Three Mile Island Nuclear Station, Unit 1
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Middletown, PA 17057

TMI-20-016

April 30, 2020

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Three Mile Island Nuclear Station, Unit 1
Renewed Facility Operating License No. DPR-50
NRC Docket Nos. 50-289

Three Mile Island Nuclear Station, Unit 2
Possession Only License No. DPR-73
NRC Docket No. 50-320

Subject: 2019 Annual Radiological Environmental Operating Report

In accordance with TMI-1 Technical Specification 6.9.2.1 and 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, 2019, for the Three Mile Island Nuclear Station.

There are no commitments in this letter.

Should you have any questions concerning this letter, please contact Mr. Daniel Jordan, Chemistry/Environmental Specialist, at (717) 948-8470.

Respectfully,

Trevor L. Orth
Decommissioning Plant Manager
Three Mile Island Nuclear Station, Unit 1

Attachment: Three Mile Island 2019 Annual Radiological Environmental Operating Report

cc: w/Attachments
Regional Administrator – NRC Region I

ATTACHMENT

Three Mile Island
Annual Radiological Environmental
Operating Report

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 2019

Prepared By
Teledyne Brown Engineering
Environmental Services

Exelon Generation®

Three Mile Island Nuclear Station
Middletown, PA 17057

April 2020

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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 2019 through 31 December 2019. During that time period, 1,701 analyses were performed on 1,315 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 stormwater 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 5 surface water samples and 8 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. Occasionally, Cs-137 is detected at very low levels (just above LLD) and is not distinguishable from background levels. Cs-137 was found in one sediment sample. No other fission or activation products were detected in sediment samples.

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 slightly above the MDC. 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 2019 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 2019 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 2019 through 31 December 2019.

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 2019. 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). 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. Three different kinds of vegetation samples and eleven 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 2019. 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 2019, the TMINS REMP had a sample recovery rate of 99.5%. 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 1/30/19 - 3/27/19, 3/27/19 - 6/17/19 and 6/27/19 - 8/10/19, compensatory grab samples were required due to the sample line being pulled into the river and disconnected. There was not an immediate ability to replace the sample tube because of adverse seasonal conditions. (IR's 04240350 and 04266250)

Dosimetry

1. N1-1

   For the sampling periods 3/20/19 - 6/21/19 and 6/21/19 - 9/22/19, the dosimeters for this subgroup were found to be missing at the time of change out, likely due to vandalism. (IR's 04291991 and 04258998)

2. R15-1

   On 12/20/19, the dosimeters were missing for the period 09-09-19 -12-20-19 and not found. (IR 04306154)

Air

1. E1-2

   For the 5/30/19 - 6/7/19 sampling period, sample was missed due to a tripped GFCI outlet and the timer reading 24.4 hours (not enough for a valid sample). (IR 04255157)

2. E1-2

   For the sampling period 7/20/19 - 7/27/19, the sampler was found out of operation. The sampler was repaired, but the weekly sample was invalid. (IR 04291955)

Milk

1. E2-2

   For the sampling periods of 1/1/19 - 3/31/19, 4/3/19 - 6/26/19 and 06/27/19 - 09/2819, no samples were able to be obtained due to owner not cooperating. Vegetation will be sampled in this sector instead. The minimum number of milk samples was still met.
   (IR 04240530) (IR 04291955) (IR 04266250)

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 2019.

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 661 to 12,700 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 17 of 36 samples. The concentrations ranged from 2.1 to 5.6 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 detected in 1 of 36 samples at a concentration of 203 pCi/L. (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. Gross beta was detected in 10 of 12 samples. The concentrations ranged from 2.3 to 7.1 pCi/L. Concentrations detected were consistent with those detected in previous years.
(Tables C–III.1, Appendix C)

Iodine-131

Monthly samples from location K1-1 were analyzed for concentrations of I-131. I-131 was not detected in any of the samples.

(Tables C–III.1, Appendix C)

Tritium

Monthly samples from location K1-1 were analyzed for tritium activity. Tritium activity was detected in 8 of 12 samples. The concentrations ranged from 220 to 91,300 pCi/L. (Table C–III.1, Appendix C)
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. No strontium activity was detected. The highest MDC was calculated at <4.3 pCi/L for Sr-89 and at <0.7 pCi/L for Sr-90. (Table C–III.1, Appendix C)

Gamma Spectrometry

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

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. No strontium activity was detected. The highest MDC was calculated at <4.8 pCi/kg wet for Sr-90. (Table C–IV.1, Appendix C)

Gamma Spectrometry

The edible portions of fish samples from both locations were analyzed for gamma-emitting nuclides. Naturally-occurring K-40 was found in all fish samples. Concentrations ranged from 2,875 to 3,790 pCi/kg wet and was consistent with levels detected in previous years. No fission or activation products were detected. (Table C–IV.2, Appendix C)

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. Potassium-40 was found in all sediment samples and ranged from 6,261 to 14,690 pCi/kg dry. Cs-137 is occasionally found in sediment at very low levels (just above LLD) and is not distinguishable from background levels. Cs-137 was found in one sample at 112 pCi/kg dry. (Figure C–5, Appendix C) No other fission or activation products were detected. (Table C–V.1, 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. Detectable gross beta activity was observed at all locations. (Table C–VI.1 and C–VI.2, Appendix C)

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 7 to 33E–3 pCi/m^3 with a mean of 14E–3 pCi/m^3. The results from the intermediate offsite locations (Group II) ranged from 5 to 32E–3 pCi/m^3 with a mean of 14E–3 pCi/m^3. The results from the Control location (Group III) ranged from 5 to 32E–3 pCi/m^3 with a mean of 15E–3 pCi/m^3. Comparison of the 2019 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 2019 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. Naturally-occurring Be-7 due to cosmic ray activity was detected in all 28 samples. These concentrations ranged from 52 to 88E–3 pCi/m3. All other nuclides were less than MDC. (Table C–VI.3, Appendix C)

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. All results were less than the MDC for I-131. (Table C–VII.1, Appendix C)

2. Terrestrial

a. Milk

Samples were collected from four locations (K15-3, 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. All results were less than the MDC. (Table C-VIII.1, Appendix C)

Strontium

Milk samples from all locations were composited quarterly and analyzed for Sr-89 and Sr-90. No Sr-89 activity was detected.

Sr-90 activity was detected in 1 sample at a concentration of 0.9 pCi/L. (Table C–VIII.2, Appendix C) 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. Naturally-occurring K-40 activity was found in all samples. The concentrations ranged from 974 to 2,206 pCi/L. All other nuclides were less than the MDC.
(Table C-VIII.3, Appendix C).

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

Forty-two food product samples were analyzed for concentrations of Sr-90. Sr-90 activity was detected in 24 of the 42 samples. The concentrations ranged from 5.6 to 39.7 pCi/kg wet.
(Table C-IX.1, Appendix C)

Gamma Spectrometry

Each food product sample was analyzed for concentrations of gamma-emitting nuclides. Naturally-occurring Be-7 due to cosmic ray activity was detected in 26 of 42 samples with concentrations ranging from 195 to 1,514 pCi/kg. Naturally-occurring K-40 activity was found in all samples. The concentrations ranged from 1,721 to 8,256 pCi/kg. All other nuclides were less than the MDC.
(Table C–IX.1, Appendix C)

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 40 mR/quarter, with a range of

9.1 to 39.1 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 2019 fall 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 2019 operations at TMINS were well below all applicable regulatory limits and were significantly less than doses received

from natural sources of radiation. The 2019 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 0.13 mrem. This dose is equivalent to 0.04% 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 2019 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 2019 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 2019 TMI-1 and TMI-2 liquid and airborne effluents combined was conservatively calculated to be 0.13 mrem. This dose is equivalent to 0.04% 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 2019 TMINS operations were the result of efforts to maintain releases "as low as reasonably achievable" (ALARA).

In conclusion, radioactive materials related to 2019 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 2019 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 2019 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 2019 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	2.25E-02	3.24E-04
	10 any organ	2.43E-02	5.15E-04
From Radionuclides In Airborne Releases (Noble Gases)	5 total body, or	2.75E-04	0*
	15 skin	4.03E-04	0*
From Radionuclides In Airborne Releases (Iodines, Tritium and Particulates)	15 any organ	1.05E-01	1.45E-05

*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	0.48
	25 total body or other organs	0.79

* *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 2019 TMINS operations was 0.363 mrem/yr based on calculations from ANSI/HI Standard N13.37.

TABLE 2

Calculated Whole Body Doses to the Maximum Individual from 2019 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	2.25E-02	3.24E-04
From Radionuclides in Airborne Releases (Noble Gases)	2.75E-04	0*
From Radionuclides In Airborne Releases (Iodines, Tritium and Particulates)	1.05E-01	1.45E-05

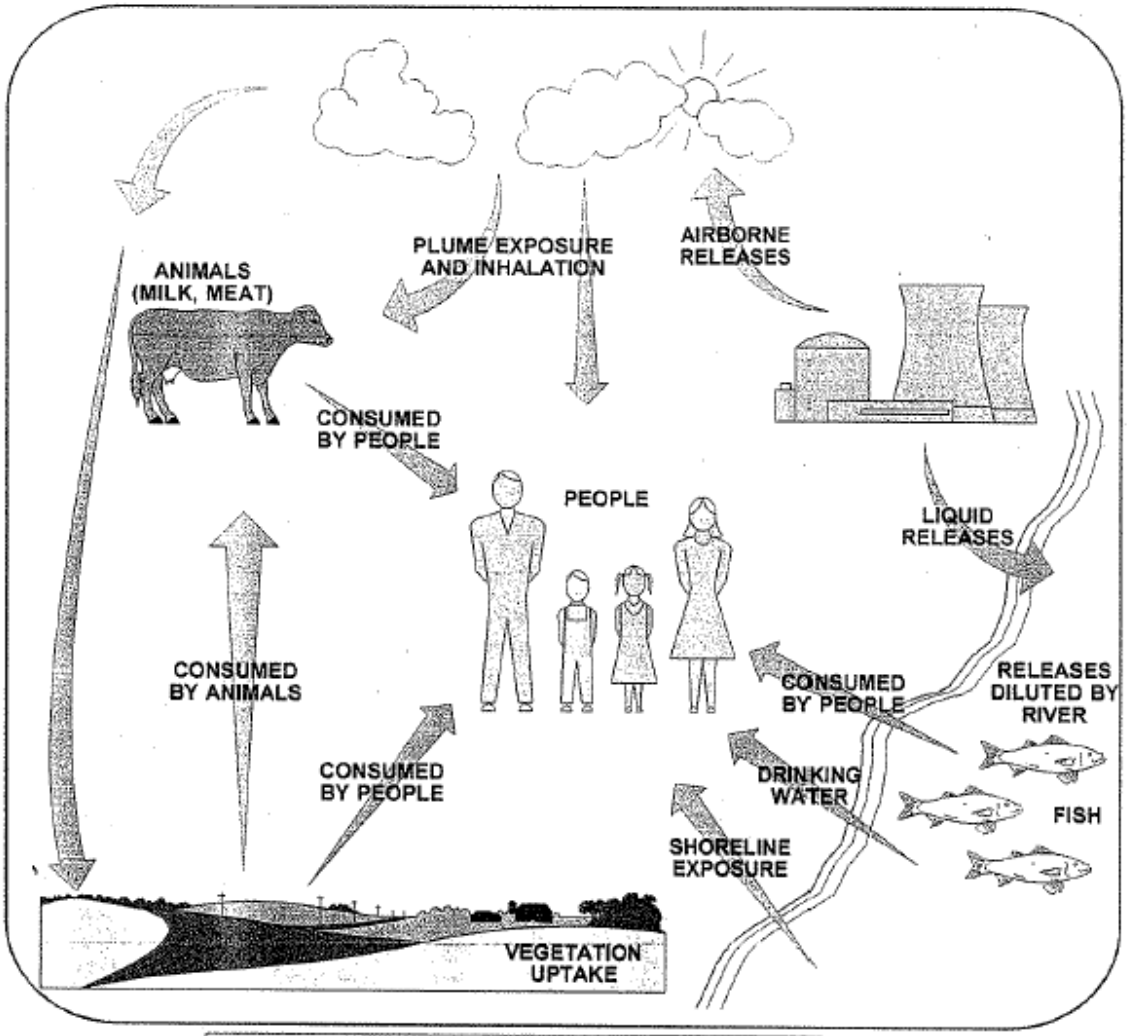
*No noble gases were released from TMI-2.

Individual Whole Body Dose Due to TMI-1 and TMI-2 Operations:	0.13 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 2019.

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, 119 out of 129 analyses performed met the specified acceptance criteria. Ten analyses did not meet the specified acceptance criteria for the following reasons and were addressed through the TBE Corrective Action Program:

1. The ERA April 2019 water Cs-134 result was evaluated as *Not Acceptable*. The reported value was 15.2 pCi/L (error 2.82 pCi/L) and the known result was 12.1 pCi/L (acceptance range of 8.39 - 14.4 pCi/L). With the error, the reported result overlaps the acceptable range. This sample was run as the workgroup duplicate on a different detector with a result of 10.7 pCi/L (within acceptable range). (NCR 19-10)

2. The ERA April 2019 water Sr-89 result was evaluated as *Not Acceptable*. The reported value was 44.9 pCi/L and the known result was 33.3 pCi/L (acceptance range of 24.5 - 40.1 pCi/L). The sample was only counted for 15 minutes instead of 200 minutes. The sample was re-prepped in duplicate and counted for 200 minutes with results of 30.7 ± 5.37 pCi/L and 33.0 ± 8.71 pCi/L. This was the 1st "high" failure for Sr-89 in 5 years. (NCR 19-11)

3. The MAPEP February 2019 soil Sr-90 result was not submitted and therefore evaluated as *Not Acceptable*. The sample was run in duplicate, with results of -1.32 ± 4.09 Bq/kg (<6.87) and -1.030 ± 3.55 Bq/kg (<5.97). The known result was a false positive test (no significant activity). TBE did not submit a result because it appeared that the results may not be accurate. TBE analyzed a substitute soil Sr-90 sample from another vendor, with a result within the acceptable range. (NCR 19-12)

4. The MAPEP February 2019 water Am-241 result was evaluated as *Not Acceptable*. The reported value was 0.764 ± 0.00725 Bq/L with a known result of 0.582 Bq/L (acceptable range 0.407 - 0.757 Bq/L). TBE's result falls within the upper acceptable range with the error. It appeared that a non-radiological interference was added and lead to an increased mass and higher result. (NCR 19-13)

5. The MAPEP February 2019 vegetation Sr-90 result was evaluated as *Not Acceptable*. The reported result was -0.1060 ± 0.0328 Bq/kg and the known result was a false positive test (no significant activity). TBE's result was correct in that there was no activity. MAPEP's evaluation was a "statistical failure" at 3 standard deviations. (NCR 19-14)

6. The ERA October 2019 water Gross Alpha result was evaluated as *Not Acceptable*. TBE's reported result was 40.5 ± 10.3 pCi/L and the known result was 27.6 pCi/L (ratio of TBE to known result at 135%). With the associated error, the result falls within the acceptable range (14.0 - 36.3 pCi/L). The sample was run as the workgroup duplicate on a different detector with a result of 30.8 ± 9.17 pCi/L (within the acceptable range). This was the first failure for drinking water Gr-A since 2012. (NCR 19-23)

7. The ERA October 2019 water Sr-90 result was evaluated as *Not Acceptable*. TBE's reported result was 32.5 ± 2.12 pCi/L and the known result was 26.5 pCi/L (ratio of TBE to known result at 123%). With the associated error, the result falls within the acceptable range (19.2 - 30.9 pCi/L). The sample was run as the workgroup duplicate on a different detector with a result of 20.0 ± 1.91 pCi/L (within the acceptable range). Both TBE results are within internal QC limits. A substitute "quick response" sample was analyzed with an acceptable result of 18.6 pCi/L (known range of 13.2 - 22.1 pCi/L). (NCR 19-24)

8. The MAPEP August 2019 soil Ni-63 result of 436 ± 22.8 Bq/kg was evaluated as Not Acceptable. The known result was 629 Bq/kg (acceptable range 440 - 818 Bq/sample). With the associated error, the TBE result falls within the lower acceptance range. All associated QC was acceptable. No reason for failure could be found. This is the first failure for soil Ni-63 since 2012. (NCR 19-25).

9. The MAPEP August 2019 water Am-241 result was not reported and therefore evaluated as *Not Acceptable*. Initial review of the results showed a large peak where Am-241 should be (same as the February, 2019 sample results). It is believed that Th-228 was intentionally added as an interference. The sample was re-prepped and analyzed using a smaller sample aliquot. The unusual large peak (Th-228) was seen again and also this time a smaller peak (Am-241). The result was 436 ± 22.8 Bq/L (acceptable range 0.365 ± 0.679 Bq/L). Th-228 is not a typical nuclide requested by clients, so there is no analytical purpose to take samples through an additional separation step. TBE will pursue using another vendor for Am-241 water cross-checks that more closely reflects actual customer samples. (NCR 19-26)

10. The Analytics September 2019 soil Cr-51 sample was evaluated as *Not Acceptable*. TBE's reported result of 0.765 ± 0.135 pCi/g exceeded the upper acceptance range (140% of the known result of 0.547 pCi/g). The TBE result was within the acceptable range (0.63 - 0.90 pCi/g) with the associated error. The Cr-51 result is very close to TBE's normal detection limit. In order to get a reportable result, the sample must be counted for 15 hours (10x longer than client samples). There is no

client or regulatory requirement for this nuclide and TBE will remove Cr-51 from the reported gamma nuclides going forward. (NCR 19-27)

For the secondary QC samples, EIS laboratory, analyzed gross beta, gramma, and I-131 for TMINS. For EIS, 114 of 114 analyses met the specified acceptance criteria.

For the secondary QC samples, GEL laboratory analyzed only H-3 and Sr-89/90 for TMINS REMP. GEL analyzed H-3 and gamma nuclides for RGPP. For these analyses, 96 of 100 cross-check samples met the specified acceptance criteria. All failures were addressed through GEL's Corrective Action Program and the pertinent failures are described below:

1. Two ERA 1st quarter 2019 water Sr-89 results were evaluated as *Not Acceptable*. The reported values were 78.5 pCi/L and 76.5 pCi/L. The known result was 66.9 pCi/L, with an acceptance range of 54.4 - 75.0 pCi/L. A review of the data as well as of the preparation processes did not reveal any errors or possible contributors to the high bias. The Laboratory has concluded that this positive bias was an isolated occurrence and that the overall process is within control. In addition, the reported value is 117% of the reference value, which is within the lab's standard acceptance criteria of +/- 25% for Laboratory Control Samples. No permanent corrective or preventative actions or improvements made at the time. The laboratory will continue to monitor the recoveries to ensure that there are no continued issues in the process. (CARR190225-1192)

2. The ERA 2nd quarter 2019 vegetation Sr-90 result was evaluated as *Not Acceptable*. The reported value was 4670 pCi/kg and the known result was 3530 pCi/kg (acceptance range of 1990 - 4600 pCi/L). The reanalysis was performed using the same processes as the original reported analysis. The reanalysis result met the acceptance range with 96% recovery. No permanent corrective or preventative actions or improvements made at the time. The laboratory will continue to monitor the recoveries to ensure that there are no continued issues in the process. (CARR190530-1211)

3. One of the two ERA 3rd quarter 2019 water Sr-89 results was evaluated as *Not Acceptable*. The reported value was 69.4 pCi/L and the known result was 58.7 (acceptance range of 47.1 - 66.5 pCi/L). A review of the data as well as of the preparation processes did not reveal any errors or possible contributors to the high bias. The Laboratory has concluded that this positive bias was an isolated occurrence and that the overall process is within control. In addition, the reported value is

118% of the reference value, which is within the lab's standard acceptance criteria of +/- 25% for Laboratory Control Samples. In addition, a duplicate sample was run using separation resin and that result was within the acceptance range. The results from the two methods compared with a relative percent difference (RPD) of 11.1%, which meets the lab's duplicate acceptance criteria. No permanent corrective or preventative actions or improvements made at the time. The laboratory will continue to monitor the recoveries to ensure that there are no continued issues in the process. (CARR190826-1250)

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.

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, 2019

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

LOCATION OF FACILITY: MIDDLETOWN COUNTY, PA **REPORTING PERIOD: 2019**

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
SURFACE WATER *(PCI/LITER)*	**H-3**	24	**2000**	3440 (5/12) *661 - 12700*	<LLD	3440 (5/12) *661 - 12700*	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**	3.2 (14/24) *2.2 - 5.6*	2.7 (3/12) *2.1 - 3.5*	3.3 (9/12) *2.2 - 5.6*	G15-2 INDICATOR WRIGHTSVILLE WATER TREATMENT PLANT 13.3 MILES SE OF SITE	0
	I-131	36	**1**	<LLD	<LLD	-		0
	H-3	36	**2000**	203 (1/24)	<LLD	203 (1/12)	G15-3 INDICATOR LANCASTER WATER TREATMENT PLANT 15.7 MILES SE OF SITE	0

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

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LOCATION OF FACILITY: MIDDLETOWN COUNTY, PA **REPORTING PERIOD: 2019**

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
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	**GR-B**	12	**4**	4.2 (10/12) *2.3 - 7.1*	NA	4.2 (10/12) *2.3 - 7.1*	K1-1 INDICATOR MAIN STATION LIQ. DISCHARGE ONSITE	0
(PCI/LITER)	**I-131 (LOW LVL)**	12	**1**	<LLD	NA	-		0
	H-3	12	**2000**	35603 (8/12) *220 - 91300*	NA	35603 (8/12) *220 - 91300*	K1-1 INDICATOR MAIN STATION LIQ. DISCHARGE ONSITE	0
	SR-89	2	**5**	<LLD	NA	-		0
	SR-90	2	**2**	<LLD	NA	-		0

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

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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*	3494 (2/2) *3197 - 3790*	3277 (2/2) *3194 - 3360*	3494 (2/2) *3197 - 3790*	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)									

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

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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
PREDATOR	**GAMMA**		4						
(PCI/KGWET)		*K-40*		*NA*	3134	3524	3524	BKGP CONTROL	0
					(2/2)	(2/2)	(2/2)	CITY ISLAND	
					2875 - 3393	*3365 - 3683*	*3365 - 3683*	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**		6						
(PCI/KG DRY)		*K-40*		*NA*	12093	9456	12360	K1-3 INDICATOR	0
					(4/4)	(2/2)	(2/2)	DOWNSTREAM OF TMINS LIQUID DISCHARGE OUTFALL	
					8961 - 14690	*6261 - 12650*	*11310 - 13410*	0.2 MILES SSW 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**		369	**10**	14	15	15	Q15-1 CONTROL	0
(E-3 PCI/CU.METER)					(305/316)	(52/53)	(52/53)	WEST FAIRVIEW FIRE DEPT SOCIAL HALL	
					5 - 33	*5 - 32*	*5 - 32*	13.4 MILES NW OF SITE	

(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, 2019

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

LOCATION OF FACILITY: MIDDLETOWN COUNTY, PA **REPORTING PERIOD: 2019**

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
AIR PARTICULATE	**GAMMA**		28						
(E-3 PCI/CU.METER)		*BE-7*		*NA*	69	80	80	Q15-1 CONTROL	0
					(24/24)	(4/4)	(4/4)	WEST FAIRVIEW FIRE DEPT SOCIAL HALL	
					52 - 85	*68 - 88*	*68 - 88*	13.4 MILES NW 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**		369						
(E-3 PCI/CU.METER)		*I-131*		**70**	<LLD	<LLD	-		0
MILK	**I-131**		92	**1**	<LLD	<LLD	-		0
(PCI/LITER)									
	SR-89		16	**5**	<LLD	<LLD	-		0
	SR-90		16	**2**	<LLD	0.9	0.9	K15-3 CONTROL	0
						(1/4)	(1/4)	MEYER'S FARM	
						0.9	0.9	14.5 MILES SSW OF SITE	
	GAMMA		92						
		K-40		*NA*	1299	1248	1326	P4-1 INDICATOR	0
					(69/69)	(23/23)	(23/23)	FARM ON VALLEY ROAD	
					1041 - 1582	*974 - 2206*	*1066 - 1582*	3.6 MILES WNW 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, 2019

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

LOCATION OF FACILITY: MIDDLETOWN COUNTY, PA **REPORTING PERIOD: 2019**

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**	42	**10**	16.3	13.4	20.4	H1-2 INDICATOR	0
(PCI/KG WET)				(18/27)	(6/15)	(11/12)	RED HILL MARKET ALONG ROUTE 441	
				6.7 - 32.1	*5.6 - 39.7*	*14.1 - 32.1*	1.0 MILES SSE OF SITE	
	GAMMA	42						
	BE-7		*NA*	885	958	1083	H1-2 INDICATOR	0
				(17/27)	(9/15)	(10/12)	RED HILL MARKET	
				260 - 1514	*195 - 1469*	*572 - 1514*	1.0 MILES SSE OF SITE	
	K-40		*NA*	4021	4627	4627	B10-2 CONTROL	0
				(27/27)	(15/15)	(15/15)	MILTON HERSHEY SCHOOL, MILTON	
				1760 - 8256	*1721 - 7265*	*1721 - 7265*	10 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**	357	*NA*	15.7	18.2	26.5	H8-1 INDICATOR	0
(MILLIREM/STD.MO.)				(314/314)	(43/43)	(4/4)	SAGINAW ROAD, STARVIEW	
				8.8 - 39.1	*12.6 - 28.8*	*22.5 - 29.4*	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, 2019

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, 2019

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, 2019

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, 2019

Sample Medium	Analysis	Sampling Method	Collection Procedure Number	Sample Size	Analytical Procedure Number
Surface Water	Gamma Spectroscopy	Monthly composite from a continuous water compositor	CY-ES-240 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 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-240 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 Operation of the Tennelec S5E Proportional Counter
Surface Water	Tritium	Monthly composite from a continuous water compositor	CY-ES-240 EIS Collection of Surface-Drinking-Effluent Water Samples for Radiological Analysis (TMI)	2 gallon	TBE, TBE-2011 Tritium Analysis in Drinking Water by Liquid Scintillation GEL, EPA 906.0 Mod, for Tritium analysis by Liquid scintillation
Surface Water	Iodine-131	Monthly composite from a continuous water compositor	CY-ES-240 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 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
Drinking Water	Gross Beta	Monthly composite from a continuous water compositor	CY-ES-240 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-240 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-240 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-240 EIS Collection of Surface-Drinking-Effluent Water Samples for Radiological Analysis (TMI)	2 gallon	TBE, TBE-2011 Tritium Analysis in Drinking Water by Liquid Scintillation
Effluent Water	Iodine-131	Monthly composite from a continuous water compositor	CY-ES-240 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-240 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, 2019

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-240 EIS Collection of Surface-Drinking-Effluent Water Samples for Radiological Analysis (TMI)	2 gallon	TBE, TBE-2011 Tritium Analysis in Drinking Water by Liquid Scintillation
Effluent Water	Strontium-89/90	Semi-annual composite from monthly samples	TBE, TBE-2023 Compositing of Samples	2 gallon	TBE, TBE-2018 Radiostrontium Analysis by Chemical Separation
Storm Water	Gamma Spectroscopy	Quarterly composite of monthly grab samples	CY-ES-240 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-240 EIS Collection of Surface-Drinking-Effluent Water Samples for Radiological Analysis (TMI)	1 gallon	TBE, TBE-2011 Tritium Analysis in Drinking Water 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 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-2018 Radiostrontium Analysis by Chemical Separation 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 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 Sample Preparation for Gamma and Beta Counting	13 filters (approx.. 3600 cubic meters)	TBE, TBE-2007 Gamma-Emitting Radioisotope Analysis EIS, CY-ES-205 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
Air Particulates	Gross Beta	One-week composite of continuous air sampling through glass fiber filter paper	CY-ES-237 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 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, 2019

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-237 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 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
Milk	I-131	Bi-weekly grab sample when cows are on pasture. Monthly all other times	CY-ES-238 Sample Collection for Radiological Analysis - Milk (TMI)	2 gallon	TBE, TBE-2012 Radioiodine in Various Matrices EIS, CY-ES-205 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
Milk	Sr-89/90	Quarterly composite of bi-weekly and monthly grab samples	TBE, TBE-2023 Compositing of Samples CY-ES-238 Sample Collection for Radiological Analysis - Milk (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-238 Sample Collection for Radiological Analysis - Milk (TMI)	2 gallon	TBE, TBE-2007 Gamma-Emitting Radioisotope Analysis EIS, CY-ES-205 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
Vegetation	Gamma Spectroscopy	Monthly and annual grab sample	CY-ES-241 Sample Collection for Gamma Counting - Vegetation (TMI)	1000 grams	TBE, TBE-2007 Gamma-Emitting Radioisotope Analysis EIS, CY-ES-205 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
Vegetation	Strontium-89/90	Monthly and annual grab sample	CY-ES-241 Sample Collection for Gamma Counting - Vegetation (TMI)	1000 grams	TBE, TBE-2018 Radiostrontium Analysis by Chemical Separation 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.	CY-ES-239 Collection of OSLD samples for radiological analysis (TMINS)	2 badges with 3 dosimeters	Landauer Incorporated

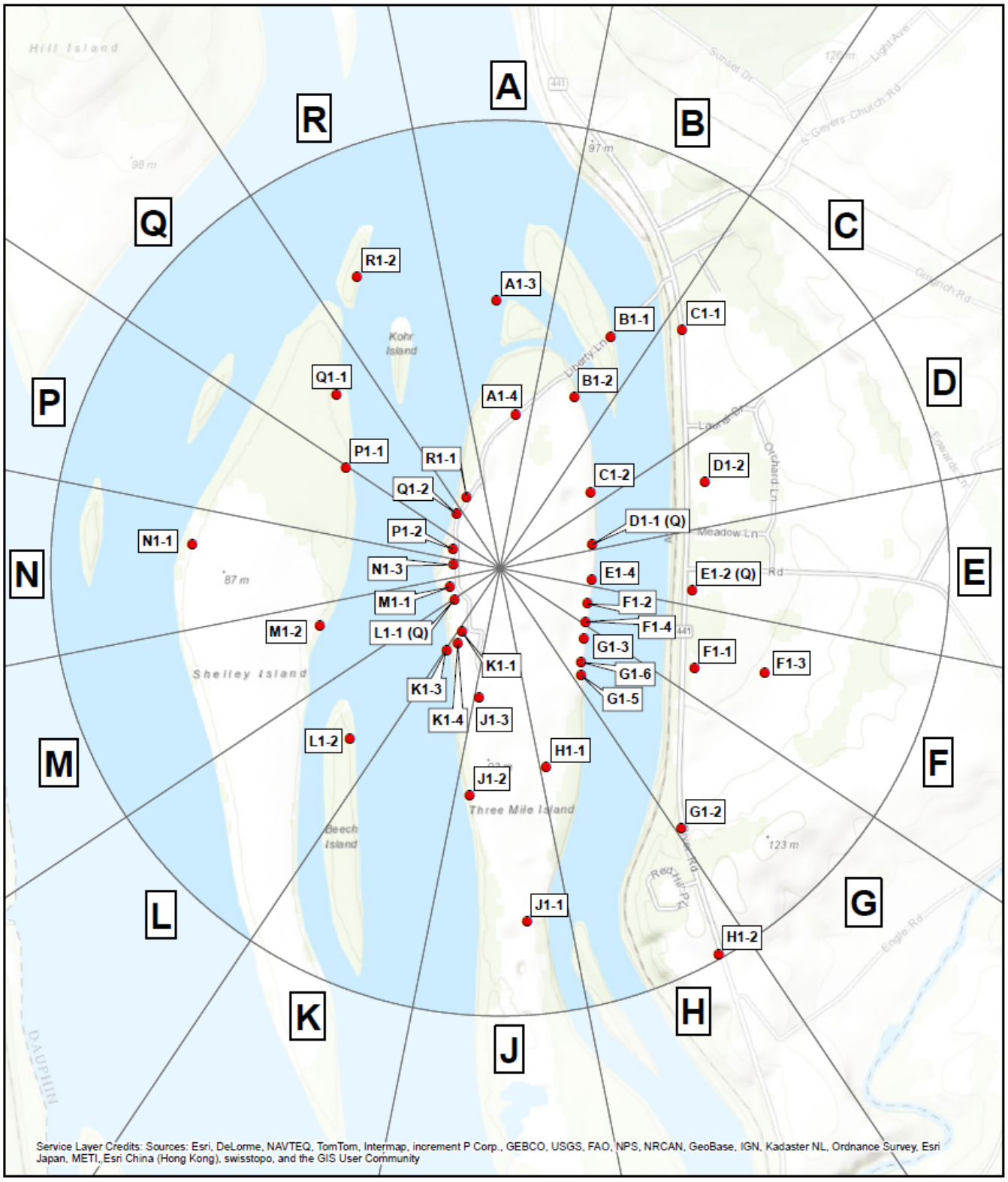

Figure B-1
Environmental Sampling Locations Within One Mile of the Three Mile Island Nuclear Station, 2019

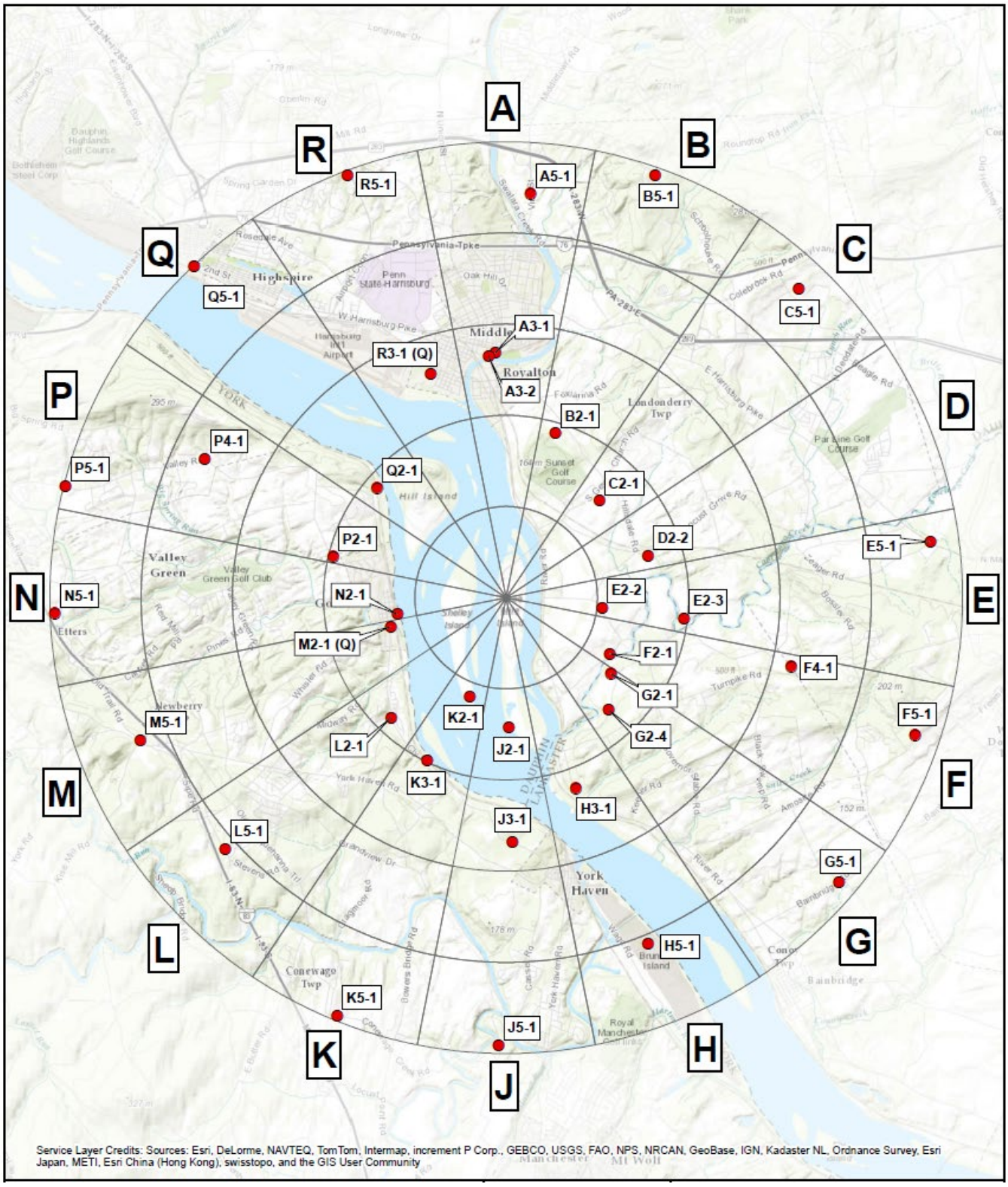

Figure B-2
Environmental Sampling Locations Between One and Five Miles of the Three Mile Island Nuclear Station, 2019

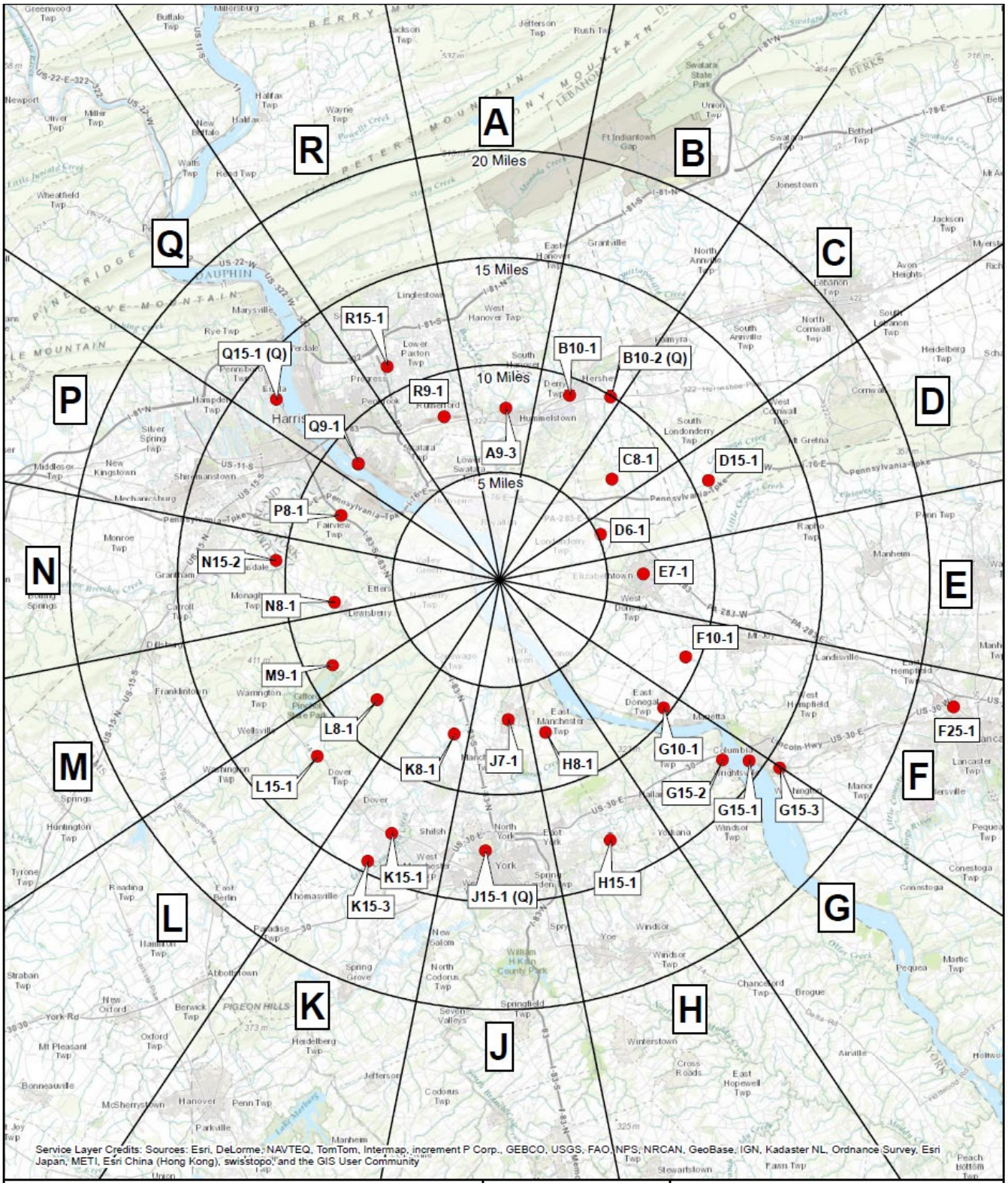

Figure B-3
Environmental Sampling Locations Greater than Five Miles of the Three Mile Island Nuclear Station, 2019

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, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	J1-2	Q9-1
01/03/19 - 01/30/19	2380 ± 302	< 192
01/30/19 - 02/27/19	< 195	< 195
02/27/19 - 03/27/19	< 183	< 198
03/27/19 - 05/01/19	< 189	< 192
05/01/19 - 05/30/19	< 190	< 192
05/30/19 - 06/27/19	12700 ± 1310	< 196
06/27/19 - 08/01/19	661 ± 151	< 196
08/01/19 - 08/29/19	748 ± 147	< 184
08/29/19 - 10/03/19	711 ± 154	< 192
10/03/19 - 10/31/19	< 191	< 193
10/31/19 - 12/04/19	< 193	< 188
12/04/19 - 01/02/20	< 186	< 183
MEAN ± 2 STD DEV	3440 ± 10454	-

Table C-I.2 CONCENTRATIONS OF I-131 IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	A3-2
01/03/19 - 01/30/19	< 0.5
01/30/19 - 02/27/19	< 0.5
02/27/19 - 03/27/19	< 0.5
03/27/19 - 05/01/19	< 0.7
05/01/19 - 05/30/19	< 0.8
05/30/19 - 06/27/19	< 0.8
06/27/19 - 08/01/19	< 0.6
08/01/19 - 08/29/19	< 1.0
08/29/19 - 10/03/19	< 0.6
10/03/19 - 10/31/19	< 0.8
10/31/19 - 12/04/19	< 0.7
12/04/19 - 01/02/20	< 0.8
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, 2019**

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	01/03/19 - 01/30/19	< 7	< 5	< 17	< 8	< 16	< 7	< 12	< 8	< 7	< 24	< 10
	01/30/19 - 02/27/19	< 6	< 6	< 13	< 8	< 12	< 8	< 12	< 5	< 6	< 27	< 11
	02/27/19 - 03/27/19	< 7	< 6	< 13	< 7	< 15	< 7	< 12	< 6	< 7	< 36	< 11
	03/27/19 - 05/01/19	< 8	< 8	< 16	< 8	< 17	< 8	< 14	< 9	< 8	< 38	< 11
	05/01/19 - 05/30/19	< 6	< 8	< 12	< 7	< 17	< 6	< 14	< 8	< 9	< 30	< 9
	05/30/19 - 06/27/19	< 5	< 6	< 13	< 8	< 16	< 7	< 10	< 7	< 6	< 28	< 10
	06/27/19 - 08/01/19	< 5	< 6	< 11	< 7	< 11	< 5	< 10	< 6	< 8	< 27	< 8
	08/01/19 - 08/29/19	< 7	< 6	< 14	< 8	< 16	< 6	< 14	< 6	< 7	< 33	< 11
	08/29/19 - 10/03/19	< 8	< 7	< 15	< 9	< 17	< 6	< 9	< 7	< 6	< 37	< 9
	10/03/19 - 10/31/19	< 8	< 9	< 15	< 8	< 20	< 8	< 11	< 9	< 6	< 38	< 10
	10/31/19 - 12/04/19	< 6	< 7	< 13	< 7	< 15	< 7	< 12	< 7	< 7	< 34	< 9
	12/04/19 - 01/02/20	< 5	< 5	< 11	< 6	< 14	< 6	< 11	< 7	< 7	< 28	< 7
	MEAN	-	-	-	-	-	-	-	-	-	-	-
Q9-1	01/03/19 - 01/30/19	< 4	< 6	< 16	< 7	< 14	< 7	< 9	< 8	< 9	< 34	< 13
	01/30/19 - 02/27/19	< 6	< 6	< 14	< 7	< 13	< 6	< 11	< 7	< 6	< 36	< 9
	02/27/19 - 03/27/19	< 7	< 6	< 16	< 7	< 15	< 8	< 11	< 8	< 7	< 31	< 10
	03/27/19 - 05/01/19	< 6	< 8	< 12	< 8	< 15	< 7	< 13	< 8	< 9	< 33	< 11
	05/01/19 - 05/30/19	< 7	< 6	< 12	< 7	< 14	< 6	< 9	< 9	< 5	< 25	< 8
	05/30/19 - 06/27/19	< 6	< 5	< 13	< 6	< 11	< 6	< 12	< 6	< 7	< 25	< 8
	06/27/19 - 08/01/19	< 6	< 5	< 10	< 4	< 11	< 6	< 10	< 6	< 4	< 22	< 7
	08/01/19 - 08/29/19	< 7	< 7	< 13	< 6	< 18	< 7	< 12	< 9	< 9	< 30	< 8
	08/29/19 - 10/03/19	< 8	< 8	< 15	< 9	< 19	< 9	< 15	< 8	< 10	< 40	< 14
	10/03/19 - 10/31/19	< 6	< 6	< 15	< 7	< 13	< 8	< 12	< 8	< 6	< 31	< 12
	10/31/19 - 12/04/19	< 8	< 7	< 16	< 7	< 18	< 8	< 14	< 8	< 7	< 33	< 10
	12/04/19 - 01/02/20	< 7	< 7	< 12	< 6	< 12	< 6	< 11	< 8	< 5	< 28	< 10
	MEAN	-	-	-	-	-	-	-	-	-	-	-

Table C-II.1 CONCENTRATIONS OF GROSS BETA IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	G15-2	G15-3	Q9-1
01/03/19 - 01/30/19	2.2 ± 1.4	< 2.0	< 1.9
01/30/19 - 02/27/19	< 2.1	2.2 ± 1.4	< 2.0
02/27/19 - 03/27/19	2.6 ± 1.4	< 1.9	< 1.8
03/27/19 - 05/01/19	< 2.1	< 2.0	< 1.9
05/01/19 - 05/30/19	< 2.2	< 2.0	< 1.9
05/30/19 - 06/27/19	3.2 ± 1.6	< 2.0	2.1 ± 1.4
06/27/19 - 08/01/19	3.8 ± 1.7	< 2.2	< 2.1
08/01/19 - 08/29/19	2.8 ± 1.6	< 2.2	< 2.1
08/29/19 - 10/03/19	4.4 ± 1.5	3.4 ± 1.5	3.5 ± 1.4
10/03/19 - 10/31/19	2.4 ± 1.5	3.8 ± 1.6	< 2.1
10/31/19 - 12/04/19	2.3 ± 1.4	3.3 ± 1.5	2.5 ± 1.4
12/04/19 - 01/02/20	5.6 ± 1.7	2.9 ± 1.4	< 1.9
MEAN ± 2 STD DEV	3.3 ± 2.3	3.1 ± 1.2	2.7 ± 1.5

Table C-II.2 CONCENTRATIONS OF I-131 IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	G15-2	G15-3	Q9-1
01/03/19 - 01/30/19	< 0.7	< 0.6	< 0.6
01/30/19 - 02/27/19	< 0.5	< 0.8	< 0.5
02/27/19 - 03/27/19	< 0.7	< 0.8	< 0.7
03/27/19 - 05/01/19	< 0.6	< 0.6	< 0.6
05/01/19 - 05/30/19	< 0.7	< 0.9	< 0.9
05/30/19 - 06/27/19	< 0.9	< 0.8	< 0.8
06/27/19 - 08/01/19	< 0.6	< 0.7	< 0.9
08/01/19 - 08/29/19	< 0.8	< 0.9	< 0.6
08/29/19 - 10/03/19	< 0.5	< 0.8	< 0.5
10/03/19 - 10/31/19	< 0.9	< 0.9	< 0.8
10/31/19 - 12/04/19	< 0.9	< 0.8	< 0.7
12/04/19 - 01/02/20	< 0.5	< 0.5	< 0.4
MEAN	-	-	-

Table C-II.3 CONCENTRATIONS OF TRITIUM IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	G15-2	G15-3	Q9-1
01/03/19 - 01/30/19	< 194	< 192	< 189
01/30/19 - 02/27/19	< 196	< 195	< 198
02/27/19 - 03/27/19	< 198	< 182	< 175
03/27/19 - 05/01/19	< 170	< 190	< 183
05/01/19 - 05/30/19	< 196	< 191	< 196
05/30/19 - 06/27/19	< 195	< 193	< 196
06/27/19 - 08/01/19	< 196	< 192	< 194
08/01/19 - 08/29/19	< 180	< 180	< 179
08/29/19 - 10/03/19	< 193	203 ± 128	< 195
10/03/19 - 10/31/19	< 192	< 190	< 192
10/31/19 - 12/04/19	< 188	< 187	< 187
12/04/19 - 01/02/20	< 188	< 189	< 187
MEAN ± 2 STD DEV	-	203 ± 0	-

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, 2019**

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
G15-2	01/03/19 - 01/30/19	< 6	< 5	< 11	< 7	< 9	< 6	< 10	< 7	< 5	< 28	< 10
	01/30/19 - 02/27/19	< 4	< 5	< 11	< 5	< 9	< 5	< 8	< 5	< 5	< 26	< 7
	02/27/19 - 03/27/19	< 9	< 7	< 18	< 9	< 12	< 8	< 15	< 8	< 7	< 38	< 10
	03/27/19 - 05/01/19	< 6	< 7	< 15	< 8	< 14	< 6	< 11	< 8	< 9	< 27	< 11
	05/01/19 - 05/30/19	< 6	< 6	< 10	< 6	< 11	< 6	< 10	< 8	< 7	< 27	< 10
	05/30/19 - 06/27/19	< 7	< 8	< 12	< 10	< 13	< 7	< 13	< 8	< 8	< 32	< 11
	06/27/19 - 08/01/19	< 5	< 7	< 12	< 7	< 16	< 7	< 11	< 7	< 6	< 27	< 12
	08/01/19 - 08/29/19	< 7	< 7	< 12	< 8	< 11	< 6	< 10	< 6	< 7	< 32	< 12
	08/29/19 - 10/03/19	< 7	< 5	< 17	< 6	< 13	< 6	< 11	< 6	< 8	< 35	< 8
	10/03/19 - 10/31/19	< 7	< 7	< 15	< 13	< 15	< 8	< 11	< 8	< 10	< 36	< 11
	10/31/19 - 12/04/19	< 8	< 6	< 14	< 6	< 11	< 8	< 11	< 8	< 7	< 32	< 12
	12/04/19 - 01/02/20	< 5	< 6	< 11	< 6	< 12	< 6	< 10	< 6	< 5	< 23	< 8
	MEAN	-	-	-	-	-	-	-	-	-	-	-
G15-3	01/03/19 - 01/30/19	< 7	< 7	< 14	< 5	< 13	< 6	< 12	< 8	< 7	< 30	< 8
	01/30/19 - 02/27/19	< 6	< 6	< 13	< 8	< 13	< 6	< 11	< 7	< 6	< 30	< 11
	02/27/19 - 03/27/19	< 7	< 7	< 12	< 6	< 13	< 6	< 11	< 7	< 7	< 35	< 9
	03/27/19 - 05/01/19	< 5	< 6	< 18	< 13	< 14	< 6	< 10	< 8	< 6	< 29	< 9
	05/01/19 - 05/30/19	< 5	< 6	< 14	< 8	< 13	< 6	< 12	< 5	< 6	< 24	< 11
	05/30/19 - 06/27/19	< 6	< 7	< 18	< 8	< 10	< 7	< 12	< 7	< 8	< 35	< 13
	06/27/19 - 08/01/19	< 6	< 7	< 14	< 8	< 16	< 7	< 10	< 9	< 7	< 34	< 11
	08/01/19 - 08/29/19	< 7	< 6	< 19	< 10	< 16	< 9	< 17	< 8	< 8	< 35	< 13
	08/29/19 - 10/03/19	< 8	< 7	< 14	< 7	< 14	< 6	< 11	< 8	< 7	< 30	< 9
	10/03/19 - 10/31/19	< 10	< 11	< 18	< 10	< 28	< 12	< 16	< 11	< 10	< 44	< 11
	10/31/19 - 12/04/19	< 8	< 6	< 14	< 8	< 13	< 8	< 13	< 7	< 6	< 36	< 9
	12/04/19 - 01/02/20	< 5	< 4	< 11	< 6	< 13	< 7	< 10	< 6	< 5	< 29	< 8
	MEAN	-	-	-	-	-	-	-	-	-	-	-
Q9-1	01/03/19 - 01/30/19	< 5	< 5	< 13	< 7	< 13	< 6	< 9	< 6	< 6	< 25	< 8
	01/30/19 - 02/27/19	< 7	< 7	< 15	< 8	< 9	< 6	< 11	< 5	< 6	< 38	< 14
	02/27/19 - 03/27/19	< 5	< 6	< 16	< 5	< 13	< 7	< 11	< 7	< 6	< 28	< 8
	03/27/19 - 05/01/19	< 6	< 6	< 14	< 7	< 13	< 8	< 13	< 8	< 6	< 31	< 9
	05/01/19 - 05/30/19	< 5	< 5	< 9	< 9	< 14	< 7	< 7	< 5	< 5	< 23	< 8
	05/30/19 - 06/27/19	< 6	< 4	< 11	< 5	< 9	< 7	< 9	< 5	< 6	< 28	< 10
	06/27/19 - 08/01/19	< 7	< 7	< 14	< 6	< 13	< 7	< 12	< 7	< 7	< 33	< 8
	08/01/19 - 08/29/19	< 6	< 5	< 10	< 5	< 13	< 5	< 10	< 6	< 5	< 27	< 9
	08/29/19 - 10/03/19	< 8	< 7	< 17	< 7	< 15	< 7	< 10	< 9	< 7	< 21	< 9
	10/03/19 - 10/31/19	< 7	< 6	< 15	< 8	< 12	< 8	< 11	< 8	< 9	< 32	< 12
	10/31/19 - 12/04/19	< 6	< 8	< 10	< 8	< 10	< 5	< 14	< 9	< 7	< 25	< 12
	12/04/19 - 01/02/20	< 7	< 5	< 12	< 7	< 14	< 7	< 12	< 8	< 7	< 28	< 10
	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, 2019**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	GR-B	I-131	H-3	SR-89	SR-90
K1-1	01/03/19 - 01/30/19	3.4 ± 1.6	< 0.5	29100 ± 2950		
	01/30/19 - 02/27/19	< 2.1	< 0.8	91300 ± 9170		
	02/27/19 - 03/27/19	2.8 ± 1.5	< 0.8	220 ± 129		
	03/27/19 - 05/01/19	2.3 ± 1.5	< 0.7	44000 ± 4460		
	05/01/19 - 05/30/19	2.9 ± 1.5	< 1.0	< 191		
	05/30/19 - 06/27/19	5.0 ± 1.8	< 0.8	75800 ± 7590		
	01/03/19 - 06/27/19				< 4.3	< 0.7
	06/27/19 - 08/01/19	4.7 ± 1.9	< 0.8	20300 ± 2090		
	08/01/19 - 08/29/19	7.1 ± 2.2	< 0.7	11400 ± 1200		
	08/29/19 - 10/03/19	6.1 ± 1.9	< 0.8	12700 ± 1330		
	10/03/19 - 10/31/19	5.3 ± 1.7	< 0.9	< 191		
	10/31/19 - 12/04/19	2.6 ± 1.4	< 0.8	< 189		
	12/04/19 - 01/02/20	< 1.8	< 0.8	< 195		
	06/27/19 - 01/02/20				< 3.1	< 0.6
	MEAN ± 2 STD DEV	4.2 ± 3.4	-	35603 ± 65147	-	-

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, 2019

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	01/03/19 - 01/30/19	< 8	< 8	< 15	< 8	< 17	< 9	< 14	< 9	< 8	< 38	< 12
	01/30/19 - 02/27/19	< 6	< 5	< 13	< 6	< 12	< 8	< 9	< 6	< 7	< 28	< 7
	02/27/19 - 03/27/19	< 6	< 8	< 15	< 6	< 15	< 7	< 10	< 8	< 7	< 24	< 12
	03/27/19 - 05/01/19	< 7	< 5	< 15	< 7	< 14	< 6	< 12	< 8	< 7	< 32	< 11
	05/01/19 - 05/30/19	< 6	< 8	< 12	< 6	< 13	< 6	< 10	< 7	< 7	< 27	< 10
	05/30/19 - 06/27/19	< 6	< 7	< 11	< 7	< 10	< 7	< 14	< 7	< 6	< 23	< 10
	06/27/19 - 08/01/19	< 5	< 5	< 12	< 5	< 13	< 6	< 11	< 7	< 6	< 24	< 6
	08/01/19 - 08/29/19	< 5	< 5	< 12	< 6	< 8	< 4	< 10	< 7	< 6	< 25	< 11
	08/29/19 - 10/03/19	< 5	< 7	< 12	< 8	< 14	< 7	< 9	< 8	< 5	< 32	< 14
	10/03/19 - 10/31/19	< 7	< 7	< 17	< 8	< 16	< 7	< 13	< 7	< 5	< 25	< 10
	10/31/19 - 12/04/19	< 5	< 5	< 12	< 5	< 11	< 6	< 11	< 5	< 6	< 28	< 10
	12/04/19 - 01/02/20	< 6	< 6	< 15	< 8	< 6	< 6	< 11	< 8	< 7	< 26	< 8
	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, 2019

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

SITE			Sr-90
BKGB			
BOTTOM FEEDER	06/12/19		< 4.1
	09/27/19		< 4.8
		MEAN	-
BKGP			
PREDATOR	06/12/19		< 3.0
	09/27/19		< 2.5
		MEAN	-
INDB			
BOTTOM FEEDER	06/06/19		< 4.4
	09/26/19		< 4.5
		MEAN	-
INDP			
PREDATOR	06/06/19		< 3.6
	09/26/19		< 2.6
		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, 2019**

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									
BOTTOM FEEDER	06/12/19	3194 ± 844	< 46	< 38	< 89	< 50	< 86	< 39	< 52
	09/27/19	3360 ± 1046	< 52	< 53	< 71	< 72	< 134	< 66	< 65
	MEAN ± 2 STD DEV	3277 ± 235	-	-	-	-	-	-	-
BKGP									
PREDATOR	06/12/19	3683 ± 772	< 42	< 42	< 94	< 47	< 107	< 51	< 49
	09/27/19	3365 ± 827	< 49	< 31	< 83	< 44	< 99	< 54	< 47
	MEAN ± 2 STD DEV	3524 ± 450	-	-	-	-	-	-	-
INDB									
BOTTOM FEEDER	06/06/19	3790 ± 820	< 52	< 46	< 121	< 43	< 109	< 60	< 49
	09/26/19	3197 ± 1060	< 82	< 81	< 164	< 75	< 186	< 95	< 95
	MEAN ± 2 STD DEV	3494 ± 839	-	-	-	-	-	-	-
INDP									
PREDATOR	06/06/19	3393 ± 566	< 33	< 32	< 70	< 39	< 77	< 37	< 30
	09/26/19	2875 ± 828	< 60	< 75	< 129	< 74	< 153	< 76	< 58
	MEAN ± 2 STD DEV	3134 ± 733	-	-	-	-	-	-	-

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, 2019

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	06/18/19	12650 ± 1616	< 94	< 92	< 104	< 117	112 ± 79
	10/30/19	6261 ± 875	< 50	< 45	< 54	< 63	< 54
	MEAN ± 2 STD DEV	9456 + 9035	-	-	-	-	112 + 0
J2-1	06/18/19	14690 ± 1688	< 110	< 112	< 102	< 137	< 140
	10/30/19	8961 ± 1508	< 60	< 57	< 65	< 102	< 91
	MEAN ± 2 STD DEV	11826 + 8102	-	-	-	-	-
K1-3	06/18/19	11310 ± 1610	< 62	< 63	< 82	< 79	< 79
	10/30/19	13410 ± 2108	< 118	< 85	< 100	< 145	< 141
	MEAN ± 2 STD DEV	12360 + 2970	-	-	-	-	-

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, 2019**

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
12/27/18 - 01/03/19	11 ± 4	10 ± 4	10 ± 3	14 ± 4	12 ± 4	11 ± 4	13 ± 4
01/03/19 - 01/10/19	15 ± 4	15 ± 4	12 ± 3	16 ± 4	14 ± 4	16 ± 4	15 ± 4
01/10/19 - 01/16/19	15 ± 5	14 ± 5	11 ± 4	13 ± 5	17 ± 5	13 ± 5	15 ± 5
01/16/19 - 01/23/19	15 ± 4	16 ± 4	14 ± 4	15 ± 4	13 ± 4	13 ± 4	13 ± 4
01/23/19 - 01/30/19	17 ± 4	22 ± 4	16 ± 4	17 ± 4	16 ± 4	18 ± 4	21 ± 4
01/30/19 - 02/07/19	17 ± 4	16 ± 4	17 ± 4	19 ± 4	16 ± 4	19 ± 4	20 ± 4
02/07/19 - 02/14/19	15 ± 4	15 ± 4	11 ± 4	15 ± 4	13 ± 4	10 ± 4	12 ± 4
02/14/19 - 02/21/19	15 ± 4	15 ± 4	16 ± 4	15 ± 4	18 ± 4	14 ± 4	16 ± 4
02/21/19 - 02/27/19	23 ± 5	23 ± 5	26 ± 5	25 ± 5	22 ± 5	26 ± 5	22 ± 5
02/27/19 - 03/07/19	12 ± 4	9 ± 3	11 ± 3	12 ± 4	11 ± 4	14 ± 4	13 ± 4
03/07/19 - 03/14/19	21 ± 5	16 ± 4	19 ± 4	20 ± 4	22 ± 5	18 ± 4	18 ± 4
03/14/19 - 03/21/19	13 ± 4	13 ± 4	11 ± 3	15 ± 4	17 ± 4	14 ± 4	13 ± 4
03/21/19 - 03/27/19	< 6	9 ± 4	< 5	7 ± 4	< 6	< 6	10 ± 5
03/27/19 - 04/04/19	10 ± 3	8 ± 3	12 ± 3	16 ± 4	11 ± 4	14 ± 4	12 ± 4
04/04/19 - 04/11/19	9 ± 4	11 ± 4	8 ± 3	11 ± 4	8 ± 4	10 ± 4	10 ± 4
04/11/19 - 04/18/19	9 ± 4	11 ± 4	10 ± 4	11 ± 4	13 ± 4	13 ± 4	12 ± 4
04/18/19 - 04/25/19	< 5	7 ± 4	5 ± 3	6 ± 4	7 ± 4	5 ± 3	5 ± 4
04/25/19 - 05/01/19	10 ± 4	7 ± 4	8 ± 4	9 ± 4	9 ± 4	6 ± 4	11 ± 4
05/01/19 - 05/09/19	10 ± 4	9 ± 3	11 ± 3	8 ± 3	8 ± 3	12 ± 4	12 ± 4
05/09/19 - 05/15/19	< 6	< 6	< 6	< 6	< 6	7 ± 4	< 6
05/15/19 - 05/22/19	20 ± 4	19 ± 4	18 ± 4	21 ± 4	14 ± 4	19 ± 4	19 ± 4
05/22/19 - 05/30/19	10 ± 3	10 ± 3	9 ± 3	7 ± 3	8 ± 3	10 ± 3	12 ± 4
05/30/19 - 06/07/19	*(1)*	16 ± 4	16 ± 4	12 ± 4	17 ± 4	10 ± 3	15 ± 4
06/07/19 - 06/13/19	12 ± 5	9 ± 4	12 ± 4	16 ± 5	9 ± 4	10 ± 4	11 ± 5
06/13/19 - 06/19/19	12 ± 4	12 ± 4	12 ± 4	8 ± 4	9 ± 4	9 ± 4	8 ± 4
06/19/19 - 06/27/19	13 ± 3	14 ± 3	17 ± 4	19 ± 4	13 ± 3	13 ± 3	17 ± 4
06/27/19 - 07/03/19	17 ± 5	20 ± 5	21 ± 5	18 ± 5	15 ± 5	17 ± 5	18 ± 5
07/03/19 - 07/11/19	11 ± 3	12 ± 3	13 ± 3	11 ± 3	14 ± 4	10 ± 3	12 ± 3
07/11/19 - 07/18/19	14 ± 4	14 ± 4	11 ± 4	12 ± 4	9 ± 4	13 ± 4	15 ± 4
07/18/19 - 07/25/19	*(1)*	10 ± 4	10 ± 4	6 ± 3	9 ± 4	9 ± 4	9 ± 4
07/25/19 - 08/01/19	16 ± 4	17 ± 4	19 ± 4	20 ± 5	18 ± 4	16 ± 4	19 ± 4
08/01/19 - 08/07/19	19 ± 5	17 ± 5	21 ± 5	16 ± 5	17 ± 5	13 ± 5	12 ± 5
08/07/19 - 08/15/19	15 ± 4	18 ± 4	17 ± 4	17 ± 4	21 ± 4	16 ± 4	17 ± 4
08/15/19 - 08/21/19	20 ± 5	24 ± 6	24 ± 5	25 ± 6	26 ± 6	18 ± 5	24 ± 5
08/21/19 - 08/29/19	10 ± 3	11 ± 4	15 ± 4	12 ± 4	11 ± 3	11 ± 3	12 ± 4
08/29/19 - 09/05/19	13 ± 4	16 ± 4	17 ± 4	16 ± 4	16 ± 4	18 ± 4	17 ± 4
09/05/19 - 09/12/19	17 ± 4	19 ± 4	17 ± 4	15 ± 4	16 ± 4	14 ± 4	19 ± 4
09/12/19 - 09/18/19	12 ± 5	15 ± 5	18 ± 5	17 ± 5	18 ± 5	16 ± 5	13 ± 5
09/18/19 - 09/26/19	15 ± 4	19 ± 4	19 ± 4	15 ± 4	19 ± 4	18 ± 4	17 ± 4
09/26/19 - 10/03/19	19 ± 4	21 ± 4	23 ± 4	21 ± 5	25 ± 5	20 ± 4	22 ± 5
10/03/19 - 10/10/19	11 ± 4	10 ± 4	12 ± 4	11 ± 4	12 ± 4	12 ± 4	13 ± 4
10/10/19 - 10/17/19	12 ± 4	16 ± 4	15 ± 4	14 ± 4	17 ± 4	13 ± 4	17 ± 4
10/17/19 - 10/24/19	11 ± 4	10 ± 4	11 ± 4	10 ± 4	9 ± 4	8 ± 3	12 ± 4
10/24/19 - 10/31/19	14 ± 4	14 ± 4	10 ± 4	12 ± 4	15 ± 4	12 ± 4	12 ± 4
10/31/19 - 11/07/19	11 ± 4	15 ± 4	16 ± 4	14 ± 4	15 ± 4	15 ± 4	19 ± 5
11/07/19 - 11/14/19	14 ± 4	10 ± 4	14 ± 4	16 ± 4	13 ± 4	14 ± 4	13 ± 4
11/14/19 - 11/21/19	16 ± 4	15 ± 4	15 ± 4	14 ± 4	14 ± 4	17 ± 4	17 ± 4
11/21/19 - 11/27/19	16 ± 4	14 ± 4	14 ± 4	14 ± 4	15 ± 4	16 ± 4	13 ± 4
11/27/19 - 12/04/19	8 ± 4	8 ± 4	7 ± 3	8 ± 4	7 ± 4	9 ± 4	9 ± 4
12/04/19 - 12/12/19	10 ± 4	13 ± 4	15 ± 4	11 ± 4	11 ± 4	14 ± 4	16 ± 4
12/12/19 - 12/19/19	17 ± 4	16 ± 4	15 ± 4	16 ± 4	18 ± 4	14 ± 4	18 ± 4
12/19/19 - 12/26/19	33 ± 5	29 ± 5	32 ± 5	32 ± 5	25 ± 5	25 ± 5	32 ± 5
12/26/19 - 01/02/20	14 ± 4	19 ± 4	19 ± 4	16 ± 4	17 ± 4	15 ± 4	17 ± 4
MEAN ± 2 STD DEV	14 ± 9	14 ± 9	15 ± 10	15 ± 10	14 ± 9	14 ± 8	15 ± 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, 2019**

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
12/27/18	01/30/19	10	22	15 ± 6	12/27/18 - 01/30/19	10	18	14 ± 5	12/27/18 - 01/30/19	13	21	16 ± 6
01/30/19	02/27/19	15	23	17 ± 7	01/30/19 - 02/27/19	10	26	17 ± 10	01/30/19 - 02/27/19	12	22	17 ± 9
02/27/19	03/27/19	9	21	13 ± 8	02/27/19 - 03/27/19	7	22	15 ± 9	02/27/19 - 03/27/19	10	18	13 ± 6
03/27/19	05/01/19	7	11	9 ± 3	03/27/19 - 05/01/19	5	16	10 ± 6	03/27/19 - 05/01/19	5	12	10 ± 5
05/01/19	05/30/19	9	20	13 ± 10	05/01/19 - 05/30/19	7	21	11 ± 10	05/01/19 - 05/30/19	12	19	14 ± 7
05/30/19	06/27/19	9	16	12 ± 4	05/30/19 - 06/27/19	8	19	13 ± 7	05/30/19 - 06/27/19	8	17	13 ± 8
06/27/19	08/01/19	10	20	15 ± 6	06/27/19 - 08/01/19	6	21	14 ± 8	06/27/19 - 08/01/19	9	19	15 ± 8
08/01/19	08/29/19	10	24	17 ± 9	08/01/19 - 08/29/19	11	26	17 ± 10	08/01/19 - 08/29/19	12	24	16 ± 11
08/29/19	10/03/19	12	21	17 ± 6	08/29/19 - 10/03/19	14	25	18 ± 6	08/29/19 - 10/03/19	13	22	17 ± 6
10/03/19	10/31/19	10	16	12 ± 4	10/03/19 - 10/31/19	8	17	12 ± 5	10/03/19 - 10/31/19	12	17	14 ± 4
10/31/19	12/04/19	8	16	13 ± 7	10/31/19 - 12/04/19	7	17	13 ± 6	10/31/19 - 12/04/19	9	19	14 ± 8
12/04/19	01/02/20	10	33	19 ± 16	12/04/19 - 01/02/20	11	32	18 ± 13	12/04/19 - 01/02/20	16	32	21 ± 16
12/27/18	01/02/20	7	33	14 ± 9	12/27/18 - 01/02/20	5	32	14 ± 9	12/27/18 - 01/02/20	5	32	15 ± 9

Table C-VI.3 CONCENTRATIONS OF GAMMA EMITTERS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2019

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	12/27/18 - 03/27/19	76 ± 18	< 3	< 3	< 3	< 3	< 6	< 3	< 3
	03/27/19 - 06/27/19	80 ± 22	< 3	< 3	< 3	< 3	< 6	< 3	< 2
	06/27/19 - 10/03/19	72 ± 18	< 2	< 2	< 2	< 2	< 3	< 2	< 2
	10/03/19 - 01/02/20	65 ± 15	< 1	< 2	< 2	< 2	< 3	< 2	< 2
	MEAN ± 2 STD DEV	73 ± 13	-	-	-	-	-	-	-
E1-2	12/27/18 - 03/27/19	64 ± 22	< 2	< 3	< 3	< 3	< 4	< 2	< 2
	03/27/19 - 06/27/19	70 ± 22	< 2	< 2	< 3	< 3	< 6	< 3	< 3
	06/27/19 - 10/03/19	75 ± 19	< 3	< 3	< 4	< 3	< 5	< 2	< 3
	10/03/19 - 01/02/20	55 ± 16	< 2	< 2	< 2	< 2	< 2	< 2	< 2
	MEAN ± 2 STD DEV	66 ± 17	-	-	-	-	-	-	-
F1-3	12/27/18 - 03/27/19	84 ± 19	< 2	< 2	< 2	< 2	< 4	< 2	< 2
	03/27/19 - 06/27/19	67 ± 20	< 2	< 2	< 2	< 3	< 5	< 2	< 2
	06/27/19 - 10/03/19	65 ± 23	< 3	< 3	< 3	< 3	< 4	< 3	< 2
	10/03/19 - 01/02/20	61 ± 16	< 2	< 2	< 3	< 2	< 3	< 2	< 2
	MEAN ± 2 STD DEV	69 ± 20	-	-	-	-	-	-	-
G2-1	12/27/18 - 03/27/19	74 ± 26	< 3	< 3	< 3	< 3	< 4	< 2	< 2
	03/27/19 - 06/27/19	85 ± 34	< 4	< 4	< 4	< 4	< 6	< 4	< 3
	06/27/19 - 10/03/19	62 ± 17	< 2	< 2	< 3	< 2	< 4	< 2	< 2
	10/03/19 - 01/02/20	52 ± 16	< 2	< 2	< 3	< 2	< 3	< 2	< 2
	MEAN ± 2 STD DEV	68 ± 28	-	-	-	-	-	-	-
H3-1	12/27/18 - 03/27/19	83 ± 28	< 3	< 4	< 4	< 3	< 6	< 3	< 3
	03/27/19 - 06/27/19	75 ± 22	< 2	< 3	< 3	< 3	< 5	< 2	< 2
	06/27/19 - 10/03/19	71 ± 20	< 2	< 3	< 3	< 2	< 4	< 2	< 2
	10/03/19 - 01/02/20	52 ± 20	< 1	< 1	< 2	< 2	< 4	< 2	< 2
	MEAN ± 2 STD DEV	70 ± 26	-	-	-	-	-	-	-
M2-1	12/27/18 - 03/27/19	77 ± 21	< 2	< 2	< 3	< 2	< 5	< 3	< 2
	03/27/19 - 06/27/19	72 ± 18	< 2	< 2	< 2	< 2	< 4	< 2	< 1
	06/27/19 - 10/03/19	76 ± 20	< 3	< 2	< 3	< 3	< 4	< 3	< 2
	10/03/19 - 01/02/20	52 ± 13	< 1	< 2	< 2	< 1	< 3	< 1	< 2
	MEAN ± 2 STD DEV	69 ± 23	-	-	-	-	-	-	-
Q15-1	12/27/18 - 03/27/19	87 ± 22	< 2	< 3	< 2	< 3	< 3	< 2	< 2
	03/27/19 - 06/27/19	77 ± 19	< 2	< 2	< 2	< 2	< 4	< 3	< 2
	06/27/19 - 10/03/19	88 ± 17	< 2	< 3	< 4	< 3	< 4	< 3	< 2
	10/03/19 - 01/02/20	68 ± 14	< 2	< 2	< 2	< 2	< 2	< 1	< 2
	MEAN ± 2 STD DEV	80 ± 19	-	-	-	-	-	-	-

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, 2019

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
12/27/18 - 01/03/19	< 59	< 57	< 47	< 59	< 58	< 52	< 53
01/03/19 - 01/10/19	< 59	< 57	< 46	< 60	< 59	< 51	< 52
01/10/19 - 01/16/19	< 37	< 36	< 47	< 38	< 37	< 52	< 53
01/16/19 - 01/23/19	< 36	< 34	< 17	< 36	< 35	< 43	< 44
01/23/19 - 01/30/19	< 45	< 43	< 45	< 45	< 44	< 50	< 51
01/30/19 - 02/07/19	< 44	< 43	< 20	< 45	< 44	< 40	< 41
02/07/19 - 02/14/19	< 59	< 57	< 21	< 59	< 58	< 65	< 66
02/14/19 - 02/21/19	< 34	< 33	< 18	< 34	< 34	< 47	< 47
02/21/19 - 02/27/19	< 60	< 57	< 56	< 59	< 59	< 62	< 63
02/27/19 - 03/07/19	< 17	< 17	< 14	< 17	< 17	< 37	< 38
03/07/19 - 03/14/19	< 57	< 55	< 29	< 57	< 57	< 32	< 32
03/14/19 - 03/21/19	< 38	< 37	< 21	< 38	< 38	< 42	< 43
03/21/19 - 03/27/19	< 43	< 23	< 59	< 43	< 43	< 65	< 66
03/27/19 - 04/04/19	< 45	< 43	< 28	< 45	< 44	< 31	< 31
04/04/19 - 04/11/19	< 38	< 37	< 28	< 39	< 38	< 37	< 38
04/11/19 - 04/18/19	< 43	< 41	< 18	< 43	< 43	< 48	< 49
04/18/19 - 04/25/19	< 25	< 24	< 20	< 25	< 24	< 40	< 41
04/25/19 - 05/01/19	< 49	< 47	< 19	< 50	< 49	< 25	< 26
05/01/19 - 05/09/19	< 35	< 34	< 20	< 35	< 35	< 22	< 22
05/09/19 - 05/15/19	< 19	< 20	< 54	< 20	< 20	< 55	< 57
05/15/19 - 05/22/19	< 45	< 46	< 20	< 46	< 46	< 18	< 26
05/22/19 - 05/30/19	< 36	< 36	< 40	< 35	< 36	< 42	< 43
05/30/19 - 06/07/19	*(1)*	< 43	< 21	< 43	< 43	< 42	< 18
06/07/19 - 06/13/19	< 41	< 51	< 25	< 33	< 33	< 32	< 33
06/13/19 - 06/19/19	< 11	< 11	< 13	< 11	< 11	< 10	< 15
06/19/19 - 06/27/19	< 47	< 49	< 22	< 48	< 48	< 23	< 24
06/27/19 - 07/03/19	< 42	< 43	< 42	< 43	< 42	< 18	< 45
07/03/19 - 07/11/19	< 32	< 18	< 19	< 49	< 49	< 49	< 51
07/11/19 - 07/18/19	< 30	< 31	< 17	< 32	< 32	< 32	< 33
07/18/19 - 07/25/19	*(1)*	< 34	< 51	< 34	< 33	< 33	< 56
07/25/19 - 08/01/19	< 24	< 25	< 39	< 42	< 42	< 41	< 23
08/01/19 - 08/07/19	< 37	< 37	< 18	< 51	< 50	< 46	< 48
08/07/19 - 08/15/19	< 21	< 22	< 38	< 21	< 21	< 18	< 42
08/15/19 - 08/21/19	< 33	< 28	< 43	< 33	< 33	< 30	< 15
08/21/19 - 08/29/19	< 21	< 22	< 35	< 24	< 21	< 37	< 38
08/29/19 - 09/05/19	< 33	< 34	< 21	< 27	< 26	< 27	< 28
09/05/19 - 09/12/19	< 32	< 32	< 28	< 31	< 30	< 29	< 16
09/12/19 - 09/18/19	< 53	< 55	< 33	< 55	< 41	< 40	< 43
09/18/19 - 09/26/19	< 37	< 38	< 37	< 37	< 37	< 40	< 41
09/26/19 - 10/03/19	< 30	< 30	< 13	< 30	< 30	< 25	< 15
10/03/19 - 10/10/19	< 36	< 15	< 23	< 30	< 30	< 30	< 31
10/10/19 - 10/17/19	< 32	< 33	< 9	< 32	< 32	< 8	< 10
10/17/19 - 10/24/19	< 46	< 46	< 19	< 25	< 24	< 24	< 25
10/24/19 - 10/31/19	< 28	< 26	< 38	< 41	< 40	< 40	< 35
10/31/19 - 11/07/19	< 33	< 18	< 26	< 27	< 27	< 27	< 14
11/07/19 - 11/14/19	< 19	< 20	< 29	< 20	< 20	< 30	< 31
11/14/19 - 11/21/19	< 19	< 17	< 16	< 37	< 36	< 36	< 38
11/21/19 - 11/27/19	< 39	< 47	< 26	< 33	< 33	< 33	< 34
11/27/19 - 12/04/19	< 28	< 24	< 14	< 38	< 38	< 36	< 37
12/04/19 - 12/12/19	< 23	< 23	< 26	< 23	< 23	< 10	< 29
12/12/19 - 12/19/19	< 39	< 33	< 15	< 16	< 16	< 16	< 14
12/19/19 - 12/26/19	< 36	< 31	< 22	< 37	< 37	< 35	< 56
12/26/19 - 01/02/20	< 27	< 14	< 34	< 27	< 27	< 26	< 36
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, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION	CONTROL FARM	INDICATOR FARMS			
PERIOD	K15-3	E2-2	F4-1	G2-1	P4-1
01/09/19	< 0.5	*(1)*	< 0.5	< 0.8	< 0.6
02/13/19	< 0.8	*(1)*	< 0.9	< 1.0	< 1.0
03/06/19	< 0.6	*(1)*	< 0.5	< 0.6	< 0.6
03/20/19	< 0.4	*(1)*	< 0.7	< 0.8	< 0.7
04/03/19	< 0.5	*(1)*	< 0.5	< 0.9	< 0.9
04/17/19	< 0.8	*(1)*	< 0.6	< 0.7	< 0.7
05/01/19	< 0.5	*(1)*	< 0.9	< 0.6	< 0.8
05/15/19	< 0.7	*(1)*	< 0.6	< 0.9	< 0.7
05/29/19	< 0.6	*(1)*	< 0.6	< 0.5	< 0.7
06/12/19	< 0.8	*(1)*	< 0.8	< 0.8	< 1.0
06/26/19	< 0.8	*(1)*	< 0.9	< 0.8	< 0.8
07/10/19	< 0.4	*(1)*	< 0.6	< 0.6	< 0.6
07/24/19	< 0.8	*(1)*	< 0.6	< 0.6	< 0.8
08/07/19	< 0.8	*(1)*	< 0.7	< 0.7	< 0.7
08/21/19	< 0.3	*(1)*	< 0.7	< 0.5	< 0.4
09/04/19	< 0.8	*(1)*	< 1.0	< 0.9	< 0.6
09/18/19	< 0.8	*(1)*	< 0.7	< 0.9	< 1.0
10/02/19	< 0.9	*(1)*	< 0.9	< 0.8	< 0.9
10/16/19	< 0.8	*(1)*	< 0.9	< 0.7	< 0.9
10/30/19	< 0.9	*(1)*	< 0.9	< 0.8	< 0.8
11/13/19	< 0.5	*(1)*	< 0.6	< 0.5	< 0.6
11/26/19	< 0.8	*(1)*	< 0.6	< 0.9	< 0.8
12/11/19	< 0.9	*(1)*	< 0.9	< 0.9	< 1.0
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, 2019

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
01/09/19 - 03/20/19	< 2.8	< 0.6	*(1)*	*(1)*	< 4.2	< 0.8	< 2.9	< 0.7	< 3.4	< 0.6
04/03/19 - 06/26/19	< 4.6	< 0.9	*(1)*	*(1)*	< 3.7	< 0.9	< 3.6	< 0.8	< 4.4	< 0.9
07/10/19 - 09/18/19	< 4.2	< 0.9	*(1)*	*(1)*	< 4.2	< 0.9	< 4.1	< 0.9	< 3.9	< 0.9
10/02/19 - 12/11/19	< 4.1	0.9 ± 0.5	*(1)*	*(1)*	< 4.2	< 1.0	< 3.8	< 0.8	< 3.8	< 0.8
MEAN ± 2 STD DEV	-	0.9 + 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, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	K-40	Cs-134	Cs-137	Ba-140	La-140
E2-2[1]						
F4-1	01/09/19	1171 ± 82	< 5	< 5	< 22	< 5
	02/13/19	1327 ± 152	< 12	< 9	< 45	< 10
	03/06/19	1229 ± 195	< 9	< 7	< 38	< 5
	03/20/19	1333 ± 189	< 9	< 7	< 24	< 9
	04/03/19	1177 ± 138	< 11	< 8	< 28	< 7
	04/17/19	1253 ± 194	< 8	< 7	< 33	< 13
	05/01/19	1422 ± 194	< 9	< 8	< 31	< 9
	05/15/19	1324 ± 163	< 7	< 7	< 30	< 8
	05/29/19	1386 ± 202	< 8	< 8	< 32	< 11
	06/12/19	1297 ± 199	< 10	< 9	< 25	< 5
	06/26/19	1044 ± 190	< 7	< 8	< 35	< 13
	07/10/19	1345 ± 186	< 10	< 10	< 32	< 10
	07/24/19	1273 ± 191	< 10	< 8	< 26	< 9
	08/07/19	1482 ± 183	< 9	< 8	< 35	< 9
	08/21/19	1329 ± 156	< 8	< 7	< 32	< 9
	09/04/19	1392 ± 194	< 9	< 9	< 42	< 10
	09/18/19	1536 ± 183	< 7	< 8	< 31	< 12
	10/02/19	1321 ± 211	< 10	< 7	< 33	< 12
	10/16/19	1191 ± 175	< 9	< 7	< 38	< 6
	10/30/19	1233 ± 168	< 9	< 9	< 36	< 11
	11/13/19	1467 ± 170	< 8	< 7	< 28	< 8
	11/26/19	1321 ± 210	< 10	< 10	< 42	< 13
	12/11/19	1422 ± 195	< 9	< 9	< 30	< 9
	MEAN ± 2 STD DEV	1316 ± 227	-	-	-	-
G2-1	1/9/2019	1434 ± 172	< 7	< 6	< 22	< 7
	02/13/19	1103 ± 178	< 7	< 7	< 34	< 11
	03/06/19	1115 ± 175	< 10	< 9	< 43	< 10
	03/20/19	1236 ± 149	< 9	< 9	< 30	< 8
	04/03/19	1316 ± 174	< 7	< 7	< 23	< 7
	04/17/19	1308 ± 194	< 7	< 7	< 28	< 10
	05/01/19	1316 ± 199	< 9	< 8	< 33	< 14
	05/15/19	1467 ± 177	< 8	< 7	< 33	< 6
	05/29/19	1126 ± 163	< 9	< 7	< 34	< 14
	06/11/19	1043 ± 184	< 9	< 11	< 37	< 12
	06/26/19	1222 ± 207	< 8	< 9	< 32	< 8
	07/10/19	1194 ± 160	< 8	< 8	< 25	< 8
	07/24/19	1114 ± 194	< 9	< 11	< 41	< 11
	08/07/19	1565 ± 173	< 8	< 9	< 33	< 10
	08/21/19	1401 ± 166	< 8	< 7	< 31	< 5
	09/04/19	1244 ± 191	< 9	< 7	< 34	< 9
	09/18/19	1485 ± 176	< 9	< 8	< 36	< 11
	10/02/19	1150 ± 173	< 10	< 9	< 41	< 13
	10/16/19	1041 ± 180	< 8	< 7	< 38	< 12
	10/30/19	1074 ± 183	< 9	< 10	< 48	< 13
	11/13/19	1392 ± 157	< 7	< 6	< 20	< 6
	11/26/19	1183 ± 149	< 8	< 8	< 25	< 8
	12/11/19	1361 ± 192	< 11	< 10	< 33	< 14
	MEAN ± 2 STD DEV	1256 ± 305	-	-	-	-

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, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	K-40	Cs-134	Cs-137	Ba-140	La-140
K15-3	01/09/19	1210 ± 105	< 4	< 4	< 18	< 5
	02/13/19	1085 ± 187	< 6	< 8	< 31	< 11
	3/6/2019	1308 ± 195	< 9	< 7	< 41	< 10
	03/20/19	1083 ± 187	< 6	< 9	< 24	< 9
	04/03/19	1208 ± 178	< 10	< 8	< 25	< 7
	04/17/19	1475 ± 205	< 8	< 8	< 39	< 11
	05/01/19	1051 ± 138	< 9	< 9	< 43	< 10
	05/15/19	1340 ± 184	< 7	< 5	< 25	< 6
	05/29/19	1128 ± 137	< 7	< 8	< 32	< 9
	06/12/19	974 ± 177	< 8	< 7	< 23	< 10
	06/26/19	1271 ± 177	< 7	< 7	< 34	< 11
	07/10/19	1211 ± 168	< 7	< 6	< 24	< 7
	07/24/19	2206 ± 244	< 10	< 8	< 33	< 9
	08/07/19	1121 ± 184	< 8	< 7	< 30	< 8
	08/21/19	1202 ± 174	< 9	< 7	< 32	< 9
	09/04/19	1379 ± 189	< 10	< 8	< 32	< 10
	09/18/19	1222 ± 189	< 5	< 6	< 27	< 7
	10/02/19	1168 ± 200	< 11	< 9	< 47	< 12
	10/16/19	1224 ± 144	< 6	< 6	< 35	< 14
	10/30/19	1255 ± 171	< 11	< 11	< 51	< 13
	11/13/19	1325 ± 174	< 9	< 7	< 24	< 10
	11/26/19	1121 ± 172	< 8	< 8	< 33	< 11
	12/11/19	1128 ± 177	< 8	< 8	< 43	< 12
	MEAN ± 2 STD DEV	1248 ± 476	-	-	-	-
P4-1	01/09/19	1240 ± 199	< 7	< 6	< 29	< 8
	02/13/19	1379 ± 138	< 9	< 9	< 40	< 10
	03/06/19	1458 ± 174	< 7	< 8	< 33	< 11
	03/20/19	1210 ± 197	< 10	< 8	< 29	< 8
	04/03/19	1465 ± 154	< 7	< 7	< 23	< 7
	04/17/19	1582 ± 201	< 7	< 7	< 32	< 12
	05/01/19	1068 ± 179	< 8	< 7	< 31	< 8
	05/15/19	1568 ± 176	< 7	< 6	< 24	< 9
	05/29/19	1263 ± 191	< 9	< 9	< 43	< 10
	06/12/19	1332 ± 159	< 9	< 8	< 27	< 7
	06/26/19	1342 ± 123	< 7	< 7	< 27	< 8
	07/10/19	1253 ± 198	< 9	< 6	< 24	< 7
	07/24/19	1227 ± 174	< 9	< 8	< 33	< 8
	08/07/19	1232 ± 196	< 9	< 8	< 35	< 8
	08/21/19	1066 ± 210	< 9	< 9	< 40	< 6
	09/04/19	1499 ± 177	< 7	< 5	< 24	< 8
	09/18/19	1473 ± 149	< 6	< 7	< 29	< 9
	10/02/19	1386 ± 210	< 9	< 9	< 36	< 12
	10/16/19	1280 ± 157	< 6	< 8	< 29	< 10
	10/30/19	1276 ± 208	< 7	< 10	< 33	< 12
	11/13/19	1117 ± 157	< 8	< 8	< 21	< 8
	11/26/19	1362 ± 157	< 10	< 8	< 42	< 12
	12/11/19	1418 ± 209	< 9	< 7	< 36	< 12
	MEAN ± 2 STD DEV	1326 ± 289	-	-	-	-

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, 2019

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							
Sunflower Leaves	06/26/19	< 3.2	1414 ± 322	7265 ± 726	< 33	< 26	< 26
Collard Leaves	06/26/19	5.6 ± 2.6	< 254	5361 ± 542	< 49	< 32	< 33
Cabbage Leaves	06/26/19	< 3.9	< 214	7067 ± 586	< 44	< 25	< 25
Sunflower Leaves	07/17/19	6.0 ± 2.6	1094 ± 287	6951 ± 767	< 24	< 31	< 27
Collard Leaves	07/17/19	< 4.1	195 ± 192	3665 ± 420	< 25	< 26	< 24
Kale Leaves	07/17/19	< 4.6	369 ± 153	3112 ± 430	< 25	< 23	< 22
Kale Leaves	08/22/19	13.9 ± 2.6	1342 ± 335	5536 ± 735	< 46	< 39	< 26
Sunflower Leaves	08/22/19	< 3.8	1469 ± 300	6543 ± 792	< 45	< 31	< 27
Squash Leaves	08/22/19	9.1 ± 3.3	998 ± 323	4614 ± 739	< 45	< 35	< 30
Tomatoes	08/22/19	< 3.7	< 259	1721 ± 518	< 28	< 42	< 34
Corn	09/26/19	< 4.3	< 178	2263 ± 515	< 27	< 22	< 21
Pumpkin Leaves	09/26/19	39.7 ± 4.9	770 ± 361	3923 ± 654	< 51	< 35	< 40
Kale Leaves	09/26/19	6.2 ± 2.1	< 335	3261 ± 664	< 54	< 40	< 37
Squash Leaves	09/26/19	< 3.3	969 ± 295	4099 ± 854	< 46	< 27	< 34
Potatoes	10/24/19	< 4.3	< 271	4025 ± 612	< 41	< 33	< 34
	MEAN ± 2 STD DEV	13.4 ± 26.5	958 ± 895	4627 ± 3530	-	-	-
E1-2							
Kale Leaves	06/26/19	6.7 ± 2.6	612 ± 256	5000 ± 743	< 40	< 29	< 22
Collard Leaves	06/26/19	11.1 ± 2.3	< 395	3885 ± 624	< 55	< 39	< 34
Cabbage Leaves	06/26/19	9.7 ± 2.5	260 ± 119	3288 ± 322	< 33	< 18	< 17
Tomato	06/26/19	< 4.3	< 179	1760 ± 389	< 33	< 24	< 19
Kale Leaves	07/17/19	8.3 ± 3.2	794 ± 229	2785 ± 527	< 23	< 27	< 24
Collard Leaves	07/17/19	10.3 ± 2.6	618 ± 196	4677 ± 598	< 30	< 28	< 26
Cabbage Leaves	07/17/19	14.7 ± 2.8	674 ± 281	3623 ± 547	< 30	< 27	< 25
Collard Leaves	08/22/19	< 3.2	776 ± 358	4721 ± 781	< 30	< 47	< 50
Kale Leaves	08/22/19	< 3.6	472 ± 334	3120 ± 731	< 49	< 41	< 29
Cabbage Leaves	08/22/19	< 4.2	< 271	2335 ± 589	< 44	< 32	< 32
Corn	09/26/19	< 4.9	< 180	3634 ± 640	< 31	< 30	< 23
Collard Leaves	09/26/19	9.2 ± 2.6	< 325	4933 ± 647	< 37	< 36	< 38
Kale Leaves	09/26/19	< 2.8	< 232	3469 ± 660	< 38	< 28	< 24
Swiss Chard Leaves	09/26/19	< 3.8	< 342	8256 ± 814	< 41	< 38	< 28
Potatoes	10/24/19	< 3.4	< 254	4123 ± 726	< 35	< 31	< 35
	MEAN ± 2 STD DEV	10.0 ± 5.0	601 ± 371	3974 ± 3028	-	-	-
H1-2							
Zuchinni Leaves	06/26/19	23.0 ± 4.0	1263 ± 321	5577 ± 662	< 50	< 38	< 34
Eggplant Leaves	06/26/19	18.2 ± 3.7	1170 ± 354	7310 ± 955	< 47	< 42	< 34
Yellow Squash Leaves	06/26/19	32.1 ± 3.4	599 ± 265	2991 ± 502	< 38	< 30	< 27
Cucumber Leaves	07/17/19	15.2 ± 3.6	1103 ± 218	2608 ± 327	< 20	< 21	< 20
Eggplant Leaves	07/17/19	29.6 ± 3.0	955 ± 288	6587 ± 703	< 27	< 25	< 28
Yellow Squash Leaves	07/17/19	15.4 ± 2.7	1482 ± 401	2645 ± 673	< 39	< 35	< 26
Zuchinni Leaves	08/22/19	14.1 ± 2.8	1125 ± 257	3075 ± 538	< 32	< 27	< 18
Squash Leaves	08/22/19	22.8 ± 3.5	572 ± 185	4918 ± 609	< 35	< 27	< 26
Sunflower Leaves	08/22/19	< 3.7	1514 ± 373	4680 ± 647	< 46	< 31	< 30
Collard Leaves	09/26/19	16.3 ± 4.0	< 390	2927 ± 669	< 54	< 36	< 35
Squash Leaves	09/26/19	15.3 ± 3.4	< 431	2982 ± 671	< 51	< 40	< 43
Sunflower Leaves	09/26/19	21.9 ± 3.2	1049 ± 378	2657 ± 604	< 46	< 40	< 41
	MEAN ± 2 STD DEV	20.4 ± 12.3	1083 ± 633	4080 ± 3358	-	-	-

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, 2019

RESULTS IN UNITS OF MILLIREM/QUARTER

STATION CODE	MEAN ± 2 S.D.	JAN - MAR	APR - JUN	JUL - SEP	OCT - DEC
A1-4	13.8 ± 5.1	11.6	16.4	11.5	15.5
A3-1	12.8 ± 5.7	9.4	15.3	11.5	15.0
A5-1	16.7 ± 6.1	13.3	19.4	14.8	19.1
A9-3	14.7 ± 4.9	12.4	17.2	12.7	16.3
B1-1	13.8 ± 5.6	10.9	15.5	11.9	16.7
B1-2	14.0 ± 5.1	11.9	16.1	11.7	16.3
B2-1	14.3 ± 5.6	11.0	16.1	12.9	17.0
B5-1	16.1 ± 5.8	13.5	19.1	13.8	18.1
C1-1	16.2 ± 6.0	12.9	19.2	14.5	18.3
C1-2	12.9 ± 4.6	10.8	14.3	11.1	15.4
C2-1	16.0 ± 5.7	12.7	18.4	14.6	18.4
C5-1	17.5 ± 5.4	14.4	20.8	16.4	18.2
C8-1	17.9 ± 5.7	14.7	20.6	16.3	20.0
D1-1	13.8 ± 6.1	11.1	15.5	11.3	17.2
D1-2	14.8 ± 4.8	12.8	17.8	12.9	15.7
D2-2	18.8 ± 5.5	16.2	21.6	16.7	20.7
D6-1	18.7 ± 6.1	14.5	21.5	18.4	20.3
E1-2	14.2 ± 4.5	12.4	16.4	12.2	15.9
E1-4	13.7 ± 5.6	11.6	15.9	10.9	16.3
E2-3	18.0 ± 5.1	15.4	19.9	16.1	20.4
E5-1	19.6 ± 5.8	16.6	22.8	17.8	21.2
E7-1	17.5 ± 4.7	14.5	20.0	17.0	18.5
F1-1	16.1 ± 5.2	13.9	19.1	14.0	17.4
F1-2	14.6 ± 5.0	12.9	15.7	12.3	17.6
F1-4	13.6 ± 5.2	11.0	16.2	11.7	15.3
F2-1	18.5 ± 5.7	15.0	19.8	17.4	21.6
F5-1	18.7 ± 5.8	15.8	20.8	16.6	21.5
G1-2	16.6 ± 5.7	13.3	19.6	15.3	18.2
G1-3	13.3 ± 6.2	10.9	15.4	10.3	16.4
G1-5	13.2 ± 4.5	11.2	13.6	11.7	16.2
G1-6	13.8 ± 5.2	11.0	16.1	12.2	16.0
G2-4	19.3 ± 5.3	16.1	21.1	18.1	21.8
G5-1	16.5 ± 5.0	13.7	19.0	15.2	18.2
H1-1	16.0 ± 5.6	12.6	17.8	14.9	18.8
H3-1	12.6 ± 5.0	10.2	14.7	10.7	14.8
H5-1	11.5 ± 5.8	8.8	14.0	9.1	13.9
H8-1	26.5 ± 6.4	22.5	28.7	25.2	29.4
J1-1	14.2 ± 6.4	11.3	16.1	11.7	17.7
J1-3	12.0 ± 6.5	9.2	14.8	9.1	14.7
J3-1	15.2 ± 5.9	11.7	17.7	13.8	17.5
J5-1	17.6 ± 6.8	14.5	21.0	14.9	20.1
J7-1	19.2 ± 6.2	15.4	21.4	18.0	22.0
K1-4	13.2 ± 5.9	10.6	15.2	10.8	16.3
K2-1	17.5 ± 5.0	15.4	18.4	15.6	*20.6*
K3-1	13.5 ± 6.8	10.6	16.5	10.6	16.4
K5-1	17.9 ± 7.6	14.3	21.6	15.0	20.7
K8-1	16.5 ± 6.8	13.3	19.5	13.7	19.3

Table C-X.1 QUARTERLY OSLD RESULTS FOR THREE MILE ISLAND NUCLEAR STATION, 2019

RESULTS IN UNITS OF MILLIREM/QUARTER

STATION CODE	MEAN ± 2 S.D.	JAN - MAR	APR - JUN	JUL - SEP	OCT - DEC
L1-1	14.9 ± 5.4	12.4	16.3	12.8	17.9
L1-2	13.9 ± 6.5	10.9	16.6	11.2	*16.7*
L2-1	14.4 ± 6.0	11.4	17.5	12.3	16.5
L5-1	14.0 ± 6.7	10.6	17.4	11.7	16.3
L8-1	15.5 ± 6.9	12.0	18.6	13.1	18.3
M1-1	13.3 ± 4.4	11.4	14.8	11.3	15.5
M1-2	15.8 ± 6.5	12.6	16.2	14.1	20.1
M2-1	12.9 ± 5.6	10.1	15.6	10.9	15.0
M5-1	15.3 ± 5.9	12.5	18.2	13.0	17.4
M9-1	19.9 ± 6.3	16.5	22.9	18.0	22.3
N1-1	14.8 ± 8.3	11.8	*(1)*	*(1)*	17.7
N1-3	13.9 ± 5.6	11.6	15.3	11.5	17.1
N2-1	21.4 ± 24.0	13.4	39.1	14.6	18.6
N5-1	13.6 ± 5.4	10.6	15.4	12.0	16.3
N8-1	17.2 ± 6.4	14.6	20.2	14.3	19.8
P1-1	14.3 ± 6.1	12.2	15.6	11.5	18.0
P1-2	13.4 ± 5.2	11.6	14.7	10.9	16.4
P2-1	18.9 ± 6.3	15.5	22.2	17.0	20.9
P5-1	15.8 ± 5.7	13.1	18.1	13.5	18.3
P8-1	13.5 ± 5.9	10.2	16.1	11.8	15.9
Q1-1	15.2 ± 6.9	11.6	16.6	13.2	19.3
Q1-2	12.5 ± 6.4	9.3	14.7	10.1	15.7
Q2-1	12.5 ± 6.0	9.4	14.2	10.6	15.8
Q5-1	16.4 ± 13.7	11.4	25.7	11.1	17.4
Q9-1	15.3 ± 5.5	12.6	18.1	13.3	17.2
R1-1	17.7 ± 21.2	10.7	33.2	11.0	16.0
R1-2	13.1 ± 6.1	10.8	15.0	10.3	16.4
R3-1	19.3 ± 5.9	15.7	22.2	18.2	21.2
R5-1	17.3 ± 6.6	13.1	20.8	16.6	18.8
R9-1	17.5 ± 8.0	13.8	20.9	14.3	21.0
B10-1	16.1 ± 6.3	12.6	17.9	14.3	19.4
D15-1	16.2 ± 6.0	13.8	19.0	13.5	18.6
F10-1	21.0 ± 6.9	17.4	24.4	18.8	23.5
F25-1	17.2 ± 4.8	14.7	18.7	15.7	19.7
G10-1	23.4 ± 7.1	19.3	25.4	21.8	27.2
G15-1	22.5 ± 6.8	19.1	25.6	20.0	25.2
H15-1	15.9 ± 6.9	12.8	18.2	13.0	19.4
J15-1	19.6 ± 7.2	15.3	22.7	17.8	22.4
K15-1	15.8 ± 6.1	12.6	18.8	13.9	18.0
L15-1	16.0 ± 5.0	13.2	17.8	14.5	18.3
N15-2	20.2 ± 12.9	14.7	28.8	15.8	21.4
Q15-1	17.1 ± 5.4	15.1	19.7	14.5	19.1
R15-1	15.3 ± 6.2	12.8	18.8	14.3	*(1)*

(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, 2019

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

COLLECTION PERIOD	SITE BOUNDARY ± 2 STD DEV	INDICATOR	CONTROL
JAN-MAR	11.2 ± 1.9	13.2 ± 4.8	14.9 ± 4.7
APR-JUN	16.4 ± 8.3	19.3 ± 7.8	21.2 ± 7.5
JUL-SEP	11.4 ± 2.4	14.3 ± 5.7	15.9 ± 5.7
OCT-DEC	16.3 ± 2.0	18.7 ± 5.1	20.9 ± 6.3

TABLE C-X.3 SUMMARY OF THE AMBIENT DOSIMETRY PROGRAM FOR THREE MILE ISLAND NUCLEAR STATION, 2019

RESULTS IN UNITS OF MILLIREMQUARTER

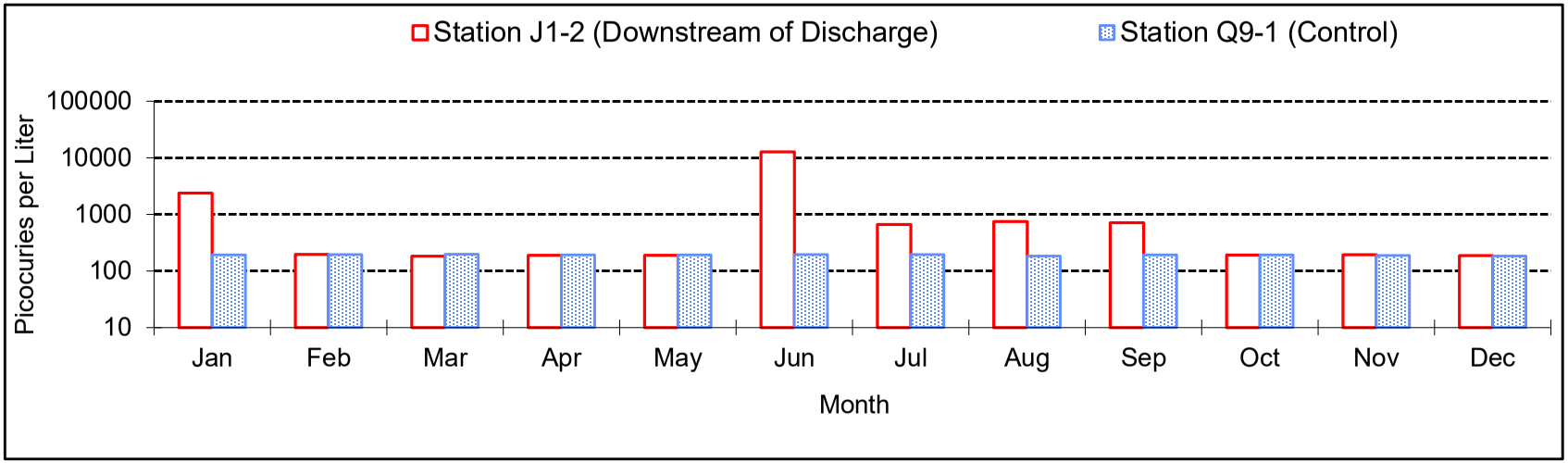
LOCATION	SAMPLES ANALYZED	PERIOD MINIMUM	PERIOD MAXIMUM	PERIOD MEAN ± 2 STD DEV
SITE BOUNDARY	76	9.1	33.2	13.9 ± 6.8
INDICATOR	238	8.8	39.1	16.3 ± 8.0
CONTROL	43	12.6	28.8	18.2 ± 8.3

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, 2019



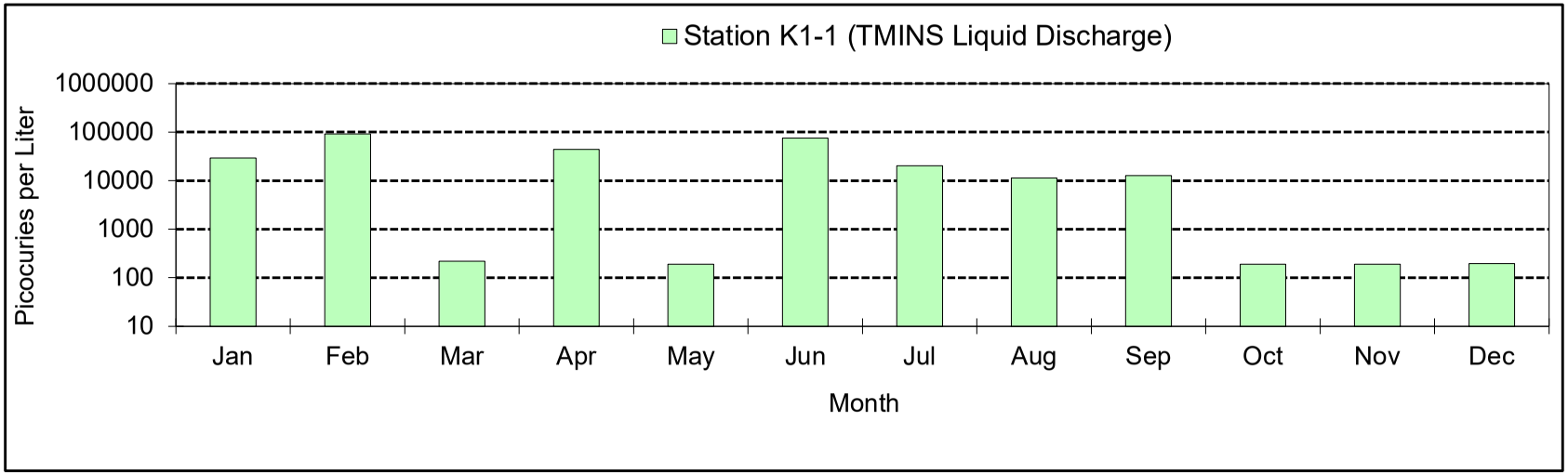


FIGURE C-2
Mean Quarterly Tritium Concentrations in Surface Water
Three Mile Island Nuclear Station, 1974 - 2019

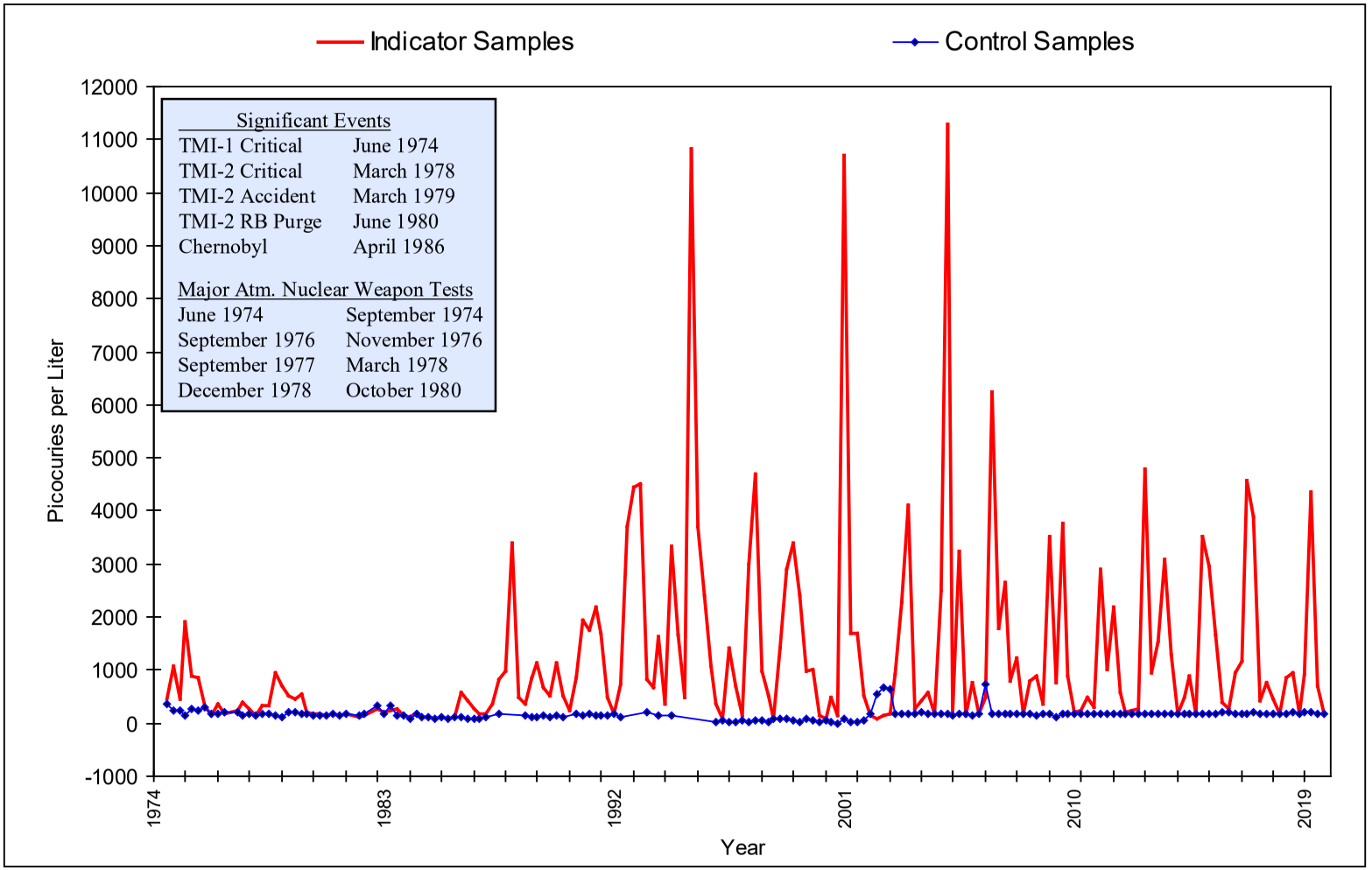


FIGURE C-3
Mean Monthly Gross Beta Concentrations in Drinking Water
Three Mile Island Nuclear Station, 2019

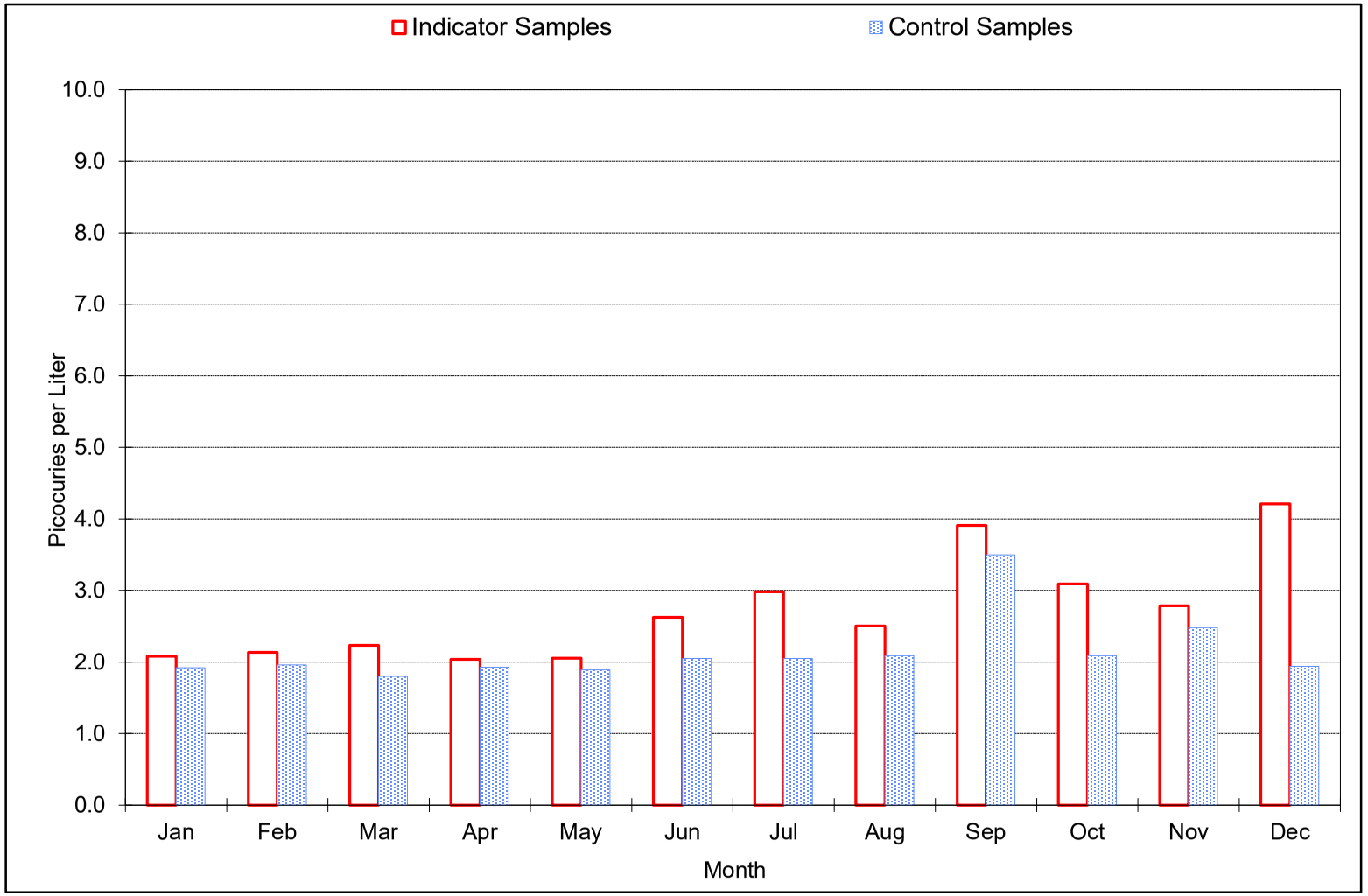
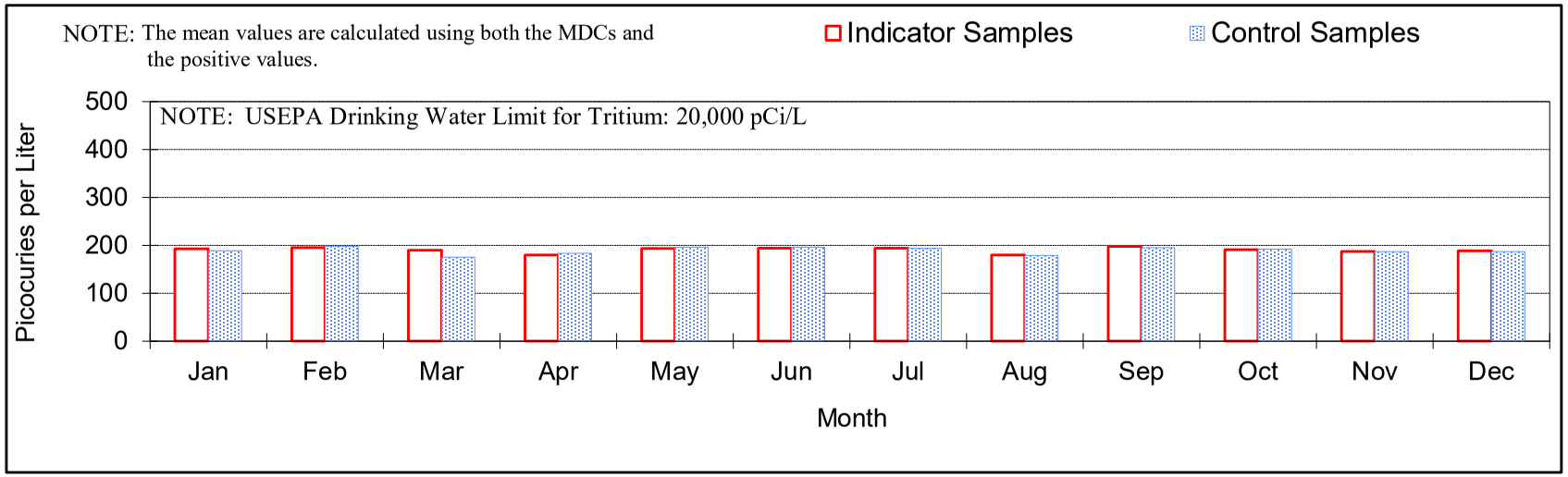


FIGURE C-4
Mean Monthly Tritium Concentrations in Drinking Water and Effluent Water
Three Mile Island Nuclear Station, 2019



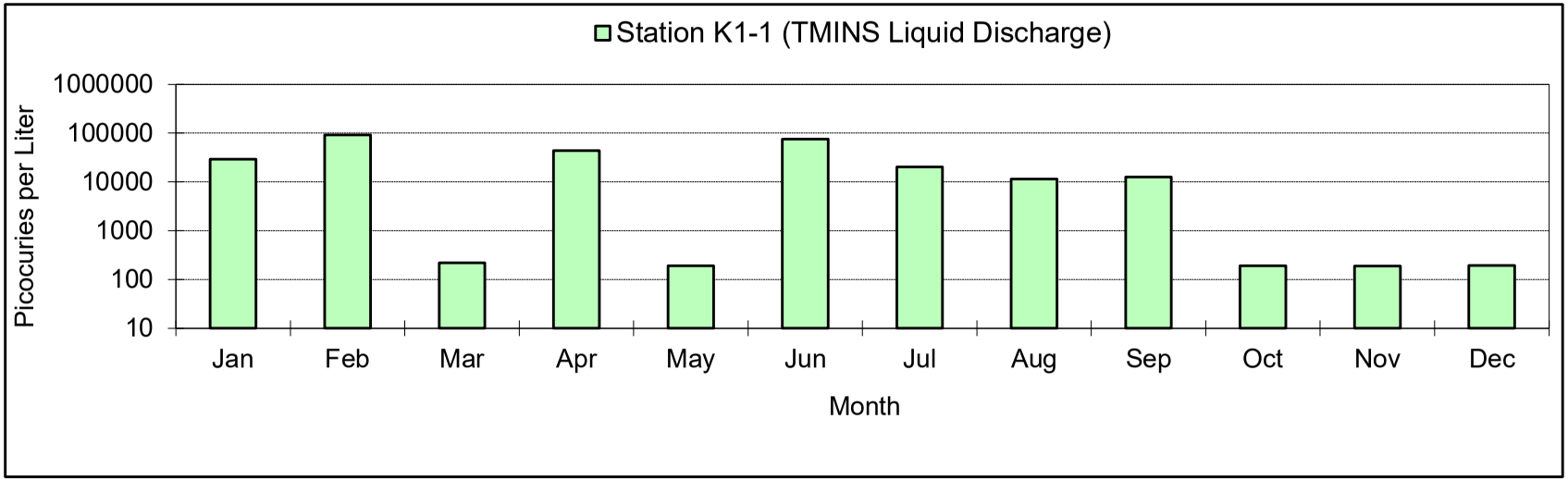


FIGURE C-5
Mean Cesium-137 Concentrations in Aquatic Sediments
Three Mile Island Nuclear Station, 1984 – 2019

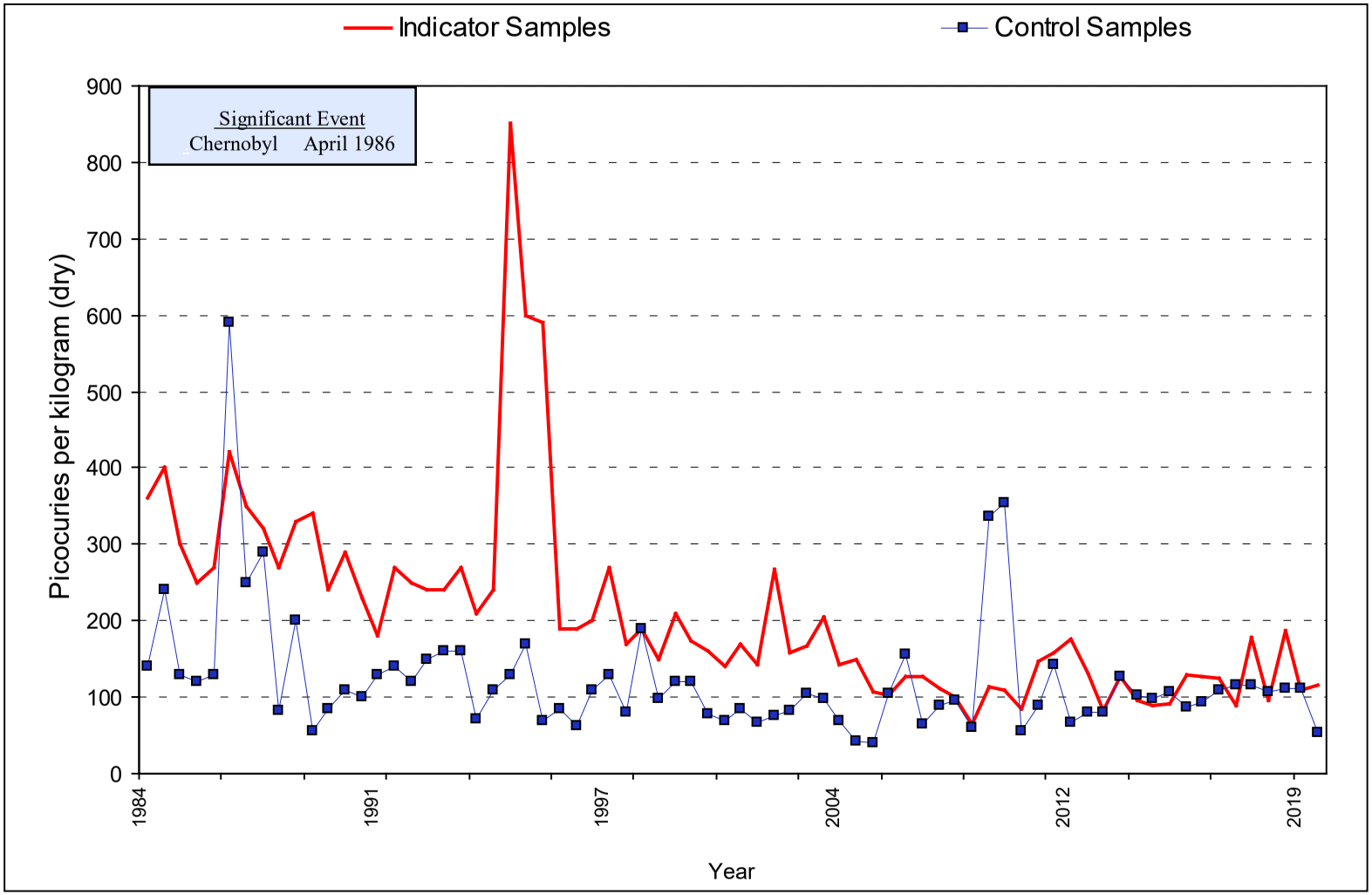


FIGURE C-6
Mean Quarterly Gross Beta Concentrations in Air Particulates
Three Mile Island Nuclear Station, 1972 - 2019

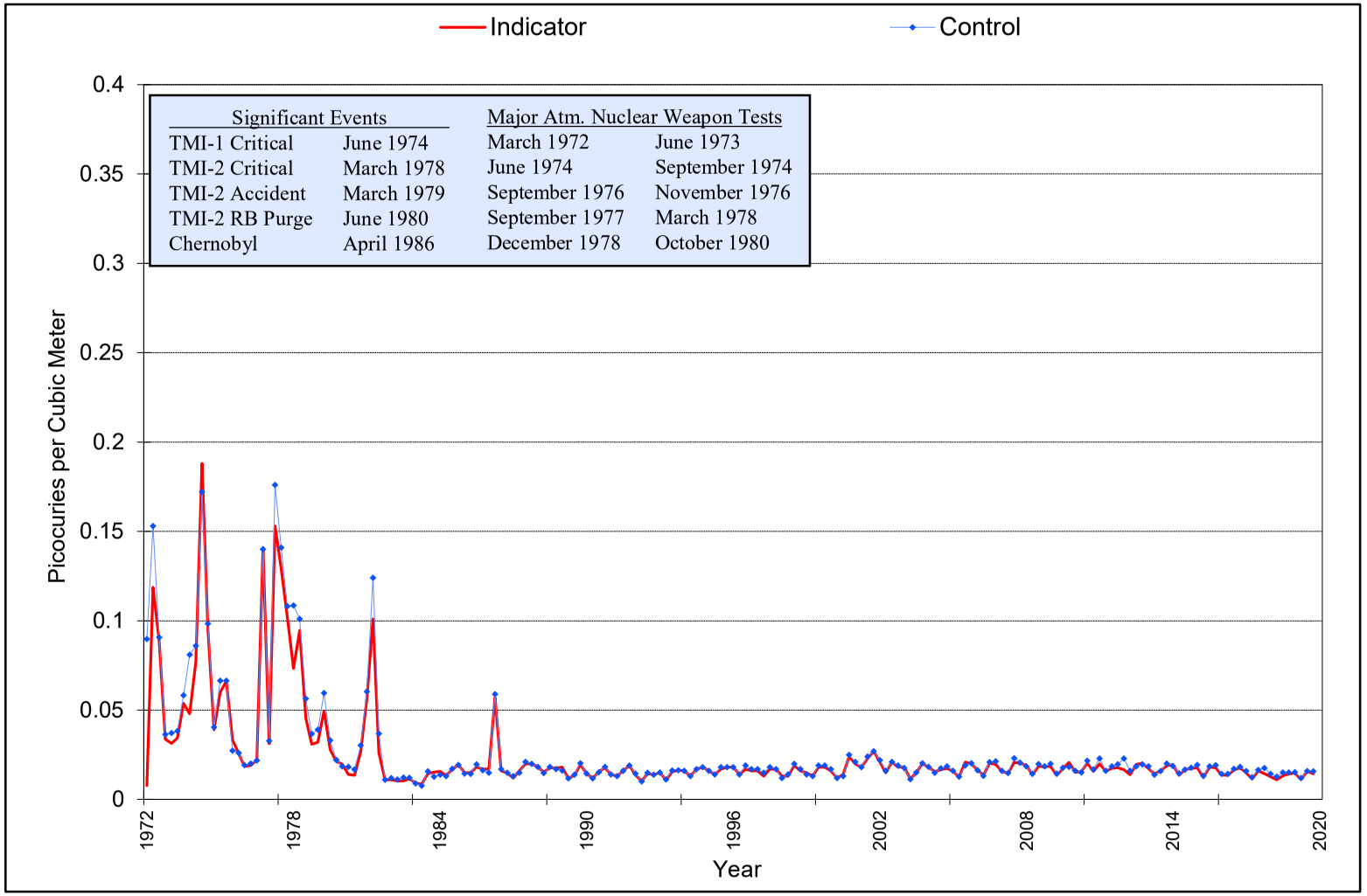
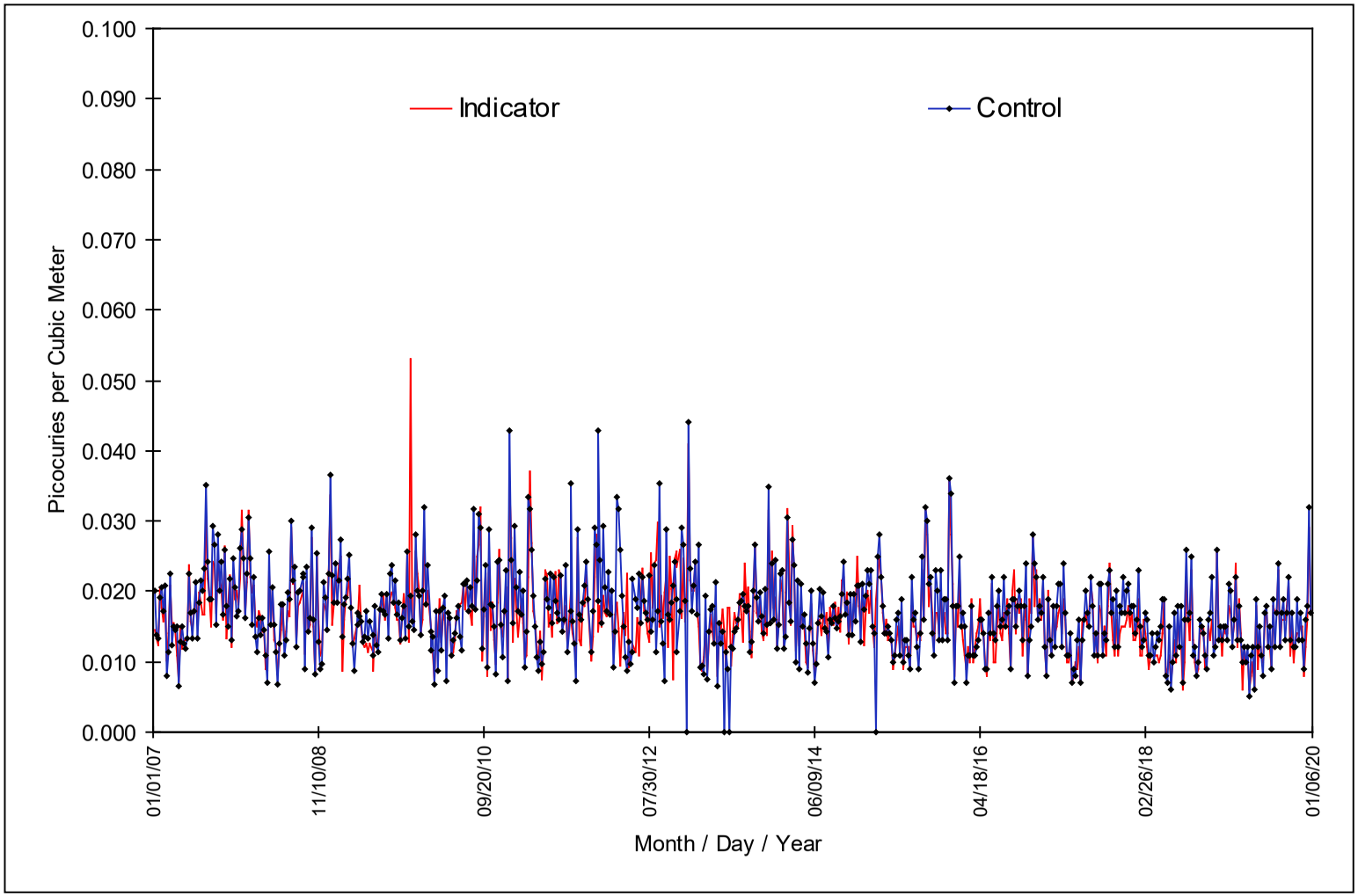
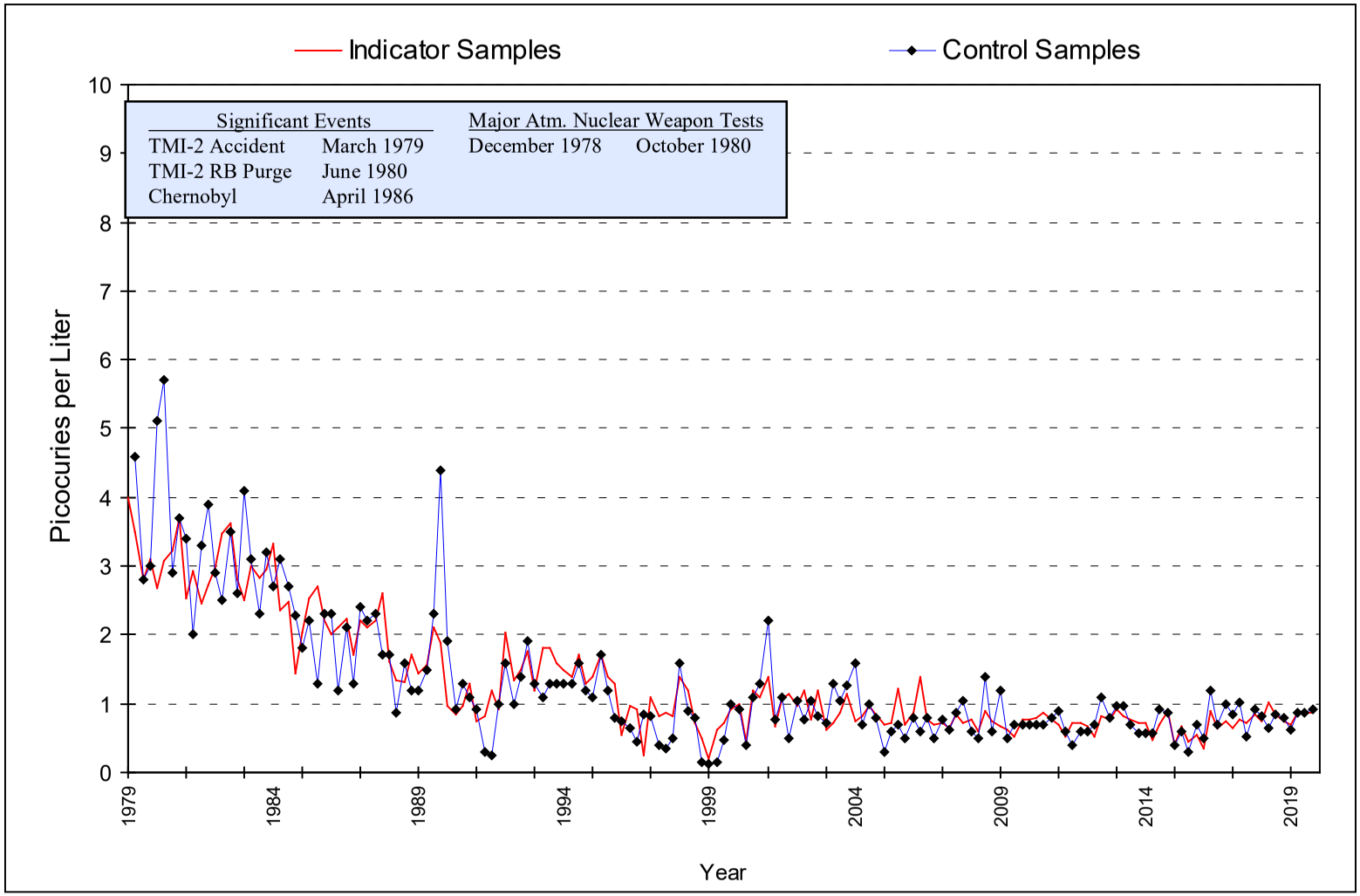


FIGURE C-7
Mean Weekly Gross Beta Concentrations in Air Particulates
Three Mile Island Nuclear Station, 2007 - 2019



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 - 2019



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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, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

LAB	COLLECTION PERIOD	Q9-1Q
EIS	01/03/19 - 01/30/19	0.9 ± 0.6
	01/30/19 - 02/27/19	1.7 ± 0.6
	02/27/19 - 03/27/19	1.6 ± 0.7
	03/27/19 - 05/01/19	1.0 ± 0.6
	05/01/19 - 05/30/19	1.2 ± 0.6
	05/30/19 - 06/27/19	1.4 ± 0.6
	06/27/19 - 08/01/19	1.6 ± 0.6
	08/01/19 - 08/29/19	1.6 ± 0.6
	08/29/19 - 10/03/19	2.5 ± 0.7
	10/03/19 - 10/31/19	1.1 ± 0.6
	10/31/19 - 12/04/19	1.9 ± 0.7
	12/04/19 - 01/02/20	1.6 ± 0.6
	MEAN ± 2 STD DEV	1.5 ± 0.9

TABLE D-I.2 CONCENTRATIONS OF TRITIUM IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

LAB	COLLECTION PERIOD	Q9-1Q
GEL	01/03/19 - 03/21/19	< 121
	03/27/19 - 06/27/19	< 122
	06/27/19 - 10/03/19	< 139
	10/03/19 - 01/02/20	< 137
	MEAN	-

TABLE D-I.3 CONCENTRATIONS OF IODINE-131 IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

LAB	COLLECTION PERIOD	Q9-1Q
EIS	01/03/19 - 01/30/19	< 0.6
	01/30/19 - 02/27/19	< 0.6
	02/27/19 - 03/27/19	< 0.9
	03/27/19 - 05/01/19	< 0.6
	05/01/19 - 05/30/19	< 0.7
	05/30/19 - 06/27/19	< 0.9
	06/27/19 - 08/01/19	< 0.9
	08/01/19 - 08/29/19	< 0.8
	08/29/19 - 10/03/19	< 0.7
	10/03/19 - 10/31/19	< 0.5
	10/31/19 - 12/04/19	< 0.8
	12/04/19 - 01/02/20	< 0.7
	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, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

LAB	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
EIS	Q9-1Q	01/03/19 - 01/30/19	< 3	< 3	< 8	< 3	< 6	< 4	< 5	< 3	< 3	< 15	< 6
		01/30/19 - 02/27/19	< 3	< 4	< 9	< 4	< 8	< 4	< 7	< 4	< 5	< 22	< 9
		02/27/19 - 03/27/19	< 4	< 4	< 7	< 4	< 8	< 4	< 6	< 4	< 4	< 17	< 6
		03/27/19 - 05/01/19	< 0	< 4	< 9	< 4	< 8	< 4	< 7	< 4	< 4	< 28	< 10
		05/01/19 - 05/30/19	< 3	< 3	< 7	< 3	< 8	< 4	< 5	< 3	< 3	< 22	< 8
		05/30/19 - 06/27/19	< 3	< 3	< 8	< 3	< 7	< 4	< 6	< 3	< 3	< 29	< 9
		06/27/19 - 08/01/19	< 3	< 4	< 9	< 4	< 9	< 5	< 7	< 4	< 4	< 25	< 10
		08/01/19 - 08/29/19	< 3	< 3	< 7	< 3	< 6	< 3	< 5	< 3	< 3	< 12	< 4
		08/29/19 - 10/03/19	< 4	< 4	< 7	< 3	< 8	< 4	< 6	< 4	< 4	< 12	< 4
		10/03/19 - 10/31/19	< 3	< 4	< 6	< 3	< 6	< 3	< 5	< 3	< 3	< 14	< 4
		10/31/19 - 12/04/19	< 4	< 4	< 10	< 5	< 10	< 5	< 8	< 4	< 4	< 24	< 10
		12/04/19 - 01/02/20	< 3	< 3	< 6	< 3	< 7	< 3	< 6	< 3	< 3	< 13	< 5
		MEAN	-	-	-	-	-	-	-	-	-	-	-

TABLE D-II.1

CONCENTRATIONS OF STRONTIUM AND GAMMA EMITTERS IN FISH SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2019

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	10/24/19			3070 ± 381	< 18	< 22	< 61	< 22	< 57	< 15	< 20

TABLE D-III.1 CONCENTRATIONS OF GAMMA EMITTERS IN SEDIMENT SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2019

LAB	SITE	COLLECTION PERIOD	K-40	Cs-134	Cs-137
EIS	J2-1	10/30/19	8300 ± 906	< 70	< 69

TABLE D-IV.1 CONCENTRATIONS OF GAMMA EMITTERS AND STRONTIUM IN FOOD PRODUCT SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2019

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	Sunflower	06/26/19	2220 ± 199	6800 ± 416	< 58	< 17	< 17		
GEL	B10-2Q	Sunflower	06/26/19						< 1.8	< 0.8
EIS	H1-2Q	Zucchini Leaves	06/26/19	842 ± 91	4210 ± 267	< 39	< 13	< 13		
GEL	H1-2Q	Zucchini Leaves	06/26/19							
EIS	H1-2Q	Eggplant	07/17/19	1130 ± 143	5620 ± 401	< 30	< 19	< 19		
GEL	H1-2Q	Eggplant	07/17/19						< 1.7	< 0.9
EIS	H1-2Q	Zucchini Leaves	08/22/19	876 ± 151	2680 ± 348	< 31	< 21	< 25		
GEL	H1-2Q	Zucchini Leaves	08/22/19						< 1.8	< 0.9
EIS	H1-2Q	Collards	09/26/19	62 ± 56	3100 ± 273	< 40	< 14	< 16		
GEL	H1-2Q	Collards	09/26/19						< 1.1	< 0.9

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, 2019

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

LAB	COLLECTION PERIOD	E1-2Q GROSS BETA	E1-2Q I-131
EIS	12/27/18 - 01/03/19	23 ± 2	< 10
	01/03/19 - 01/10/19	22 ± 2	< 13
	01/10/19 - 01/16/19	19 ± 1	< 21
	01/16/19 - 01/23/19	22 ± 1	< 18
	01/23/19 - 01/30/19	29 ± 1	< 16
	01/30/19 - 02/07/19	28 ± 2	< 9.1
	02/07/19 - 02/14/19	17 ± 2	< 16
	02/14/19 - 02/21/19	21 ± 2	< 15
	02/21/19 - 02/27/19	33 ± 3	< 23
	02/27/19 - 03/07/19	19 ± 3	< 17
	03/07/19 - 03/14/19	34 ± 3	< 10
	03/14/19 - 03/21/19	20 ± 2	< 16
	03/21/19 - 03/27/19	14 ± 2	< 13
	03/27/19 - 04/04/19	17 ± 2	< 13
	04/04/19 - 04/11/19	20 ± 2	< 11
	04/11/19 - 04/18/19	14 ± 2	< 13
	04/18/19 - 04/25/19	12 ± 2	< 18
	04/25/19 - 05/01/19	14 ± 2	< 15
	05/01/19 - 05/09/19	15 ± 2	< 15
	05/09/19 - 05/15/19	8 ± 2	< 20
	05/15/19 - 05/22/19	23 ± 2	< 18
	05/22/19 - 05/30/19	14 ± 2	< 8
	05/30/19 - 06/07/19	19 ± 2	< 15
	06/07/19 - 06/13/19	13 ± 2	< 20
	06/13/19 - 06/19/19	16 ± 2	< 16
	06/19/19 - 06/27/19	17 ± 2	< 13
	06/27/19 - 07/03/19	25 ± 3	< 14
	07/03/19 - 07/11/19	21 ± 2	< 13
	07/11/19 - 07/18/19	20 ± 2	< 9
	07/18/19 - 07/25/19	21 ± 2	< 13
	07/25/19 - 08/01/19	32 ± 3	< 12
	08/01/19 - 08/07/19	28 ± 3	< 20
	08/07/19 - 08/15/19	31 ± 2	< 13
	08/15/19 - 08/21/19	33 ± 3	< 15
	08/21/19 - 08/29/19	19 ± 2	< 13
	08/29/19 - 09/05/19	26 ± 2	< 13
	09/05/19 - 09/12/19	33 ± 3	< 16
	09/12/19 - 09/18/19	27 ± 3	< 13
	09/18/19 - 09/26/19	36 ± 2	< 9
	09/26/19 - 10/03/19	31 ± 2	< 15
	10/03/19 - 10/10/19	15 ± 2	< 12
	10/10/19 - 10/17/19	30 ± 2	< 10
	10/17/19 - 10/24/19	14 ± 2	< 13
	10/24/19 - 10/31/19	22 ± 2	< 8
	10/31/19 - 11/07/19	23 ± 2	< 13
	11/07/19 - 11/14/19	25 ± 2	< 8
	11/14/19 - 11/21/19	24 ± 2	< 10
	11/21/19 - 11/28/19	27 ± 3	< 15
	11/27/19 - 12/04/19	9 ± 2	< 11
	12/04/19 - 12/12/19	22 ± 2	< 9
	12/12/19 - 12/19/19	20 ± 2	< 10
	12/19/19 - 12/26/19	46 ± 3	< 18
	12/26/19 - 01/02/20	31 ± 2	< 12
	MEAN ± 2 STD DEV	23 ± 15	-

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, 2019

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

LAB	SITE	COLLECTION PERIOD	Be-7	Cs-134	Cs-137
EIS	E1-2Q	12/27/18 - 03/27/19	74 ± 10	< 0.9	< 1.0
		03/29/18 - 06/28/18	68 ± 10	< 0.8	< 0.7
		06/27/19 - 10/03/19	74 ± 9	< 0.8	< 0.7
		10/03/19 - 01/02/20	60 ± 8	< 0.8	< 0.8
		MEAN ± 2 STD DEV	69 ± 14	-	-

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, 2019

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	01/09/19	< 0.6	1490 ± 90	< 4	< 4	< 26	< 7		
EIS		02/13/19	< 0.6	1410 ± 118	< 6	< 5	< 23	< 10		
EIS		03/06/19	< 0.8	1040 ± 74	< 4	< 4	< 18	< 7		
EIS		03/20/19	< 0.7	1270 ± 83	< 4	< 4	< 24	< 7		
GEL	01/09/19 - 03/20/19								< 5.5	< 1.7
EIS		04/03/19	< 0.9	1300 ± 109	< 5	< 6	< 36	< 11		
EIS		04/17/19	< 0.7	1400 ± 86	< 3	< 4	< 26	< 8		
EIS		05/01/19	< 0.9	1230 ± 81	< 4	< 4	< 25	< 10		
EIS		05/15/19	< 0.8	1510 ± 95	< 4	< 6	< 21	< 8		
EIS		05/29/19	< 0.8	1510 ± 97	< 5	< 6	< 22	< 7		
EIS		06/11/19	< 1.0	1230 ± 82	< 4	< 4	< 24	< 7		
EIS		06/26/19	< 0.9	1310 ± 83	< 3	< 4	< 24	< 7		
GEL	04/03/19 - 06/26/19								< 3.6	< 1.6
EIS		07/10/19	< 0.8	1180 ± 80	< 3	< 4	< 19	< 6		
EIS		07/24/19	< 0.7	1310 ± 110	< 6	< 5	< 34	< 12		
EIS		08/07/19	< 0.7	1350 ± 114	< 5	< 6	< 28	< 8		
EIS		08/21/19	< 0.7	1340 ± 111	< 5	< 6	< 23	< 9		
EIS		09/04/19	< 0.9	1520 ± 95	< 5	< 5	< 19	< 7		
EIS		09/18/19	< 0.8	1420 ± 86	< 4	< 4	< 22	< 6		
GEL	07/10/19 - 09/19/19								< 3.7	< 1.9
EIS		10/02/19	< 0.7	1270 ± 90	< 5	< 6	< 21	< 8		
EIS		10/16/19	< 0.6	1310 ± 89	< 4	< 5	< 22	< 6		
EIS		10/30/19	< 0.6	1020 ± 102	< 7	< 7	< 31	< 10		
EIS		11/13/19	< 0.8	1250 ± 109	< 5	< 6	< 23	< 10		
EIS		11/26/19	< 0.6	1250 ± 82	< 4	< 4	< 18	< 6		
EIS		12/11/19	< 0.8	1470 ± 89	< 3	< 4	< 17	< 5		
GEL	10/02/19 - 12/11/19								< 3.8	< 1.7
		MEAN ± 2 STD DEV		1321 ± 273	-	-	-	-	-	-

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

FIGURE D-1
MONTHLY GROSS BETA CONCENTRATIONS IN DRINKING WATER SAMPLES COLLECTED FROM TMINS LOCATION Q9-1Q, 2019

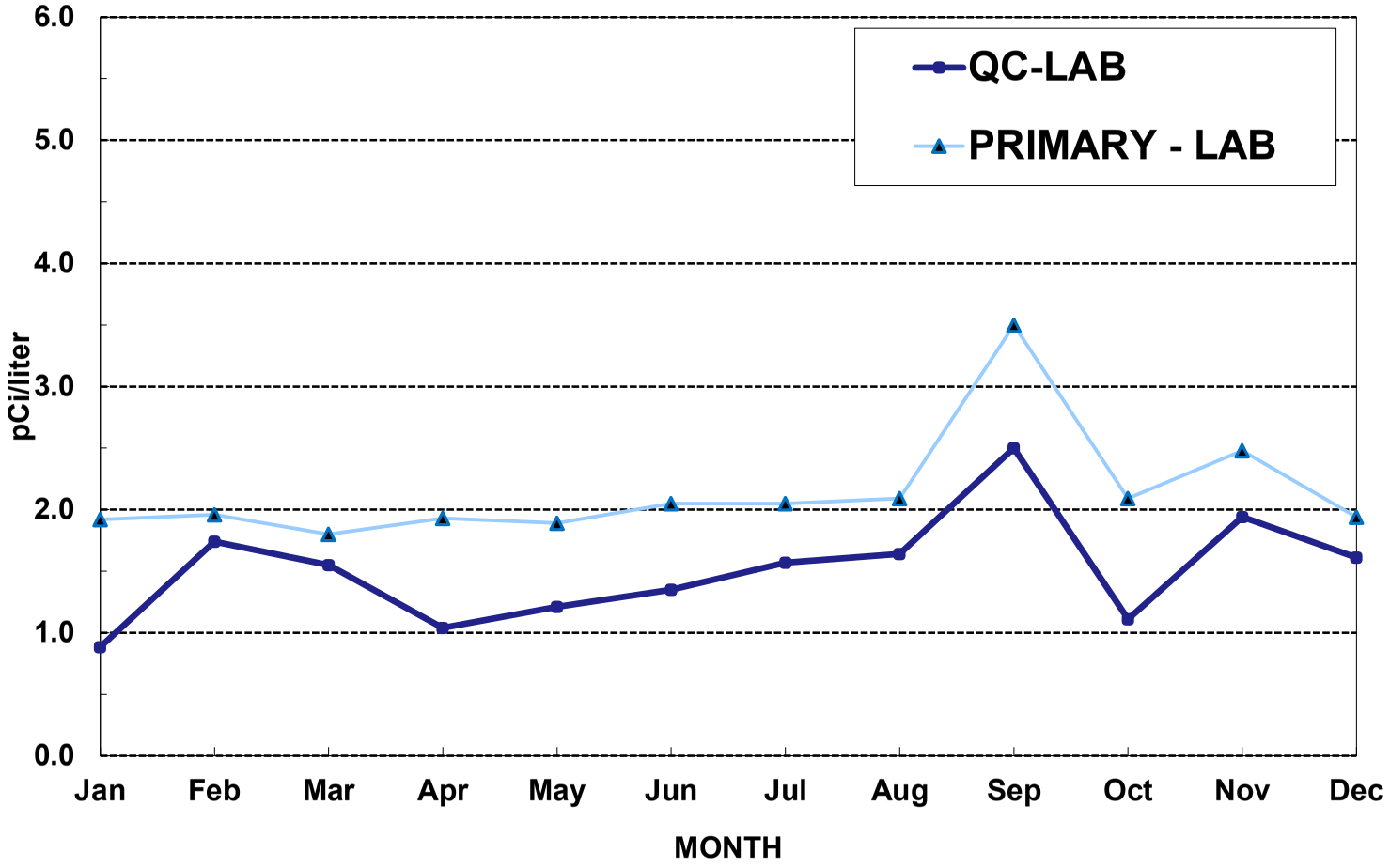
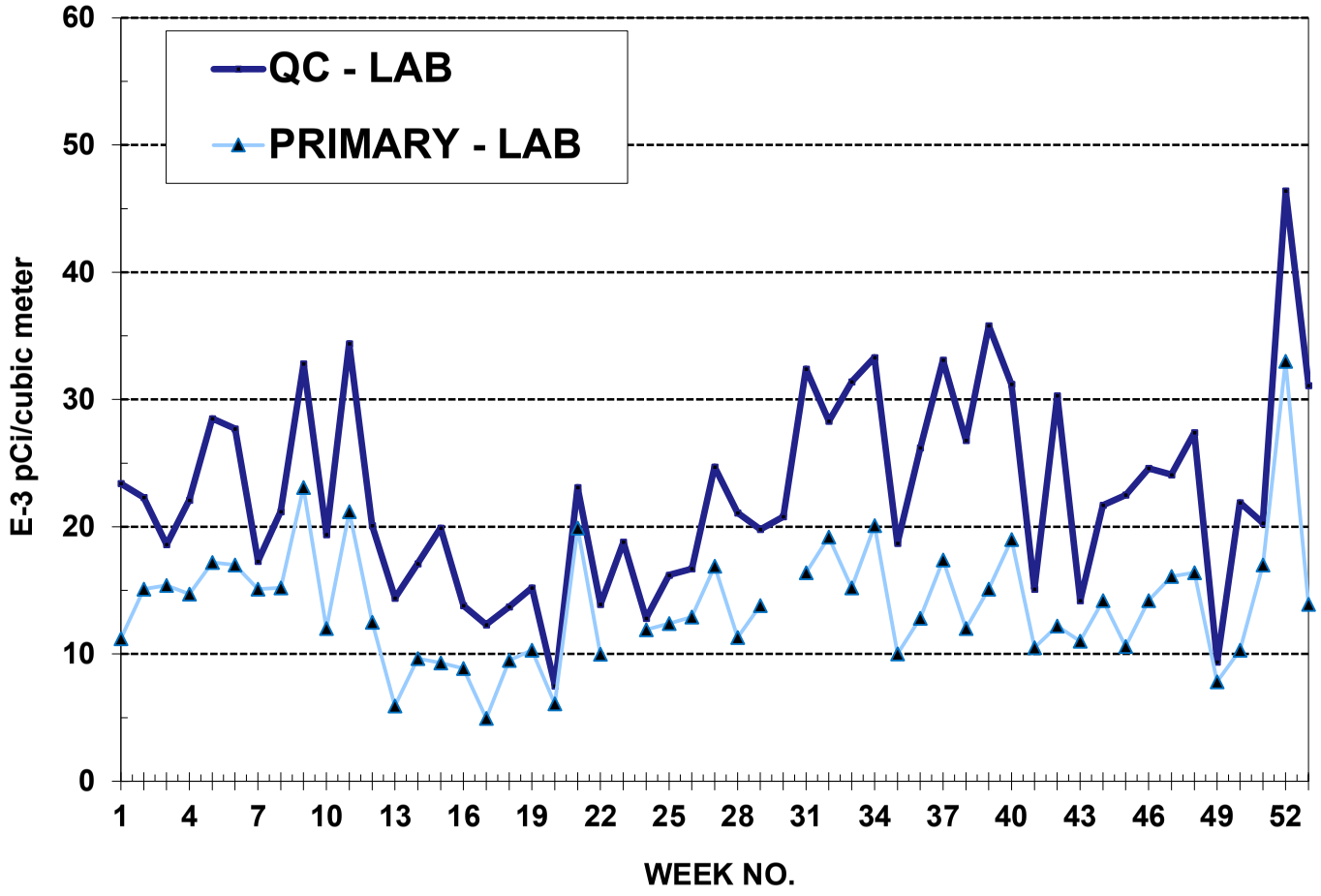


FIGURE D-2
WEEKLY GROSS BETA CONCENTRATIONS IN AIR PARTICULATE SAMPLES COLLECTED FROM TMINS LOCATION E1-2Q, 2019



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 2019	E12468A	Milk	Sr-89	pCi/L	87.1	96	0.91	A
			Sr-90	pCi/L	12.6	12.6	1.00	A
	E12469A	Milk	Ce-141	pCi/L	113	117	0.97	A
			Co-58	pCi/L	153	143	1.07	A
			Co-60	pCi/L	289	299	0.97	A
			Cr-51	pCi/L	233	293	0.80	A
			Cs-134	pCi/L	147	160	0.92	A
			Cs-137	pCi/L	193	196	0.98	A
			Fe-59	pCi/L	153	159	0.96	A
			I-131	pCi/L	91.5	89.5	1.02	A
			Mn-54	pCi/L	149	143	1.04	A
			Zn-65	pCi/L	209	220	0.95	A
	E12470	Charcoal	I-131	pCi	77.5	75.2	1.03	A
	E12471	AP	Ce-141	pCi	60.7	70.2	0.87	A
			Co-58	pCi	87.9	85.8	1.02	A
			Co-60	pCi	175	179	0.98	A
			Cr-51	pCi	165	176	0.94	A
			Cs-134	pCi	91.2	95.9	0.95	A
			Cs-137	pCi	120	118	1.02	A
			Fe-59	pCi	108	95.3	1.13	A
			Mn-54	pCi	94.2	85.7	1.10	A
			Zn-65	pCi	102	132	0.77	W
	E12472	Water	Fe-55	pCi/L	2230	1920	1.16	A
	E12473	Soil	Ce-141	pCi/g	0.189	0.183	1.03	A
			Co-58	pCi/g	0.209	0.224	0.93	A
			Co-60	pCi/g	0.481	0.466	1.03	A
			Cr-51	pCi/g	0.522	0.457	1.14	A
			Cs-134	pCi/g	0.218	0.250	0.87	A
			Cs-137	pCi/g	0.370	0.381	0.97	A
			Fe-59	pCi/g	0.263	0.248	1.06	A
			Mn-54	pCi/g	0.248	0.223	1.11	A
			Zn-65	pCi/g	0.371	0.344	1.08	A
	E12474	AP	Sr-89	pCi	88.3	95.2	0.93	A
			Sr-90	pCi	11.7	12.5	0.94	A
August 2019	E12562	Soil	Sr-90	pCi/g	4.710	6.710	0.70	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 2019	E12475	Milk	Sr-89	pCi/L	70.0	93.9	0.75	W
			Sr-90	pCi/L	12.0	12.9	0.93	A
	E12476	Milk	Ce-141	pCi/L	150	167	0.90	A
			Co-58	pCi/L	170	175	0.97	A
			Co-60	pCi/L	211	211	1.00	A
			Cr-51	pCi/L	323	331	0.98	A
			Cs-134	pCi/L	180	207	0.87	A
			Cs-137	pCi/L	147	151	0.97	A
			Fe-59	pCi/L	156	148	1.05	A
			I-131	pCi/L	81.1	92.1	0.88	A
			Mn-54	pCi/L	160	154	1.04	A
			Zn-65	pCi/L	303	293	1.03	A
	E12477	Charcoal	I-131	pCi	95.9	95.1	1.01	A
	E12478	AP	Ce-141	pCi	129	138	0.93	A
			Co-58	pCi	128	145	0.88	A
			Co-60	pCi	181	174	1.04	A
			Cr-51	pCi	292	274	1.07	A
			Cs-134	pCi	166	171	0.97	A
			Cs-137	pCi	115	125	0.92	A
			Fe-59	pCi	119	123	0.97	A
			Mn-54	pCi	129	128	1.01	A
			Zn-65	pCi	230	242	0.95	A
	E12479	Water	Fe-55	pCi/L	1810	1850	0.98	A
	E12480	Soil	Ce-141	pCi/g	0.305	0.276	1.10	A
			Co-58	pCi/g	0.270	0.289	0.93	A
			Co-60	pCi/g	0.358	0.348	1.03	A
			Cr-51	pCi/g	0.765	0.547	1.40	N[(1)]
			Cs-134	pCi/g	0.327	0.343	0.95	A
			Cs-137	pCi/g	0.308	0.321	0.96	A
			Fe-59	pCi/g	0.257	0.245	1.05	A
			Mn-54	pCi/g	0.274	0.255	1.07	A
			Zn-65	pCi/g	0.536	0.485	1.11	A
	E12481	AP	Sr-89	pCi	95.9	91.9	1.04	A
			Sr-90	pCi	12.3	12.6	0.97	A
	E12563	Soil	Sr-90	pCi/g	0.392	0.360	1.09	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 19-27***

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 2019	19-GrF40	AP	Gross Alpha	Bq/sample	0.184	0.528	0.158 - 0.898	A
			Gross Beta	Bq/sample	0.785	0.948	0.474 - 1.422	A
	19-MaS40	Soil	Ni-63	Bq/kg	420	519.0	363 - 675	A
			Sr-90	Bq/kg			*(1)*	NR(3)
	19-MaW40	Water	Am-241	Bq/L	0.764	0.582	0.407 - 0.757	N(4)
			Ni-63	Bq/L	4.72	5.8	4.1 - 7.5	A
			Pu-238	Bq/L	0.443	0.451	0.316 - 0.586	A
			Pu-239/240	Bq/L	-0.00161	0.0045	*(2)*	A
	19-RdF40	AP	U-234/233	Bq/sample	0.1138	0.106	0.074 - 0.138	A
			U-238	Bq/sample	0.107	0.110	0.077 - 0.143	A
	19-RdV40	Vegetation	Cs-134	Bq/sample	2.14	2.44	1.71 - 3.17	A
			Cs-137	Bq/sample	2.22	2.30	1.61 - 2.99	A
			Co-57	Bq/sample	2.16	2.07	1.45 - 2.69	A
			Co-60	Bq/sample	0.02382		*(1)*	A
			Mn-54	Bq/sample	-0.03607		*(1)*	A
			Sr-90	Bq/sample	-0.1060		*(1)*	N(5)
			Zn-65	Bq/sample	1.35	1.71	1.20 - 2.22	W
August 2019	19-GrF41	AP	Gross Alpha	Bq/sample	0.192	0.528	0.158 - 0.898	W
			Gross Beta	Bq/sample	0.722	0.937	0.469 - 1.406	A
	19-MaS41	Soil	Ni-63	Bq/kg	436	629	440 - 818	N(6)
			Sr-90	Bq/kg	444	572	400 - 744	W
	19-MaW41	Water	Am-241	Bq/L				NR(7)
			Ni-63	Bq/L	7.28	9.7	6.8 - 12.6	W
			Pu-238	Bq/L	0.0207	0.0063	*(2)*	A
			Pu-239/240	Bq/L	0.741	0.727	0.509 - 0.945	A
	19-RdF41	AP	U-234/233	Bq/sample	0.0966	0.093	0.065 - 0.121	A
			U-238	Bq/sample	0.0852	0.096	0.067-0.125	A
	19-RdV41	Vegetation	Cs-134	Bq/sample	0.0197		*(1)*	A
			Cs-137	Bq/sample	3.21	3.28	2.30 - 4.26	A
			Co-57	Bq/sample	4.62	4.57	3.20 - 5.94	A
			Co-60	Bq/sample	4.88	5.30	3.71 - 6.89	A
			Mn-54	Bq/sample	4.54	4.49	3.14 - 5.84	A
			Sr-90	Bq/sample	0.889	1.00	0.70 - 1.30	A
			Zn-65	Bq/sample	2.78	2.85	2.00 - 3.71	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 19-12***
*(4) See **NCR 19-13***
*(5) See **NCR 19-14***
*(6) See **NCR 19-25***
*(7) See **NCR 19-26***

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]
April 2019	Rad-117	Water	Ba-133	pCi/L	26.3	24.1	18.6 - 27.8	A
			Cs-134	pCi/L	15.2	12.1	8.39 - 14.4	N(1)
			Cs-137	pCi/L	33.6	33.1	28.8 - 39.4	A
			Co-60	pCi/L	11.9	11.5	8.67 - 15.5	A
			Zn-65	pCi/L	87.1	89.2	80.3 - 107	A
			GR-A	pCi/L	19	19.3	9.56 - 26.5	A
			GR-B	pCi/L	20.2	29.9	19.1 - 37.7	A
			U-Nat	pCi/L	55.5	55.9	45.6 - 61.5	A
			H-3	pCi/L	21500	21400	18700 - 23500	A
			Sr-89	pCi/L	44.9	33.3	24.5 - 40.1	N(2)
			Sr-90	pCi/L	24.5	26.3	19.0 - 30.7	A
			I-131	pCi/L	28.9	28.4	23.6 - 33.3	A
October 2019	Rad-119	Water	Ba-133	pCi/L	42.7	43.8	35.7 - 48.8	A
			Cs-134	pCi/L	53.5	55.9	45.2 - 61.5	A
			Cs-137	pCi/L	77.7	78.7	70.8 - 89.2	A
			Co-60	pCi/L	51.5	53.4	48.1 - 61.3	A
			Zn-65	pCi/L	36.6	34.0	28.5 - 43.1	A
			GR-A	pCi/L	40.5	27.6	14.0 - 36.3	N(3)
			GR-B	pCi/L	36.3	39.8	26.4 - 47.3	A
			U-Nat	pCi/L	27.66	28.0	22.6 - 31.1	A
			H-3	pCi/L	22800	23400	20500 - 25700	A
			Sr-89	pCi/L	47.1	45.5	35.4 - 52.7	A
			Sr-90	pCi/L	32.5	26.5	19.2 - 30.9	N(4)
			I-131	pCi/L	26.0	23.9	19.8 - 28.4	A
December 2019	QR 120419D	Water	Sr-90	pCi/L	20.1	18.6	13.2 - 22.1	A

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

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

*(1) See **NCR 19-10***
*(2) See **NCR 19-11***
*(3) See **NCR 19-23***
*(4) See **NCR 19-24***

TABLE E.4 Analytics Environmental Radioactivity Cross Check Program
Exelon Industrial Services (2019)

Month/Year	Identification Number	Matrix	Nuclide	Units	EIS Reported Value	Known Value [a]	Ratio of Analytics to EIS Result	Evaluation [b]
March 2019	E 12379	Water	Gr-B	pCi/L	264	288	92	Pass
	E 12380	Charcoal	I-131	pCi	73.0	75.6	97	Pass
	E 12378A	Milk	I-131	pCi/L	92	89.5	103	Pass
			Ce-141	pCi/L	101	117	86	Pass
			Cr-51	pCi/L	227	293	77	Pass
			Cs-134	pCi/L	138	160	86	Pass
			Cs-137	pCi/L	184	196	94	Pass
			Co-58	pCi/L	128	143	90	Pass
			Mn-54	pCi/L	141	143	99	Pass
			Fe-59	pCi/L	149	159	94	Pass
			Zn-65	pCi/L	177	220	80	Pass
			Co-60	pCi/L	262	299	88	Pass
June 2019	E12383	AP	Ce-141	pCi/Filter	97.7	88	111	Pass
			Cr-51	pCi/Filter	222	223	100	Pass
			Cs-134	pCi/Filter	80.9	93	87	Pass
			Cs-137	pCi/Filter	119	111	107	Pass
			Co-58	pCi/Filter	77.7	74	105	Pass
			Mn-54	pCi/Filter	142	126	113	Pass
			Fe-59	pCi/Filter	121	93.5	129	Pass
			Zn-65	pCi/Filter	185	164	113	Pass
			Co-60	pCi/Filter	139	131	106	Pass
	E12382	Water	I-131	pCi/L	115	89.1	129	Pass
			Ce-141	pCi/L	142	145	98	Pass
			Cr-51	pCi/L	327	368	89	Pass
			Cs-134	pCi/L	139	153	91	Pass
			Cs-137	pCi/L	186	184	101	Pass
			Co-58	pCi/L	115	122	94	Pass
			Mn-54	pCi/L	214	207	103	Pass
			Fe-59	pCi/L	154	154	100	Pass
			Zn-65	pCi/L	257	270	95	Pass
			Co-60	pCi/L	216	216	100	Pass
	E12381	Water	Gr-B	pCi/L	199	199	100	Pass
September 2019	E12384	AP	Gr-B	pCi	270.7	221	122	Pass
December 2019	E12386	Water	Gr-B	pCi/L	260	269	97	Pass
	E12387	Cartridge Detector 2	I-131	pCi	79.0	88.2	90	Pass
	E12387	Cartridge Detector 3	I-131	pCi	79.1	88.2	90	Pass
	E12387	Cartridge Detector 4	I-131	pCi	79.2	88.2	90	Pass
December 2019	E12385	AP Detector 2	Ce-141	pCi/Filter	98.5	99.1	99	Pass
			Cr-51	pCi/Filter	246	288	85	Pass
			Cs-134	pCi/Filter	123	135.0	91	Pass
			Cs-137	pCi/Filter	128	121.0	106	Pass
			Co-58	pCi/Filter	117	107.0	109	Pass
			Mn-54	pCi/Filter	170	155.0	110	Pass
			Fe-59	pCi/Filter	124	104.0	119	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 (2019)

Month/Year	Identification Number	Matrix	Nuclide	Units	EIS Reported Value	Known Value [a]	Ratio of Analytics to EIS Result	Evaluation [b]
December 2019	E12385	AP	Zn-65	pCi/Filter	194	190	102	Pass
		Detector 2	Co-60	pCi/Filter	139	138	101	Pass
	E12385	AP	Ce-141	pCi/Filter	95.7	99.1	97	Pass
		Detector 3	Cr-51	pCi/Filter	257.1	288	89	Pass
			Cs-134	pCi/Filter	128	135.0	95	Pass
			Cs-137	pCi/Filter	128	121.0	105	Pass
			Co-58	pCi/Filter	111	107.0	104	Pass
			Mn-54	pCi/Filter	173	155.0	112	Pass
			Fe-59	pCi/Filter	121.7	104.0	117	Pass
			Zn-65	pCi/Filter	203	190	107	Pass
			Co-60	pCi/Filter	147.5	138	107	Pass
	E12385	AP	Ce-141	pCi/Filter	102	99.1	103	Pass
		Detector 4	Cr-51	pCi/Filter	299	288	104	Pass
			Cs-134	pCi/Filter	122	135.0	90	Pass
			Cs-137	pCi/Filter	122	121.0	101	Pass
			Co-58	pCi/Filter	102	107.0	95	Pass
			Mn-54	pCi/Filter	167	155.0	108	Pass
			Fe-59	pCi/Filter	132	104.0	127	Pass
			Zn-65	pCi/Filter	195	190	103	Pass
			Co-60	pCi/Filter	146	138	106	Pass
	E12388	Milk	I-131	pCi/L	100	94.5	106	Pass
		Detector 2	Ce-141	pCi/L	82.4	83.0	99	Pass
			Cr-51	pCi/L	271	241	112	Pass
			Cs-134	pCi/L	112	113	99	Pass
			Cs-137	pCi/L	123	102	121	Pass
			Co-58	pCi/L	84.9	89.9	94	Pass
			Mn-54	pCi/L	128	130	98	Pass
			Fe-59	pCi/L	95.5	87	110	Pass
			Zn-65	pCi/L	148	159	93	Pass
			Co-60	pCi/L	119	115	103	Pass
	E12388	Milk	I-131	pCi/L	99.3	94.5	105	Pass
		Detector 3	Ce-141	pCi/L	80.7	83.0	97	Pass
			Cr-51	pCi/L	227.9	241	95	Pass
			Cs-134	pCi/L	103.4	113	92	Pass
			Cs-137	pCi/L	109.2	102	107	Pass
			Co-58	pCi/L	101.9	89.9	113	Pass
			Mn-54	pCi/L	140.8	130	108	Pass
			Fe-59	pCi/L	102.1	87	117	Pass
			Zn-65	pCi/L	166.2	159	105	Pass
			Co-60	pCi/L	111	115	97	Pass
	E12388	Milk	I-131	pCi/L	104	94.5	110	Pass
		Detector 4	Ce-141	pCi/L	78.3	83.0	94	Pass
			Cr-51	pCi/L	235.4	241	98	Pass
			Cs-134	pCi/L	114	113	101	Pass
			Cs-137	pCi/L	105	102	103	Pass
			Co-58	pCi/L	92	89.9	102	Pass
			Mn-54	pCi/L	143	130	110	Pass
			Fe-59	pCi/L	104	87	119	Pass
			Zn-65	pCi/L	164	159	103	Pass
			Co-60	pCi/L	123	115	107	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 (2019)

Month/Year	ID Number	Matrix	Nuclide	Units	EIS Reported Value	Known Value [a]	Acceptance Ratio of ERA to EIS Result	Evaluation [b]
April 2019	RAD-117	Water	Ba-133	pCi/L	23.0	24.1	95	Pass
			Cs-134	pCi/L	10.8	12.1	89	Pass
			Cs-137	pCi/L	34	33.1	104	Pass
			Co-60	pCi/L	11.3	11.5	98	Pass
			Zn-65	pCi/L	88.0	89.2	99	Pass
			I-131	pCi/L	25.3	28.4	89	Pass
			GR-B	pCi/L	28.8	29.9	96	Pass
			H-3	pCi/L	20,766	21,400	97	Pass
July 2019	RAD-118		H-3	pCi/L	17,684	16,700	106	Pass
September 2019	MRAD-31	AP	Am-241	pCi/Filter	28.4	32	89	Pass
			Cs-134	pCi/Filter	60.7	59	103	Pass
			Cs-137	pCi/Filter	440	437	101	Pass
			Co-60	pCi/Filter	57.5	58.4	98	Pass
			Zn-65	pCi/Filter	381	364	105	Pass
October 2019	RAD-119	Water	Ba-133	pCi/L	37.2	43.8	85	Pass
			Cs-134	pCi/L	52.2	55.9	93	Pass
			Cs-137	pCi/L	80.3	78.7	102	Pass
			Co-60	pCi/L	54.8	53.4	103	Pass
			Zn-65	pCi/L	39.3	34	116	Pass
			I-131	pCi/L	25.4	23.9	106	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) ERA evaluation based on EIS internal QC limits in accordance with the NRC Resolution Test criteria

TABLE E.6 DOE's Mixed Analyte Performance Evaluation Program (MAPEP)
GEL Laboratories (Gamma, H-3 & Sr-90)

Quarter/Year	Identification Number	Matrix	Nuclide	Units	Reported Value	Known Value [a]	Acceptance Range	Evaluation [b]
2nd/2019	19-MaS40	Soil	Sr-90	Bq/Kg	3.44		False Positive Test	A
	19-MaW40	Water	H-3	Bq/L	389	421	295 - 547	A
			Sr-90	Bq/L	5.86	6.35	4.45 - 8.26	A
			Cs-134	Bq/L	5.32	5.99	4.19 - 7.79	A
			Cs-137	Bq/L	0		False Positive Test	A
			Co-60	Bq/L	6.7	6.7	4.7 - 8.7	A
			Fe-55	Bq/L	0.0173		False Positive Test	A
			Mn-54	Bq/L	8.8	8.4	5.9 - 10.9	A
			Zn-65	Bq/L	-0.0318		False Positive Test	A
	19-RdF40	AP	Sr-90	Bq/sample	0.616	0.662	0.463 - 0.861	A
	19-RdV40	Veg	Sr-90	Bq/sample	0.00951		False Positive Test	A
4th/2019	19-MaS41	Soil	S-90	Bq/Kg	609	572	400 - 744	A
	19-MaW41	Water	H-3	Bq/L	166	175	123 - 228	A
			Sr-90	Bq/L	9.34	10.6	7.4 - 13.8	A
			Cs-134	Bq/L	0.0266		False Positive Test	A
			Cs-137	Bq/L	19.7	18.4	12.9 - 23.9	A
			Co-60	Bq/L	9.01	8.8	6.2 - 11.4	A
			Fe-55	Bq/L	13.8	15.70	11.0 - 20.4	A
			Mn-54	Bq/L	22.6	20.6	14.4 - 26.8	A
			Zn-65	Bq/L	23.1	20.3	5.27 - 9.79	A
	19-RdF41	AP	Sr-90	Bq/sample	0.442	0.498	0.349 - 0.647	A
	19-RdV41	Veg	Sr-90	Bq/sample	0.847	1.00	0.70 - 1.30	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

TABLE E.7 ERA Environmental Radioactivity Cross Check Program
GEL Laboratories (Gamma, H-3 & Sr-89/90)

Quarter/Year	Identification Number	Matrix	Nuclide	Units	Reported Value	Known Value [a]	Acceptance Limits	Evaluation [b]
1st/2019	RAD-116	Water	Cs-134	pCi/L	48.2	49.1	39.5 - 54.0	A
			Cs-137	pCi/L	128	125	112 - 140	A
			Co-60	pCi/L	104	96.4	86.8 - 108	A
			Zn-65	pCi/L	88.1	77.4	69.5 - 93.2	A
			H-3	pCi/L	2,160	2,110	1,740 - 2,340	A
			H-3	pCi/L	1,920	2,110	1,740 - 2,340	A
			Sr-89	pCi/L	78.5	66.9	54.4 - 75.0	N(1)
			Sr-89	pCi/L	76.5	66.9	54.4 - 75.0	N(1)
			Sr-90	pCi/L	40.1	41.0	30.2 - 47.1	A
			Sr-90	pCi/L	42.2	41.0	30.2 - 47.1	A
2nd/2019	MRAD-30	Soil	Sr-90	pCi/kg	1,220	1,350	420 - 2,100	A
		Veg	Sr-90	pCi/kg	4,670	3,530	1,900 - 4,600	N(2)
		AP	Sr-90	pCi	169	181	114 - 246	A
		Water	Sr-90	pCi/L	365	315	227 - 389	A
			H-3	pCi/L	22,200	23,700	17,900 - 28,800	A
			Cs-134	pCi/L	116	123	92.9 - 135	A
			Cs-137	pCi/L	126	125	107 - 142	A
			Co-60	pCi/L	1,200.0	1,100	949 - 1,260	A
			Fe-55	pCi/L	1,310	1,320	776 - 1,920	A
			Mn-54	pCi/L	<5.6	<100	<100	A
			Zn-65	pCi/L	1,990	1,780	1,580 - 2,250	A
	RAD-116	Water	Sr-89	pCi/L	35.9	33.3	24.5 - 40.2	A
			Sr-89	pCi/L	34.4	33.3	24.5 - 40.2	A
3rd/2019	RAD-118	Water	Cs-134	pCi/L	30.4	32.0	25.1 - 35.2	A
			Cs-137	pCi/L	23	21	17.6 - 26.7	A
			Co-60	pCi/L	102	95.1	85.6 - 107	A
			Zn-65	pCi/L	49.2	41.2	35.3 - 51.4	A
			H-3	pCi/L	14,700	16,700	14,600 - 18,400	A
			H-3	pCi/L	14,700	16,700	14,600 - 18,400	A
			H-3	pCi/L	15,000	16,700	14,600 - 18,400	A
			Sr-89	pCi/L	69.4	58.7	47.1 - 66.5	N(3)
			Sr-89	pCi/L	62.1	58.7	47.1 - 66.5	A
			Sr-90	pCi/L	34.3	38.5	28.3 - 44.3	A
			Sr-90	pCi/L	33.4	38.5	28.3 - 44.3	A
4th/2019	MRAD-31	Soil	Sr-90	pCi/kg	1,660	1,910	594 - 2,980	A
		Veg	Sr-90	pCi/kg	4,010	3,940	2,220 - 5,130	A
		AP	Sr-90	pCi	34.8	34.5	21.8 - 47.0	A
		Water	Sr-90	pCi/L	508	481	346 - 595	A
			H-3	pCi/L	20,900	22,300	16,800 - 27,100	A
			Cs-134	pCi/L	1,820	1,960	1,480 - 2,160	A
			Cs-137	pCi/L	1,820	1,840	1,580 - 2,090	A
			Co-60	pCi/L	1,970	1,870	1,610 - 2,150	A
			Fe-55	pCi/L	1,410	1,460	858 - 2,120	A
			Mn-54	pCi/L	<7.24	<100	<100	A
			Zn-65	pCi/L	1,490	1,370	1,220 - 1,730	A

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

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

(1) ***CARR190225-1192***
(2) ***CARR190530-1211***
(3) ***CARR190826-1250***

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TABLE E.8 Analytics Environmental Radioactivity Cross Check Program
GEL Laboratories (Gamma and Sr-89/90 only)

Quarter/Year	Identification Number	Matrix	Nuclide	Units	Reported Value	Known Value [a]	Acceptance Limits	Evaluation [b]
1st/2019	E12367	Water	Cs-134	pCi/L	143	155	0.92	A
			Cs-137	pCi/L	209	191	1.10	A
			Co-58	pCi/L	143	139	1.03	A
			Co-60	pCi/L	318	290	1.10	A
			Fe-59	pCi/L	176	154	1.14	A
			M:n-54	pCi/L	155	139	1.12	A
			Zn-65	pCi/L	244	214	1.14	A
2nd/2019	E12361	Milk	Sr-89	pCi/L	101	82.9	1.22	A
			Sr-90	pCi/L	12.1	13.5	0.90	A
	E12363	Water	Cs-134	pCi/L	137	153	0.89	A
			Cs-137	pCi/L	190	184	1.03	A
			Co-58	pCi/L	122	122	1.00	A
			Co-60	pCi/L	222	216	1.03	A
			Fe-59	pCi/L	173	154	1.12	A
			Mn-54	pCi/L	227	270	1.10	A
			Zn-65	pCi/L	301	270	1.11	A
3rd/2019	E12369	Milk	Sr-89	pCi/L	87.1	93.9	0.93	A
			Sr-90	pCi/L	7.02	12.9	0.54	A
	E12371	Water	Cs-134	pCi/L	150	157	0.96	A
			Cs-137	pCi/L	122	114	1.07	A
			Co-58	pCi/L	136	133	1.03	A
			Co-60	pCi/L	168	160	1.04	A
			Fe-59	pCi/L	127	112	1.13	A
			Mn-54	pCi/L	134	117	1.15	A
			Zn-65	pCi/L	257	222	1.16	A
4th/2019	E12373	Milk	Sr-89	pCi/L	66.0	80.6	0.82	A
			Sr-90	pCi/L	11.1	11.0	1.00	A
	E12375	Water	Cs-134	pCi/L	106	114	0.93	A
			Cs-137	pCi/L	109	103	1.06	A
			Co-58	pCi/L	95.4	91.1	1.05	A
			Co-60	pCi/L	122	117	1.05	A
			Fe-59	pCi/L	93.2	88.2	1.06	A
			Mn-54	pCi/L	144	131	1.10	A
			Zn-65	pCi/L	191	161	1.19	A

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

(b) Analytics evaluation based on laboratory's internal acceptance criteria of 75% - 125%:
A = Acceptable - Reported value falls within the Acceptance Limits
N = Not Acceptable - Reported value falls outside of the Acceptance Limits

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 2019

Prepared By
Teledyne Brown Engineering
Environmental Services

Three Mile Island Nuclear Station
Middletown, PA 17057

April 2020

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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 2019. During that time period 462 analyses were performed on 243 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 27 of 52 groundwater monitoring locations. The groundwater tritium concentrations ranged from 188 ± 123 pCi/L to 3,840 ± 445 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 detected in 3 storm water samples. The concentrations ranged from 219 ± 127 to 381 ± 131 pCi/L. Tritium was detected in 3 of 4 precipitation water locations. The concentrations ranged from 237 ± 124 to 802 ± 152 pCi/L.

Gross Alpha and Gross Beta analyses in the dissolved and suspended fractions were performed on 25 groundwater samples during the second quarter sampling in 2019. Neither Gross Alpha (dissolved) nor Gross Alpha (suspended) was detected at any of the 25 groundwater locations. Gross Beta (dissolved) was detected at all 25 groundwater locations. The concentrations ranged from 1.4 to

12.6 pCi/L. Gross Beta (suspended) was detected at 3 of the 25 groundwater locations. The concentrations ranged from 3.3 to 5.7 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 2019.

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 2019. TMINS groundwater movement is into the Susquehanna River which surrounds the station on all sides.

In December 2019, 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 2015 hydrogeologic investigation report, including changes at the Station as well as RGPP sampling activities and groundwater flow. Relevant conclusions from the report are:

- AFE-TMI-6-BWST, 1 BWST is retained as an AFE

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 Gel Laboratories (subcontracted from Exelon Industrial Services) on samples collected in 2019.

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 2019.

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 3,840 pCi/L.
(Table B-I.1, Appendix B)

Tritium Split Samples

Tritium values ranged from the detection limit to 418 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 analyzed on any split samples in 2019.

Gross Alpha and Gross Beta (dissolved and suspended)

Gross Alpha and Gross Beta analyses in the dissolved and suspended fractions were performed on 25 groundwater samples during the second quarter sampling in 2019.

Gross Alpha (dissolved) was not detected at any of the groundwater locations. Gross Alpha (suspended) was also not detected at any of the groundwater locations.

Gross Beta (dissolved) was detected at all 25 groundwater locations. The concentrations ranged from 1.4 to 12.6 pCi/L. Gross Beta (suspended) was detected in 3 of the 25 groundwater locations. The concentrations ranged from 3.3 to 5.7 pCi/L. (Table B-I.1, Appendix B)

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

Gross Alpha and Gross Beta were not analyzed on any split samples in

2019. (Table C-I.1, Appendix C)

Gamma Emitters

Sixty-one locations were analyzed for gamma-emitting nuclides in 2019. Naturally-occurring K-40 was detected in 1 sample at a concentration of 102 ± 61 pCi/L. No other gamma-emitting nuclides were detected. (Table B-I.2, Appendix B)

Gamma Emitters Split Samples

One location analyzed a sample for gamma-emitting nuclides in 2019. No gamma-emitting nuclides were detected in this sample. (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 2019. (Table B-I.3, Appendix B)

Hard-To-Detect Split Samples

Hard to detects were not analyzed on any split samples in 2019. (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 2019. Tritium was not detected above the required detection limit of 200 pCi/L in any of the 15 samples analyzed. (Table B-II.1, Appendix B)

Tritium Split Samples

Two locations analyzed for tritium in 2019. Tritium was not detected above the required detection limit of 200 pCi/L in either sample analyzed. (Table C-II.1, Appendix C)

Gamma Emitters

Three locations analyzed for gamma-emitting nuclides in 2019. No 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 2019. 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 3 of 4 samples at a concentration range of 219 to 381 pCi/L. (Table B–III.1, Appendix B)

Gamma Emitters

Four 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 237 to 731 pCi/L. (Table B–IV.1, Appendix B)

Tritium Split Samples

Samples from one location were analyzed for tritium activity. Tritium was not detected in any of the 4 samples. (Table C–III.1, Appendix C).

Gamma Emitters

Precipitation water was not analyzed for Gamma Emitters in 2019.

Gamma Emitters Split Samples

No gamma-emitting nuclides were analyzed in 2019.

E. Leaks, Spills, and Releases

There were no leaks, spills or releases in 2019. 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

There were no compensatory/corrective actions taken in 2019.

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 2019.

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APPENDIX A

LOCATION DESIGNATION & DISTANCE

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TABLE A-1: Radiological Groundwater Protection Program - Sampling Locations, Three Mile Island Nuclear Station, 2019

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

TABLE A-1: Radiological Groundwater Protection Program - Sampling Locations, Three Mile Island Nuclear Station, 2019

Site	Site Type
MW-TMI-21S	Monitoring Well
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

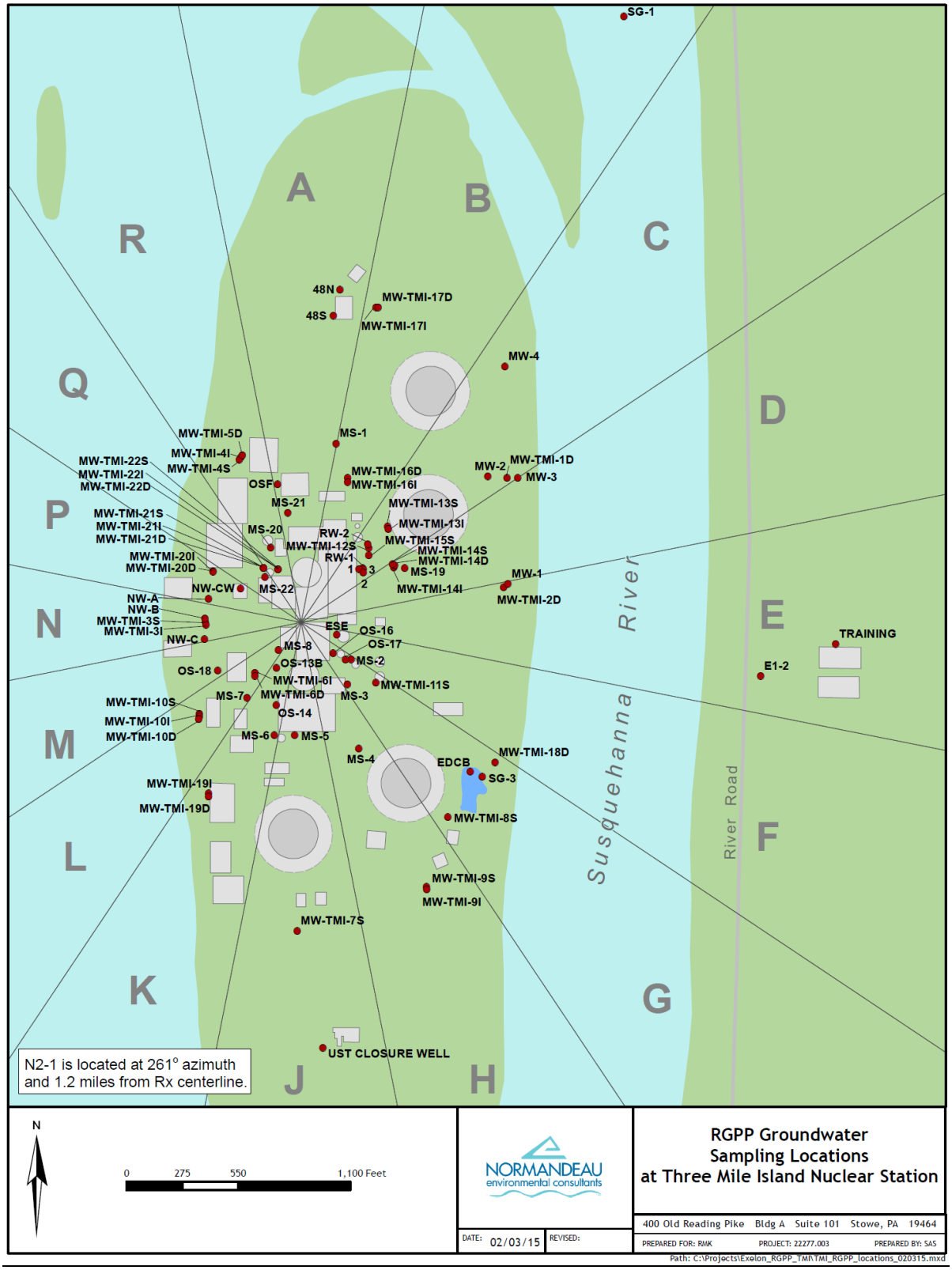

Figure A – 1
Sampling Locations at the Three Mile Island Nuclear Station, 2019

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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 PROTECTION PROGRAM, THREE MILE ISLAND NUCLEAR STATION, 2019

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	02/19/19		< 190						
48S	05/21/19		< 181	< 2.5	< 0.4	< **5.3**	< 0.6	2.5 ± 1.4	< 1.5
48S	08/27/19		< 193						
48S	11/19/19		< 198						
MS-1	02/18/19		< 191						
MS-1	02/18/19	*NP*	< 197						
MS-1	05/21/19	*NP*	< 191						
MS-1	05/21/19		< 183	< 4.8	< 0.8	< **8.2**	< 0.8	6.4 ± 3.0	< 1.6
MS-1	08/27/19		< 191						
MS-1	08/27/19	*NP*	< 181						
MS-1	11/18/19		265 ± 133						
MS-1	11/18/19	*DUP*	246 ± 124						
MS-1	11/18/19	*NP*	474 ± 135						
MS-2	02/22/19		200 ± 126						
MS-2	05/21/19		< 181	< 5.9	< 1.0	< 1.2	< 0.4	2.8 ± 0.9	< 1.6
MS-2	08/28/19		< 194						
MS-2	11/20/19		201 ± 126						
MS-3	02/22/19		200 ± 129						
MS-3	05/21/19		< 198	< 4.3	< 0.7	< 1.3	< 0.4	5.3 ± 1.1	< 1.6
MS-3	08/28/19		226 ± 126						
MS-3	11/20/19		262 ± 128						
MS-4	05/21/19		< 185						
MS-5	02/22/19		< 193						
MS-5	05/21/19		< 197	< 6.3	< 0.6	< 1.4	< 0.7	3.7 ± 0.9	< 1.3
MS-5	08/28/19		< 192						
MS-5	11/20/19		< 197						
MS-7	02/19/19		< 195						
MS-7	05/23/19		< 196	< 6.1	< 0.9	< 0.9	< 0.7	1.6 ± 0.6	< 1.3
MS-7	08/28/19		< 180						
MS-7	11/21/19		< 196						
MS-7	11/21/19	*DUP*	< 185						
MS-8	02/22/19		267 ± 131						
MS-8	05/21/19		< 197	< 7.0	< 0.9	< 1.3	< 0.7	4.6 ± 0.9	< 1.3
MS-8	08/28/19		< 193						
MS-8	11/20/19		196 ± 128						
MS-20	02/19/19		310 ± 132						
MS-20	05/21/19		294 ± 124	< 5.7	< 0.9	< 1.2	< 0.4	5.8 ± 1.1	< 1.6
MS-20	08/27/19		361 ± 134						
MS-20	08/27/19	*DUP*	313 ± 126						
MS-20	11/20/19		430 ± 137						
MS-21	02/19/19		< 189						
MS-21	05/21/19		< 198	< 6.5	< 0.9	< 1.1	< 0.7	2.3 ± 0.7	< 1.3
MS-21	08/27/19		< 195						
MS-21	08/27/19	*DUP*	< 182						
MS-21	11/20/19		< 191						
MS-22	02/19/19		901 ± 166						
MS-22	02/19/19	*NP*	929 ± 167						
MS-22	05/21/19	*NP*	963 ± 170						
MS-22	05/21/19		820 ± 158	< 6.6	< 0.9	< 1.4	< 0.4	11.8 ± 1.4	5.7 ± 0.7
MS-22	05/21/19		889 ± 164						
MS-22	08/27/19	*NP*	649 ± 137						
MS-22	08/27/19		518 ± 140						

Bolded values indicate LLD was not met due to high solid content in the sample

NP = Non-purge study samples

TABLE B-I.1 CONCENTRATIONS OF TRITIUM, STRONTIUM, GROSS ALPHA AND GROSS BETA IN GROUNDWATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, THREE MILE ISLAND NUCLEAR STATION, 2019

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)
MS-22	11/20/19		893 ± 166						
MS-22	11/20/19	*NP*	844 ± 163						
MW-1	05/22/19		< 183						
MW-1	05/22/19	*DUP*	< 198						
MW-2	05/22/19		< 184						
MW-TMI-1D	05/22/19		< 197						
MW-TMI-2D	05/22/19		234 ± 123						
MW-TMI-3I	02/19/19		310 ± 132						
MW-TMI-3I	05/23/19		< 197	< 5.0	< 0.7	< **5.3**	< 0.6	8.8 ± 2.6	< 2.6
MW-TMI-3I	08/27/19		389 ± 134						
MW-TMI-3I	11/18/19		244 ± 133						
MW-TMI-3I	11/18/19	*DUP*	202 ± 119						
MW-TMI-4I	05/23/19		< 196						
MW-TMI-4S	05/23/19		< 182						
MW-TMI-6D	02/19/19		< 190						
MW-TMI-6D	02/19/19	*DUP*	< 192						
MW-TMI-6D	05/23/19		< 188	< 4.2	< 0.8	< 1.7	< 0.4	2.9 ± 1.0	< 1.6
MW-TMI-6D	08/28/19		328 ± 126						
MW-TMI-6D	11/21/19		211 ± 114						
MW-TMI-6I	02/19/19		263 ± 130						
MW-TMI-6I	05/23/19		< 187	< 6.5	< 0.8	< 1.2	< 0.4	2.4 ± 0.9	< 1.6
MW-TMI-6I	08/28/19		261 ± 124						
MW-TMI-6I	11/21/19		225 ± 114						
MW-TMI-7S	05/22/19		< 184						
MW-TMI-8S	05/22/19		< 185						
MW-TMI-9I	05/22/19		< 181						
MW-TMI-9S	05/22/19		< 185						
MW-TMI-10D	05/23/19		< 184						
MW-TMI-10I	02/18/19		396 ± 137						
MW-TMI-10I	02/18/19	*DUP*	356 ± 136						
MW-TMI-10I	02/18/19	*NP*	404 ± 138						
MW-TMI-10I	05/23/19	*NP*	465 ± 138						
MW-TMI-10I	05/23/19		308 ± 128						
MW-TMI-10I	05/23/19	*DUP*	447 ± 132						
MW-TMI-10I	08/27/19		390 ± 136						
MW-TMI-10I	08/27/19	*NP*	407 ± 129						
MW-TMI-10I	11/21/19		293 ± 134						
MW-TMI-10I	11/21/19	*NP*	356 ± 128						
MW-TMI-10S	02/18/19		215 ± 126						
MW-TMI-10S	02/18/19	*NP*	258 ± 128						
MW-TMI-10S	05/23/19	*NP*	386 ± 133						
MW-TMI-10S	05/23/19		456 ± 133	< 5.1	< 0.8	< 1.7	< 0.4	5.7 ± 1.4	< 1.6
MW-TMI-10S	08/27/19		729 ± 158						
MW-TMI-10S	08/27/19	*NP*	720 ± 145						
MW-TMI-10S	11/21/19		413 ± 139						
MW-TMI-10S	11/21/19	*NP*	352 ± 130						
MW-TMI-12S	02/19/19		< 194						
MW-TMI-12S	05/21/19		< 186	< 5.3	< 0.8	< 1.1	< 0.4	6.1 ± 1.0	< 1.6
MW-TMI-12S	08/28/19		< 192						
MW-TMI-12S	11/20/19		< 192						
MW-TMI-13I	02/19/19		199 ± 127						
MW-TMI-13I	05/22/19		< 183						

Bolded values indicate LLD was not met due to high solid content in the sample

NP = Non-purge study samples

TABLE B-I.1 CONCENTRATIONS OF TRITIUM, STRONTIUM, GROSS ALPHA AND GROSS BETA IN GROUNDWATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, THREE MILE ISLAND NUCLEAR STATION, 2019

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-13I	05/22/19	*DUP*	< 182						
MW-TMI-13I	08/28/19		< 181						
MW-TMI-13I	08/28/19	*DUP*	< 180						
MW-TMI-13I	11/21/19		< 171						
MW-TMI-14D	02/19/19		307 ± 133						
MW-TMI-14D	05/22/19		268 ± 127						
MW-TMI-14D	05/22/19	*DUP*	260 ± 125						
MW-TMI-14D	08/28/19		< 196						
MW-TMI-14D	11/21/19		222 ± 128						
MW-TMI-14I	02/19/19		< 190						
MW-TMI-14I	02/19/19	*DUP*	< 190						
MW-TMI-14I	05/22/19		< 177						
MW-TMI-14I	08/28/19		< 184						
MW-TMI-14I	11/21/19		< 196						
MW-TMI-16D	05/22/19		557 ± 136						
MW-TMI-17I	05/23/19		< 188						
MW-TMI-18D	05/23/19		< 177						
MW-TMI-19I	05/23/19		< 187						
MW-TMI-20I	05/23/19		369 ± 130						
MW-TMI-21D	02/19/19		3840 ± 445						
MW-TMI-21D	02/19/19	*NP*	3730 ± 431						
MW-TMI-21D	05/21/19		3110 ± 374						
MW-TMI-21D	05/21/19	*NP*	3400 ± 402						
MW-TMI-21D	08/27/19	*NP*	3450 ± 403						
MW-TMI-21D	08/27/19		3230 ± 388						
MW-TMI-21D	11/20/19	*NP*	2810 ± 345						
MW-TMI-21D	11/20/19		2750 ± 340						
MW-TMI-21I	02/19/19		696 ± 150						
MW-TMI-21I	02/19/19	*NP*	1020 ± 175						
MW-TMI-21I	05/21/19	*NP*	621 ± 146						
MW-TMI-21I	05/21/19		532 ± 138						
MW-TMI-21I	08/27/19	*NP*	948 ± 162						
MW-TMI-21I	08/27/19		948 ± 166						
MW-TMI-21I	11/20/19		791 ± 156						
MW-TMI-21I	11/20/19	*NP*	760 ± 156						
MW-TMI-21S	02/19/19		289 ± 135						
MW-TMI-21S	02/19/19	*NP*	407 ± 138						
MW-TMI-21S	05/21/19	*NP*	369 ± 137						
MW-TMI-21S	05/21/19		380 ± 130	< 6.6	< 0.9	< 1.9	< 0.6	6.7 ± 1.3	3.3 ± 0.6
MW-TMI-21S	05/21/19		454 ± 135						
MW-TMI-21S	08/27/19	*NP*	265 ± 124						
MW-TMI-21S	08/27/19		284 ± 121						
MW-TMI-21S	11/20/19		1090 ± 183						
MW-TMI-21S	11/20/19	*NP*	1080 ± 184						
MW-TMI-22D	02/19/19		3080 ± 370						
MW-TMI-22D	02/19/19	*NP*	2760 ± 218						
MW-TMI-22D	05/21/19	*NP*	3200 ± 384						
MW-TMI-22D	05/21/19		2570 ± 321						
MW-TMI-22D	08/27/19	*NP*	2560 ± 316						
MW-TMI-22D	08/27/19		1910 ± 253						
MW-TMI-22D	11/20/19		1930 ± 261						
MW-TMI-22D	11/20/19	*NP*	1800 ± 251						
MW-TMI-22I	02/19/19		1490 ± 218						
MW-TMI-22I	02/19/19	*NP*	1360 ± 174						

NP = Non-purge study samples

TABLE B-I.1 CONCENTRATIONS OF TRITIUM, STRONTIUM, GROSS ALPHA AND GROSS BETA IN GROUNDWATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, THREE MILE ISLAND NUCLEAR STATION, 2019

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-22I	05/21/19	*NP*	909 ± 167						
MW-TMI-22I	05/21/19		806 ± 158						
MW-TMI-22I	05/21/19	*Recount*	697 ± 155						
MW-TMI-22I	05/21/19	*Reanalysis*	765 ± 152						
MW-TMI-22I	08/27/19	*NP*	967 ± 167						
MW-TMI-22I	08/27/19		1150 ± 180						
MW-TMI-22I	11/20/19		1310 ± 202						
MW-TMI-22I	11/20/19	*NP*	1200 ± 195						
MW-TMI-22S	02/19/19		594 ± 146						
MW-TMI-22S	02/19/19	*NP*	580 ± 144						
MW-TMI-22S	05/21/19	*NP*	701 ± 150						
MW-TMI-22S	05/21/19		578 ± 143	< 9.1	< 0.7	< 1.6	< 0.8	7.1 ± 1.1	4.5 ± 0.7
MW-TMI-22S	05/21/19		583 ± 143						
MW-TMI-22S	08/27/19	*NP*	506 ± 132						
MW-TMI-22S	08/27/19		436 ± 130						
MW-TMI-22S	11/20/19		466 ± 139						
MW-TMI-22S	11/20/19	*NP*	290 ± 131						
N2-1	05/30/19		< 188						
NW-A	02/19/19		306 ± 128						
NW-A	05/21/19		307 ± 128	< 6.8	< 0.8	< 1.7	< 0.6	3.0 ± 1.0	< 1.5
NW-A	08/27/19		< 187						
NW-A	11/20/19		258 ± 132						
NW-B	02/19/19		372 ± 135						
NW-B	05/21/19		301 ± 131	< 3.8	< 0.7	< 1.6	< 0.6	2.5 ± 1.0	< 1.5
NW-B	08/27/19		< 189						
NW-B	11/20/19		256 ± 130						
NW-C	02/19/19		610 ± 144						
NW-C	05/21/19		476 ± 137	< 3.2	< 0.6	< 1.6	< 0.6	1.4 ± 0.9	< 1.5
NW-C	08/27/19		458 ± 137						
NW-C	11/20/19		355 ± 134						
NW-CW	02/19/19		432 ± 138						
NW-CW	05/21/19		351 ± 132	< 4.1	< 0.7	< 1.6	< 0.6	1.9 ± 0.9	< 1.5
NW-CW	08/27/19		< 187						
NW-CW	11/19/19		358 ± 137						
OS-14	02/22/19		213 ± 128						
OS-14	05/21/19		< 194	< 4.7	< 0.9	< **3.2**	< 0.7	12.6 ± 1.7	< 1.3
OS-14	08/28/19		234 ± 127						
OS-14	11/20/19		188 ± 123						
OS-16	02/22/19		287 ± 130						
OS-16	05/21/19		< 190	< 3.5	< 0.7	< 1.2	< 0.6	4.6 ± 0.8	< 1.5
OS-16	08/28/19		194 ± 125						
OS-16	11/20/19		< 193						
OS-18	05/23/19		< 184						
OSF	02/19/19		363 ± 132						
OSF	05/21/19		235 ± 127	< 3.9	< 0.7	< **4.0**	< 0.6	5.1 ± 1.4	< 1.5
OSF	08/27/19		255 ± 123						
OSF	11/20/19		515 ± 143						
RW-1	02/19/19		< 190						
RW-1	05/21/19		< 192	< 3.2	< 0.6	< 1.7	< 0.6	5.5 ± 1.2	< 1.5
RW-1	08/28/19		< 192						
RW-1	11/20/19		< 193						
TRAINING CENTER	05/22/19		< 184						

Bolded values indicate LLD was not met due to high solid content in the sample

NP = Non-purge study samples

TABLE B-I.2

CONCENTRATIONS OF GAMMA EMITTERS IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2019

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		05/21/19	< 60	< 84	< 7	< 7	< 15	< 6	< 14	< 6	< 9	< 9	< 7	< 35	< 9
MS-1		05/21/19	< 59	< 121	< 6	< 7	< 12	< 8	< 10	< 7	< 11	< 8	< 6	< 21	< 12
MS-2		05/21/19	< 59	< 77	< 4	< 5	< 15	< 8	< 14	< 6	< 12	< 6	< 5	< 35	< 13
MS-3		02/22/19	< 36	< 71	< 4	< 4	< 10	< 5	< 8	< 5	< 7	< 5	< 4	< 20	< 7
MS-3		05/21/19	< 47	102 ± 61	< 5	< 6	< 12	< 5	< 10	< 6	< 10	< 7	< 6	< 26	< 11
MS-3		08/28/19	< 55	< 75	< 6	< 6	< 11	< 5	< 12	< 7	< 10	< 8	< 7	< 32	< 12
MS-3		11/20/19	< 55	< 124	< 5	< 7	< 11	< 8	< 14	< 7	< 10	< 8	< 7	< 26	< 5
MS-4		05/21/19	< 28	< 29	< 3	< 3	< 7	< 4	< 7	< 4	< 6	< 4	< 3	< 17	< 6
MS-5		02/22/19	< 35	< 75	< 4	< 4	< 8	< 5	< 7	< 4	< 7	< 4	< 3	< 18	< 5
MS-5		05/21/19	< 60	< 121	< 6	< 7	< 16	< 8	< 15	< 9	< 12	< 8	< 7	< 31	< 9
MS-5		08/28/19	< 67	< 76	< 8	< 9	< 16	< 8	< 20	< 9	< 15	< 9	< 9	< 37	< 12
MS-5		11/20/19	< 29	< 65	< 4	< 4	< 7	< 3	< 8	< 4	< 6	< 4	< 3	< 17	< 6
MS-7		05/23/19	< 45	< 102	< 5	< 5	< 9	< 4	< 9	< 6	< 10	< 6	< 5	< 29	< 8
MS-8		02/22/19	< 38	< 77	< 4	< 5	< 9	< 5	< 8	< 4	< 7	< 5	< 4	< 18	< 7
MS-8		05/21/19	< 70	< 59	< 8	< 8	< 13	< 10	< 12	< 7	< 15	< 8	< 8	< 41	< 12
MS-8		08/28/19	< 65	< 153	< 8	< 7	< 14	< 8	< 16	< 8	< 13	< 7	< 8	< 34	< 11
MS-8		11/20/19	< 54	< 116	< 6	< 6	< 14	< 8	< 17	< 8	< 10	< 6	< 6	< 30	< 11
MS-20		05/21/19	< 42	< 56	< 5	< 6	< 10	< 6	< 11	< 5	< 10	< 6	< 6	< 26	< 10
MS-21		05/21/19	< 55	< 105	< 6	< 6	< 12	< 6	< 16	< 7	< 8	< 7	< 8	< 37	< 12
MS-22		05/21/19	< 38	< 39	< 4	< 4	< 9	< 3	< 8	< 5	< 8	< 4	< 4	< 28	< 11
MW-1		05/22/19	< 44	< 58	< 3	< 5	< 10	< 4	< 10	< 5	< 9	< 5	< 5	< 20	< 11
MW-1	*DUP*	05/22/19	< 55	< 120	< 7	< 7	< 12	< 7	< 13	< 6	< 10	< 6	< 7	< 34	< 11
MW-2		05/22/19	< 63	< 77	< 6	< 7	< 15	< 7	< 14	< 7	< 10	< 7	< 8	< 35	< 10
MW-TMI-10D		05/23/19	< 37	< 65	< 5	< 4	< 9	< 5	< 8	< 4	< 8	< 4	< 4	< 20	< 9
MW-TMI-10S		05/23/19	< 42	< 87	< 4	< 4	< 10	< 4	< 8	< 5	< 7	< 4	< 5	< 18	< 8
MW-TMI-12S		05/21/19	< 65	< 99	< 8	< 7	< 13	< 8	< 15	< 9	< 11	< 7	< 7	< 37	< 11
MW-TMI-16D		05/22/19	< 52	< 59	< 5	< 8	< 10	< 7	< 12	< 6	< 11	< 7	< 6	< 29	< 10
MW-TMI-17I		05/23/19	< 58	< 106	< 6	< 8	< 13	< 7	< 14	< 6	< 11	< 6	< 8	< 34	< 10
MW-TMI-18D		05/23/19	< 53	< 98	< 6	< 8	< 11	< 5	< 14	< 6	< 10	< 8	< 6	< 33	< 7
MW-TMI-19I		05/23/19	< 38	< 81	< 4	< 5	< 9	< 5	< 9	< 5	< 8	< 5	< 4	< 21	< 7
MW-TMI-1D		05/22/19	< 56	< 57	< 6	< 6	< 13	< 6	< 9	< 7	< 12	< 7	< 6	< 29	< 10
MW-TMI-20I		05/23/19	< 39	< 55	< 5	< 4	< 11	< 5	< 8	< 4	< 8	< 6	< 5	< 24	< 11
MW-TMI-21S		05/21/19	< 37	< 74	< 4	< 4	< 8	< 4	< 8	< 4	< 8	< 4	< 4	< 29	< 9
MW-TMI-22S		05/21/19	< 38	< 76	< 4	< 4	< 9	< 4	< 8	< 5	< 8	< 4	< 4	< 32	< 10

TABLE B-I.2

CONCENTRATIONS OF GAMMA EMITTERS IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2019

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-2D	05/22/19	< 47	< 151	< 7	< 8	< 15	< 8	< 14	< 6	< 12	< 8	< 6	< 36	< 13
MW-TMI-3I	05/23/19	< 55	< 62	< 6	< 6	< 11	< 7	< 13	< 7	< 11	< 6	< 6	< 32	< 11
MW-TMI-4I	05/23/19	< 44	< 47	< 5	< 5	< 11	< 5	< 11	< 6	< 9	< 6	< 6	< 26	< 10
MW-TMI-4S	05/23/19	< 48	< 75	< 5	< 5	< 11	< 6	< 10	< 4	< 8	< 5	< 5	< 28	< 7
MW-TMI-6D	05/23/19	< 32	< 65	< 4	< 3	< 9	< 4	< 7	< 3	< 6	< 5	< 4	< 21	< 8
MW-TMI-6I	05/23/19	< 38	< 86	< 5	< 4	< 9	< 4	< 8	< 4	< 8	< 5	< 5	< 25	< 8
MW-TMI-7S	05/22/19	< 51	< 136	< 7	< 8	< 17	< 8	< 13	< 8	< 11	< 6	< 7	< 36	< 11
MW-TMI-8S	05/22/19	< 44	< 116	< 6	< 7	< 17	< 9	< 13	< 8	< 12	< 7	< 7	< 24	< 9
MW-TMI-9I	05/22/19	< 52	< 140	< 6	< 6	< 15	< 6	< 14	< 7	< 11	< 8	< 7	< 29	< 10
MW-TMI-9S	05/22/19	< 59	< 76	< 7	< 6	< 11	< 7	< 14	< 7	< 11	< 8	< 4	< 30	< 13
N2-1	05/30/19	< 49	< 42	< 5	< 5	< 11	< 5	< 12	< 6	< 10	< 4	< 6	< 34	< 9
NW-A	05/21/19	< 59	< 55	< 7	< 7	< 15	< 9	< 17	< 9	< 11	< 9	< 8	< 38	< 15
NW-B	05/21/19	< 56	< 54	< 7	< 7	< 12	< 8	< 11	< 6	< 12	< 7	< 5	< 33	< 11
NW-C	05/21/19	< 35	< 80	< 4	< 4	< 8	< 5	< 9	< 4	< 7	< 5	< 4	< 21	< 6
NW-CW	05/21/19	< 53	< 100	< 7	< 7	< 16	< 7	< 17	< 7	< 13	< 8	< 7	< 36	< 10
OS-14	02/22/19	< 35	< 57	< 4	< 4	< 9	< 5	< 9	< 4	< 6	< 5	< 4	< 19	< 7
OS-14	05/21/19	< 66	< 71	< 6	< 6	< 14	< 7	< 18	< 6	< 13	< 8	< 7	< 37	< 11
OS-14	08/28/19	< 48	< 120	< 6	< 6	< 14	< 4	< 9	< 8	< 11	< 8	< 8	< 30	< 13
OS-14	11/20/19	< 58	< 57	< 7	< 7	< 15	< 6	< 15	< 9	< 13	< 8	< 8	< 30	< 13
OS-16	02/22/19	< 38	< 42	< 4	< 4	< 8	< 4	< 8	< 5	< 7	< 5	< 5	< 19	< 6
OS-16	05/21/19	< 57	< 55	< 5	< 6	< 12	< 6	< 10	< 6	< 11	< 6	< 6	< 30	< 11
OS-16	08/28/19	< 61	< 66	< 7	< 7	< 13	< 8	< 17	< 8	< 11	< 8	< 8	< 33	< 11
OS-16	11/20/19	< 45	< 109	< 5	< 5	< 11	< 6	< 11	< 6	< 9	< 6	< 6	< 24	< 6
OS-18	05/23/19	< 44	< 76	< 4	< 5	< 11	< 5	< 8	< 5	< 7	< 5	< 4	< 25	< 10
OSF	05/21/19	< 58	< 119	< 6	< 6	< 15	< 7	< 12	< 7	< 9	< 7	< 7	< 35	< 10
RW-1	05/21/19	< 64	< 78	< 7	< 7	< 17	< 9	< 14	< 7	< 11	< 8	< 7	< 38	< 8
TRAINING CENTER	05/22/19	< 59	< 84	< 6	< 6	< 14	< 7	< 12	< 7	< 10	< 7	< 7	< 27	< 12

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, 2019**

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 2019

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, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE		COLLECTION DATE	H-3
SW-E-1		02/19/19	< 192
SW-E-1		05/22/19	< 191
SW-E-1		08/28/19	< 190
SW-E-1		11/20/19	< 192
SW-E-2		02/19/19	< 192
SW-E-2		05/22/19	< 181
SW-E-2		08/28/19	< 193
SW-E-2	*DUP*	08/28/19	< 180
SW-E-2		11/20/19	< 189
SW-E-3		02/19/19	< 194
SW-E-3		05/22/19	< 179
SW-E-3	*DUP*	05/22/19	< 183
SW-E-3		08/28/19	< 192
SW-E-3		11/20/19	< 194
SW-E-3	*DUP*	11/20/19	< 171

TABLE B-II.2

CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2019

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	05/22/19	< 52	< 99	< 5	< 6	< 14	< 6	< 15	< 5	< 8	< 8	< 5	< 30	< 11
SW-E-2	05/22/19	< 41	< 39	< 4	< 5	< 10	< 4	< 10	< 5	< 8	< 5	< 5	< 23	< 8
SW-E-3	05/22/19	< 43	< 124	< 5	< 5	< 10	< 5	< 12	< 6	< 11	< 7	< 6	< 29	< 8
SW-E-3	05/22/19	< 53	< 138	< 6	< 4	< 14	< 7	< 15	< 6	< 12	< 6	< 6	< 34	< 9

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, 2019

RESULTS IN UNITS OF PCI/LITER + 2 SIGMA

SITE	COLLECTION DATES	H-3
EDCB	01/03/19 - 03/27/19	219 ± 127
EDCB	05/01/19 - 06/27/19	< 195
EDCB	08/01/19 - 10/03/19	234 ± 122
EDCB	10/31/19 - 01/02/20	381 ± 131

TABLE B-III.2

CONCENTRATIONS OF GAMMA EMITTERS IN STORM WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2019

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	01/03/19 - 03/27/19	< 50	< 115	< 5	< 6	< 10	< 4	< 11	< 7	< 8	< 7	< 5	< 32	< 9
EDCB	05/01/19 - 06/27/19	< 72	< 140	< 8	< 6	< 13	< 9	< 15	< 7	< 10	< 9	< 8	< 29	< 10
EDCB	08/01/19 - 10/03/19	< 57	< 134	< 6	< 7	< 18	< 7	< 14	< 6	< 14	< 9	< 7	< 33	< 11
EDCB	10/31/19 - 01/02/20	< 62	< 86	< 6	< 6	< 12	< 8	< 9	< 5	< 11	< 6	< 8	< 26	< 5

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, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	H-3
TM-PR-ESE	02/18/19	< 195
TM-PR-ESE	04/18/19	< 194
TM-PR-ESE	07/27/19	237 ± 124
TM-PR-ESE	11/18/19	802 ± 152
TM-PR-MS-1	02/18/19	< 191
TM-PR-MS-1	04/18/19	< 197
TM-PR-MS-1	07/27/19	< 187
TM-PR-MS-1	11/18/19	< 181
TM-PR-MS-2	02/18/19	< 200
TM-PR-MS-2	04/18/19	< 195
TM-PR-MS-2	07/27/19	< 184
TM-PR-MS-2	11/18/19	731 ± 148
TM-PR-MS-4	02/18/19	< 198
TM-PR-MS-4	04/18/19	< 193
TM-PR-MS-4	07/27/19	< 188
TM-PR-MS-4	11/18/19	443 ± 128

APPENDIX C

DATA TABLES

COMPARISON LAB

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TABLE C-I.1 **CONCENTRATIONS OF TRITIUM IN GROUNDWATER SPLIT SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, THREE MILE ISLAND NUCLEAR STATION, 2019**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

LAB	SITE	COLLECTION DATE	H-3
GEL	MS-1	11/18/19	< 118
	MS-7	11/21/19	< 117
	MS-20	08/27/19	418 ± 103
	MS-21	08/27/19	< 128
	MW-1	05/22/19	< 172
	MW-TMI-3I	11/18/19	< 119
	MW-TMI-6D	02/19/19	< 135
	MW-TMI-10I	02/18/19	403 ± 93
	MW-TMI-10I	05/23/19	385 ± 136
	MW-TMI-13I	08/28/19	< 130
	MW-TMI-13I	05/22/19	< 173
	MW-TMI-14D	05/22/19	214 ± 92
	MW-TMI-14I	02/19/19	< 132

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, 2019

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	05/22/19	< 2	< 3	< 2	< 2	< 3	< 3	< 2	< 2	< 2	< 11	< 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, 2019**

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 2019

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, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

LAB	SITE	COLLECTION DATE	H-3
GEL	SW-E-2	08/28/19	< 122
	SW-E-3	05/22/19	< 170

TABLE C-II.2 CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER SPLIT SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, THREE MILE ISLAND NUCLEAR STATION, 2019

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-3	05/22/19	< 1	< 2	< 1	< 1	< 2	< 2	< 2	< 1	< 2	< 8	< 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, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

LAB	SITE	COLLECTION DATES	H-3
GEL	TM-PR-MS-2Q	02/18/19 - 02/17/19	< 112
		04/18/19 - 05/24/19	< 168
		07/27/19 - 08/27/19	< 125
		11/18/19 - 12/18/19	< 133