	08/23/18	RAD-114	Water	µg/L	Uranium (Nat) mass	78.36	75.5	61.5 - 83.2	Acceptable

ERA	3rd / 2018	08/23/18	RAD-114	Water	µg/L	Uranium (Nat) mass	77.8	75.5	61.5 - 83.2	Acceptable
ERA	3rd / 2018	08/23/18	RAD-114	Water	pCi/L	Tritium	19900	20400	17900 - 22400	Acceptable
ERA	3rd / 2018	08/23/18	RAD-114	Water	pCi/L	Tritium	21200	20400	17900 - 22400	Acceptable
ERA	3rd / 2018	08/23/18	RAD-114	Water	pCi/L	Strontium-89	61.5	62.7	50.7 - 70.6	Acceptable
ERA	3rd / 2018	08/23/18	RAD-114	Water	pCi/L	Strontium-89	69	62.7	50.7 - 70.6	Acceptable
ERA	3rd / 2018	08/23/18	RAD-114	Water	pCi/L	Strontium-90	34.4	40.1	29.5 - 46.1	Acceptable
ERA	3rd / 2018	08/23/18	RAD-114	Water	pCi/L	Strontium-90	36.2	40.1	29.5 - 46.1	Acceptable
ERA	3rd / 2018	08/23/18	RAD-114	Water	pCi/L	Iodine-131	25.6	28.1	23.4 - 33.0	Acceptable
ERA	3rd / 2018	08/23/18	RAD-114	Water	pCi/L	Iodine-131	28.7	28.1	23.4 - 33.0	Acceptable

TABLE E.8

2018 ECKERT & ZIEGLER ANALYTICS PERFORMANCE EVALUATION RESULTS
GEL LABORATORIES

PT Provider	Quarter / Year	Report Received Date	Sample Number	Sample Media	Unit	Analyte / Nuclide	GEL Value	Known value	Acceptance Range/ Ratio	Evaluation
EZA	1st / 2018	05/11/18	E12171	Cartridge	pCi	Iodine-131	9.20E+01	8.52E+01	0.97	Acceptable
EZA	1st / 2018	05/11/18	E12172	Milk	pCi/L	Strontium-89	9.16E+01	9.01E+01	1.02	Acceptable
EZA	1st / 2018	05/11/18	E12172	Milk	pCi/L	Strontium-90	8.00E+01	1.25E+02	0.64	Acceptable
EZA	1st / 2018	05/11/18	E12173	Milk	pCi/L	Iodine-131	1.05E+02	1.08E+02	0.97	Acceptable
EZA	1st / 2018	05/11/18	E12173	Milk	pCi/L	Cerium-141	7.23E+01	7.70E+01	0.94	Acceptable
EZA	1st / 2018	05/11/18	E12173	Milk	pCi/L	Cobalt-58	1.11E+02	1.14E+02	0.97	Acceptable
EZA	1st / 2018	05/11/18	E12173	Milk	pCi/L	Cobalt-60	1.90E+02	1.87E+02	1.02	Acceptable
EZA	1st / 2018	05/11/18	E12173	Milk	pCi/L	Chromium-51	3.00E+02	3.26E+02	0.92	Acceptable
EZA	1st / 2018	05/11/18	E12173	Milk	pCi/L	Cesium-134	1.58E+02	1.80E+02	0.88	Acceptable
EZA	1st / 2018	05/11/18	E12173	Milk	pCi/L	Cesium-137	1.75E+02	1.72E+02	1.02	Acceptable
EZA	1st / 2018	05/11/18	E12173	Milk	pCi/L	Manganese-54	1.36E+02	1.31E+02	1.04	Acceptable
EZA	1st / 2018	05/11/18	E12173	Milk	pCi/L	Iron-59	1.52E+02	1.39E+02	1.10	Acceptable
EZA	1st / 2018	05/11/18	E12173	Milk	pCi/L	Zinc-65	2.73E+02	2.44E+02	1.12	Acceptable
EZA	1st / 2018	05/11/18	E12174	Water	pCi/L	Iodine-131	9.37E+01	9.10E+01	1.03	Acceptable
EZA	1st / 2018	05/11/18	E12174	Water	pCi/L	Cerium-141	7.86E+01	7.34E+01	1.07	Acceptable
EZA	1st / 2018	05/11/18	E12174	Water	pCi/L	Chromium-51	3.44E+02	3.10E+02	1.11	Acceptable
EZA	1st / 2018	05/11/18	E12174	Water	pCi/L	Cesium-134	1.61E+02	1.71E+02	0.94	Acceptable
EZA	1st / 2018	05/11/18	E12174	Water	pCi/L	Cesium-137	1.64E+02	1.64E+02	1.00	Acceptable
EZA	1st / 2018	05/11/18	E12174	Water	pCi/L	Cobalt-58	1.92E+02	1.78E+02	1.08	Acceptable
EZA	1st / 2018	05/11/18	E12174	Water	pCi/L	Manganese-54	1.36E+02	1.25E+02	1.09	Acceptable
EZA	1st / 2018	05/11/18	E12174	Water	pCi/L	Iron-59	1.48E+02	1.32E+02	1.12	Acceptable
EZA	1st / 2018	05/11/18	E12174	Water	pCi/L	Zinc-65	2.53E+02	2.33E+02	1.09	Acceptable
EZA	1st / 2018	05/11/18	E12174	Water	pCi/L	Cobalt-60	1.92E+02	1.78E+02	1.08	Acceptable
EZA	2nd/2018	07/07/18	E12171	Cartridge	pCi	Iodine-131	7.22E+01	7.16E+01	1.01	Acceptable
EZA	2nd/2018	07/07/18	E12172	Milk	pCi/L	Strontium-89	9.58E+01	8.46E+01	1.13	Acceptable
EZA	2nd/2018	07/07/18	E12172	Milk	pCi/L	Strontium-90	8.47E+00	1.14E+01	0.74	Acceptable
EZA	2nd/2018	07/07/18	E12173	Milk	pCi/L	Iodine-131	7.89E+01	7.19E+01	1.10	Acceptable
EZA	2nd/2018	07/07/18	E12173	Milk	pCi/L	Cerium-141	9.01E+01	8.22E+01	1.10	Acceptable
EZA	2nd/2018	07/07/18	E12173	Milk	pCi/L	Cobalt-58	9.26E+01	8.90E+01	1.04	Acceptable
EZA	2nd/2018	07/07/18	E12173	Milk	pCi/L	Cobalt-60	1.18E+02	1.13E+02	1.04	Acceptable
EZA	2nd/2018	07/07/18	E12173	Milk	pCi/L	Chromium-51	2.58E+02	2.39E+02	1.08	Acceptable
EZA	2nd/2018	07/07/18	E12173	Milk	pCi/L	Cesium-134	1.10E+02	1.14E+02	0.97	Acceptable
EZA	2nd/2018	07/07/18	E12173	Milk	pCi/L	Cesium-137	1.04E+02	9.88E+01	1.05	Acceptable
EZA	2nd/2018	07/07/18	E12173	Milk	pCi/L	Manganese-54	1.42E+02	1.30E+02	1.09	Acceptable
EZA	2nd/2018	07/07/18	E12173	Milk	pCi/L	Iron-59	8.87E+01	8.60E+01	1.03	Acceptable
EZA	2nd/2018	07/07/18	E12173	Milk	pCi/L	Zinc-65	1.83E+02	1.57E+02	1.16	Acceptable
EZA	2nd/2018	07/07/18	E12174	Water	pCi/L	Iodine-131	7.31E+01	7.44E+01	0.98	Acceptable
EZA	2nd/2018	07/07/18	E12174	Water	pCi/L	Cerium-141	1.02E+02	8.58E+01	1.19	Acceptable
EZA	2nd/2018	07/07/18	E12174	Water	pCi/L	Chromium-51	2.73E+02	2.49E+02	1.10	Acceptable
EZA	2nd/2018	07/07/18	E12174	Water	pCi/L	Cesium-134	1.06E+02	1.19E+02	0.89	Acceptable
EZA	2nd/2018	07/07/18	E12174	Water	pCi/L	Cesium-137	9.86E+01	1.03E+02	0.96	Acceptable
EZA	2nd/2018	07/07/18	E12174	Water	pCi/L	Cobalt-58	9.76E+01	9.29E+01	1.05	Acceptable
EZA	2nd/2018	07/07/18	E12174	Water	pCi/L	Manganese-54	1.47E+02	1.35E+02	1.09	Acceptable
EZA	2nd/2018	07/07/18	E12174	Water	pCi/L	Iron-59	1.08E+02	8.97E+01	1.20	Acceptable

EZA	2nd/2018	07/07/18	E12174	Water	pCi/L	Zinc-65	1.97E+02	1.64E+02	1.20	Acceptable
EZA	2nd/2018	07/07/18	E12174	Water	pCi/L	Cobalt-60	1.22E+02	1.18E+02	1.03	Acceptable
EZA	3rd/2018	11/12/18	E12240	Cartridge	pCi	Iodine-131	7.95E+01	8.03E+01	0.99	Acceptable
EZA	3rd/2018	11/12/18	E12241	Milk	pCi/L	Strontium-89	8.57E+01	8.17E+01	1.05	Acceptable
EZA	3rd/2018	11/12/18	E12241	Milk	pCi/L	Strontium-90	9.22E+00	1.48E+01	0.62	Acceptable
EZA	3rd/2018	11/12/18	E12242	Milk	pCi/L	Iodine-131	7.18E+01	5.82E+01	1.23	Acceptable
EZA	3rd/2018	11/12/18	E12242	Milk	pCi/L	Cerium-141	1.43E+02	1.28E+02	1.12	Acceptable
EZA	3rd/2018	11/12/18	E12242	Milk	pCi/L	Chromium-51	2.54E+02	2.65E+02	0.96	Acceptable
EZA	3rd/2018	11/12/18	E12242	Milk	pCi/L	Cesium-134	1.18E+02	1.23E+02	0.96	Acceptable
EZA	3rd/2018	11/12/18	E12242	Milk	pCi/L	Cesium-137	1.53E+02	1.47E+02	1.04	Acceptable
EZA	3rd/2018	11/12/18	E12242	Milk	pCi/L	Cobalt-58	1.54E+02	1.44E+02	1.07	Acceptable
EZA	3rd/2018	11/12/18	E12242	Milk	pCi/L	Manganese-54	1.84E+02	1.67E+02	1.09	Acceptable
EZA	3rd/2018	11/12/18	E12242	Milk	pCi/L	Iron-59	1.20E+02	1.19E+02	1.01	Acceptable
EZA	3rd/2018	11/12/18	E12242	Milk	pCi/L	Zinc-65	2.44E+02	2.01E+02	1.22	Acceptable
EZA	3rd/2018	11/12/18	E12242	Milk	pCi/L	Cobalt-60	2.02E+02	1.90E+02	1.06	Acceptable
EZA	3rd/2018	11/12/18	E12243	Water	pCi/L	Iodine-131	6.76E+01	6.25E+01	1.08	Acceptable
EZA	3rd/2018	11/12/18	E12243	Water	pCi/L	Cerium-141	1.48E+02	1.33E+02	1.11	Acceptable
EZA	3rd/2018	11/12/18	E12243	Water	pCi/L	Chromium-51	2.92E+02	2.75E+02	1.06	Acceptable
EZA	3rd/2018	11/12/18	E12243	Water	pCi/L	Cesium-134	1.20E+02	1.28E+02	0.94	Acceptable
EZA	3rd/2018	11/12/18	E12243	Water	pCi/L	Cesium-137	1.64E+02	1.54E+02	1.07	Acceptable
EZA	3rd/2018	11/12/18	E12243	Water	pCi/L	Cobalt-58	1.53E+02	1.50E+02	1.02	Acceptable
EZA	3rd/2018	11/12/18	E12243	Water	pCi/L	Manganese-54	1.91E+02	1.74E+02	1.1	Acceptable
EZA	3rd/2018	11/12/18	E12243	Water	pCi/L	Iron-59	1.39E+02	1.24E+02	1.12	Acceptable
EZA	3rd/2018	11/12/18	E12243	Water	pCi/L	Zinc-65	2.41E+02	2.09E+02	1.15	Acceptable
EZA	3rd/2018	11/12/18	E12243	Water	pCi/L	Cobalt-60	2.09E+02	1.98E+02	1.06	Acceptable
EZA	4th/2018	01/23/19	E12346	Cartridge	pCi	Iodine-131	8.92E+01	8.98E+01	0.99	Acceptable
EZA	4th/2018	01/23/19	E12347	Milk	pCi/L	Strontium-89	8.67E+01	9.19E+01	0.94	Acceptable
EZA	4th/2018	01/23/19	E12347	Milk	pCi/L	Strontium-90	1.07E+01	1.33E+01	0.80	Acceptable
EZA	4th/2018	01/23/19	E12348	Milk	pCi/L	Iodine-131	9.58E+01	9.33E+01	1.03	Acceptable
EZA	4th/2018	01/23/19	E12348	Milk	pCi/L	Cerium-141	1.37E+02	1.33E+02	1.03	Acceptable
EZA	4th/2018	01/23/19	E12348	Milk	pCi/L	Chromium-51	2.66E+02	2.98E+02	0.89	Acceptable
EZA	4th/2018	01/23/19	E12348	Milk	pCi/L	Cesium-134	1.52E+02	1.71E+02	0.89	Acceptable
EZA	4th/2018	01/23/19	E12348	Milk	pCi/L	Cesium-137	1.25E+02	1.21E+02	1.03	Acceptable
EZA	4th/2018	01/23/19	E12348	Milk	pCi/L	Cobalt-58	1.19E+02	1.19E+02	1.00	Acceptable
EZA	4th/2018	01/23/19	E12348	Milk	pCi/L	Manganese-54	1.70E+02	1.54E+02	1.10	Acceptable
EZA	4th/2018	01/23/19	E12348	Milk	pCi/L	Iron-59	1.25E+02	1.14E+02	1.09	Acceptable
EZA	4th/2018	01/23/19	E12348	Milk	pCi/L	Zinc-65	2.75E+02	2.64E+02	1.04	Acceptable
EZA	4th/2018	01/23/19	E12348	Milk	pCi/L	Cobalt-60	2.12E+02	2.12E+02	1.00	Acceptable
EZA	4th/2018	01/23/19	E12349	Water	pCi/L	Iodine-131	8.19E+01	8.04E+01	1.02	Acceptable
EZA	4th/2018	01/23/19	E12349	Water	pCi/L	Cerium-141	1.26E+02	1.24E+02	1.02	Acceptable
EZA	4th/2018	01/23/19	E12349	Water	pCi/L	Chromium-51	3.20E+02	2.78E+02	1.15	Acceptable
EZA	4th/2018	01/23/19	E12349	Water	pCi/L	Cesium-134	1.41E+02	1.60E+02	0.88	Acceptable
EZA	4th/2018	01/23/19	E12349	Water	pCi/L	Cesium-137	1.21E+02	1.13E+02	1.07	Acceptable
EZA	4th/2018	01/23/19	E12349	Water	pCi/L	Cobalt-58	1.09E+02	1.11E+02	0.99	Acceptable
EZA	4th/2018	01/23/19	E12349	Water	pCi/L	Manganese-54	1.51E+02	1.44E+02	1.05	Acceptable
EZA	4th/2018	01/23/19	E12349	Water	pCi/L	Iron-59	1.16E+02	1.07E+02	1.09	Acceptable
EZA	4th/2018	01/23/19	E12349	Water	pCi/L	Zinc-65	2.76E+02	2.46E+02	1.12	Acceptable
EZA	4th/2018	01/23/19	E12349	Water	pCi/L	Cobalt-60	2.06E+02	1.98E+02	1.04	Acceptable

APPENDIX F

ANNUAL RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM REPORT (ARGPPR)

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Docket No: 50-289
50-320

THREE MILE ISLAND NUCLEAR STATION
UNITS 1 AND 2

Annual Radiological Groundwater
Protection Program Report (ARGPPR)

1 January through 31 December 2018

Prepared By
Teledyne Brown Engineering
Environmental Services

Three Mile Island Nuclear Station
Middletown, PA 17057

April 2019

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Table Of Contents

Appendices

I. Summary and Conclusions

In 2006, Exelon instituted a comprehensive program to evaluate the impact of station operations on groundwater and surface water in the vicinity of Three Mile Island Nuclear Station. This report covers groundwater, surface water, storm water, and precipitation samples collected from the environment, both on and off station property in 2018. During that time period 443 analyses were performed on 211 samples from 60 locations.

In assessing all the data gathered for this report, it was concluded that the operation of Three Mile Island Nuclear Station had no adverse radiological impact on the environment.

Gamma-emitting radionuclides associated with licensed plant operations were not detected at concentrations greater than their respective Lower Limits of Detection (LLDs) as specified in the Offsite Dose Calculation Manual (ODCM) in any of the groundwater, surface water, storm water, and precipitation samples. In the case of tritium, Exelon specified that its laboratories achieve a lower limit of detection 10 times lower than that required by federal regulation.

Strontium-89 (Sr-89) and Strontium-90 (Sr-90) were not detected at a concentration greater than their respective LLD of 10 and 1 picocurie per liter (pCi/L) in the groundwater samples tested.

Tritium was not detected in any ground water, surface water, storm water or precipitation water samples at concentrations greater than the United States Environmental Protection Agency (USEPA) drinking water standard (and the Nuclear Regulatory Commission Reporting Limit) of 20,000 pCi/L. Low levels of tritium were detected at concentrations greater than the LLD of 200 pCi/L in 32 of 52 groundwater monitoring locations. The groundwater tritium concentrations ranged from 180 ± 119 pCi/L to 4,540 ± 507 pCi/L. Tritium that was detected in groundwater at the Station is believed to be the result of previous tank leakage, historical releases, the recapture of gaseous tritium releases via rainwater, and/or background from external sources greater than 200 pCi/L**.** Tritium was not detected at any surface water location. Tritium was not detected in any storm water samples. Tritium was detected in 3 of 4 precipitation water locations. The concentrations ranged from 204 ± 124 to 469 ± 135 pCi/L.

Gross Alpha and Gross Beta analyses in the dissolved and suspended fractions were performed on 27 groundwater samples during the second quarter sampling in 2018. Gross Alpha (dissolved) was not detected at any of the 27 groundwater locations. Gross Alpha (suspended) was detected at 1 of the groundwater locations at a concentration of 2.0 ± 0.8 pCi/L. Gross Beta (dissolved) was detected at 23 of the groundwater locations. The concentrations ranged from 1.4

to 10.2 pCi/L. Gross Beta (suspended) was detected at 2 of the 27 groundwater locations. The concentrations ranged from 2.0 to 3.9 pCi/L.

Hard-To-Detect analyses, which include Fe-55, Ni-63, Am-241, Cm-242, Cm-243/244, Pu-238, Pu-239/240, U-234, U-235 and U-238, were not analyzed in 2018.

II. Introduction

The Three Mile Island Nuclear Station (TMINS) established a revised and more comprehensive groundwater monitoring program in 2006 as part of an Exelon Nuclear fleetwide assessment.

Conestoga Rovers & Associates (CRA) performed the initial assessment. CRA prepared a Hydrogeologic Investigation Report (HIR) for Exelon to determine whether groundwater at and near TMINS has been adversely impacted by any releases of radionuclides. The CRA report documents the results of the May 2006 Hydrogeologic Investigation Work Plan. CRA assessed groundwater quality at the Station and identified locations designated as Areas for Further Evaluation. The results and conclusions of this Phase 1 study were made available to state and federal regulators, as well as the public on an Exelon web site for station specific reports.

As a result of the Phase 1 study, the Radiological Groundwater Protection Program (RGPP) was revised to a long term monitoring program. This report covers those analyses performed by Teledyne Brown Engineering (TBE) and Exelon Industrial Services (EIS)/GEL Laboratories on well water, surface water, storm water, and precipitation water samples collected in 2018. TMINS groundwater movement is into the Susquehanna River which surrounds the station on all sides.

In September 2015, GHD completed an additional five-year update hydrogeologic investigation report for the Station (*NEI 07-07, Hydrogeologic Investigation Report*). The referenced report summarized station activities since the 2006 hydrogeologic investigation report, including changes at the Station as well as RGPP sampling activities and groundwater flow. Relevant conclusions from the report are:

- None of the Areas of Further Evaluation (AFEs) identified in 2006 indicate current impacts to groundwater and are no longer considered AFEs.
- One new AFE, AFE-TMI-6-BWST, was identified based on laboratory analytical data.
- In July 2012, elevated tritium concentrations were noted for a sample collected from an electric vault west of MS-22. The source of this elevated tritium concentration was believed to be the BWST.
- Tritium is not migrating off of the Station property at concentrations greater than the USEPA Drinking Water Standard of 20,000 pCi/L.
- Gamma-emitting radionuclides associated with licensed plant operations were not detected at concentrations greater than their respective LLDs.
- Strontium 89 or 90 were not detected at concentrations greater than their respective LLDs.

This report covers those analyses performed by Teledyne Brown Engineering (TBE) and Exelon Industrial Services (EIS)/Gel Laboratories on samples collected in 2018.

A. Objectives of the RGPP

The long-term objectives of the Radiological Groundwater Protection Program (RGPP) are as follows:

1. Identify suitable locations to monitor and evaluate potential impacts from station operations before significant radiological impact to the environment and potential drinking water sources.

2. Understand the local hydrogeologic regime in the vicinity of the station and maintain up-to-date knowledge of flow patterns on the surface and shallow subsurface.

3. Perform routine water sampling and radiological analysis of water from selected locations.

4. Notify stakeholders in a timely manner for new leaks, spills, or other detections with potential radiological significance.

5. Regularly assess analytical results to identify adverse trends.

6. Take necessary corrective actions to protect groundwater resources.

B. Implementation of the Objectives

The objectives identified have been implemented at Three Mile Island Nuclear Station as discussed below:

1. Three Mile Island Nuclear Station continues to sample and monitor the groundwater at the station in accordance with station procedures. Sample frequencies and locations are adjusted based on monitoring results and investigations.

2. The Three Mile Island Nuclear Station reports describe the local hydrogeologic regime. Periodically, the flow patterns on the surface and shallow subsurface are updated based on ongoing measurements.

3. Three Mile Island Nuclear Station will continue to perform routine sampling and radiological analysis of water from selected locations.

4. Three Mile Island Nuclear Station has implemented procedures to identify and report leaks, spills, or other detections with potential

radiological significance in a timely manner.

5. Three Mile Island Nuclear Station staff and consulting hydrogeologist assess analytical results on an ongoing basis to identify adverse trends.

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, Storm Water, and Precipitation

Samples of water are collected, managed, transported and analyzed in accordance with approved procedures. Groundwater, surface water, storm water and precipitation are collected. 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. For split samples, collectors will periodically collect samples that are sent to Exelon Industrial Services/GEL Laboratories to confirm that TBE is producing comparable data. 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 hydrogeologist for adverse trends or changes to hydrogeologic conditions.

D. Characteristics of Tritium (H-3)

Tritium (chemical symbol H-3) is a radioactive isotope of hydrogen. The most common form of tritium is tritium oxide, which is also called "tritiated water." 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 is created in the environment from naturally-occurring processes both cosmic and subterranean, as well as from anthropogenic (i.e., man-made) sources. Tritium is produced naturally in the upper atmosphere when cosmic rays strike air molecules. This “cosmogenic” tritium

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 lithium present in crystalline rocks by neutrons produced by the radioactive decay of naturally abundant uranium and thorium. Lithogenic production of tritium is usually negligible compared to other sources due to the limited abundance of lithium in rock. The lithogenic tritium is introduced directly to groundwater.

A major anthropogenic source of tritium and strontium-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.

The chemical properties of tritium are essentially those of ordinary hydrogen. 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, all tritium is essentially cleared. Organically bound tritium (tritium that is incorporated in organic compounds) can remain in the body for a longer period.

Tritium has a radiological 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 is one of the least dangerous radionuclides, because it emits very weak radiation 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 Exelon Industrial Services (EIS)/GEL Laboratories to analyze the environmental samples for radioactivity for the Three Mile Island Nuclear Station RGPP in 2018.

In order to achieve the stated objectives, the current program includes the

following analyses, as applicable:

1. Concentrations of gamma-emitters in groundwater, surface water, and storm water

2. Concentrations of strontium in groundwater

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

4. Concentrations of Am-241 in groundwater

5. Concentrations of Cm-242 and Cm-243/244 in groundwater

6. Concentrations of Pu-238 and PU-239/240 in groundwater

7. Concentrations of U-234, U-235 and U-238 in groundwater

8. Concentrations of Fe-55 in groundwater

9. Concentrations of Ni-63 in groundwater

10. Concentrations of Gross Alpha and Gross Beta (Dissolved and Suspended) in groundwater

B. Data Interpretation

1. Lower Limit of Detection and Minimum Detectable Concentration

The lower limit of detection (LLD) is specified by federal regulation as 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 calibration standards, sample volume or weight measurements, sampling uncertainty and other factors. Exelon reports the uncertainty of a measurement created by statistical process (counting error).

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, surface water, and storm water 13 nuclides, Be-7, K-40, Mn-54, Co-58, Fe-59, Co-60, Zn-65, Nb-95, Zr-95, Cs-134, Cs-137, Ba-140 and La-140 were reported.

The radio-analytical laboratory counts tritium results to an 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

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

Tritium

Samples from 52 locations were analyzed for tritium activity. Tritium values ranged from the detection limit to 4,540 pCi/L. (Table B-I.1, Appendix B)

Tritium Split Samples

Tritium values ranged from 177 to 1,550 pCi/L. (Table C-I.1, Appendix C)

Strontium

Sr-89 and Sr-90 were not detected above their required detection limits of 10 and 1.0 pCi/L, respectively. (Table B-I.1, Appendix B)

Strontium Split Samples

Sr-89 and Sr-90 were not detected above the required detection limit. (Table C-I.1, Appendix C)

Gross Alpha and Gross Beta (dissolved and suspended)

Gross Alpha and Gross Beta analyses in the dissolved and suspended fractions were performed on 27 groundwater samples during the second quarter sampling in 2018.

Gross Alpha (dissolved) was not detected at any of the groundwater locations. Gross Alpha (suspended) was detected at 1 of the 27 groundwater locations with a concentration of 2.0 pCi/L.

Gross Beta (dissolved) was detected at 23 of 27 groundwater locations. The concentrations ranged from 1.4 to 10.2 pCi/L. Gross Beta (suspended) was detected in 2 of the 27 groundwater locations. The concentrations ranged from 2.0 to 3.9 pCi/L. (Table B-I.1, Appendix B)

Gross Alpha and Gross Beta (dissolved and suspended) Split Samples

One split sample was analyzed for Gross Alpha and Gross Beta in 2018. Neither Gross Alpha nor Gross Beta was detected.
(Table C-I.1, Appendix C)

Gamma Emitters

No gamma-emitting nuclides were detected. (Table B-I.2, Appendix B)

Gamma Emitters Split Samples

Two locations were analyzed for gamma-emitting nuclides in 2018. No gamma-emitting nuclides were detected in any split samples.
(Table C-I.2, Appendix C)

Hard-To-Detect

Hard-To-Detect analyses, which include Fe-55, Ni-63, Am-241, Cm-242, Cm-243/244, Pu-238, Pu-239/240, U-234, U-235 and U-238, were not analyzed in 2018. (Table B-I.3, Appendix B)

Hard-To-Detect Split Samples

Hard to detects were not analyzed on any split samples in 2018.
(Table C-I.3, Appendix C)

B. Surface Water Results

Samples were collected from surface water locations in accordance with the station radiological groundwater protection program. Analytical results

and anomalies are discussed below.

Tritium

Three locations analyzed for tritium in 2018. Tritium was not detected above the required detection limit of 200 pCi/L in any of the 14 samples analyzed. (Table B-II.1, Appendix B)

Tritium Split Samples

Two locations were analyzed for tritium in 2018. Tritium was not detected above the required detection limit of 200 pCi/L in the samples analyzed. (Table C-II.1, Appendix C)

Gamma Emitters

Three locations analyzed for gamma-emitting nuclides in 2018. No detections of gamma-emitting nuclides were detected. (Table B–II.2, Appendix B)

Gamma Emitters Split Samples

One surface water sample was analyzed for gamma-emitting nuclides in 2018. No gamma-emitting nuclides were detected.
(Table C–II.2, Appendix C).

C. Storm Water Results

Samples were collected from storm water locations in accordance with the station radiological groundwater protection program. Analytical results and anomalies are discussed below.

Tritium

One location analyzed for tritium. Tritium was detected in 1 of 4 samples at a concentration of 219 ± 117 pCi/L. (Table B–III.1, Appendix B)

Gamma Emitters

Samples from one location were analyzed for gamma-emitting nuclides. No gamma emitting nuclides were detected. (Table B–III.2, Appendix B)

D. Precipitation Water Results

Samples were collected a 4 locations. The following analyses were performed:

Tritium

Samples from 4 locations were analyzed for tritium activity. Tritium activity was detected at 3 of 4 locations. The concentrations ranged from 204 to 469 pCi/L. (Table B–IV.1, Appendix B)

Tritium Split Samples

Samples from one location were analyzed for tritium activity. Tritium activity was detected in 3 of 4 samples. The concentrations ranged from 216 to 398 pCi/L (Table C–III.1, Appendix C).

Gamma Emitters

Precipitation water was not analyzed for Gamma Emitters in 2018.

Gamma Emitters Split Samples

No gamma-emitting nuclides were analyzed in 2018.

E. Leaks, Spills, and Releases

A potential leak was identified at TMI in 2012 due to elevated MS-22 tritium concentration readings. TMI continues to monitor MS-22 and surrounding wells, in addition to tritium plumes from previous years, and reports the activity and dose to the public in the ARERR. The elevated MS-22 well tritium concentrations were voluntarily reported under the reporting requirements for the NEI Groundwater Protection Initiative (GPI) as implemented in Exelon's Reportability procedure LS-AA-1120, RAD 1.34 (IR 1385497/1515261).

In May and June 2015, it was determined that multiple Borated Water Storage Tank (BWST) connections (10 of 13 bolted flange connections) had evidence of leakage in the form of boron deposits in addition to the main 24-inch flange (IR 1670674/2427517/2508405/2509685).

F. Actions Taken

1. Compensatory/Corrective Actions

   Fully encapsulating enclosures were installed around all BWST connections including the 24-inch main outlet flange. Each enclosure was fitted with a Tygon tubing discharge point, connected to a water collection bottle to prevent tritiated water from reaching the ground surface. The outlet flange and leaking connections were repaired during the TMI refueling outage in November 2015.

TMI has an extensive groundwater monitoring program with over 50 monitoring wells. No monitoring wells outside the BWST investigation area have seen elevated tritium concentrations. TMI continues to monitor the BWST area wells closely. The leakage has been mitigated by repairing the leaking flanges, and groundwater tritium concentrations have decreased during 2018.

APPENDIX A

LOCATION DESIGNATION & DISTANCE

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TABLE A-1: Radiological Groundwater Protection Program - Sampling Locations, Three Mile Island Nuclear Station, 2018

Site	Site Type
#3	Monitoring Well
48N	Monitoring Well
48S	Production Potable Well
E1-2	Monitoring Well, Offsite
EDCB	Storm Water
MS-1	Monitoring Well
MS-19	Monitoring Well
MS-2	Monitoring Well
MS-20	Monitoring Well
MS-21	Monitoring Well
MS-22	Monitoring Well
MS-3	Monitoring Well
MS-4	Monitoring Well
MS-5	Monitoring Well
MS-6	Monitoring Well
MS-7	Monitoring Well
MS-8	Monitoring Well
MW-1	Monitoring Well
MW-2	Monitoring Well
MW-3	Monitoring Well
MW-4	Monitoring Well
N2-1	Monitoring Well, Offsite
NW-A	Production Well
NW-B	Production Well
NW-C	Production Well
NW-CW	Clearwell
OS-13B	Monitoring Well
OS-14	Monitoring Well
OS-16	Monitoring Well
OS-17	Monitoring Well
OS-18	Monitoring Well
OSF	Production Potable Well
RW-1	Monitoring Well
RW-2	Monitoring Well
SW-E-1	Surface Water
SW-E-2	Surface Water
SW-E-3	Surface Water
MW-TMI-9S*	Monitoring Well
MW-TMI-10D	Monitoring Well
MW-TMI-10I	Monitoring Well
MW-TMI-10S	Monitoring Well
MW-TMI-11S*	Monitoring Well
MW-TMI-12S	Monitoring Well
MW-TMI-13I	Monitoring Well
MW-TMI-13S	Monitoring Well
MW-TMI-14D	Monitoring Well
MW-TMI-14I	Monitoring Well
MW-TMI-14S	Monitoring Well
MW-TMI-16D	Monitoring Well
MW-TMI-16I	Monitoring Well
MW-TMI-17D	Monitoring Well
MW-TMI-17I	Monitoring Well
MW-TMI-18D	Monitoring Well
MW-TMI-19D	Monitoring Well
MW-TMI-19I	Monitoring Well
MW-TMI-1D	Monitoring Well
MW-TMI-20D	Monitoring Well
MW-TMI-20I	Monitoring Well
MW-TMI-21D	Monitoring Well
MW-TMI-21I	Monitoring Well
MW-TMI-21S	Monitoring Well

TABLE A-1: Radiological Groundwater Protection Program - Sampling Locations, Three Mile Island Nuclear Station, 2018

Site	Site Type
MW-TMI-22D	Monitoring Well
MW-TMI-22I	Monitoring Well
MW-TMI-22S	Monitoring Well
MW-TMI-2D	Monitoring Well
MW-TMI-3I	Monitoring Well
MW-TMI-4I	Monitoring Well
MW-TMI-4S	Monitoring Well
MW-TMI-5D	Monitoring Well
MW-TMI-6D	Monitoring Well
MW-TMI-6I	Monitoring Well
MW-TMI-7S	Monitoring Well
MW-TMI-8S	Monitoring Well
MW-TMI-9I	Monitoring Well
TRAINING CENTER	Offsite Monitoring Well
TM-PR-ESE	Precipitation Water
TM-PR-MS-1	Precipitation Water
TM-PR-MS-2	Precipitation Water
TM-PR-MS-20	Precipitation Water
TM-PR-MS-22	Precipitation Water
TM-PR-MS-4	Precipitation Water
TM-PR-NW-B	Precipitation Water
TM-PR-MW-TMI-22S	Precipitation Water

* NO WATER PRESENT TO SAMPLE

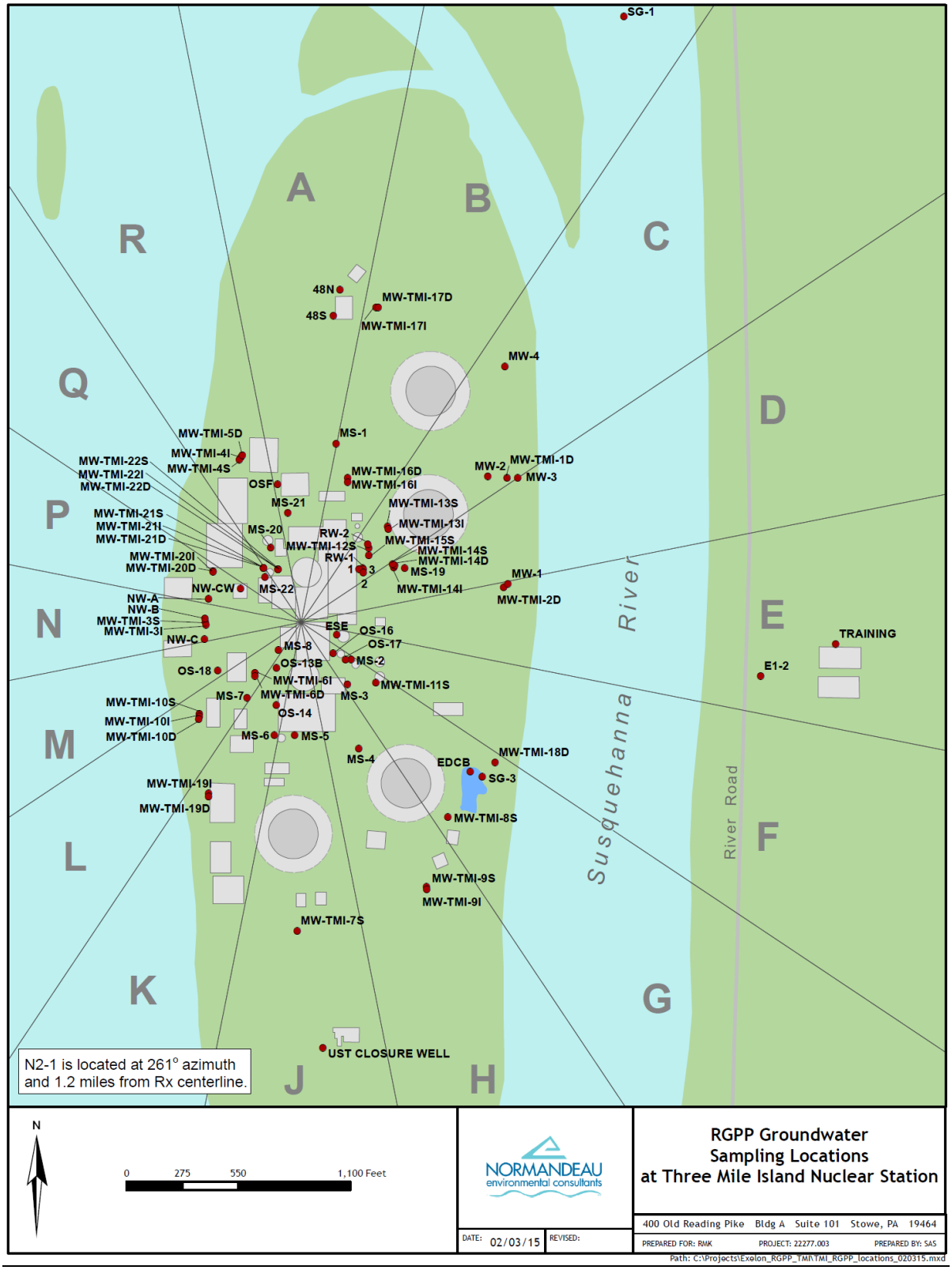

Figure A – 1
Sampling Locations at the Three Mile Island Nuclear Station, 2018

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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 SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROCTION PROGRAM, THREE MILE ISLAND NUCLEAR 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)
48S	02/27/18		< 190						
48S	05/22/18		< 190	< 3.6	< 0.6	< 3.0	< 0.8	4.7 ± 1.5	< 1.4
48S	08/28/18		< 184						
48S	11/07/18		< 192						
MS-1	02/26/18		236 ± 127						
MS-1	05/24/18		253 ± 120	< 5.3	< 0.6	< 7.8	< 0.5	< 4.6	< 1.6
MS-1	08/28/18		< 184						
MS-1	11/06/18		< 194						
MS-1	11/06/18		< 192						
MS-2	02/28/18		231 ± 129						
MS-2	02/28/18		331 ± 133						
MS-2	05/22/18		316 ± 124	< 4.8	< 0.8	< 1.2	< 0.4	3.7 ± 1.0	< 1.4
MS-2	08/29/18		< 189						
MS-2	08/29/18		199 ± 125						
MS-2	11/07/18		237 ± 128						
MS-2	11/07/18		283 ± 131						
MS-3	02/28/18		299 ± 131						
MS-3	05/22/18		225 ± 129	< 3.8	< 0.5	< 1.5	< 0.8	5.9 ± 1.1	< 1.4
MS-3	08/29/18		325 ± 129						
MS-3	11/07/18		211 ± 132						
MS-4	05/24/18		180 ± 119						
MS-5	02/28/18		< 190						
MS-5	05/22/18		< 195	< 3.8	< 0.6	< 1.4	< 0.8	4.7 ± 1.0	< 1.4
MS-5	08/29/18		< 186						
MS-5	11/07/18		< 196						
MS-7	02/28/18		< 192						
MS-7	05/23/18		< 193	< 4.0	< 0.8	< 1.3	< 0.8	3.6 ± 0.9	< 1.4
MS-7	08/28/18		198 ± 124						
MS-7	08/28/18		< 187						
MS-7	11/06/18		< 196						
MS-7	11/06/18		259 ± 135						
MS-8	02/28/18		< 191						
MS-8	05/22/18		< 196	< 3.6	< 0.8	< 1.2	< 0.8	4.1 ± 0.9	< 1.4
MS-8	08/29/18		311 ± 129						
MS-8	11/07/18		< 198						
MS-20	02/27/18		458 ± 139						
MS-20	05/22/18		529 ± 135	< 7.2	< 0.6	< 1.2	< 0.4	5.0 ± 1.0	< 1.5
MS-20	08/28/18		559 ± 143						
MS-20	11/07/18		680 ± 149						
MS-21	02/27/18		< 192						
MS-21	05/22/18		< 198	< 4.1	< 0.6	< 0.9	< 0.4	2.2 ± 0.7	< 1.4
MS-21	08/28/18		194 ± 123						
MS-21	11/07/18		< 196						
MS-22	02/27/18		1590 ± 225						
MS-22	05/22/18		979 ± 178						
MS-22	05/22/18			< 5.5	< 0.8	< 1.2	< 0.5	5.2 ± 0.9	< 1.4
MS-22	08/28/18		966 ± 162						
MS-22	11/07/18		1160 ± 191						
MS-22	11/07/18		1220 ± 198						
MW-1	05/23/18		< 188						
MW-1	05/23/18		< 185						
MW-2	05/23/18		< 188						
MW-TMI-1D	05/23/18		207 ± 119						
MW-TMI-2D	05/23/18		< 176						
MW-TMI-3I	02/28/18		212 ± 128						
MW-TMI-3I	05/24/18		< 189	< 4.2	< 0.6	< 3.0	< 0.8	7.1 ± 1.9	< 1.4
MW-TMI-3I	05/24/18	*Recount*	371 ± 125						
MW-TMI-3I	05/24/18	*Reanalysis*	335 ± 127						

TABLE B-I.1 CONCENTRATIONS OF TRITIUM, STRONTIUM, GROSS ALPHA AND GROSS BETA IN GROUNDWATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROCTION PROGRAM, THREE MILE ISLAND NUCLEAR 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-TMI-3I	05/24/18		193 ± 124	< 4.0	< 0.9	< 2.2	< 0.7	4.9 ± 1.9	< 1.5
MW-TMI-3I	08/30/18		314 ± 129						
MW-TMI-3I	08/30/18		395 ± 134						
MW-TMI-3I	11/06/18		273 ± 131						
MW-TMI-4I	05/23/18		< 181						
MW-TMI-4S	05/23/18		278 ± 124						
MW-TMI-6D	02/28/18		200 ± 128						
MW-TMI-6D	05/23/18		< 198	< 4.9	< 0.6	< 0.7	< 0.5	1.8 ± 0.6	< 1.7
MW-TMI-6D	08/28/18		341 ± 132						
MW-TMI-6D	11/06/18		< 194						
MW-TMI-6I	02/28/18		237 ± 128						
MW-TMI-6I	05/23/18		< 196	< 4.9	< 0.7	< 1.2	2.0 ± 0.8	2.5 ± 0.9	2.0 ± 1.0
MW-TMI-6I	08/28/18		188 ± 122						
MW-TMI-6I	11/06/18		< 191						
MW-TMI-7S	05/24/18		< 179						
MW-TMI-8S	05/24/18		< 191						
MW-TMI-9I	05/24/18		< 180						
MW-TMI-9S	05/24/18		< 178						
MW-TMI-10D	05/23/18		< 178						
MW-TMI-10I	02/27/18		583 ± 144						
MW-TMI-10I	02/27/18		556 ± 141						
MW-TMI-10I	05/23/18		429 ± 138						
MW-TMI-10I	05/23/18		451 ± 135						
MW-TMI-10I	08/30/18		623 ± 144						
MW-TMI-10I	11/06/18		395 ± 137						
MW-TMI-10I	11/06/18		483 ± 140						
MW-TMI-10S	02/27/18		228 ± 128						
MW-TMI-10S	05/23/18		383 ± 138	< 5.6	< 0.8	< 1.3	< 0.7	5.3 ± 1.1	< 1.9
MW-TMI-10S	08/30/18		666 ± 147						
MW-TMI-10S	11/06/18		477 ± 143						
MW-TMI-10S	11/06/18		617 ± 151						
MW-TMI-12S	02/27/18		< 193						
MW-TMI-12S	05/24/18		< 193	< 2.3	< 0.6	< 1.0	< 0.8	4.6 ± 0.9	3.9 ± 1.2
MW-TMI-12S	05/24/18	*Recount*							3.9 ± 1.7
MW-TMI-12S	08/29/18		< 190						
MW-TMI-12S	11/07/18		< 192						
MW-TMI-13I	02/26/18		< 193						
MW-TMI-13I	05/23/18		< 194						
MW-TMI-13I	05/23/18		< 186						
MW-TMI-13I	08/28/18		< 186						
MW-TMI-13I	11/06/18		< 190						
MW-TMI-14D	02/28/18		310 ± 132						
MW-TMI-14D	05/23/18		213 ± 126						
MW-TMI-14D	08/28/18		325 ± 131						
MW-TMI-14D	11/06/18		281 ± 136						
MW-TMI-14I	02/28/18		< 193						
MW-TMI-14I	02/28/18		< 193						
MW-TMI-14I	05/23/18		< 178						
MW-TMI-14I	08/28/18		< 187						
MW-TMI-14I	11/06/18		< 192						
MW-TMI-14I	11/06/18		< 198						
MW-TMI-16D	05/24/18		702 ± 145	< 5.2	< 0.6	< 0.8	< 0.4	6.4 ± 0.9	< 1.6
MW-TMI-17I	05/24/18		< 177						
MW-TMI-18D	05/23/18		< 182						
MW-TMI-19I	05/24/18		< 178						
MW-TMI-20I	05/24/18		238 ± 121						
MW-TMI-21D	02/27/18		3730 ± 432						
MW-TMI-21D	05/22/18		3780 ± 444						

TABLE B-I.1 CONCENTRATIONS OF TRITIUM, STRONTIUM, GROSS ALPHA AND GROSS BETA IN GROUNDWATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROCTION PROGRAM, THREE MILE ISLAND NUCLEAR 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-TMI-21D	08/28/18	4070 ± 460						
MW-TMI-21D	11/07/18	3920 ± 454						
MW-TMI-21D	11/07/18	3730 ± 437						
MW-TMI-21I	02/27/18	1300 ± 197						
MW-TMI-21I	02/27/18	1050 ± 173						
MW-TMI-21I	05/22/18	1150 ± 190						
MW-TMI-21I	08/28/18	1170 ± 181						
MW-TMI-21I	11/07/18	1030 ± 179						
MW-TMI-21I	11/07/18	911 ± 170						
MW-TMI-21S	02/27/18	673 ± 144						
MW-TMI-21S	05/22/18	984 ± 178						
MW-TMI-21S	05/22/18		< 5.9	< 0.7	< 1.6	< 0.5	7.1 ± 1.2	< 1.4
MW-TMI-21S	08/28/18	463 ± 136						
MW-TMI-21S	11/07/18	436 ± 145						
MW-TMI-21S	11/07/18	435 ± 140						
MW-TMI-22D	02/27/18	3350 ± 392						
MW-TMI-22D	05/22/18	2980 ± 364						
MW-TMI-22D	08/28/18	3680 ± 421						
MW-TMI-22D	11/07/18	3110 ± 374						
MW-TMI-22D	11/07/18	3240 ± 389						
MW-TMI-22I	02/27/18	4540 ± 507						
MW-TMI-22I	05/22/18	2650 ± 328						
MW-TMI-22I	08/28/18	1830 ± 243						
MW-TMI-22I	11/07/18	1210 ± 195						
MW-TMI-22I	11/07/18	1430 ± 216						
MW-TMI-22S	02/27/18	2050 ± 263						
MW-TMI-22S	05/22/18	972 ± 171						
MW-TMI-22S	05/22/18		< 5.4	< 0.8	< 1.8	< 0.5	6.6 ± 1.3	< 1.4
MW-TMI-22S	08/28/18	1150 ± 181						
MW-TMI-22S	11/07/18	511 ± 142						
MW-TMI-22S	11/07/18	431 ± 140						
N2-1	05/31/18	< 191						
NW-A	02/27/18	397 ± 137						
NW-A	05/22/18	260 ± 128	< 3.8	< 0.7	< 1.2	< 0.8	3.7 ± 1.2	< 1.4
NW-A	08/28/18	403 ± 135						
NW-A	11/07/18	267 ± 135						
NW-B	02/27/18	221 ± 127						
NW-B	05/22/18	< 187	< 4.5	< 0.8	< 1.0	< 0.8	3.1 ± 1.0	< 1.4
NW-B	08/28/18	286 ± 129						
NW-B	11/07/18	< 196						
NW-C	02/27/18	668 ± 147						
NW-C	05/22/18	674 ± 147	< 4.1	< 0.9	< 0.9	< 0.8	1.4 ± 0.8	< 1.4
NW-C	08/28/18	1400 ± 207						
NW-C	08/28/18	1300 ± 200						
NW-C	11/07/18	523 ± 147						
NW-CW	02/27/18	322 ± 132						
NW-CW	05/22/18	246 ± 126	< 5.0	< 0.8	< 1.0	< 0.8	3.0 ± 1.0	< 1.4
NW-CW	08/28/18	393 ± 134						
NW-CW	11/07/18	380 ± 141						
OS-14	02/28/18	< 192						
OS-14	05/22/18	< 195	< 4.5	< 0.6	< 2.1	< 0.4	10.2 ± 1.5	< 1.4
OS-14	08/29/18	< 184						
OS-14	11/07/18	< 195						
OS-16	02/28/18	315 ± 133						
OS-16	05/22/18	< 195	< 6.6	< 0.6	< 1.0	< 0.4	4.3 ± 0.8	< 1.4
OS-16	08/29/18	376 ± 133						
OS-16	11/07/18	281 ± 134						
OS-18	05/23/18	< 190						

TABLE B-I.1 CONCENTRATIONS OF TRITIUM, STRONTIUM, GROSS ALPHA AND GROSS BETA IN GROUNDWATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROCTION PROGRAM, THREE MILE ISLAND NUCLEAR 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)
OSF	02/27/18	313 ± 131						
OSF	05/22/18	321 ± 131	< 3.9	< 0.6	< 2.9	< 0.8	7.7 ± 1.7	< 1.4
OSF	08/28/18	345 ± 131						
OSF	11/07/18	< 194						
RW-1	02/27/18	< 193						
RW-1	05/22/18	< 189	< 3.7	< 0.9	< 1.1	< 0.8	8.1 ± 1.3	< 1.4
RW-1	08/28/18	196 ± 126						
RW-1	11/07/18	< 195						
TRAINING CENTER	05/21/18	< 190						

TABLE B-I.2

CONCENTRATIONS OF GAMMA EMITTERS IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	Be-7	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140
48S	05/22/18	< 32	< 73	< 3	< 4	< 9	< 4	< 7	< 4	< 7	< 4	< 4	< 29	< 9
MS-1	05/24/18	< 48	< 87	< 6	< 6	< 13	< 7	< 13	< 6	< 8	< 5	< 5	< 37	< 11
MS-2	05/22/18	< 39	< 63	< 4	< 3	< 9	< 4	< 7	< 4	< 8	< 4	< 4	< 26	< 8
MS-3	02/28/18	< 66	< 120	< 7	< 8	< 13	< 8	< 19	< 9	< 16	< 8	< 9	< 34	< 12
MS-3	05/22/18	< 30	< 60	< 3	< 3	< 6	< 3	< 6	< 3	< 5	< 3	< 3	< 26	< 8
MS-3	08/29/18	< 59	< 56	< 7	< 7	< 18	< 7	< 16	< 7	< 14	< 8	< 7	< 39	< 9
MS-3	11/07/18	< 51	< 104	< 5	< 5	< 12	< 5	< 9	< 6	< 9	< 5	< 5	< 34	< 12
MS-4	05/24/18	< 46	< 74	< 5	< 5	< 11	< 7	< 10	< 5	< 8	< 6	< 5	< 29	< 14
MS-5	02/28/18	< 61	< 68	< 8	< 7	< 16	< 8	< 16	< 8	< 15	< 9	< 8	< 28	< 11
MS-5	05/22/18	< 33	< 59	< 3	< 4	< 8	< 3	< 7	< 3	< 6	< 4	< 4	< 32	< 9
MS-5	08/29/18	< 56	< 71	< 7	< 6	< 17	< 6	< 12	< 8	< 14	< 6	< 7	< 33	< 9
MS-5	11/07/18	< 41	< 89	< 4	< 5	< 10	< 6	< 10	< 6	< 10	< 5	< 5	< 30	< 9
MS-7	05/23/18	< 35	< 44	< 4	< 4	< 10	< 3	< 8	< 5	< 7	< 5	< 4	< 32	< 13
MS-8	02/28/18	< 65	< 66	< 6	< 6	< 19	< 8	< 21	< 9	< 14	< 9	< 9	< 29	< 14
MS-8	05/22/18	< 17	< 30	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 2	< 2	< 14	< 6
MS-8	08/29/18	< 66	< 66	< 9	< 7	< 18	< 6	< 18	< 8	< 13	< 9	< 8	< 38	< 13
MS-8	11/07/18	< 41	< 78	< 4	< 5	< 10	< 4	< 8	< 5	< 9	< 5	< 4	< 30	< 9
MS-20	05/22/18	< 36	< 37	< 4	< 4	< 9	< 3	< 7	< 3	< 6	< 3	< 3	< 26	< 9
MS-21	05/22/18	< 18	< 33	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 17	< 5
MS-22	05/22/18	< 18	< 19	< 2	< 2	< 5	< 2	< 4	< 2	< 3	< 2	< 2	< 18	< 6
MW-1	05/23/18	< 26	< 23	< 2	< 3	< 6	< 3	< 5	< 3	< 5	< 3	< 3	< 22	< 6
MW-1	05/23/18	< 17	< 38	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 14	< 5
MW-2	05/23/18	< 17	< 33	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 2	< 2	< 16	< 5
MW-TMI-1D	05/23/18	< 40	< 35	< 4	< 4	< 8	< 4	< 8	< 4	< 8	< 4	< 4	< 34	< 10
MW-TMI-2D	05/23/18	< 41	< 37	< 4	< 4	< 8	< 5	< 9	< 5	< 8	< 5	< 4	< 31	< 13
MW-TMI-3I	05/24/18	< 38	< 78	< 4	< 5	< 10	< 5	< 8	< 5	< 7	< 4	< 4	< 29	< 12
MW-TMI-3I	05/24/18	< 19	< 32	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 15	< 6
MW-TMI-4I	05/23/18	< 46	< 100	< 5	< 5	< 11	< 5	< 11	< 5	< 10	< 5	< 5	< 28	< 13
MW-TMI-4S	05/23/18	< 43	< 83	< 3	< 5	< 9	< 4	< 7	< 5	< 7	< 5	< 4	< 29	< 9
MW-TMI-6D	05/23/18	< 16	< 30	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 15	< 4
MW-TMI-6I	05/23/18	< 18	< 28	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 15	< 5
MW-TMI-7S	05/24/18	< 33	< 79	< 4	< 4	< 10	< 5	< 9	< 4	< 8	< 4	< 4	< 23	< 11
MW-TMI-8S	05/24/18	< 17	< 34	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 15	< 5
MW-TMI-9I	05/24/18	< 44	< 79	< 5	< 5	< 10	< 6	< 10	< 6	< 10	< 6	< 5	< 33	< 12

TABLE B-I.2

CONCENTRATIONS OF GAMMA EMITTERS IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	Be-7	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140
MW-TMI-9S	05/24/18	< 41	< 54	< 5	< 5	< 11	< 5	< 9	< 6	< 10	< 5	< 5	< 36	< 9
MW-TMI-10D	05/23/18	< 39	< 86	< 4	< 5	< 10	< 4	< 10	< 5	< 8	< 5	< 4	< 32	< 11
MW-TMI-10S	05/23/18	< 28	< 60	< 3	< 4	< 7	< 3	< 6	< 3	< 5	< 3	< 3	< 25	< 10
MW-TMI-12S	05/24/18	< 35	< 34	< 4	< 4	< 8	< 4	< 7	< 4	< 6	< 4	< 4	< 26	< 9
MW-TMI-16D	05/24/18	< 41	< 29	< 4	< 5	< 10	< 5	< 8	< 4	< 8	< 5	< 4	< 31	< 9
MW-TMI-17I	05/24/18	< 39	< 38	< 4	< 4	< 9	< 4	< 9	< 5	< 6	< 5	< 5	< 26	< 10
MW-TMI-18D	05/23/18	< 41	< 66	< 4	< 5	< 9	< 6	< 9	< 5	< 9	< 4	< 4	< 27	< 14
MW-TMI-19I	05/24/18	< 44	< 108	< 5	< 5	< 11	< 5	< 11	< 5	< 8	< 5	< 5	< 32	< 10
MW-TMI-20I	05/24/18	< 45	< 48	< 4	< 5	< 9	< 5	< 8	< 5	< 8	< 5	< 5	< 33	< 8
MW-TMI-21S	05/22/18	< 16	< 38	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 17	< 6
MW-TMI-22S	05/22/18	< 17	< 13	< 1	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 19	< 5
N2-1	05/31/18	< 38	< 26	< 5	< 5	< 9	< 5	< 9	< 5	< 8	< 5	< 5	< 30	< 7
NW-A	05/22/18	< 29	< 63	< 3	< 3	< 8	< 3	< 6	< 4	< 6	< 4	< 3	< 27	< 9
NW-B	05/22/18	< 32	< 62	< 3	< 4	< 9	< 4	< 6	< 4	< 7	< 3	< 3	< 28	< 10
NW-C	05/22/18	< 30	< 60	< 3	< 3	< 9	< 3	< 7	< 3	< 6	< 3	< 3	< 25	< 10
NW-CW	05/22/18	< 33	< 54	< 3	< 4	< 9	< 4	< 8	< 4	< 6	< 4	< 3	< 30	< 12
OS-14	02/28/18	< 74	< 180	< 9	< 8	< 21	< 10	< 18	< 10	< 18	< 9	< 9	< 35	< 13
OS-14	05/22/18	< 16	< 36	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 14	< 5
OS-14	08/29/18	< 56	< 56	< 5	< 6	< 15	< 6	< 16	< 9	< 13	< 8	< 9	< 39	< 11
OS-14	11/07/18	< 48	< 97	< 4	< 5	< 10	< 3	< 10	< 6	< 9	< 5	< 5	< 35	< 11
OS-16	02/28/18	< 71	< 91	< 8	< 9	< 18	< 7	< 12	< 8	< 13	< 8	< 8	< 46	< 13
OS-16	05/22/18	< 13	< 30	< 1	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 1	< 11	< 4
OS-16	08/29/18	< 54	< 91	< 6	< 7	< 14	< 7	< 13	< 7	< 12	< 7	< 8	< 34	< 10
OS-16	11/07/18	< 46	< 89	< 5	< 5	< 10	< 5	< 10	< 5	< 10	< 5	< 5	< 33	< 11
OS-18	05/23/18	< 25	< 59	< 2	< 3	< 6	< 3	< 5	< 3	< 5	< 3	< 3	< 21	< 7
OSF	05/22/18	< 32	< 59	< 3	< 4	< 8	< 4	< 8	< 3	< 6	< 4	< 3	< 28	< 9
RW-1	05/22/18	< 26	< 27	< 3	< 3	< 7	< 3	< 6	< 3	< 5	< 3	< 3	< 24	< 7
TRAINING CENTER	05/21/18	< 17	< 37	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 16	< 7

TABLE B-I.3 **CONCENTRATIONS OF HARD TO DETECTS IN GROUNDWATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM THREE MILE ISLAND NUCLEAR 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

There were no hard to detect analyses for 2018

TABLE B-II.1 CONCENTRATIONS OF TRITIUM IN SURFACE WATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	H-3
SW-E-1	02/28/18	< 193
SW-E-1	05/23/18	< 194
SW-E-1	08/28/18	< 185
SW-E-1	11/07/18	< 183
SW-E-2	02/26/18	< 193
SW-E-2	05/21/18	< 174
SW-E-2	05/21/18	< 187
SW-E-2	08/28/18	< 187
SW-E-2	11/07/18	< 192
SW-E-3	02/26/18	< 193
SW-E-3	05/21/18	< 181
SW-E-3	08/28/18	< 187
SW-E-3	08/28/18	< 187
SW-E-3	11/07/18	< 196

TABLE B-II.2 **CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018**

RESULTS IN UNITS OF PCI/LITER + 2 SIGMA

SITE	COLLECTION DATE	Be-7	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140
SW-E-1	05/23/18	< 17	< 31	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 15	< 5
SW-E-2	05/21/18	< 31	< 33	< 3	< 4	< 7	< 4	< 7	< 4	< 8	< 4	< 4	< 22	< 8
SW-E-2	05/21/18	< 15	< 23	< 1	< 2	< 3	< 2	< 3	< 2	< 3	< 2	< 1	< 15	< 5
SW-E-3	05/21/18	< 28	< 67	< 3	< 3	< 7	< 3	< 5	< 3	< 6	< 3	< 3	< 28	< 7

TABLE B-III.1 CONCENTRATIONS OF TRITIUM IN STORM WATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM - THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF PCI/LITER + 2 SIGMA

SITE	COLLECTION DATES	H-3
EDCB	01/30/18 - 03/27/18	< 181
EDCB	03/27/18 - 06/26/18	219 ± 117
EDCB	06/26/18 - 09/25/18	< 197
EDCB	10/31/18 - 01/03/19	< 190

TABLE B-III.2

CONCENTRATIONS OF GAMMA EMITTERS IN STORM WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF PCI/LITER + 2 SIGMA

SITE	COLLECTION DATES	Be-7	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140
EDCB	01/30/18 - 03/27/18	< 73	< 147	< 9	< 8	< 15	< 10	< 18	< 6	< 14	< 8	< 8	< 30	< 12
EDCB	03/27/18 - 06/26/18	< 51	< 32	< 5	< 7	< 10	< 5	< 12	< 5	< 11	< 6	< 7	< 33	< 12
EDCB	06/26/18 - 09/25/18	< 21	< 73	< 3	< 2	< 5	< 3	< 5	< 3	< 4	< 3	< 3	< 12	< 3
EDCB	10/31/18 - 01/03/19	< 57	< 60	< 7	< 6	< 13	< 6	< 15	< 6	< 9	< 5	< 5	< 28	< 11

TABLE B-IV.1 CONCENTRATIONS OF TRITIUM IN PRECIPITATION WATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	H-3
TM-PR-ESE	02/28/18	469 ± 135
TM-PR-ESE	05/21/18	< 195
TM-PR-ESE	07/26/18	245 ± 128
TM-PR-ESE	11/05/18	281 ± 128
TM-PR-MS-1	02/28/18	< 185
TM-PR-MS-1	05/21/18	< 194
TM-PR-MS-1	07/26/18	< 194
TM-PR-MS-1	11/05/18	< 200
TM-PR-MS-2	02/28/18	409 ± 131
TM-PR-MS-2	05/21/18	< 193
TM-PR-MS-2	07/26/18	274 ± 131
TM-PR-MS-2	11/05/18	265 ± 127
TM-PR-MS-4	02/28/18	204 ± 124
TM-PR-MS-4	05/21/18	< 196
TM-PR-MS-4	07/26/18	< 196
TM-PR-MS-4	11/05/18	< 186

APPENDIX C

DATA TABLES

COMPARISON LAB

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TABLE C-I.1 CONCENTRATIONS OF TRITIUM, STRONTIUM, GROSS ALPHA AND GROSS BETA IN GROUNDWATER SPLIT SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

LAB	SITE	COLLECTION DATE	H-3	Sr-89	Sr-90	Gross Alpha	Gross Beta
GEL	MS-2	02/28/18	177 ± 88				
	MS-2	08/29/18	< 121				
	MS-2	11/07/18	193 ± 81				
	MS-7	08/28/18	250 ± 91				
	MS-7	11/06/18	< 116				
	MW-1	05/23/18	< 116				
	MW-TMI-3I	05/24/18	259 ± 84	< 0.4	< 0.3	< 21.5	< 10.4
	MW-TMI-3I	08/30/18	257 ± 80				
	MW-TMI-10I	02/27/18	444 ± 96				
	MW-TMI-10I	05/23/18	456 ± 92				
	MW-TMI-13I	05/23/18	< 113				
	MW-TMI-14I	02/28/18	< 144				
	MW-TMI-14I	11/06/18	< 114				
	MW-TMI-21I	02/27/18	1550 ± 119				

TABLE C-I.2 CONCENTRATIONS OF GAMMA EMITTERS IN GROUNDWATER SPLIT SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

LAB	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
GEL	MW-1	02/23/18	< 1	< 3	< 2	< 1	< 3	< 3	< 2	< 2	< 2	< 9	< 3
	MW-TMI-3I	05/24/18	< 2	< 4	< 2	< 2	< 3	< 3	< 2	< 2	< 2	< 10	< 4

TABLE C-I.3 **CONCENTRATIONS OF HARD TO DETECTS IN GROUNDWATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, THREE MILE ISLAND NUCLEAR STATION, 2018**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	Am-241	Cm-242	Cm-243/244	Pu-238	Pu-239/240	U-233/234	U-235	U-238	Fe-55	Ni-63

There were no hard to detect analyses for 2018

TABLE C-II.1 CONCENTRATIONS OF TRITIUM IN SURFACE WATER SPLIT SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

LAB	SITE	COLLECTION DATE	H-3
GEL	SW-E-2	05/21/18	< 115
	SW-E-3	08/28/18	< 103

TABLE C-II.2 CONCENTRATIONS OF GAMMA EMITTERS IN GROUNDWATER SPLIT SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

LAB	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
GEL	SW-E-2	05/21/18	< 2	< 4	< 2	< 2	< 3	< 3	< 2	< 2	< 1	< 11	< 3

TABLE C-III.1 CONCENTRATIONS OF TRITIUM IN PRECIPITATION WATER SPLIT SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, THREE MILE ISLAND NUCLEAR STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

LAB	SITE	COLLECTION DATES	H-3
GEL	TM-PR-MS-2Q	02/28/18 - 03/27/18	398 ± 95
	TM-PR-MS-2Q	05/21/18 - 06/28/18	< 161
	TM-PR-MS-2Q	07/26/18 - 08/30/18	216 ± 84
	TM-PR-MS-2Q	11/05/18 - 12/10/18	257 ± 115