Constellation

Three Mile Island Nuclear Station
2625 River RD
Middletown, PA 17057

TMI-23-008

April 18, 2023

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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Three Mile Island Nuclear Station, Unit 1
Renewed Facility 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: 2022 Annual Radiological Environmental Operating Report

In accordance with TMI-1 Decommissioning Quality Assurance Program Section E.7.2 and TMI-2 Technical Specification 6.8.1.2, enclosed is the Annual Radiological Environmental Operating Report covering the time period for January 1 through December 31, 2022, 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
Site Decommissioning Director
Three Mile Island Nuclear Station, Unit 1

Attachment: Three Mile Island 2022 Annual Radiological Environmental Operating Report

cc: w/ Attachment

Regional Administrator – NRC Region I
NRC Project Manager, NMSS – Three Mile Island, Unit 1 and Unit 2
David Baracco – Commonwealth of Pennsylvania - Bureau of Radiation Protection
T.R. Devik – TMI-2 Solutions, LLC

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 2022

Prepared By
Teledyne Brown Engineering
Environmental Services

Three Mile Island Nuclear Station
Middletown, PA 17057

April 2023

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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 Constellation covers the period 1 January 2022 through 31 December 2022. During that time period, 1,645 analyses were performed on 1,311 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 surface water and effluent water sample was due to TMINS activities or releases. No other fission or activation products potentially attributed to TMI liquid releases were detected.

Fish (predator and bottom feeder) and sediment samples were analyzed for concentrations of gamma-emitting nuclides. Fish samples were also analyzed for concentrations of Sr-90. No Sr-90 activity was detected. No fission or activation products were detected in fish or 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, Sr-89 or Sr-90 activities were detected. Occasionally Sr-90 activity may be detected and 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. 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, Constellation (formerly Exelon) changed the type of dosimetry used for the Radiological Environmental Monitoring Program (REMP). Optically Stimulated Luminescent Dosimetry (OSLD) were deployed and ThermoLuminescent 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 2022 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 2022 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 Constellation Energy Company (formerly Exelon) and became operational in 1974. TMI-2 is operated and owned by TMI-2 Solutions, LLC. 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 Energy Solutions under contract with TMI-2 Solutions. LLC.

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 Constellation Energy Group (CEG)/GEL Laboratories on samples collected during the period 1 January 2022 through 31 December 2022.

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 Constellation by Constellation Energy Group (CEG) 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 2022. 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 four locations (F4-1, G2-1, J18-1 and P4-1) from March through November, and monthly from December through February. A single sample was collected in January from control location K15-3. This control location

was replaced with J18-1 in March. 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 September 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. Three different kinds of vegetation samples and nine 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, Constellation 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 22 locations (A1-4, B1-2, C1-2, D1-1, E1-4, F1-2, F1-4, G1-3, G1-5, G1-6, H1-1, H1-3, J1-4, J1-3, K1-4, K1-5, 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, H1-3, H3-1, H5-1, H8-1, J1-1, J1-4, J3-1, J5-1, J7-1, K1-5, 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 CEG/GEL to analyze the environmental samples for radioactivity for the TMINS REMP in 2022. 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. <u>Lower Limit of Detection and Minimum Detectable Concentration</u>

   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. *In order to meet MDC requirements, I-131 is prepped and analyzed by a different methodology than gamma spectroscopy.*

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 2022, the TMINS REMP had a sample recovery rate of >99%. Issue Reports (IR) were initiated to document significant exceptions and missing samples. All exceptions are listed below:

Water Q9-1 (Surface Water and Drinking Water)

For the sampling periods 01/01/22 - 04/02/22 and 04/02/22 - 04/23/22, composite samplers were not set back up for collection due to no access to plant for visitors because of COVID. Weekly grab samples were collected by a plant worker at both locations and used to make a monthly composite. Composite samplers were set up on 04/23/22 and routine compositing continued from that date. (IR's 4499010 and 4517062)

Milk (P4-1)

On 08/03/22, TMI REMP biweekly collection efforts for the P4-1 milk farm did not have samples available due to farmer selling his herd. No samplers were available at the location for the collection. The samples will not be available for the near future (period 09/03/22 – 12/31/22). (IR 4514765)

Dosimetry (E1-2)

During the routine TMI air sampling tour for 09/01/22, the CGS the field technician arrived at the TMI E1-2 sample station for air collection and found the two main dosimeters of legal record plus the QA dosimeter for the REMP program were missing. The field tech did a complete sweep of the area, but nothing was found. The previous AR for lost samples at the site are 04394059 and 04466619. The missing dosimeter numbers are EX000601061, EX00082424R and EX00081796B. The dosimeters were replaced. (IR 4520477)

Air Samplers

1. G2-1 (Sample period 06/11/22 – 06/16/22)

   Upon arrival at the G2-1 air sampler station on 06/16/22 for TMI air sample collection in support of the REMP program, the field tech found that the pump for G2-1 was not functioning as expected. Although running, vacuum was much higher than normal. The field tech diagnosed the issue to an Internal issue with the air pump. Suspected sample loss due to the issue. (IR 4506053)

2. M2-1 (Sample period 10/01/22 – 10/06/22)

   Upon arrival at the M2-1 air sampler station on 10/06/22 for TMI air sample collection in support of the REMP program, the field tech found that the AP filter for M2-1 had developed a hole in the sample. Suspected sample loss due to the weather. (IR 4527418)

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 indicates that the appropriate procedures and equipment are in place to assure reliable program implementation.

E. Program Changes

OSLD K1-5 was added at the site boundary and OSLD's H1-3 and J1-4 were added as closest to the ISFSI pad.

There were no other changes to the program in 2022.

IV. Results and Discussion

A. Aquatic Environment

1. Surface Water

Samples were taken weekly from a continuous sampler at one location (J1-2) and weekly grab samples from two locations (Q9-1 and 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 4 of 12 samples at location J1-2, which is located immediately downstream of the TMINS effluent outfall. The concentrations ranged from 741 to 1,070 pCi/L, well below any regulatory limits. 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. (Figures C–1 and C–2, Appendix C)

Iodine

Monthly samples were taken from location A3-2 and analyzed for I-131. 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. I-131 activity was not detected in any sample. (Table C–I.2, Appendix C).

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 13 of 36 samples. The concentrations ranged from 1.8 to 4.4 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 sample. (Table C–II.2, Appendix C)

Tritium

Monthly samples from all locations were analyzed for tritium activity (Table C–II.3, Appendix C). Tritium was not detected in any sample. (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 7 of 12 samples. The concentrations ranged from 2.1 to 3.8 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 4 of 12 samples. The concentrations ranged from 2,700 to 3,610 pCi/L. Concentrations detected were consistent with those detected in previous years. (Table C–III.1 & 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 <4.7 pCi/L for Sr-89 and at <0.9 pCi/L for Sr-90. (Table C–III.1, Appendix C)

Gamma Spectrometry

Samples 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 <4.6 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 2,267 to 3,658 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 804 to 13,070 pCi/kg dry. No fission or activation products were detected. (Figure C–5 & 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 6 to 29E–3 pCi/m^3 with a mean of 16E–3 pCi/m^3. The results from the intermediate offsite locations (Group II) ranged from 7 to 36E–3 pCi/m^3 with a mean of 16E–3 pCi/m^3. The results from the Control location (Group III) ranged from 8 to 32E–3 pCi/m^3 with a mean of 17E–3 pCi/m^3. Comparison of the 2022 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 2022 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 41 to 86E–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 three locations (J18-1, F4-1 and G2-1) biweekly March through November and monthly December through February. Samples were collected from one location (P4-1) monthly January-February and biweekly March through July. 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 or Sr-90 activity was detected. (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 806 to 1,493 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

Six food product samples were analyzed for concentrations of Sr-90. No Sr-90 activity was detected in any sample.
(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 25 of 48 samples with concentrations ranging from 313 to 4,583 pCi/kg. Naturally occurring K-40 activity was found in all samples. The concentrations ranged from 1,867 to 6,698 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 Dosimeters (OSLD). Ninety-three OSLD locations were established around the site. Results of OSLD measurements are listed in Tables C–X.1 to C–X.3, Appendix C.

The nearest resident to the Independent Spent Fuel Storage Installation (ISFSI) saw no detectable gamma radiation levels above background due to ISFSI. Therefore, ISFSI operations did not have an impact to members of the public in 2022.

All of the OSLD measurements were below 37 mR/quarter, with a range of 12.5 to 36.6 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. Independent Spent Fuel Storage Instillation (ISFSI)

ISFSI operations began in October 2021. Forty-two casks and 1 GTCC container were added to the GCE ISFSI pad in 2022 utilizing the NAC MAGNASTOR® System. Site boundary Environmental OSLD's, which measure gamma radiation closest to ISFSI are C1-2, D1-1, E1-4, F1-2, G1-3, K1-3, K1-5, L1-1, M1-1 and N1-3. OSLD K1-5 was added at the site boundary and OSLD's H1-3 and J1-4 were added as closest to the ISFSI pad. There was no radiation detected above background. Therefore, there was no direct radiation attributed to TMI from ISFSI operations to any resident.

E. Land Use Survey

A Land Use Survey conducted in the 2022 fall growing season around the Three Mile Island Nuclear Station (TMINS) was performed by Constellation Energy Group (CEG) for compliance with TMI-2 Tech Spec 6.7.2.b and Section 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	0.5	3.2
G	SE	0.7	0.6	1.4
H	SSE	0.7	0.8	-
J	S	2.2	2.5	-
K	SSW	0.6	1.6	4.9
L	SW	0.5	1.7	-
M	WSW	1.2	1.3	-
N	W	1.2	1.3	-
P	WNW	1.1	1.5	3.7
Q	NW	1.1	1.2	-
R	NNW	1.1	2.4	-

F. Radiological Impact of TMINS Operations

An assessment of potential radiological impact indicated that radiation doses to the public from 2022 operations at TMINS were well below all applicable regulatory limits and were significantly less than doses received from natural sources of radiation. The 2022 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 0.009 mrem. This dose is equivalent to 0.003% 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 2022 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 2022 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 2022 TMI-1 and TMI-2 liquid and airborne effluents combined was conservatively calculated to be 0.009 mrem. This dose is equivalent to 0.003% 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 2022 TMINS operations were the result of efforts to maintain releases "as low as reasonably achievable" (ALARA).

In conclusion, radioactive materials related to 2022 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 2022 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 2022 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 2022 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	5.66E-03	3.86E-04
	10 any organ	6.81E-03	6.14E-04
From Radionuclides in Airborne Releases (Noble Gases)	5 total body, or	0*	0*
	15 skin	0*	0*
From Radionuclides in Airborne Releases (Iodines, Tritium and Particulates)	15 any organ	2.57E-03	1.03E-04

*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	0.006
	25 total body or other organs	0.010

* *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 2022 TMINS operations was 0.629 mrem/yr based on calculations from ANSI/HI Standard N13.37.

TABLE 2

Calculated Whole Body Doses to the Maximum Individual from 2022 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	5.66E-03	3.86E-04
From Radionuclides in Airborne Releases (Noble Gases)	0*	0*
From Radionuclides In Airborne Releases (Iodines, Tritium and Particulates)	2.57E-03	1.03E-04

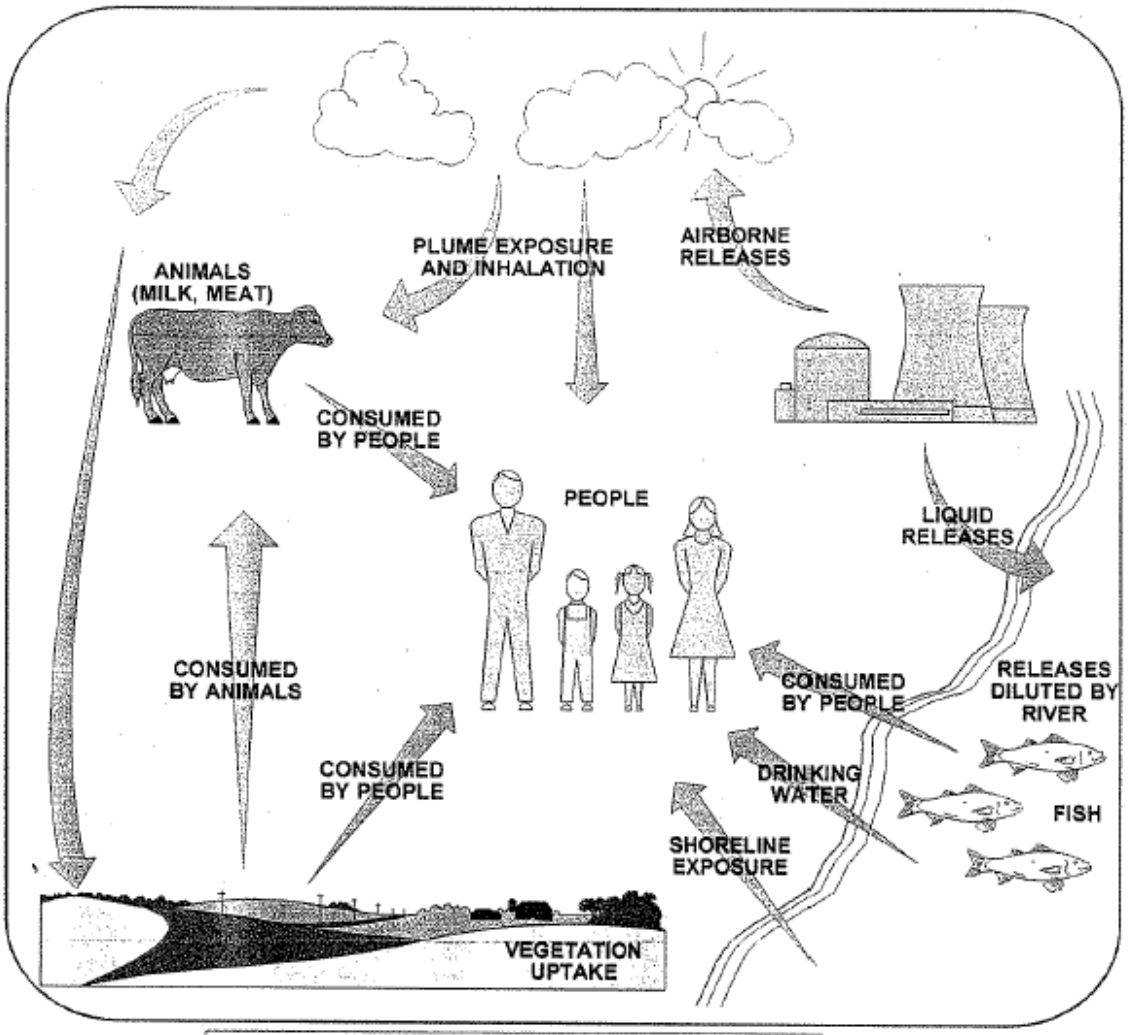
*No noble gases were released from TMI-1 or TMI-2.

Individual Whole Body Dose Due to TMI-1 and TMI-2 Operations:	0.009 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

G. Errata Data

There was no errata data for 2022.

H. 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 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")
   - 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, 142 out of 150 analyses performed met the specified acceptance criteria. Eight analyses did not meet the specified acceptance criteria and were addressed through the TBE Corrective Action Program. A summary is found below:

NOTE: Two analyses (soil for Tc-99 and U-238) that did not meet acceptance criteria was performed for TBE information and is not on the list of required ICP analyses.

1. The Analytics March 2022 AP Ce-141 result was evaluated as *Not Acceptable*. The reported value for Ce-141 was 60.9 pCi and the known result was 42.0 pCi/L (1.45 ratio of reported result vs. known; TBE's internal acceptance range is 0.70 - 1.30). This sample was used as the workgroup duplicate with a result of 45.7 (109% of known) and was also counted on a different detector with a result of 50.9 (121% of known). This was TBE's first failure for AP Ce-141. (NCR 22-04)

2. The MAPEP February 2022 Urine U-234 & U-238 results were evaluated as *Not Acceptable*. TBE's reported values of 0.142 and 0.0254 were above the known upper ranges of 0.0096 and 0.0134 respectively for U-234 and U-238. These spiked values were below TBE's typical MDC for urine client samples. The samples were re-prepped using a larger sample aliquot and counted for 60 hours as opposed to 48 hours. The recount results were 0.00732 for U-234 and 0.0119 for U-238 (both within acceptable range). MAPEP urine samples will be flagged to use a larger sample aliquot and counting time than typical client samples. MAPEP did not include any urine cross-check samples in August. (NCR 22-05)

3. The ERA MRAD September 2022 AP Pu-238 was evaluated as *Not Acceptable*. The reported value was 38.8 pCi and the known result was 29.9 (acceptance range 22.6 – 36.7). The AP filter was cut in half prior to digestion (shared with Fe-55) but should have been complete digested together and aliquotted afterwards like typical client samples. This is the first failure for AP Pu-238. (NCR 22-19)

4. The ERA October 2022 water Uranium result was evaluated as *Not Acceptable*. The reported value was 10.54 pCi/L and the known was 8.53 (acceptance range 6.60 – 9.88) or 124% of the known (acceptable for TBE QC). The 2-sigma error was 3.2, placing the reported result well within the acceptable range. This sample was used as the workgroup duplicate with a result of 8.2 +/- 2.9 pCi/L (also within the acceptable range). All other QA was reviewed with no anomalies. (NCR 22-20)

5. The Analytics AP Co-60 result was evaluated as *Not Acceptable*. The reported value was 207 pCi and the known was 147 (141% of the known). TBE's internal QC acceptance is 70 - 130%. All QA was reviewed with no anomalies. This sample was used as the workgroup duplicate and counted on a different detector with a result of 167 pCi (114% of the known). This is the first failure for AP Co-60 - average result ratio compared to the known is 109%. (NCR 22-21)

6. The MAPEP August 2022 water Tc-99 result was evaluated as *Not Acceptable*. The reported value was 1.86 +/- 0.414 Bq/L for this "false positive" test. The evaluation of the submitted result to the 3 times the uncertainty indicated a slight positive. This sample was used as the workgroup duplicate with a result of 0.88 +/- 0.374 Bq/L. All QC was reviewed, and no anomalies found. This is the first unacceptable since the resumption of reporting water Tc-99 for the 3rd quarter of 2020. TBE to known ratios have ranged from 94-109% during this time. (NCR 22-22)

For the secondary QC samples, the CGS laboratory analyzed gross beta, gramma, and I-131 for TMINS. For the CGS Laboratory, 91 out of 92 analyses performed met the specified NRC Resolution Test Criteria (NRC Inspection Manual, Inspection Procedure 84750, March 15, 1994). Laboratory results are reported with 2-sigma uncertainty. When evaluating with the NRC Resolution Test, a 1-sigma uncertainty is used to determine Pass or Fail. Any failures are addressed through the Corrective Action Program. A summary of these failures are described below:

1. The ERA 2nd quarter 2022 water reported result of 35.8 pCi/L for gross beta passed on the low end of the vendor acceptance criteria but failed NRC Resolution Test Criteria. Low recovery of activity was likely due to an ineffective residue correction factor that undercompensates for the significant residue weight present in the study. This low value and a low uncertainty in turn resulted in the failure. A set of 3rd party NIST-traceable standards has been procured to build a residue correction curve for more accurate results going forward.

For the secondary QC samples, GEL laboratory only analyzed H-3 and Sr-89/90 nuclides for the TMINS REMP. Gross alpha & gamma nuclides were also analyzed for the TMINS RGPP. For these nuclides, 81 out of 82 cross-check samples met the specified acceptance criteria. Failures were addressed through GEL's Corrective Action Program. A summary of these failures are described below:

1. The MAPEP 4th quarter vegetation reported result of 1.12 Bq/kg for Sr-90 was evaluated as Not Acceptable. The data for the Sr-90 analysis was reviewed and no anomalies were noted. The QC in the analysis batch met acceptance criteria. The lab evaluated both the prep and instrument processes for possible areas of contamination that contributed to the positive bias. A definitive source was not determined.
2. The ERA 4th quarter MRAD water reported result of 283 pCi/L for Sr-90 was evaluated as *Not Acceptable*. For this same study, the vegetation result of 4,560 pCi/kg was evaluated as *Not Acceptable*. The known result for the water was 224 pCi/L with an acceptance range of 161 - 277 pCi/L. The known result for the vegetation was 2,960 pCi/kg with an acceptance range of 1,670 – 3,860 pCi/kg. An investigation

determined that the lab met all quality control criteria specified in each method and all internal procedures and policies were performed as required. The lab will continue to monitor the recoveries of these parameters to ensure that there are no continued issues. During the same reporting period, the lab successfully passed Sr-90 water samples for MAPEP. Samples for both studies were prepared and analyzed by the same processes and procedures.

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. Constellation. "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, 2022

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

LOCATION OF FACILITY: MIDDLETOWN COUNTY, PA **REPORTING PERIOD: 2022**

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**	864 (4/12) *741 - 1070*	<LLD	864 (4/12) *741 - 1070*	J1-2 INDICATOR DOWNSTREAM OF TMINS LIQUID DISCHARGE OUTFALL 0.5 MILES S OF SITE	0
	I-131	12	**1**	<LLD	<LLD	<LLD		0
	GAMMA	24						
	MN-54		**15**	<LLD	<LLD	-		0
	CO-58		**15**	<LLD	<LLD	-		0
	FE-59		**30**	<LLD	<LLD	-		0
	CO-60		**15**	<LLD	<LLD	-		0
	ZN-65		**30**	<LLD	<LLD	-		0
	NB-95		**15**	<LLD	<LLD	-		0
	ZR-95		**30**	<LLD	<LLD	-		0
	CS-134		**15**	<LLD	<LLD	-		0
	CS-137		**18**	<LLD	<LLD	-		0
	BA-140		**60**	<LLD	<LLD	-		0
	LA-140		**15**	<LLD	<LLD	-		0
DRINKING WATER *(PCI/LITER)*	**GR-B**	36	**4**	3.2 (10/24) *1.8 - 4.4*	2.0 (3/12) *1.8 - 2.1*	3.4 (7/12) *2.1 - 4.4*	G15-2 INDICATOR WRIGHTSVILLE WATER PLANT 13.3 MILES SE OF SITE	0
	I-131	36	**1**	<LLD	<LLD	-		0
	H-3	36	**2000**	<LLD	<LLD	-		0
	GAMMA	36						
	MN-54		**15**	<LLD	<LLD	-		0
	CO-58		**15**	<LLD	<LLD	-		0
	FE-59		**30**	<LLD	<LLD	-		0
	CO-60		**15**	<LLD	<LLD	-		0
	ZN-65		**30**	<LLD	<LLD	-		0
	NB-95		**15**	<LLD	<LLD	-		0
	ZR-95		**30**	<LLD	<LLD	-		0
	CS-134		**15**	<LLD	<LLD	-		0
	CS-137		**18**	<LLD	<LLD	-		0
	BA-140		**60**	<LLD	<LLD	-		0
	LA-140		**15**	<LLD	<LLD	-		0

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

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EFFLUENT WATER *(PCI/LITER)*	**GR-B**	12	**4**	3.1 (7/12) *2.1 - 3.8*	NA	3.1 (7/12) *2.1 - 3.8*	K1-1 INDICATOR RML-7 MAIN STATION DISCHARGE BLDG 0.2 MILES ONSITE	0
	I-131 (LOW LVL)	12	**1**	<LLD	NA	-		0
	H-3	12	**2000**	3205 (4/12) *2700 - 3610*	NA	3205 (4/12) *2700 - 3610*	K1-1 INDICATOR RML-7 MAIN STATION DISCHARGE BLDG 0.2 MILES ONSITE	0
	SR-89	2	**5**	<LLD	NA	-		0
	SR-90	2	**2**	<LLD	NA	-		0
	GAMMA	12						
	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 *(PCI/KGWET)*	**SR-90**	4	**10**	<LLD	<LLD	-		0
	GAMMA	4						
	K-40		*NA*	3842 (2/2) *3535 - 4148*	3245 (2/2) *2832 - 3658*	4148 (1/1)	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

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

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PREDATOR	**SR-90**		4	**10**	<LLD	<LLD	-		0
(PCI/KGWET)	**GAMMA**		4						
		K-40		*NA*	2762	3151.5	3151.5	BKGP CONTROL	0
					(2/2)	(2/2)	(2/2)	CITY ISLAND	
					2267 - 3257	*3026 - 3277*	*3026 - 3277*	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*	10806	8809	12630	J2-1 INDICATOR	0
					(4/4)	(2/2)	(2/2)	YORK HAVEN DAM	
					8847 - 13070	*8043 - 9575*	*12190 - 13070*	1.5 MILES S OF SITE	
		MN-54		*NA*	<LLD	<LLD	-		0
		CO-58		*NA*	<LLD	<LLD	-		0
		CO-60		*NA*	<LLD	<LLD	-		0
		CS-134		**150**	<LLD	<LLD	-		0
		CS-137		**180**	<LLD	<LLD	-		0
AIR PARTICULATE	**GR-B**		364	**10**	16	17	17	Q15-1 CONTROL	0
(E-3 PCI/CU.METER)					(310/312)	(52/52)	(52/52)	WEST FAIRVIEW FIRE DEPT SOCIAL HALL	
					6 - 36	*8 - 32*	*8 - 32*	13.4 MILES NW OF SITE	
	GAMMA		28						
		BE-7		*NA*	67	68	72	H3-1 INDICATOR	0
					(24/24)	(4/4)	(4/4)	FALMOUTH-COLLINS SUBSTATION	
					41 - 86	*55 - 81*	*66 - 86*	2.2 MILES SSE 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

(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, 2022

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

LOCATION OF FACILITY: MIDDLETOWN COUNTY, PA **REPORTING PERIOD: 2022**

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 IODINE *(E-3 PCI/CU.METER)*	**GAMMA**	*I-131*	364	**70**	<LLD	<LLD	-		0
MILK *(PCI/LITER)*	**I-131**		78	**1**	<LLD	<LLD	-		0
	SR-89		15	**5**	<LLD	<LLD	-		0
	SR-90		15	**2**	<LLD	<LLD	-		0
	GAMMA		78						
		K-40		*NA*	1251	1213	1291	P4-1 INDICATOR	0
					(56/56)	(22/22)	(12/12)	FISHER FARM	
					806 - 1493	*828 - 1483*	*1095 - 1432*	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
VEGETATION *(PCI/KG WET)*	**SR-90**		6	**10**	<LLD	<LLD	-		0
	GAMMA		48						
		BE-7		*NA*	1239	912	1639	H1-2 INDICATOR	0
					(16/30)	(9/18)	(10/12)	RED HILL MARKET	
					313 - 4583	*383 - 1318*	*464 - 4583*	1.0 MILES SSE OF SITE	
		K-40		*NA*	3738	4017	4450	H1-2 INDICATOR	0
					(30/30)	(18/18)	(12/12)	RED HILL MARKET	
					1867 - 6017	*2245 - 6698*	*3017 - 6017*	1.0 MILES SSE OF SITE	
		I-131		**60**	<LLD	<LLD	-		0
		CS-134		**60**	<LLD	<LLD	-		0
		CS-137		**80**	<LLD	<LLD	-		0
DIRECT RADIATION *(MILLIREM/STD.MO.)*	**OSLD - QUARTERLY**		371	*NA*	18.3	18.9	31.9	J1-4 INDICATOR	0
					(327/327)	(44/44)	(4/4)	TMI	
					12.5 - 36.6	*15.2 - 29.9*	*23.3 - 35.2*	0.1 MILES S 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

X/YY/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, 2022

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	1.2	33°	NNE of site at 2389 Sunset Drive, Middletown
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 & 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 N. Market Street (Route 230) and Zeager Road
ID	E7-1	3	6.7	88°	E of site along Hummelstown Street, Elizabethtown
ID	F1-2	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 ESE of site along 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	G1-2	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

TABLE B-2: Radiological Environmental Monitoring Program - Sampling Locations, Distance and Direction, Three Mile Island Nuclear Station, 2022

Sample Medium	Station Code	Map Number	Distance (miles)	Azimuth	Description
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
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
ID	H1-3	1	0.1	82°	SSE of site, TMI
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 Rds, 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
ID	J1-4	1	0.1	307°	S of site, 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
M	J18-1	3	17.6	188°	S of site at Stump Dairy on Arnold Road, York
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	K1-5	1	0.1	277°	SSW of site, TNI
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 Rd and Route 295, Zions View
ID	K15-1	3	12.8	203°	SSW of site behind McDonald's & 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

TABLE B-2: **Radiological Environmental Monitoring Program - Sampling Locations, Distance and Direction, Three Mile Island Nuclear Station, 2022**

Sample Medium	Station Code	Map Number	Distance (miles)	Azimuth	Description
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 Bldg 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
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 Rd (Route 262) and Beinhower Rd
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	1.7	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, 2022

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 CGS Collection of Surface-Drinking-Effluent Water Samples for Radiological Analysis (TMI)	2 gallon	TBE, TBE-2007 Gamma-Emitting Radioisotope Analysis
Surface Water	Gross Beta	Monthly composite from a continuous water compositor	CY-ES-240 CGS 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
Surface Water	Tritium	Monthly composite from a continuous water compositor	CY-ES-240 CGS Collection of Surface-Drinking-Effluent Water Samples for Radiological Analysis (TMI)	2 gallon	TBE, TBE-2011 Tritium Analysis in Drinking Water by Liquid Scintillation
Surface Water	Iodine-131	Monthly composite from a continuous water compositor	CY-ES-240 CGS Collection of Surface-Drinking-Effluent Water Samples for Radiological Analysis (TMI)	2 gallon	TBE, TBE-2012 Radioiodine in Various Matrices CGS, CY-ES-205 Operation of HPGE Gamma Detectors
Drinking Water	Gross Beta	Monthly composite from a continuous water compositor	CY-ES-240 CGS 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 CGS, CY-ES-206 Operation of the Tennelec S5E Proportional Counter
Drinking Water	Gamma Spectroscopy	Monthly composite from a continuous water compositor	CY-ES-240 CGS Collection of Surface-Drinking-Effluent Water Samples for Radiological Analysis (TMI)	2 gallon	TBE, TBE-2007 Gamma-Emitting Radioisotope Analysis EIS, CY-ES-205 Operation of HPGE Gamma Detectors
Drinking Water	Iodine-131	Monthly composite from a continuous water compositor	CY-ES-240 CGS Collection of Surface-Drinking-Effluent Water Samples for Radiological Analysis (TMI)	2 gallon	TBE, TBE-2012 Radioiodine in Various Matrices CGS, CY-ES-204 Sample Preparation for Gamma Analysis CGS, CY-ES-205 Operation of HPGE Gamma Detectors
Drinking Water	Tritium	Monthly composite from a continuous water compositor	CY-ES-240 CGS 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
Effluent Water	Iodine-131	Monthly composite from a continuous water compositor	CY-ES-240 CGS Collection of Surface-Drinking-Effluent Water Samples for Radiological Analysis (TMI)	2 gallon	TBE, TBE-2012 Radioiodine in Various Matrices

TABLE B-3: Radiological Environmental Monitoring Program – Summary of Sample Collection and Analytical Methods, Three Mile Island Nuclear Station, 2022

Sample Medium	Analysis	Sampling Method	Collection Procedure Number	Sample Size	Analytical Procedure Number
Effluent Water	Gamma Spectroscopy	Monthly composite from a continuous water compositor	CY-ES-240 CGS Collection of Surface-Drinking-Effluent Water Samples for Radiological Analysis (TMI)	2 gallon	TBE, TBE-2007 Gamma-Emitting Radioisotope Analysis
Effluent Water	Tritium	Monthly composite from a continuous water compositor	CY-ES-240 CGS 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 CGS 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 CGS 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 CGS, CY-ES-205 Operation of HPGE Gamma Detectors
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 CGS, CY-ES-205 Operation of HGPE Gamma Detectors
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 CGS, CY-ES-205 Operation of HPGE Gamma Detectors

TABLE B-3: Radiological Environmental Monitoring Program – Summary of Sample Collection and Analytical Methods, Three Mile Island Nuclear Station, 2022

Sample Medium	Analysis	Sampling Method	Collection Procedure Number	Sample Size	Analytical Procedure Number
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 CGS,CY-ES-206 Operation of the Tennelec S5E Proportional Counter
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 CGS, CY-ES-205 Operation of HGPE Gamma Detectors
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 CGS, CY-ES-205 Operation of HGPE Gamma Detectors
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 CGS, CY-ES-205 Operation of HGPE Gamma Detectors
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 CGS, CY-ES-205 Operation of HGPE Gamma Detectors
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

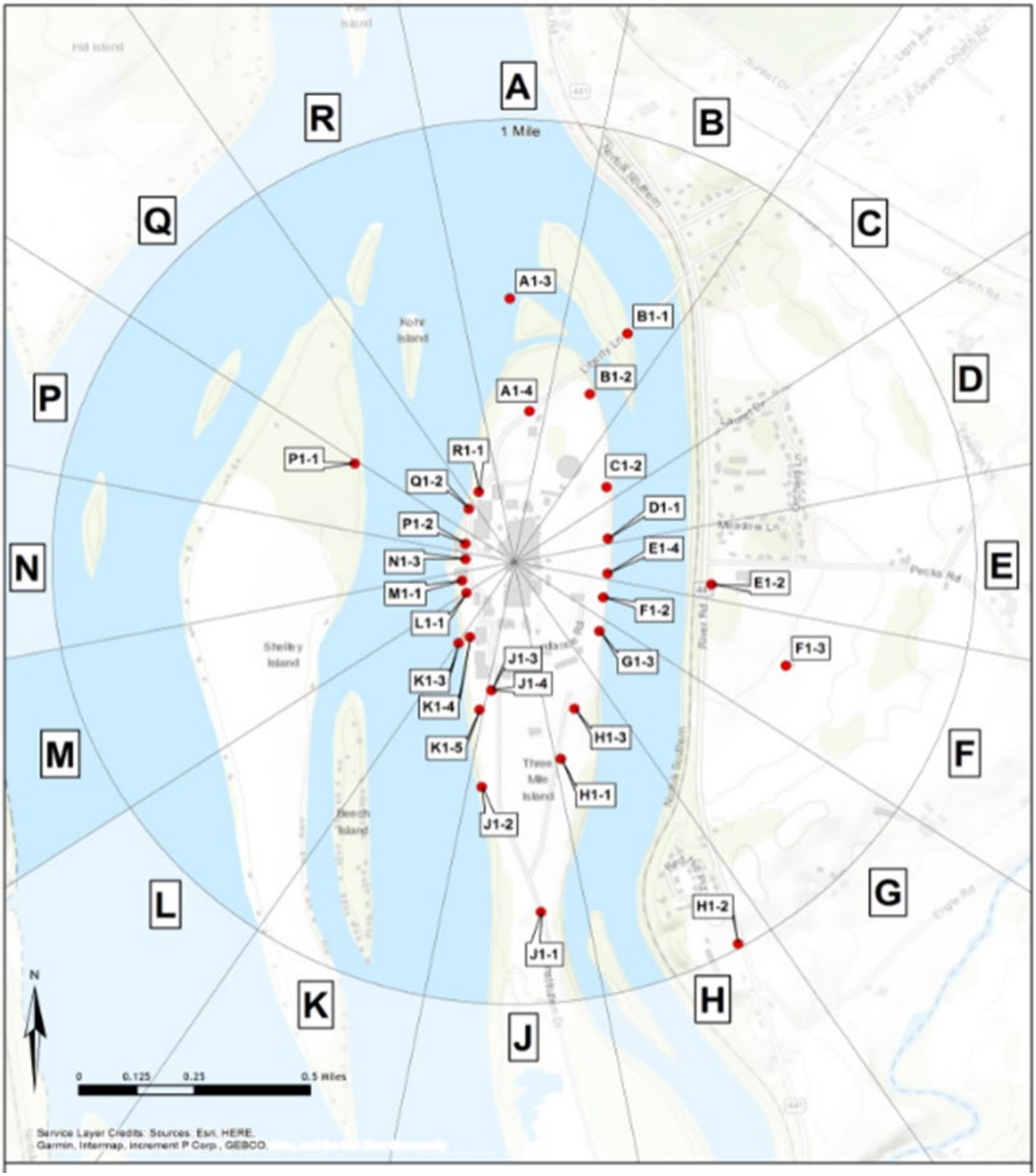

Figure B-1
Environmental Sampling Locations Within One Mile of the Three Mile Island Nuclear Station, 2022

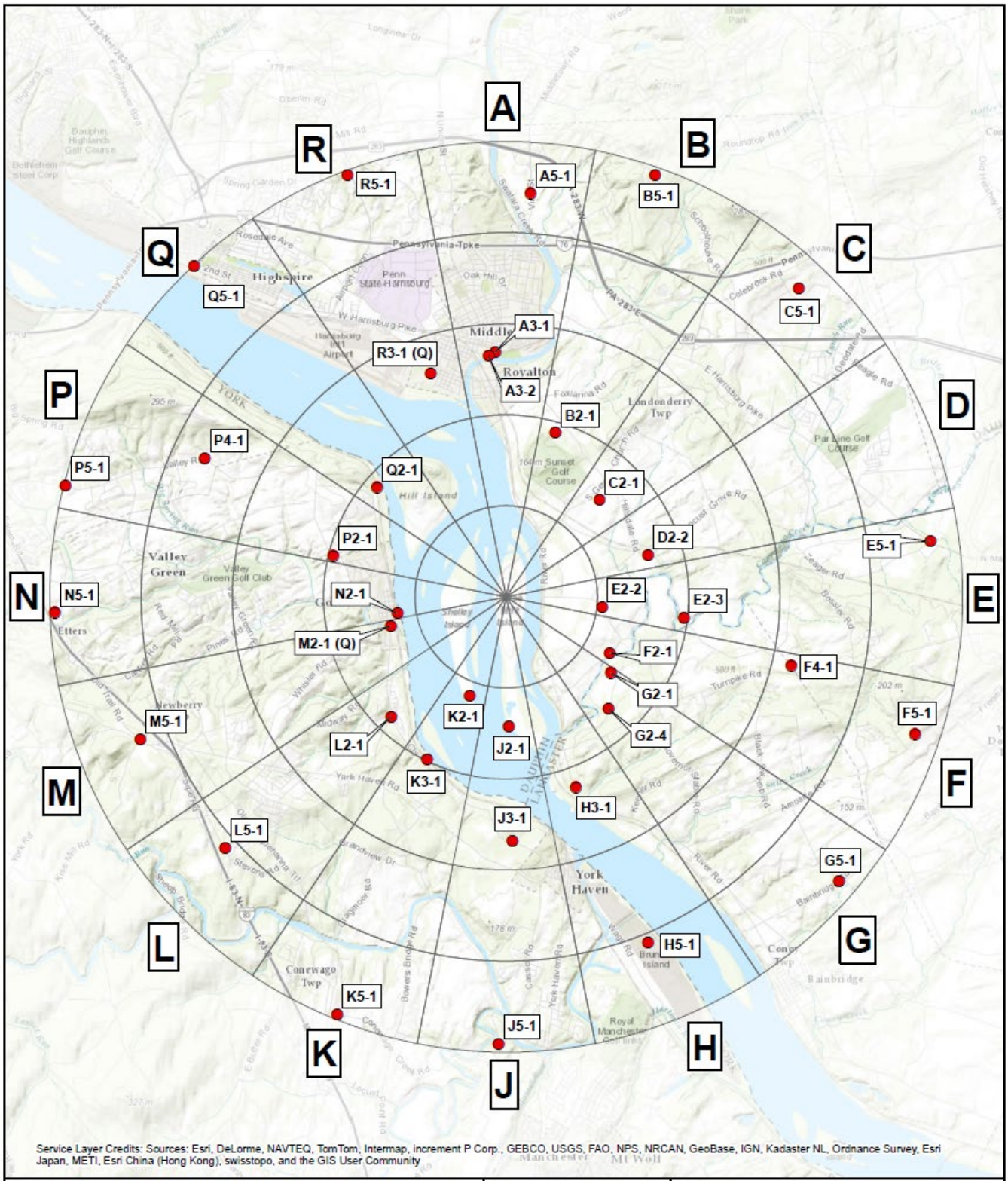

Figure B-2
Environmental Sampling Locations Between One and Five Miles of the Three Mile Island Nuclear Station, 2022

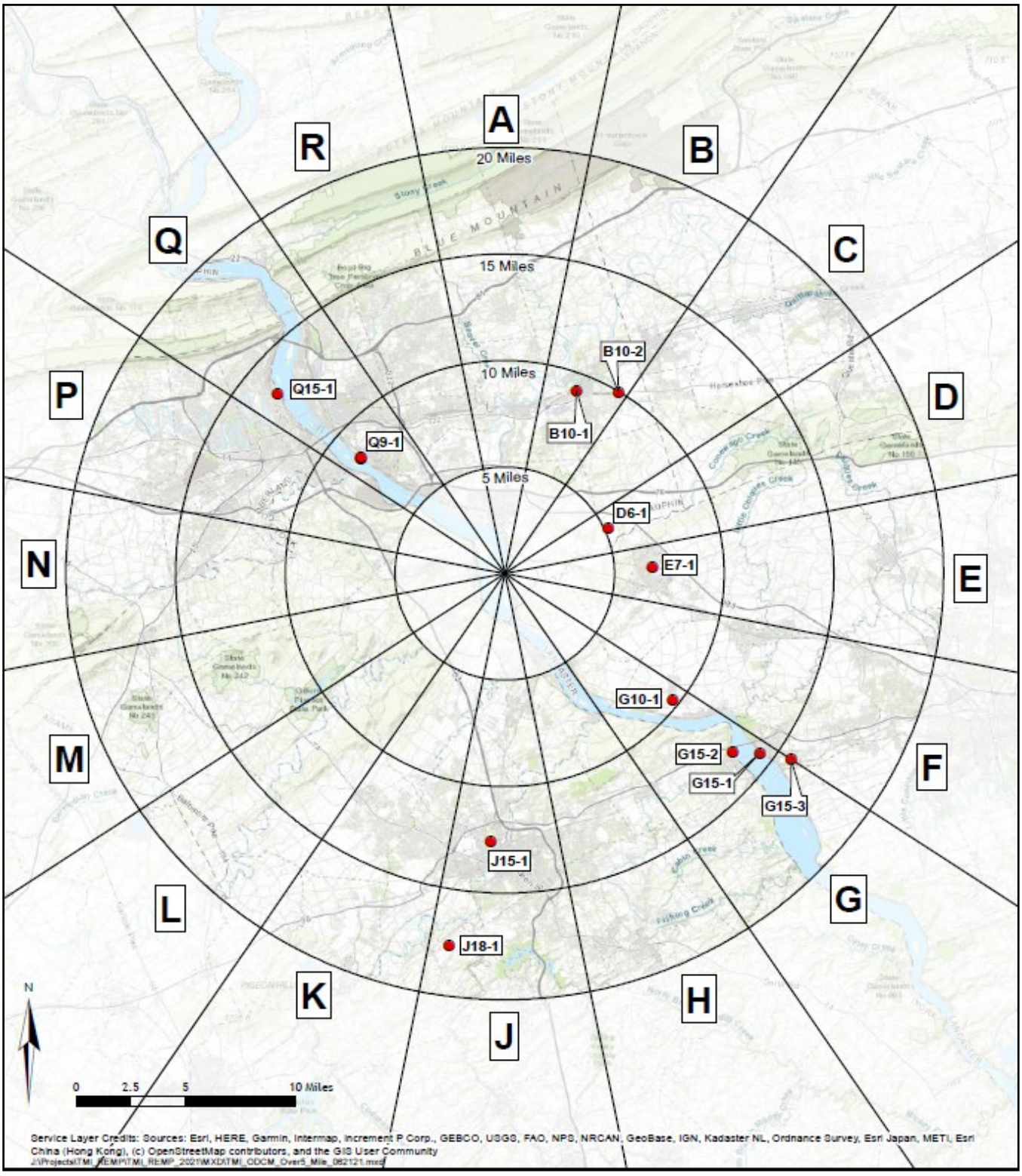

Figure B-3
Environmental Sampling Locations Greater than Five Miles of the Three Mile Island Nuclear Station, 2022

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, 2022

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	J1-2	Q9-1
12/29/21 - 02/03/22	< 195	< 199
02/03/22 - 03/03/22	< 186	< 195
03/03/22 - 03/30/22	< 194	< 194
03/30/22 - 04/27/22	< 163	< 163
04/27/22 - 06/02/22	< 192	< 191
06/02/22 - 06/30/22	< 192	< 194
06/30/22 - 07/27/22	894 ± 164	< 189
07/27/22 - 09/01/22	741 ± 154	< 179
09/01/22 - 09/29/22	< 172	< 192
09/29/22 - 11/03/22	752 ± 152	< 168
11/03/22 - 11/30/22	< 189	< 190
11/30/22 - 12/29/22	1070 ± 180	< 189
MEAN ± 2 STD DEV	864 ± 308	-

Table C-I.2 CONCENTRATIONS OF I-131 IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2022

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	A3-2
12/29/21 - 02/03/22	< 0.8
02/03/22 - 03/03/22	< 0.6
03/03/22 - 03/30/22	< 0.9
03/30/22 - 04/27/22	< 0.8
04/27/22 - 06/02/22	< 1.0
06/02/22 - 06/30/22	< 0.9
06/30/22 - 07/27/22	< 0.8
07/27/22 - 09/01/22	< 0.9
09/01/22 - 09/29/22	< 0.8
09/29/22 - 11/03/22	< 0.9
11/03/22 - 11/30/22	< 0.7
11/30/22 - 12/29/22	< 0.7
MEAN ± 2 STD DEV	-

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, 2022**

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	12/29/21 - 02/03/22	< 6	< 7	< 12	< 7	< 12	< 7	< 11	< 7	< 6	< 26	< 10
	02/03/22 - 03/03/22	< 8	< 9	< 14	< 8	< 15	< 6	< 10	< 8	< 8	< 28	< 8
	03/03/22 - 03/30/22	< 8	< 6	< 10	< 8	< 16	< 5	< 11	< 6	< 6	< 27	< 10
	03/30/22 - 04/27/22	< 6	< 5	< 11	< 6	< 11	< 5	< 9	< 6	< 5	< 23	< 8
	04/27/22 - 06/02/22	< 5	< 6	< 13	< 8	< 11	< 5	< 11	< 5	< 5	< 24	< 5
	06/02/22 - 06/30/22	< 6	< 7	< 16	< 6	< 14	< 6	< 10	< 5	< 7	< 38	< 12
	06/30/22 - 07/27/22	< 6	< 5	< 13	< 7	< 13	< 6	< 10	< 7	< 7	< 24	< 8
	07/27/22 - 09/01/22	< 6	< 5	< 14	< 6	< 11	< 6	< 10	< 6	< 7	< 29	< 9
	09/01/22 - 09/29/22	< 7	< 7	< 16	< 5	< 16	< 8	< 13	< 5	< 7	< 27	< 8
	09/29/22 - 11/03/22	< 6	< 5	< 13	< 8	< 11	< 7	< 9	< 7	< 6	< 27	< 7
	11/03/22 - 11/30/22	< 6	< 5	< 13	< 6	< 17	< 7	< 10	< 7	< 7	< 28	< 9
	11/30/22 - 12/29/22	< 7	< 7	< 11	< 5	< 13	< 7	< 13	< 6	< 8	< 33	< 9
	MEAN	-	-	-	-	-	-	-	-	-	-	-
Q9-1	12/29/21 - 02/03/22	< 7	< 6	< 16	< 6	< 11	< 7	< 10	< 9	< 8	< 35	< 9
	02/03/22 - 03/03/22	< 6	< 6	< 13	< 7	< 11	< 4	< 11	< 8	< 7	< 23	< 7
	03/03/22 - 03/30/22	< 5	< 6	< 11	< 6	< 12	< 7	< 10	< 7	< 6	< 26	< 9
	03/30/22 - 04/27/22	< 6	< 6	< 11	< 6	< 12	< 6	< 10	< 5	< 6	< 28	< 6
	04/27/22 - 06/02/22	< 5	< 5	< 7	< 8	< 14	< 7	< 12	< 8	< 6	< 22	< 9
	06/02/22 - 06/30/22	< 6	< 7	< 13	< 7	< 14	< 7	< 10	< 6	< 6	< 28	< 9
	06/30/22 - 07/27/22	< 6	< 5	< 12	< 6	< 14	< 6	< 13	< 7	< 7	< 32	< 9
	07/27/22 - 09/01/22	< 5	< 7	< 11	< 6	< 10	< 5	< 9	< 6	< 6	< 30	< 12
	09/01/22 - 09/29/22	< 7	< 8	< 14	< 10	< 13	< 8	< 12	< 6	< 8	< 29	< 14
	09/29/22 - 11/03/22	< 7	< 8	< 13	< 4	< 16	< 7	< 10	< 10	< 10	< 26	< 7
	11/03/22 - 11/30/22	< 7	< 6	< 13	< 9	< 12	< 7	< 13	< 7	< 7	< 27	< 11
	11/30/22 - 12/29/22	< 8	< 7	< 14	< 6	< 14	< 6	< 9	< 7	< 6	< 35	< 13
	MEAN	-	-	-	-	-	-	-	-	-	-	-

Table C-II.1 **CONCENTRATIONS OF GROSS BETA IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2022**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	G15-2	G15-3	Q9-1
12/29/21 - 02/03/22	< 2.1	< 2.0	< 1.9
02/03/22 - 03/03/22	< 2.6	< 2.4	< 2.3
03/03/22 - 03/30/22	4.2 ± 1.5	2.3 ± 1.3	< 1.8
03/30/22 - 04/27/22	< 2.3	< 2.1	< 2.1
04/27/22 - 06/02/22	2.1 ± 1.4	< 2.0	< 1.9
06/02/22 - 06/30/22	< 2.4	< 2.3	< 2.3
06/30/22 - 07/27/22	3.9 ± 1.6	< 2.1	2.1 ± 1.4
07/27/22 - 09/01/22	4.4 ± 2.1	< 2.8	< 2.7
09/01/22 - 09/29/22	< 2.8	< 2.6	< 2.4
09/29/22 - 11/03/22	2.8 ± 1.7	< 2.3	< 2.3
11/03/22 - 11/30/22	3.9 ± 1.5	3.9 ± 1.4	1.8 ± 1.2
11/30/22 - 12/29/22	2.8 ± 1.4	1.8 ± 1.2	2.1 ± 1.2
MEAN ± 2 STD DEV	3.4 ± 1.7	2.6 ± 2.2	2.0 ± 0.4

Table C-II.2 **CONCENTRATIONS OF I-131 IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2022**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	G15-2	G15-3	Q9-1
12/29/21 - 02/03/22	< 0.8	< 0.7	< 0.8
02/03/22 - 03/03/22	< 0.8	< 0.7	< 0.9
03/03/22 - 03/30/22	< 0.7	< 0.9	< 0.9
03/30/22 - 04/27/22	< 0.9	< 0.8	< 0.9
04/27/22 - 06/02/22	< 0.9	< 1.0	< 0.9
06/02/22 - 06/30/22	< 0.8	< 0.8	< 0.9
06/30/22 - 07/27/22	< 0.9	< 0.9	< 0.9
07/27/22 - 09/01/22	< 0.9	< 0.7	< 0.8
09/01/22 - 09/29/22	< 0.7	< 0.9	< 0.7
09/29/22 - 11/03/22	< 0.9	< 0.8	< 0.9
11/03/22 - 11/30/22	< 0.8	< 0.8	< 0.7
11/30/22 - 12/29/22	< 0.9	< 0.8	< 0.9
MEAN	-	-	-

Table C-II.3 **CONCENTRATIONS OF TRITIUM IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2022**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	G15-2	G15-3	Q9-1
12/29/21 - 02/03/22	< 199	< 199	< 200
02/03/22 - 03/03/22	< 192	< 195	< 194
03/03/22 - 03/30/22	< 186	< 196	< 197
03/30/22 - 04/27/22	< 177	< 198	< 155
04/27/22 - 06/02/22	< 178	< 186	< 188
06/02/22 - 06/30/22	< 177	< 183	< 179
06/30/22 - 07/27/22	< 189	< 189	< 197
07/27/22 - 09/01/22	< 185	< 181	< 176
09/01/22 - 09/29/22	< 187	< 196	< 185
09/29/22 - 11/03/22	< 178	< 176	< 189
11/03/22 - 11/30/22	< 180	< 174	< 199
11/30/22 - 12/29/22	< 171	< 170	< 173
MEAN	-	-	-

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

Table C-II.4

CONCENTRATIONS OF GAMMA EMITTERS IN DRINKING WATER SAMPLES COLLECTED COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2022

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	12/29/21 - 02/03/22	< 7	< 7	< 10	< 8	< 12	< 7	< 11	< 7	< 6	< 29	< 11
	02/03/22 - 03/03/22	< 7	< 7	< 13	< 5	< 11	< 6	< 11	< 7	< 8	< 26	< 8
	03/03/22 - 03/30/22	< 6	< 6	< 13	< 6	< 12	< 8	< 10	< 7	< 8	< 28	< 11
	03/30/22 - 04/27/22	< 4	< 4	< 10	< 4	< 12	< 5	< 9	< 5	< 5	< 25	< 8
	04/27/22 - 06/02/22	< 6	< 6	< 12	< 7	< 11	< 7	< 10	< 7	< 6	< 31	< 9
	06/02/22 - 06/30/22	< 5	< 7	< 11	< 6	< 11	< 7	< 11	< 7	< 6	< 29	< 9
	06/30/22 - 07/27/22	< 5	< 7	< 13	< 9	< 16	< 6	< 13	< 8	< 9	< 27	< 10
	07/27/22 - 09/01/22	< 6	< 4	< 15	< 6	< 12	< 5	< 12	< 6	< 5	< 34	< 11
	09/01/22 - 09/29/22	< 7	< 6	< 14	< 6	< 12	< 6	< 10	< 9	< 6	< 25	< 12
	09/29/22 - 11/03/22	< 7	< 7	< 16	< 7	< 11	< 6	< 11	< 8	< 7	< 28	< 11
	11/03/22 - 11/30/22	< 5	< 5	< 11	< 6	< 13	< 6	< 9	< 5	< 6	< 24	< 13
	11/30/22 - 12/29/22	< 7	< 6	< 14	< 7	< 16	< 8	< 11	< 8	< 8	< 31	< 10
	MEAN	-	-	-	-	-	-	-	-	-	-	-
G15-3	12/29/21 - 02/03/22	< 8	< 6	< 11	< 6	< 12	< 6	< 9	< 6	< 6	< 24	< 10
	02/03/22 - 03/03/22	< 7	< 6	< 12	< 7	< 12	< 7	< 11	< 7	< 6	< 24	< 6
	03/03/22 - 03/30/22	< 7	< 6	< 11	< 6	< 13	< 8	< 11	< 7	< 8	< 32	< 10
	03/30/22 - 04/27/22	< 5	< 5	< 8	< 5	< 11	< 6	< 10	< 6	< 5	< 17	< 9
	04/27/22 - 06/02/22	< 5	< 8	< 15	< 6	< 15	< 5	< 14	< 7	< 6	< 29	< 9
	06/02/22 - 06/30/22	< 5	< 4	< 12	< 5	< 9	< 8	< 10	< 5	< 6	< 32	< 11
	06/30/22 - 07/27/22	< 6	< 6	< 16	< 6	< 13	< 6	< 9	< 6	< 7	< 26	< 10
	07/27/22 - 09/01/22	< 6	< 5	< 15	< 7	< 13	< 6	< 10	< 7	< 6	< 32	< 11
	09/01/22 - 09/29/22	< 7	< 6	< 18	< 6	< 13	< 8	< 14	< 6	< 7	< 30	< 13
	09/29/22 - 11/03/22	< 6	< 7	< 15	< 4	< 14	< 8	< 13	< 6	< 8	< 28	< 11
	11/03/22 - 11/30/22	< 7	< 7	< 13	< 7	< 13	< 5	< 10	< 8	< 6	< 29	< 8
	11/30/22 - 12/29/22	< 6	< 7	< 9	< 6	< 11	< 6	< 12	< 7	< 9	< 29	< 7
	MEAN	-	-	-	-	-	-	-	-	-	-	-
Q9-1	12/29/21 - 02/03/22	< 7	< 7	< 11	< 8	< 12	< 8	< 13	< 8	< 7	< 39	< 12
	02/03/22 - 03/03/22	< 7	< 6	< 12	< 8	< 14	< 8	< 10	< 7	< 7	< 30	< 8
	03/03/22 - 03/30/22	< 4	< 5	< 9	< 6	< 9	< 6	< 10	< 5	< 5	< 24	< 8
	03/30/22 - 04/27/22	< 6	< 5	< 10	< 5	< 7	< 7	< 10	< 5	< 6	< 28	< 8
	04/27/22 - 06/02/22	< 7	< 8	< 15	< 7	< 16	< 6	< 13	< 7	< 7	< 27	< 7
	06/02/22 - 06/30/22	< 6	< 7	< 12	< 7	< 9	< 6	< 12	< 6	< 6	< 33	< 13
	06/30/22 - 07/27/22	< 5	< 6	< 13	< 5	< 11	< 2	< 9	< 5	< 6	< 29	< 14
	07/27/22 - 09/01/22	< 6	< 6	< 11	< 6	< 9	< 7	< 8	< 5	< 6	< 35	< 12
	09/01/22 - 09/29/22	< 6	< 7	< 11	< 5	< 16	< 8	< 11	< 7	< 6	< 33	< 9
	09/29/22 - 11/03/22	< 5	< 6	< 16	< 7	< 15	< 7	< 12	< 7	< 7	< 25	< 9
	11/03/22 - 11/30/22	< 3	< 5	< 8	< 4	< 7	< 4	< 6	< 5	< 4	< 20	< 7
	11/30/22 - 12/29/22	< 6	< 8	< 15	< 8	< 13	< 7	< 12	< 5	< 7	< 34	< 11
	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, 2022

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	GR-B	I-131	H-3	SR-89	SR-90
K1-1	12/29/21 - 02/03/22	< 2.0	< 0.8	< 199		
	02/03/22 - 03/03/22	< 2.4	< 0.8	< 190		
	03/03/22 - 03/30/22	2.4 ± 1.3	< 0.9	< 197		
	03/30/22 - 04/27/22	< 2.1	< 0.9	< 162		
	04/27/22 - 06/02/22	< 2.0	< 0.9	< 191		
	06/02/22 - 06/30/22	< 2.3	< 0.9	< 182		
	06/30/22 - 07/27/22	3.7 ± 1.6	< 0.8	3200 ± 376		
	07/27/22 - 09/01/22	3.8 ± 2.1	< 0.9	3310 ± 394		
	12/29/21 - 06/30/22				< 4.1	< 0.7
	09/01/22 - 09/29/22	2.9 ± 1.9	< 0.7	< 188		
	09/29/22 - 11/03/22	3.4 ± 1.7	< 1.0	3610 ± 421		
	11/03/22 - 11/30/22	3.5 ± 1.3	< 0.8	< 198		
	11/30/22 - 12/29/22	2.1 ± 1.3	< 0.9	2700 ± 335		
	06/30/22 - 12/29/22				< 4.7	< 0.9
	MEAN ± 2 STD DEV	3.1 ± 1.3	-	3205 ± 757	-	-

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, 2022**

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	12/29/21 - 02/03/22	< 7	< 8	< 12	< 8	< 12	< 7	< 10	< 8	< 8	< 31	< 12
	02/03/22 - 03/03/22	< 6	< 6	< 21	< 8	< 17	< 7	< 14	< 9	< 7	< 33	< 13
	03/03/22 - 03/30/22	< 5	< 5	< 13	< 6	< 10	< 5	< 8	< 7	< 7	< 23	< 9
	03/30/22 - 04/27/22	< 3	< 3	< 6	< 3	< 8	< 4	< 5	< 4	< 4	< 15	< 5
	04/27/22 - 06/02/22	< 7	< 7	< 13	< 7	< 14	< 7	< 13	< 8	< 10	< 30	< 12
	06/02/22 - 06/30/22	< 7	< 6	< 11	< 7	< 17	< 8	< 12	< 7	< 7	< 36	< 12
	06/30/22 - 07/27/22	< 8	< 7	< 17	< 5	< 13	< 6	< 10	< 9	< 8	< 28	< 7
	07/27/22 - 09/01/22	< 4	< 4	< 12	< 6	< 11	< 7	< 13	< 6	< 5	< 30	< 10
	09/01/22 - 09/29/22	< 7	< 7	< 16	< 9	< 18	< 11	< 14	< 11	< 10	< 39	< 13
	09/29/22 - 11/03/22	< 6	< 6	< 13	< 8	< 15	< 7	< 8	< 5	< 7	< 32	< 11
	11/03/22 - 11/30/22	< 6	< 6	< 16	< 7	< 11	< 7	< 9	< 9	< 6	< 24	< 7
	11/30/22 - 12/29/22	< 7	< 5	< 9	< 7	< 13	< 7	< 10	< 5	< 7	< 38	< 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, 2022

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

SITE	COLLECTION PERIOD	Sr-90
BKGB		
BOTTOM FEEDER	06/16/22	< 4.3
	10/12/22	< 4.6
	MEAN	-
BKGP		
PREDATOR	06/16/22	< 4.3
	10/12/22	< 4.2
	MEAN	-
INDB		
BOTTOM FEEDER	06/14/22	< 4.1
	09/29/22	< 4.2
	MEAN	-
INDP		
PREDATOR	06/14/22	< 3.8
	09/29/22	< 4.4
	MEAN	-

Table C-IV.2 CONCENTRATIONS OF GAMMA EMITTERS IN PREDATOR AND BOTTOM FEEDER (FISH) SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2022

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	06/16/22	3658 ± 911	< 53	< 56	< 92	< 56	< 136	< 41	< 56
	10/12/22	2832 ± 733	< 39	< 45	< 110	< 43	< 101	< 54	< 59
	MEAN ± 2 STD DEV	3245 ± 1168	-	-	-	-	-	-	-
BKGP									
PREDATOR	06/16/22	3277 ± 919	< 47	< 55	< 110	< 58	< 129	< 66	< 59
	10/12/22	3026 ± 993	< 73	< 63	< 138	< 69	< 130	< 70	< 84
	MEAN ± 2 STD DEV	3152 ± 355	-	-	-	-	-	-	-
INDB									
BOTTOM FEEDER	06/14/22	3535 ± 1089	< 74	< 58	< 135	< 79	< 170	< 82	< 84
	09/29/22	4148 ± 1166	< 90	< 65	< 161	< 88	< 138	< 89	< 72
	MEAN ± 2 STD DEV	3842 ± 867	-	-	-	-	-	-	-
INDP									
PREDATOR	06/14/22	2267 ± 885	< 47	< 46	< 83	< 46	< 82	< 64	< 57
	09/29/22	3257 ± 914	< 72	< 55	< 153	< 51	< 145	< 70	< 54
	MEAN ± 2 STD DEV	2762 ± 1400	-	-	-	-	-	-	-

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, 2022

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	06/14/22	8043 ± 1563	< 77	< 63	< 66	< 97	< 77
	11/21/22	9575 ± 881	< 47	< 40	< 43	< 54	< 50
	MEAN ± 2 STD DEV	8809 ± 2167	-	-	-	-	-
J2-1	06/14/22	12190 ± 1621	< 72	< 79	< 132	< 92	< 95
	11/21/22	13070 ± 1107	< 48	< 46	< 52	< 66	< 64
	MEAN ± 2 STD DEV	12630 ± 1245	-	-	-	-	-
K1-3	06/14/22	8847 ± 1377	< 67	< 55	< 69	< 82	< 74
	11/21/22	9115 ± 1629	< 79	< 68	< 123	< 98	< 98
	MEAN ± 2 STD DEV	8981 ± 379	-	-	-	-	-

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, 2022

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
12/29/21 - 01/05/22	16 ± 4	15 ± 4	14 ± 4	17 ± 5	16 ± 4	15 ± 4	17 ± 5
01/05/22 - 01/12/22	26 ± 5	28 ± 5	29 ± 5	24 ± 5	27 ± 5	28 ± 5	26 ± 5
01/12/22 - 01/19/22	23 ± 5	21 ± 5	25 ± 5	23 ± 5	19 ± 5	24 ± 5	24 ± 5
01/19/22 - 01/27/22	23 ± 5	21 ± 4	21 ± 4	21 ± 4	21 ± 4	22 ± 5	21 ± 4
01/27/22 - 02/03/22	20 ± 5	16 ± 4	15 ± 5	16 ± 4	13 ± 4	17 ± 5	18 ± 5
02/03/22 - 02/10/22	15 ± 4	19 ± 5	13 ± 4	11 ± 4	18 ± 5	17 ± 5	17 ± 5
02/10/22 - 02/16/22	16 ± 4	15 ± 4	19 ± 5	18 ± 4	17 ± 4	19 ± 5	16 ± 4
02/16/22 - 02/24/22	15 ± 4	16 ± 4	17 ± 4	15 ± 4	15 ± 4	14 ± 4	15 ± 4
02/24/22 - 03/03/22	14 ± 4	13 ± 4	21 ± 5	18 ± 4	18 ± 4	19 ± 4	19 ± 4
03/03/22 - 03/11/22	16 ± 4	14 ± 4	16 ± 4	11 ± 3	12 ± 3	12 ± 3	16 ± 4
03/11/22 - 03/16/22	20 ± 6	14 ± 5	20 ± 6	18 ± 6	15 ± 5	14 ± 5	18 ± 6
03/16/22 - 03/24/22	11 ± 3	10 ± 3	15 ± 4	12 ± 4	15 ± 4	13 ± 4	15 ± 4
03/24/22 - 03/30/22	8 ± 4	9 ± 4	7 ± 4	8 ± 4	< 6	9 ± 4	9 ± 4
03/30/22 - 04/06/22	7 ± 4	12 ± 4	12 ± 4	7 ± 4	9 ± 4	9 ± 4	9 ± 4
04/06/22 - 04/13/22	7 ± 3	6 ± 3	7 ± 3	8 ± 4	8 ± 4	7 ± 3	8 ± 4
04/13/22 - 04/20/22	9 ± 4	12 ± 4	12 ± 4	12 ± 4	13 ± 4	13 ± 4	11 ± 4
04/20/22 - 04/27/22	16 ± 4	12 ± 4	20 ± 5	18 ± 4	12 ± 4	19 ± 5	20 ± 5
04/27/22 - 05/06/22	14 ± 4	13 ± 3	15 ± 4	14 ± 4	13 ± 4	14 ± 4	16 ± 4
05/06/22 - 05/12/22	16 ± 5	14 ± 5	13 ± 5	14 ± 5	15 ± 5	15 ± 5	17 ± 5
05/12/22 - 05/19/22	10 ± 4	7 ± 3	16 ± 7	7 ± 3	10 ± 4	9 ± 4	8 ± 4
05/19/22 - 05/26/22	12 ± 4	13 ± 4	13 ± 4	15 ± 4	15 ± 4	12 ± 4	15 ± 5
05/26/22 - 06/02/22	12 ± 4	14 ± 5	13 ± 4	12 ± 4	16 ± 5	15 ± 5	16 ± 5
06/02/22 - 06/08/22	15 ± 5	20 ± 5	18 ± 5	15 ± 5	16 ± 5	18 ± 5	17 ± 5
06/08/22 - 06/16/22	13 ± 4	13 ± 4	13 ± 4	< 4	15 ± 4	15 ± 4	11 ± 4
06/16/22 - 06/23/22	15 ± 4	12 ± 4	13 ± 4	12 ± 4	12 ± 4	12 ± 4	12 ± 4
06/23/22 - 06/30/22	10 ± 4	8 ± 4	8 ± 4	7 ± 4	9 ± 4	9 ± 4	8 ± 4
06/30/22 - 07/07/22	10 ± 4	10 ± 4	9 ± 4	14 ± 4	11 ± 4	7 ± 4	8 ± 4
07/07/22 - 07/15/22	16 ± 4	16 ± 4	12 ± 4	18 ± 4	16 ± 4	16 ± 4	22 ± 4
07/15/22 - 07/21/22	20 ± 5	20 ± 5	16 ± 5	20 ± 5	21 ± 5	20 ± 5	19 ± 5
07/21/22 - 07/27/22	20 ± 6	20 ± 6	16 ± 6	23 ± 6	20 ± 6	22 ± 6	18 ± 6
07/27/22 - 08/04/22	17 ± 4	17 ± 4	16 ± 4	21 ± 4	19 ± 4	17 ± 4	16 ± 4
08/04/22 - 08/11/22	14 ± 4	14 ± 4	10 ± 3	12 ± 4	13 ± 4	13 ± 4	16 ± 4
08/11/22 - 08/19/22	15 ± 4	20 ± 4	16 ± 4	20 ± 4	18 ± 4	18 ± 4	18 ± 4
08/19/22 - 08/25/22	16 ± 5	22 ± 5	18 ± 5	23 ± 5	24 ± 5	21 ± 5	28 ± 5
08/25/22 - 09/01/22	22 ± 5	28 ± 5	28 ± 5	28 ± 5	25 ± 5	25 ± 5	24 ± 5
09/01/22 - 09/07/22	12 ± 5	15 ± 5	17 ± 5	12 ± 4	12 ± 4	10 ± 4	13 ± 5
09/07/22 - 09/15/22	16 ± 4	15 ± 4	13 ± 3	12 ± 3	14 ± 4	16 ± 4	16 ± 4
09/15/22 - 09/22/22	28 ± 5	29 ± 5	36 ± 5	26 ± 6	27 ± 5	26 ± 5	32 ± 5
09/22/22 - 09/29/22	12 ± 4	12 ± 4	11 ± 4	10 ± 4	9 ± 4	12 ± 4	14 ± 4
09/29/22 - 10/06/22	14 ± 4	15 ± 4	15 ± 4	10 ± 4	15 ± 4	14 ± 4	10 ± 4
10/06/22 - 10/12/22	19 ± 5	18 ± 5	20 ± 5	24 ± 5	21 ± 5	26 ± 5	23 ± 5
10/12/22 - 10/21/22	21 ± 4	22 ± 4	17 ± 3	22 ± 4	20 ± 4	24 ± 4	22 ± 4
10/21/22 - 10/27/22	13 ± 5	15 ± 5	17 ± 5	17 ± 5	19 ± 5	17 ± 5	18 ± 5
10/27/22 - 11/03/22	18 ± 5	16 ± 4	22 ± 5	18 ± 4	16 ± 4	20 ± 5	18 ± 5
11/03/22 - 11/10/22	13 ± 4	17 ± 4	20 ± 5	18 ± 4	20 ± 4	18 ± 4	19 ± 4
11/10/22 - 11/17/22	11 ± 4	10 ± 4	11 ± 4	10 ± 4	12 ± 4	13 ± 4	10 ± 4
11/17/22 - 11/23/22	21 ± 5	25 ± 5	21 ± 5	22 ± 5	23 ± 5	24 ± 5	23 ± 5
11/23/22 - 11/30/22	23 ± 5	22 ± 5	23 ± 5	21 ± 4	30 ± 5	26 ± 5	25 ± 5
11/30/22 - 12/07/22	24 ± 5	21 ± 5	23 ± 5	23 ± 5	20 ± 5	21 ± 5	24 ± 5
12/07/22 - 12/15/22	17 ± 4	17 ± 4	17 ± 4	14 ± 4	16 ± 4	14 ± 4	20 ± 4
12/15/22 - 12/21/22	13 ± 4	13 ± 4	18 ± 5	16 ± 5	13 ± 4	15 ± 4	16 ± 5
12/21/22 - 12/29/22	14 ± 5	17 ± 4	22 ± 4	22 ± 4	23 ± 4	22 ± 4	22 ± 4
MEAN ± 2 STD DEV	16 ± 9	16 ± 10	17 ± 11	16 ± 11	16 ± 10	17 ± 10	17 ± 11

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, 2022**

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
12/29/21 - 02/03/22	15	28	21 ± 9	12/29/21 - 02/03/22	13	29	20 ± 10	12/29/21 - 02/03/22	17	26	21 ± 7
02/03/22 - 03/03/22	13	19	15 ± 4	02/03/22 - 03/03/22	11	21	17 ± 5	02/03/22 - 03/03/22	15	19	17 ± 3
03/03/22 - 03/30/22	8	20	13 ± 8	03/03/22 - 03/30/22	7	20	13 ± 7	03/03/22 - 03/30/22	9	18	15 ± 7
03/30/22 - 04/27/22	6	16	10 ± 7	03/30/22 - 04/27/22	7	20	12 ± 9	03/30/22 - 04/27/22	8	20	12 ± 12
04/27/22 - 06/02/22	7	16	12 ± 5	04/27/22 - 06/02/22	7	16	13 ± 5	04/27/22 - 06/02/22	8	17	14 ± 7
06/02/22 - 06/30/22	8	20	13 ± 8	06/02/22 - 06/30/22	7	18	13 ± 7	06/02/22 - 06/30/22	8	17	12 ± 8
06/30/22 - 08/04/22	10	20	17 ± 8	06/30/22 - 08/04/22	7	23	17 ± 9	06/30/22 - 08/04/22	8	22	17 ± 10
08/04/22 - 09/01/22	14	28	19 ± 10	08/04/22 - 09/01/22	10	28	19 ± 11	08/04/22 - 09/01/22	16	28	22 ± 11
09/01/22 - 09/29/22	12	29	17 ± 14	09/01/22 - 09/29/22	9	36	16 ± 16	09/01/22 - 09/29/22	13	32	19 ± 18
09/29/22 - 11/03/22	13	22	17 ± 6	09/29/22 - 11/03/22	10	26	19 ± 8	09/29/22 - 11/03/22	10	23	18 ± 10
11/03/22 - 11/30/22	10	25	18 ± 11	11/03/22 - 11/30/22	10	30	19 ± 11	11/03/22 - 11/30/22	10	25	19 ± 13
11/30/22 - 12/29/22	13	24	17 ± 8	11/30/22 - 12/29/22	13	23	19 ± 7	11/30/22 - 12/29/22	16	24	20 ± 7
12/29/21 - 12/29/22	6	29	16 ± 10	12/29/21 - 12/29/22	7	36	16 ± 11	12/29/21 - 12/29/22	8	32	17 ± 11

Table C-VI.3 CONCENTRATIONS OF GAMMA EMITTERS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2022

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	12/29/21 - 03/30/22	84 ± 18	< 2	< 2	< 3	< 2	< 4	< 3	< 2
	03/30/22 - 06/30/22	74 ± 19	< 1	< 1	< 2	< 1	< 3	< 1	< 2
	06/30/22 - 09/29/22	68 ± 24	< 4	< 3	< 3	< 3	< 7	< 3	< 3
	09/29/22 - 12/29/22	46 ± 14	< 2	< 2	< 3	< 2	< 4	< 2	< 2
	MEAN ± 2 STD DEV	68 ± 32	-	-	-	-	-	-	-
E1-2	12/29/21 - 03/30/22	83 ± 22	< 3	< 3	< 3	< 3	< 6	< 2	< 3
	03/30/22 - 06/30/22	66 ± 17	< 1	< 2	< 3	< 2	< 2	< 1	< 1
	06/30/22 - 09/29/22	59 ± 21	< 3	< 2	< 3	< 2	< 3	< 2	< 2
	09/29/22 - 12/29/22	62 ± 21	< 2	< 2	< 3	< 2	< 3	< 2	< 2
	MEAN ± 2 STD DEV	67 ± 22	-	-	-	-	-	-	-
F1-3	12/29/21 - 03/30/22	64 ± 18	< 2	< 2	< 2	< 2	< 3	< 2	< 2
	03/30/22 - 06/30/22	73 ± 17	< 2	< 1	< 1	< 1	< 2	< 2	< 1
	06/30/22 - 09/29/22	61 ± 32	< 4	< 4	< 3	< 4	< 5	< 3	< 3
	09/29/22 - 12/29/22	41 ± 16	< 2	< 2	< 2	< 2	< 3	< 2	< 2
	MEAN ± 2 STD DEV	60 ± 27	-	-	-	-	-	-	-
G2-1	12/29/21 - 03/30/22	60 ± 18	< 2	< 2	< 1	< 2	< 4	< 2	< 2
	03/30/22 - 06/30/22	77 ± 30	< 3	< 3	< 3	< 3	< 4	< 3	< 3
	06/30/22 - 09/29/22	76 ± 21	< 3	< 2	< 3	< 3	< 5	< 3	< 2
	09/29/22 - 12/29/22	66 ± 24	< 3	< 3	< 3	< 3	< 5	< 3	< 2
	MEAN ± 2 STD DEV	70 ± 16	-	-	-	-	-	-	-
H3-1	12/29/21 - 03/30/22	86 ± 20	< 3	< 3	< 3	< 3	< 6	< 2	< 2
	03/30/22 - 06/30/22	72 ± 19	< 2	< 2	< 3	< 1	< 3	< 2	< 2
	06/30/22 - 09/29/22	66 ± 22	< 3	< 3	< 3	< 3	< 5	< 2	< 2
	09/29/22 - 12/29/22	66 ± 17	< 2	< 2	< 3	< 2	< 5	< 2	< 2
	MEAN ± 2 STD DEV	72 ± 19	-	-	-	-	-	-	-
M2-1	12/29/21 - 03/30/22	59 ± 20	< 2	< 3	< 3	< 3	< 4	< 2	< 2
	03/30/22 - 06/30/22	77 ± 23	< 2	< 2	< 2	< 2	< 5	< 2	< 3
	06/30/22 - 09/29/22	65 ± 19	< 2	< 2	< 2	< 3	< 4	< 2	< 2
	09/29/22 - 12/29/22	62 ± 16	< 3	< 4	< 4	< 3	< 5	< 3	< 2
	MEAN ± 2 STD DEV	66 ± 15	-	-	-	-	-	-	-
Q15-1	12/29/21 - 03/30/22	65 ± 17	< 2	< 3	< 2	< 2	< 3	< 2	< 2
	03/30/22 - 06/30/22	81 ± 18	< 3	< 2	< 2	< 2	< 5	< 2	< 2
	06/30/22 - 09/29/22	73 ± 23	< 2	< 3	< 2	< 3	< 4	< 2	< 1
	09/29/22 - 12/29/22	55 ± 20	< 2	< 2	< 3	< 2	< 4	< 2	< 2
	MEAN ± 2 STD DEV	68 ± 22	-	-	-	-	-	-	-

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, 2022

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
12/29/21 - 01/05/22	< 39	< 32	< 40	< 39	< 39	< 39	< 24
01/05/22 - 01/12/22	< 37	< 37	< 30	< 35	< 35	< 35	< 35
01/12/22 - 01/19/22	< 32	< 32	< 16	< 36	< 36	< 37	< 37
01/19/22 - 01/27/22	< 47	< 19	< 34	< 46	< 47	< 47	< 34
01/27/22 - 02/03/22	< 45	< 44	< 37	< 36	< 30	< 37	< 37
02/03/22 - 02/10/22	< 30	< 30	< 37	< 20	< 30	< 38	< 37
02/10/22 - 02/16/22	< 39	< 38	< 23	< 53	< 53	< 54	< 54
02/16/22 - 02/24/22	< 27	< 26	< 36	< 26	< 18	< 26	< 36
02/24/22 - 03/03/22	< 34	< 33	< 35	< 14	< 34	< 36	< 35
03/03/22 - 03/11/22	< 35	< 34	< 27	< 26	< 26	< 22	< 27
03/11/22 - 03/16/22	< 22	< 22	< 27	< 64	< 64	< 62	< 63
03/16/22 - 03/24/22	< 20	< 20	< 27	< 20	< 20	< 11	< 27
03/24/22 - 03/30/22	< 30	< 29	< 22	< 51	< 51	< 52	< 52
03/30/22 - 04/06/22	< 42	< 41	< 57	< 34	< 41	< 42	< 57
04/06/22 - 04/13/22	< 42	< 17	< 22	< 41	< 41	< 42	< 33
04/13/22 - 04/20/22	< 16	< 36	< 45	< 37	< 38	< 36	< 43
04/20/22 - 04/27/22	< 17	< 20	< 27	< 26	< 26	< 23	< 27
04/27/22 - 05/06/22	< 26	< 25	< 22	< 25	< 25	< 26	< 26
05/06/22 - 05/12/22	< 28	< 65	< 54	< 65	< 65	< 65	< 55
05/12/22 - 05/19/22	< 19	< 19	< 29	< 37	< 37	< 37	< 38
05/19/22 - 05/26/22	< 18	< 34	< 26	< 34	< 34	< 34	< 27
05/26/22 - 06/02/22	< 43	< 42	< 59	< 59	< 60	< 60	< 25
06/02/22 - 06/08/22	< 24	< 57	< 48	< 56	< 56	< 57	< 49
06/08/22 - 06/16/22	< 17	< 35	< 14	< 34	< 35	< 35	< 24
06/16/22 - 06/23/22	< 46	< 46	< 14	< 35	< 34	< 34	< 35
06/23/22 - 06/30/22	< 21	< 50	< 29	< 50	< 50	< 50	< 29
06/30/22 - 07/07/22	< 15	< 36	< 39	< 35	< 36	< 36	< 17
07/07/22 - 07/15/22	< 51	< 50	< 15	< 37	< 37	< 37	< 37
07/15/22 - 07/21/22	< 51	< 21	< 14	< 50	< 50	< 50	< 14
07/21/22 - 07/27/22	< 41	< 41	< 57	< 24	< 57	< 57	< 58
07/27/22 - 08/04/22	< 26	< 46	< 18	< 42	< 42	< 42	< 43
08/04/22 - 08/11/22	< 45	< 44	< 16	< 31	< 31	< 31	< 32
08/11/22 - 08/19/22	< 13	< 27	< 23	< 27	< 27	< 27	< 24
08/19/22 - 08/25/22	< 28	< 54	< 52	< 53	< 54	< 54	< 51
08/25/22 - 09/01/22	< 63	< 62	< 25	< 59	< 60	< 60	< 62
09/01/22 - 09/07/22	< 28	< 65	< 40	< 64	< 64	< 65	< 35
09/07/22 - 09/15/22	< 15	< 33	< 50	< 33	< 33	< 34	< 51
09/15/22 - 09/22/22	< 23	< 22	< 24	< 13	< 23	< 23	< 25
09/22/22 - 09/29/22	< 48	< 48	< 12	< 48	< 48	< 19	< 12
09/29/22 - 10/06/22	< 53	< 52	< 28	< 21	< 51	< 53	< 29
10/06/22 - 10/12/22	< 48	< 47	< 35	< 48	< 48	< 19	< 35
10/12/22 - 10/21/22	< 12	< 29	< 42	< 29	< 29	< 29	< 43
10/21/22 - 10/27/22	< 49	< 48	< 30	< 36	< 36	< 35	< 35
10/27/22 - 11/03/22	< 37	< 36	< 29	< 36	< 36	< 19	< 30
11/03/22 - 11/10/22	< 35	< 34	< 46	< 34	< 35	< 33	< 16
11/10/22 - 11/17/22	< 28	< 65	< 58	< 58	< 58	< 60	< 27
11/17/22 - 11/23/22	< 19	< 37	< 40	< 37	< 37	< 35	< 20
11/23/22 - 11/30/22	< 67	< 66	< 44	< 65	< 65	< 28	< 46
11/30/22 - 12/07/22	< 23	< 53	< 15	< 53	< 53	< 53	< 16
12/07/22 - 12/15/22	< 14	< 32	< 42	< 32	< 32	< 32	< 43
12/15/22 - 12/21/22	< 19	< 40	< 42	< 39	< 40	< 40	< 43
12/21/22 - 12/29/22	< 46	< 47	< 34	< 44	< 44	< 44	< 26
MEAN	-	-	-	-	-	-	-

TABLE C-VIII.1 CONCENTRATIONS OF I-131 IN MILK SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2022

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION	CONTROL FARM	INDICATOR FARMS		
PERIOD	J18-1	F4-1	G2-1	P4-1
01/19/22	< 0.8	< 0.7	< 0.9	< 0.7
02/16/22	< 0.7	< 0.8	< 0.7	< 0.6
03/16/22	< 0.8	< 0.9	< 0.9	< 0.8
03/30/22	< 0.7	< 0.7	< 0.7	< 0.8
04/13/22	< 0.9	< 0.9	< 0.9	< 0.8
04/27/22	< 0.8	< 0.8	< 0.9	< 0.9
05/11/22	< 0.6	< 0.5	< 0.5	< 0.6
05/26/22	< 0.8	< 0.7	< 0.7	< 0.9
06/08/22	< 1.0	< 0.8	< 1.0	< 1.0
06/22/22	< 0.8	< 0.8	< 0.9	< 0.8
07/07/22	< 0.8	< 0.8	< 0.8	< 0.9
07/20/22	< 0.8	< 0.6	< 0.7	< 0.7
08/03/22	< 0.9	< 0.9	< 0.9	*(1)*
08/17/22	< 0.9	< 0.8	< 0.8	*(1)*
08/31/22	< 0.9	< 0.9	< 0.8	*(1)*
09/15/22	< 0.8	< 0.8	< 0.8	*(1)*
09/29/22	< 0.5	< 0.8	< 0.8	*(1)*
10/12/22	< 0.8	< 0.8	< 0.7	*(1)*
10/27/22	< 0.8	< 0.8	< 0.9	*(1)*
11/10/22	< 0.9	< 0.9	< 0.9	*(1)*
11/23/22	< 0.8	< 0.6	< 0.6	*(1)*
12/07/22	< 0.8	< 0.6	< 0.4	*(1)*
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, 2022

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION	CONTROL FARM		INDICATOR FARMS					
	J18-1		F4-1		G2-1		P4-1	
PERIOD	Sr-89	Sr-90	Sr-89	Sr-90	Sr-89	Sr-90	Sr-89	Sr-90
01/19/22 - 03/30/22	< 3.8	< 0.9	< 4.7	< 0.9	< 4.4	< 0.9	< 4.6	< 1.0
04/13/22 - 06/22/22	< 4.4	< 0.9	< 4.2	< 0.8	< 4.1	< 0.8	< 4.2	< 0.8
07/07/22 - 09/29/22	< 3.6	< 0.9	< 3.3	< 0.9	< 3.5	< 0.8	< 4.9	< 0.8
10/12/22 - 12/07/22	< 4.7	< 0.9	< 4.4	< 0.9	< 4.8	< 0.8	*(1)*	
MEAN	-	-	-	-	-	-	-	-

(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, 2022

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	K-40	Cs-134	Cs-137	Ba-140	La-140
F4-1	01/19/22	1247 ± 176	< 10	< 8	< 32	< 9
	02/16/22	1404 ± 222	< 9	< 7	< 25	< 8
	03/16/22	1289 ± 211	< 8	< 8	< 29	< 7
	03/30/22	1121 ± 179	< 10	< 7	< 31	< 11
	04/13/22	1207 ± 188	< 9	< 9	< 42	< 7
	04/27/22	1301 ± 188	< 10	< 9	< 31	< 11
	05/11/22	1230 ± 177	< 7	< 7	< 27	< 14
	05/26/22	1334 ± 165	< 9	< 7	< 26	< 10
	06/08/22	1449 ± 193	< 8	< 8	< 34	< 9
	06/22/22	1385 ± 160	< 7	< 7	< 29	< 7
	07/07/22	980 ± 196	< 10	< 10	< 39	< 8
	07/20/22	1464 ± 147	< 6	< 7	< 28	< 8
	08/03/22	1399 ± 143	< 6	< 6	< 30	< 10
	08/17/22	1271 ± 151	< 7	< 7	< 26	< 10
	08/31/22	1360 ± 173	< 8	< 8	< 31	< 11
	09/15/22	1283 ± 192	< 10	< 9	< 36	< 9
	09/29/22	1144 ± 189	< 7	< 8	< 36	< 12
	10/12/22	1177 ± 181	< 9	< 8	< 26	< 10
	10/27/22	1372 ± 150	< 7	< 7	< 29	< 7
	11/10/22	1318 ± 194	< 10	< 9	< 37	< 6
	11/23/22	1279 ± 166	< 7	< 7	< 28	< 8
	12/07/22	1368 ± 148	< 6	< 6	< 23	< 9
	MEAN ± 2 STD DEV	1290 ± 232	-	-	-	-
G2-1	01/19/22	1216 ± 125	< 6	< 6	< 21	< 8
	02/16/22	997 ± 142	< 7	< 7	< 21	< 9
	03/16/22	1343 ± 192	< 9	< 9	< 39	< 8
	03/30/22	1265 ± 183	< 9	< 9	< 37	< 11
	04/13/22	1192 ± 186	< 10	< 8	< 47	< 9
	04/27/22	1222 ± 162	< 8	< 9	< 35	< 7
	05/11/22	1289 ± 131	< 6	< 6	< 25	< 7
	05/26/22	1094 ± 184	< 6	< 10	< 34	< 10
	06/08/22	1129 ± 177	< 8	< 7	< 34	< 9
	06/22/22	936 ± 151	< 8	< 7	< 37	< 10
	07/07/22	1382 ± 156	< 8	< 6	< 24	< 8
	07/20/22	1447 ± 181	< 8	< 6	< 31	< 10
	08/03/22	1095 ± 163	< 6	< 8	< 29	< 9
	08/17/22	1493 ± 135	< 7	< 7	< 18	< 7
	08/31/22	806 ± 156	< 6	< 6	< 29	< 10
	09/15/22	920 ± 185	< 9	< 9	< 39	< 15
	09/29/22	1365 ± 174	< 8	< 8	< 25	< 7
	10/12/22	1250 ± 169	< 10	< 8	< 29	< 7
	10/27/22	1230 ± 175	< 8	< 8	< 33	< 7
	11/10/22	1242 ± 154	< 9	< 10	< 35	< 13
	11/23/22	1185 ± 173	< 8	< 9	< 36	< 11
	12/07/22	1078 ± 176	< 11	< 10	< 38	< 12
	MEAN ± 2 STD DEV	1190 ± 347	-	-	-	-

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, 2022

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD		K-40	Cs-134	Cs-137	Ba-140	La-140
J18-1	01/19/22		1329 ± 149	< 7	< 6	< 25	< 7
	02/16/22		1260 ± 177	< 7	< 7	< 26	< 7
	03/16/22		1136 ± 188	< 9	< 10	< 39	< 9
	03/30/22		1153 ± 152	< 9	< 8	< 26	< 8
	04/13/22		1159 ± 173	< 8	< 9	< 33	< 13
	04/27/22		1259 ± 176	< 8	< 8	< 37	< 10
	05/11/22		1329 ± 164	< 7	< 7	< 36	< 9
	05/26/22		1112 ± 180	< 8	< 8	< 34	< 10
	06/08/22		1206 ± 174	< 7	< 4	< 36	< 14
	06/22/22		1322 ± 183	< 9	< 8	< 28	< 9
	07/07/22		1483 ± 174	< 8	< 7	< 21	< 5
	07/20/22		828 ± 121	< 7	< 9	< 38	< 12
	08/03/22		1197 ± 143	< 6	< 7	< 29	< 8
	08/17/22		1160 ± 179	< 7	< 7	< 25	< 9
	08/31/22		1250 ± 192	< 8	< 9	< 32	< 10
	09/15/22		1293 ± 186	< 5	< 7	< 32	< 12
	09/29/22		1220 ± 185	< 10	< 9	< 36	< 13
	10/12/22		1131 ± 200	< 9	< 8	< 27	< 9
	10/27/22		1175 ± 147	< 7	< 5	< 24	< 9
	11/10/22		1376 ± 184	< 9	< 9	< 33	< 12
	11/23/22		1166 ± 161	< 7	< 6	< 28	< 10
	12/07/22		1131 ± 186	< 9	< 7	< 29	< 5
	MEAN ± 2 STD DEV		1213 ± 255	-	-	-	-
P4-1	01/19/22		1174 ± 150	< 8	< 8	< 26	< 7
	02/16/22		1317 ± 169	< 8	< 7	< 30	< 3
	03/16/22		1432 ± 192	< 9	< 11	< 33	< 13
	03/30/22		1296 ± 209	< 8	< 9	< 30	< 15
	04/13/22		1370 ± 222	< 8	< 10	< 37	< 13
	04/27/22		1358 ± 216	< 9	< 9	< 32	< 7
	05/11/22		1384 ± 150	< 7	< 7	< 27	< 8
	05/26/22		1290 ± 204	< 7	< 8	< 31	< 10
	06/08/22		1293 ± 196	< 11	< 7	< 38	< 12
	06/22/22		1130 ± 170	< 9	< 10	< 35	< 7
	07/07/22		1358 ± 177	< 7	< 8	< 26	< 8
	07/20/22		1095 ± 155	< 7	< 7	< 19	< 6
	08/03/22	*(1)*					
	08/17/22	*(1)*					
	08/31/22	*(1)*					
	09/15/22	*(1)*					
	09/29/22	*(1)*					
	10/12/22	*(1)*					
	10/27/22	*(1)*					
	11/10/22	*(1)*					
	11/23/22	*(1)*					
	12/07/22	*(1)*					
	MEAN ± 2 STD DEV		1291 ± 211	-	-	-	-

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

Table C-IX.1 CONCENTRATIONS OF STRONTIUM AND GAMMA EMITTERS IN FOOD PRODUCT SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2022

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							
Cabbage	06/22/22		< 287	4262 ± 675	< 30	< 40	< 37
Kale	06/22/22		< 367	4361 ± 827	< 34	< 31	< 28
Broccoli	06/22/22		< 344	5422 ± 856	< 31	< 32	< 36
Kale	07/20/22		990 ± 507	5018 ± 895	< 53	< 58	< 47
Cabbage	07/20/22		575 ± 279	3304 ± 595	< 42	< 27	< 30
Broccoli	07/20/22		1061 ± 340	4456 ± 655	< 48	< 36	< 39
Corn	08/17/22	< 4.1	< 126	2752 ± 427	< 21	< 20	< 16
Tomato	08/17/22	< 4.1	< 185	2296 ± 501	< 27	< 29	< 26
Potato	08/17/22	< 4.5	< 173	2245 ± 461	< 23	< 21	< 24
Kale	08/17/22		383 ± 234	4677 ± 503	< 29	< 30	< 28
Cabbage	08/17/22		1049 ± 382	5355 ± 729	< 34	< 34	< 35
Lettuce	08/17/22		652 ± 206	5352 ± 574	< 27	< 30	< 26
Kale	09/20/22		1153 ± 452	6698 ± 1156	< 51	< 53	< 53
Cabbage	09/20/22		1318 ± 356	5143 ± 675	< 31	< 35	< 35
Collard Greens	09/20/22		1024 ± 314	3667 ± 740	< 30	< 33	< 34
MEAN ± 2 STD DEV		-	912 ± 610	4017 ± 2737	-	-	-
E1-2							
Broccoli	06/22/22		< 382	3275 ± 614	< 44	< 40	< 37
Cabbage	06/22/22		< 249	2881 ± 539	< 29	< 30	< 35
Cauliflower	06/22/22		410 ± 201	3079 ± 499	< 23	< 26	< 19
Cabbage	07/20/22		937 ± 293	2913 ± 593	< 42	< 23	< 28
Broccoli	07/20/22		467 ± 306	3063 ± 537	< 56	< 45	< 37
Cauliflower	07/20/22		< 295	4334 ± 618	< 41	< 23	< 31
Corn	08/17/22	< 4.4	< 108	2022 ± 372	< 15	< 13	< 15
Tomato	08/17/22	< 4.3	< 105	1867 ± 300	< 17	< 16	< 13
Potato	08/17/22	< 4.3	< 197	5495 ± 672	< 28	< 34	< 29
Cauliflower	08/17/22		603 ± 308	4303 ± 620	< 29	< 33	< 26
Kale	08/17/22		707 ± 265	3606 ± 687	< 48	< 44	< 46
Cabbage	08/17/22		313 ± 167	4237 ± 372	< 20	< 21	< 20
Kale	09/20/22		< 367	2815 ± 553	< 42	< 40	< 33
Collard Greens	09/20/22		< 456	2506 ± 627	< 42	< 43	< 42
Cabbage	09/20/22		< 358	2970 ± 623	< 34	< 37	< 29
MEAN ± 2 STD DEV		-	573 ± 453	3264 ± 2246	-	-	-
H1-2							
Zucchini	06/22/22		< 366	4391 ± 834	< 33	< 31	< 36
Yellow Squash Leaves	06/22/22		464 ± 165	3750 ± 504	< 24	< 24	< 21
Cucumber	06/22/22		583 ± 233	3842 ± 582	< 30	< 35	< 27
Pumpkin	07/20/22		476 ± 245	5775 ± 719	< 51	< 34	< 36
Cucumber	07/20/22		828 ± 296	3693 ± 674	< 36	< 36	< 34
Yellow Squash	07/20/22		< 421	6017 ± 828	< 47	< 38	< 37
Yellow Squash	08/17/22		771 ± 231	3017 ± 401	< 25	< 25	< 22
Zucchini	08/17/22		1110 ± 245	3653 ± 526	< 28	< 27	< 25
Pumpkin	08/17/22		750 ± 383	4067 ± 699	< 35	< 39	< 28
Pumpkin	09/20/22		4583 ± 651	5416 ± 814	< 43	< 46	< 40
Butternut Squash	09/20/22		3388 ± 514	5112 ± 923	< 36	< 46	< 35
Eggplant	09/20/22		3435 ± 800	4668 ± 1134	< 57	< 59	< 44
MEAN ± 2 STD DEV			1639 ± 3076	4450 ± 1898	-	-	-

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, 2022

RESULTS IN UNITS OF MILLIREM/QUARTER - MISSING

STATION CODE	MEAN ± 2 S.D.	JAN - MAR	APR - JUN	JUL - SEP	OCT - DEC
A1-4	14.6 ± 1.7	14.8	14.6	13.5	15.5
A3-1	14.5 ± 3.4	12.5	15.3	16.4	13.8
A5-1	19.6 ± 2.8	17.8	19.7	19.7	21.2
A9-3	15.9 ± 2.4	14.8	14.9	17.1	16.8
B1-1	15.3 ± 4.3	15.2	15.2	12.8	18.0
B1-2	14.9 ± 1.7	14.8	15.8	13.7	15.1
B2-1	14.7 ± 1.7	14.4	14.3	16.0	14.2
B5-1	18.7 ± 2.3	18.3	17.3	19.8	19.4
B10-1	17.6 ± 3.0	17.2	17.7	19.5	15.9
C1-1	17.4 ± 4.3	16.6	14.9	20.0	17.9
C1-2	14.6 ± 2.1	13.7	14.7	13.8	16.0
C2-1	16.7 ± 3.6	16.8	14.6	19.0	16.5
C5-1	18.2 ± 2.1	17.3	17.5	18.2	19.6
C8-1	19.1 ± 3.5	17.4	17.7	20.6	20.5
D1-1	15.7 ± 1.4	15.2	15.8	15.0	16.6
D1-2	16.8 ± 3.4	16.5	15.0	19.1	16.6
D15-1	18.1 ± 3.3	16.8	17.1	20.4	18.1
D2-2	19.6 ± 2.8	19.3	17.9	21.3	19.7
D6-1	20.3 ± 3.7	18.7	19.0	21.0	22.6
E1-2	14.8 ± 2.4	14.4	13.8	*(1)*	16.1
E1-4	17.0 ± 4.1	16.7	16.1	15.2	19.9
E2-3	19.7 ± 2.0	18.9	19.5	21.2	19.3
E5-1	20.4 ± 2.0	20.0	19.1	21.0	21.3
E7-1	18.3 ± 3.0	17.0	19.1	20.0	17.0
F1-1	16.8 ± 1.7	15.9	16.2	17.8	17.1
F1-2	16.5 ± 1.2	16.0	16.1	16.4	17.3
F1-4	16.4 ± 3.7	14.5	17.0	15.3	18.6
F2-1	20.2 ± 3.4	18.4	19.0	21.9	21.3
F5-1	19.6 ± 3.6	18.2	19.6	22.1	18.4
F10-1	21.2 ± 3.0	20.3	19.9	23.2	21.5
F25-1	18.1 ± 2.4	17.1	17.0	18.9	19.3
G1-2	18.2 ± 4.0	16.3	16.8	19.1	20.6
G1-3	15.0 ± 2.9	14.4	15.8	13.2	16.5
G1-5	17.4 ± 3.1	15.7	18.5	16.4	18.9
G1-6	18.3 ± 4.3	16.2	17.7	18.0	21.3
G2-4	21.1 ± 4.1	20.5	19.4	24.1	20.5
G5-1	17.8 ± 3.1	15.7	17.5	19.1	18.7
G10-1	25.8 ± 6.0	25.5	22.7	29.9	25.1
G15-1	16.5 ± 1.5	16.4	15.9	17.5	16.0
H1-1	24.4 ± 7.5	18.8	25.8	26.8	26.1
H1-3	30.9 ± 16.9	18.6	32.4	36.1	36.6
H3-1	13.9 ± 1.6	13.3	13.2	14.9	14.3
H5-1	14.1 ± 2.7	13.7	12.9	13.8	16.0
H8-1	29.1 ± 5.0	27.3	26.9	32.2	30.0
H15-1	17.9 ± 1.8	17.2	17.9	17.3	19.2
J1-1	15.4 ± 3.6	14.1	15.0	14.3	18.0
J1-3	30.3 ± 13.3	20.9	34.0	30.2	35.9

(1) SEE PROGRAM EXCEPTIONS SECTION FOR INFORMATION

Table C-X.1 QUARTERLY OSLD RESULTS FOR THREE MILE ISLAND NUCLEAR STATION, 2022

RESULTS IN UNITS OF MILLIREM/QUARTER - MISSING

STATION CODE	MEAN ± 2 S.D.	JAN - MAR	APR - JUN	JUL - SEP	OCT - DEC
J1-4	31.9 ± 11.5	23.3	35.2	33.9	35.0
J3-1	18.0 ± 2.2	17.5	16.7	18.9	18.9
J5-1	20.4 ± 4.2	18.4	18.8	21.9	22.5
J7-1	21.7 ± 2.5	20.2	21.1	22.6	22.8
J15-1	20.5 ± 2.4	22.0	19.8	20.8	19.3
K1-4	15.9 ± 4.4	15.6	14.5	14.4	19.1
K1-5	22.6 ± 9.7	15.7	25.0	23.0	26.8
K2-1	19.4 ± 2.0	18.2	19.3	19.3	20.7
K3-1	16.1 ± 3.0	14.6	15.5	16.1	18.1
K5-1	19.3 ± 1.4	18.5	19.1	20.2	19.5
K8-1	18.6 ± 1.9	19.1	17.4	18.3	19.6
K15-1	16.8 ± 1.1	16.5	16.2	16.9	17.5
L1-1	16.9 ± 2.5	16.9	17.2	15.2	18.2
L1-2	15.2 ± 1.3	14.9	14.9	14.8	16.2
L2-1	17.4 ± 2.0	16.0	17.2	17.9	18.3
L5-1	16.5 ± 1.0	15.9	16.6	16.5	17.1
L8-1	17.3 ± 2.6	16.3	16.0	18.5	18.3
L15-1	18.3 ± 3.2	17.0	16.9	19.1	20.2
M1-1	16.2 ± 3.9	15.2	17.5	14.0	18.1
M1-2	17.3 ± 3.1	15.9	16.1	18.5	18.8
M2-1	16.3 ± 1.0	16.5	16.1	15.7	16.9
M5-1	17.1 ± 1.5	16.7	16.4	17.3	18.1
M9-1	21.8 ± 2.9	20.1	21.0	23.1	22.8
N1-1	16.4 ± 1.0	16.2	16.7	16.8	15.7
N1-3	18.3 ± 2.2	17.4	18.6	17.5	19.8
N2-1	18.8 ± 4.2	17.3	17.4	18.7	21.8
N5-1	15.3 ± 2.3	14.3	14.6	15.6	16.8
N8-1	18.9 ± 2.8	17.7	17.9	19.5	20.6
N15-2	20.0 ± 2.5	19.3	18.8	20.4	21.6
P1-1	15.9 ± 1.7	16.1	15.0	15.6	17.0
P1-2	21.5 ± 1.1	22.2	21.7	20.9	21.3
P2-1	21.8 ± 2.6	20.8	21.5	21.1	23.7
P5-1	18.2 ± 2.6	16.9	18.2	17.7	20.0
P8-1	15.4 ± 2.8	15.0	14.4	14.7	17.5
Q1-1	16.9 ± 3.5	16.5	16.2	19.4	15.3
Q1-2	16.2 ± 3.7	16.3	15.6	14.3	18.7
Q2-1	15.7 ± 2.9	14.2	14.9	16.0	17.5
Q5-1	16.4 ± 2.4	15.5	15.3	17.1	17.8
Q9-1	16.8 ± 1.2	16.0	17.1	17.3	16.6
Q15-1	19.5 ± 2.0	19.3	18.7	20.9	19.0
R1-1	16.1 ± 2.9	15.7	16.5	14.3	17.8
R1-2	15.0 ± 0.9	15.2	14.4	14.9	15.5
R3-1	20.3 ± 4.2	17.2	20.7	21.3	21.8
R5-1	18.6 ± 2.0	19.0	18.5	19.5	17.2
R9-1	18.1 ± 2.5	16.5	18.3	19.5	18.2
R15-1	16.2 ± 1.8	16.3	15.9	17.3	15.2

TABLE C-X.2 **MEAN QUARTERLY OSLD RESULTS FOR THE SITE BOUNDARY, INDICATOR AND CONTROL LOCATIONS FOR THREE MILE ISLAND NUCLEAR STATION, 2022**

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

COLLECTION PERIOD	SITE BOUNDARY ± 2 STD DEV	INDICATOR	CONTROL
JAN-MAR	16.8 ± 5.1	17.0 ± 4.7	18.5 ± 5.8
APR-JUN	19.8 ± 12.9	17.2 ± 4.9	17.9 ± 4.1
JUL-SEP	18.7 ± 13.8	18.8 ± 6.2	19.9 ± 7.3
OCT-DEC	21.3 ± 13.2	18.7 ± 5.5	19.1 ± 5.4

TABLE C-X.3 **SUMMARY OF THE AMBIENT DOSIMETRY PROGRAM FOR THREE MILE ISLAND NUCLEAR STATION, 2021**

RESULTS IN UNITS OF MILLIREMQUARTER

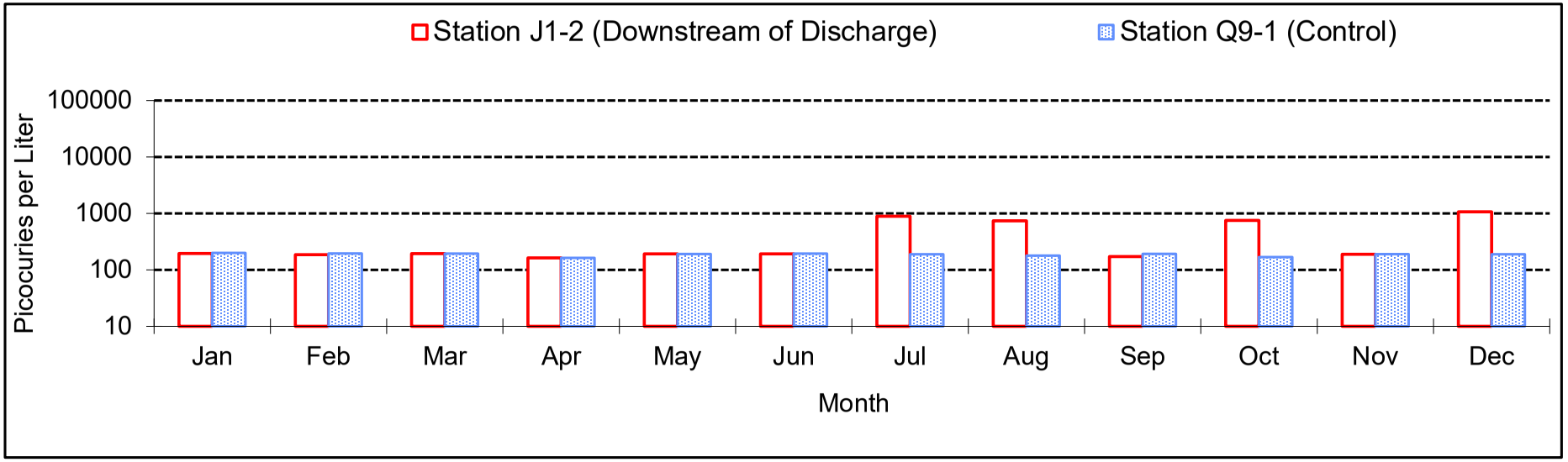
LOCATION	SAMPLES ANALYZED	PERIOD MINIMUM	PERIOD MAXIMUM	PERIOD MEAN ± 2 STD DEV
SITE BOUNDARY	88	13.2	36.6	19.1 ± 12.1
INDICATOR	239	12.5	32.2	17.9 ± 5.6
CONTROL	44	15.2	29.9	18.9 ± 5.8

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, H1-3, J1-3, J1-4, K1-4, K1-5, 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, P8-1, 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, 2022



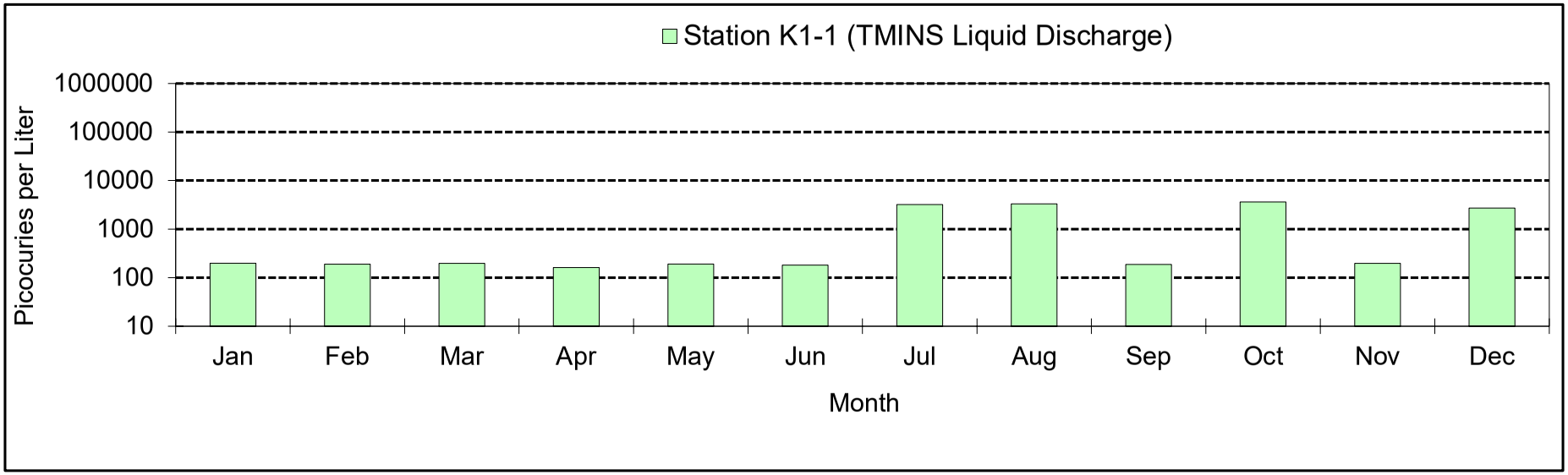


FIGURE C-2
Mean Quarterly Tritium Concentrations in Surface Water
Three Mile Island Nuclear Station, 1974 - 2022

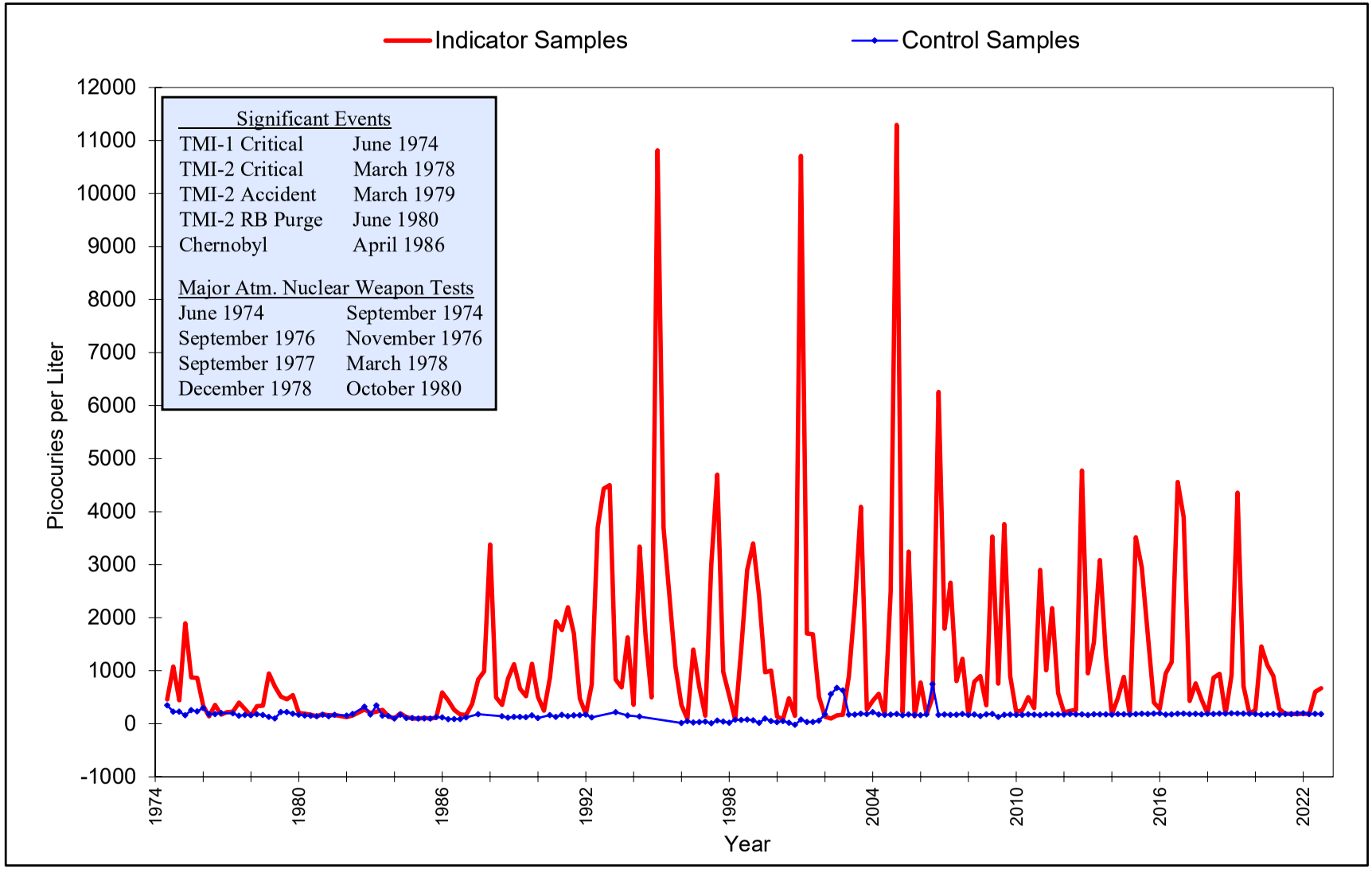


FIGURE C-3
Mean Monthly Gross Beta Concentrations in Drinking Water
Three Mile Island Nuclear Station, 2022

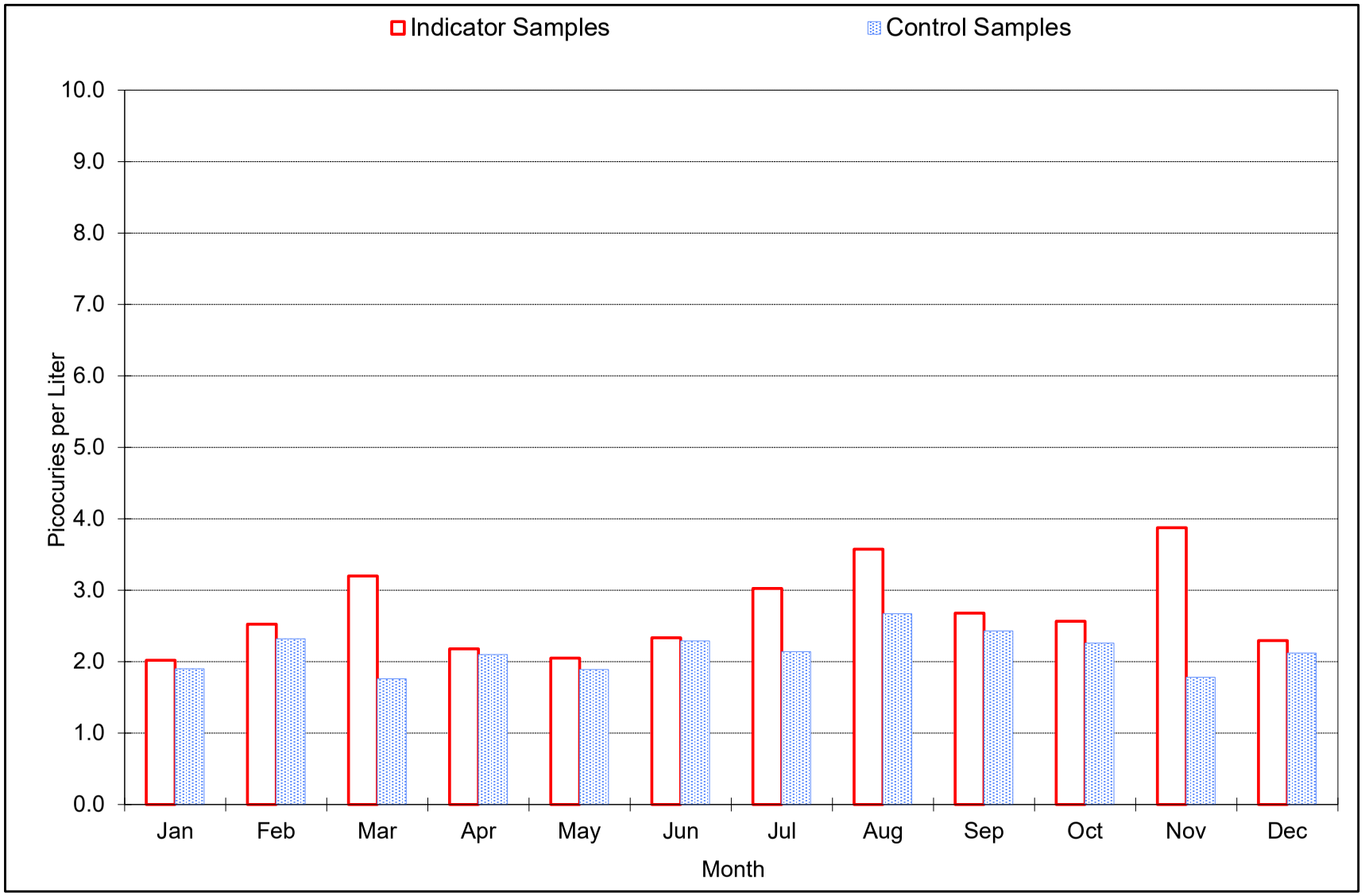
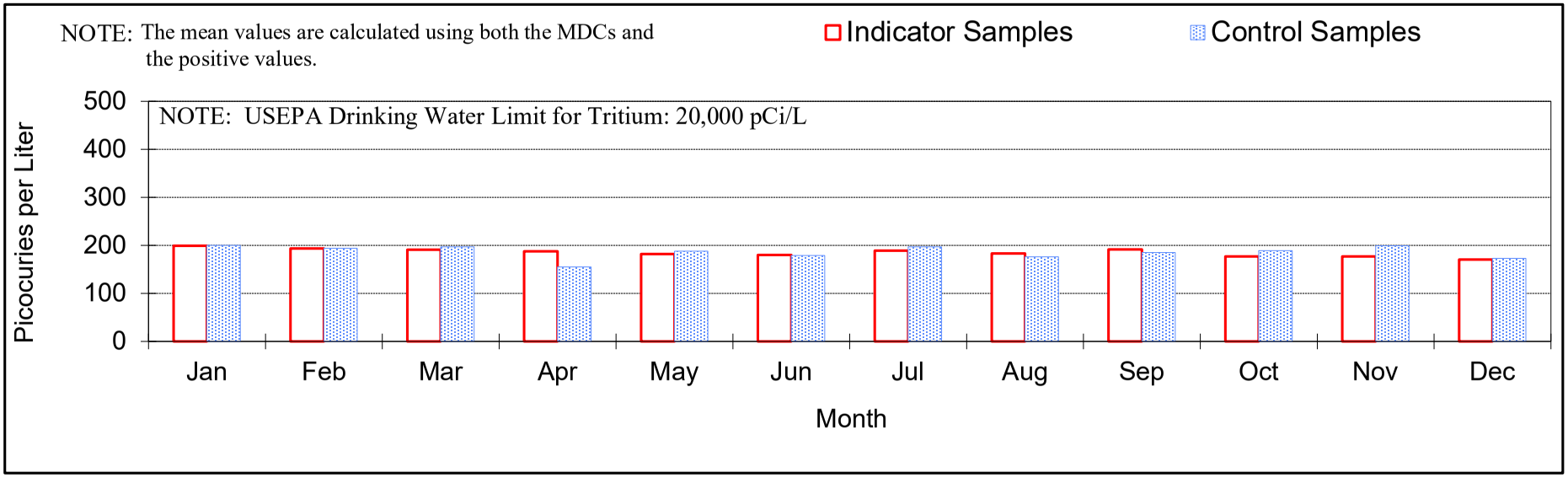


FIGURE C-4
Mean Monthly Tritium Concentrations in Drinking Water and Effluent Water
Three Mile Island Nuclear Station, 2022



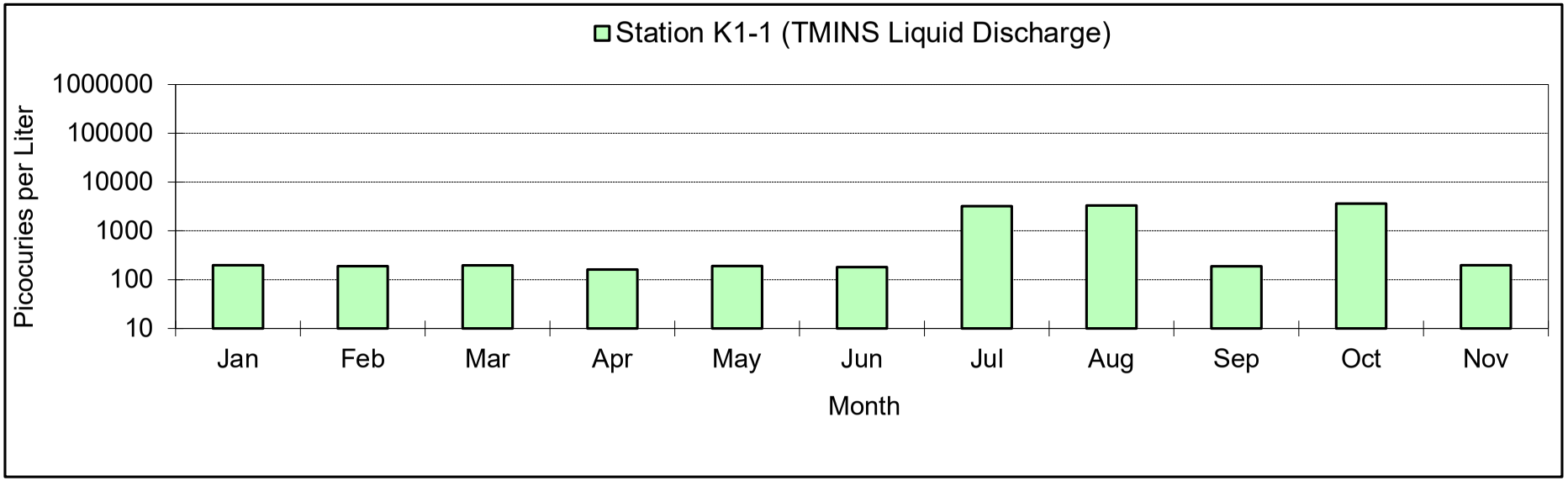


FIGURE C-5
Mean Cesium-137 Concentrations in Aquatic Sediments
Three Mile Island Nuclear Station, 1984 – 2022

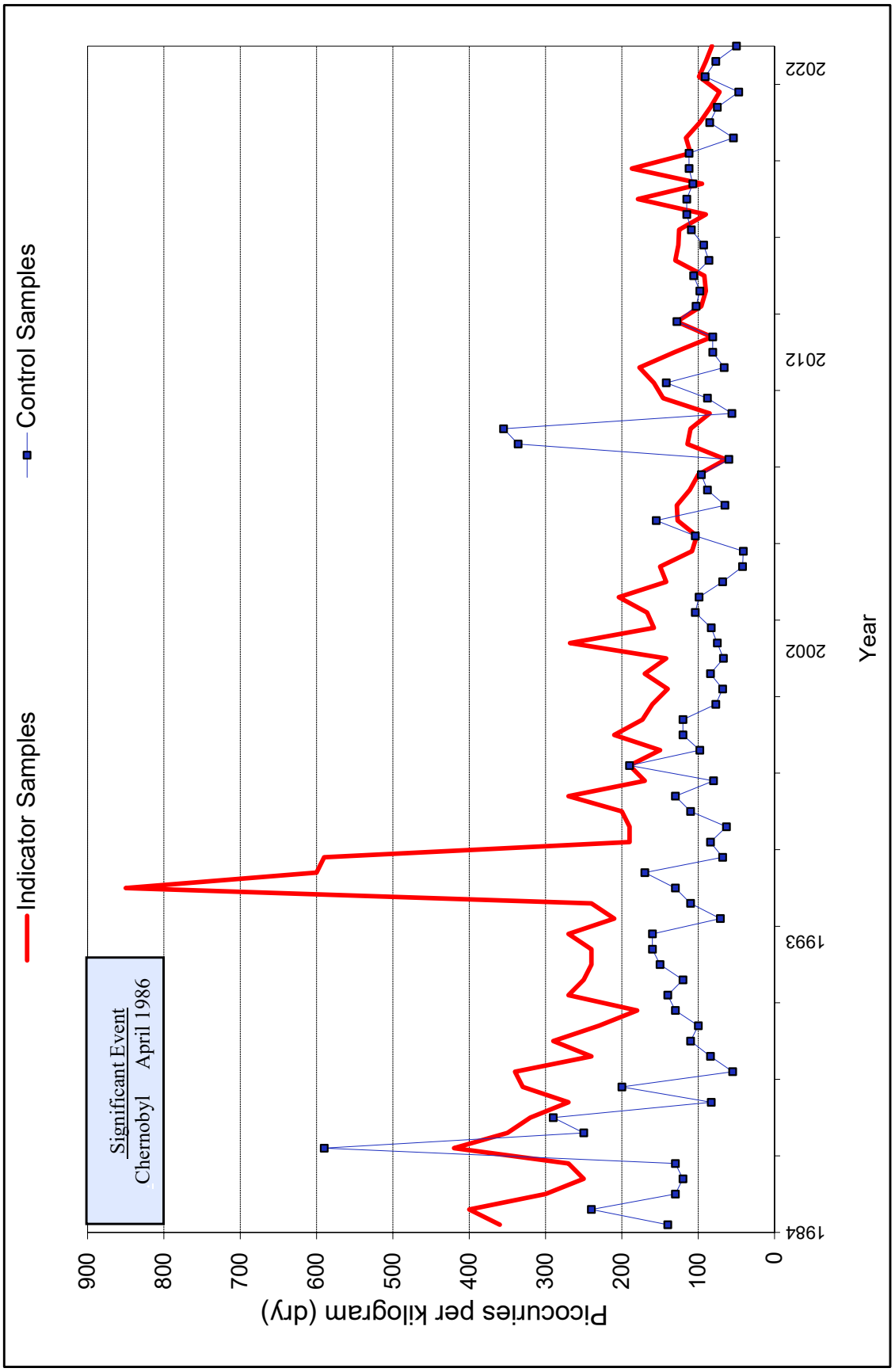


FIGURE C-6
Mean Quarterly Gross Beta Concentrations in Air Particulates
Three Mile Island Nuclear Station, 1972 - 2022

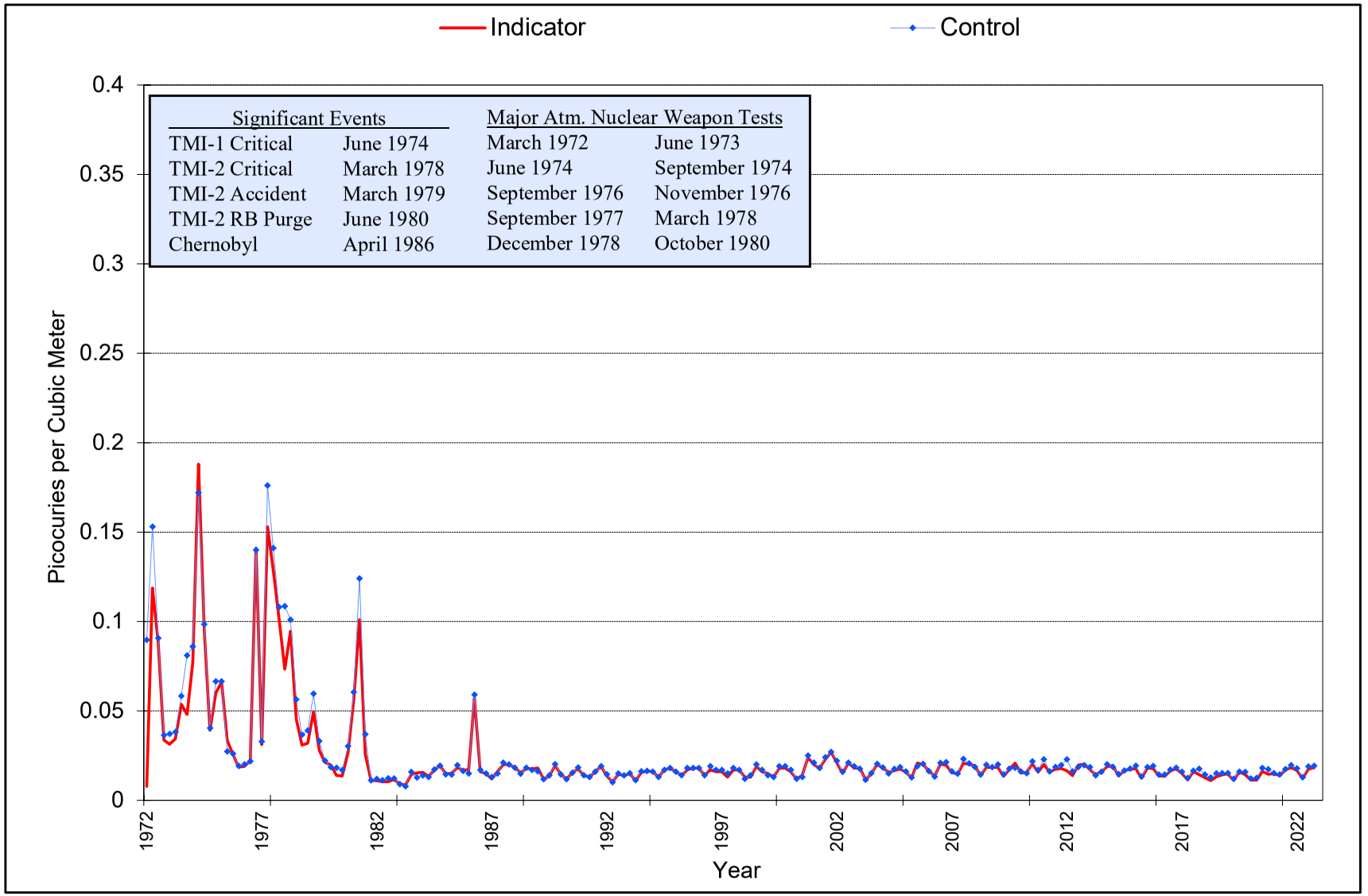
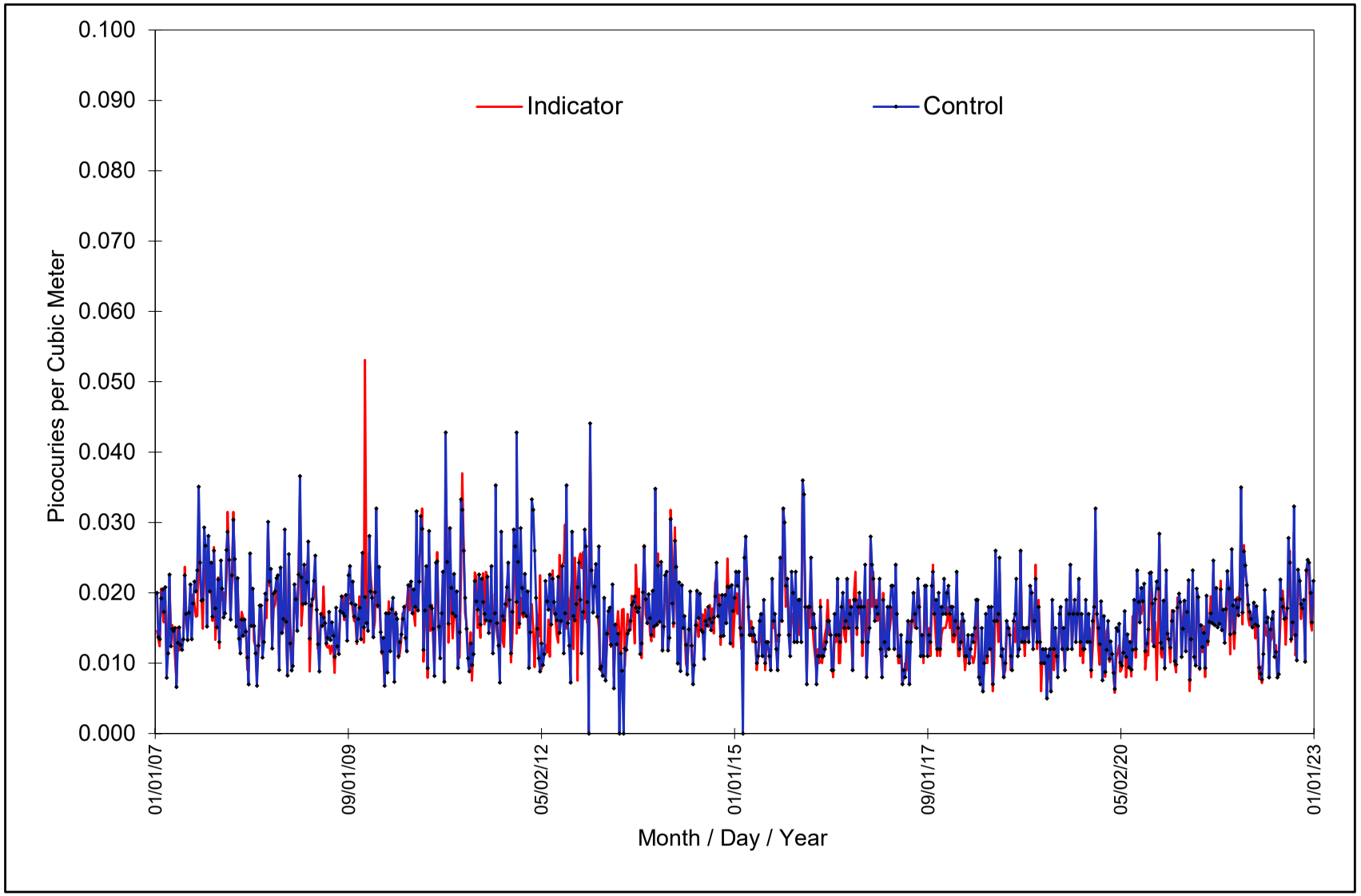
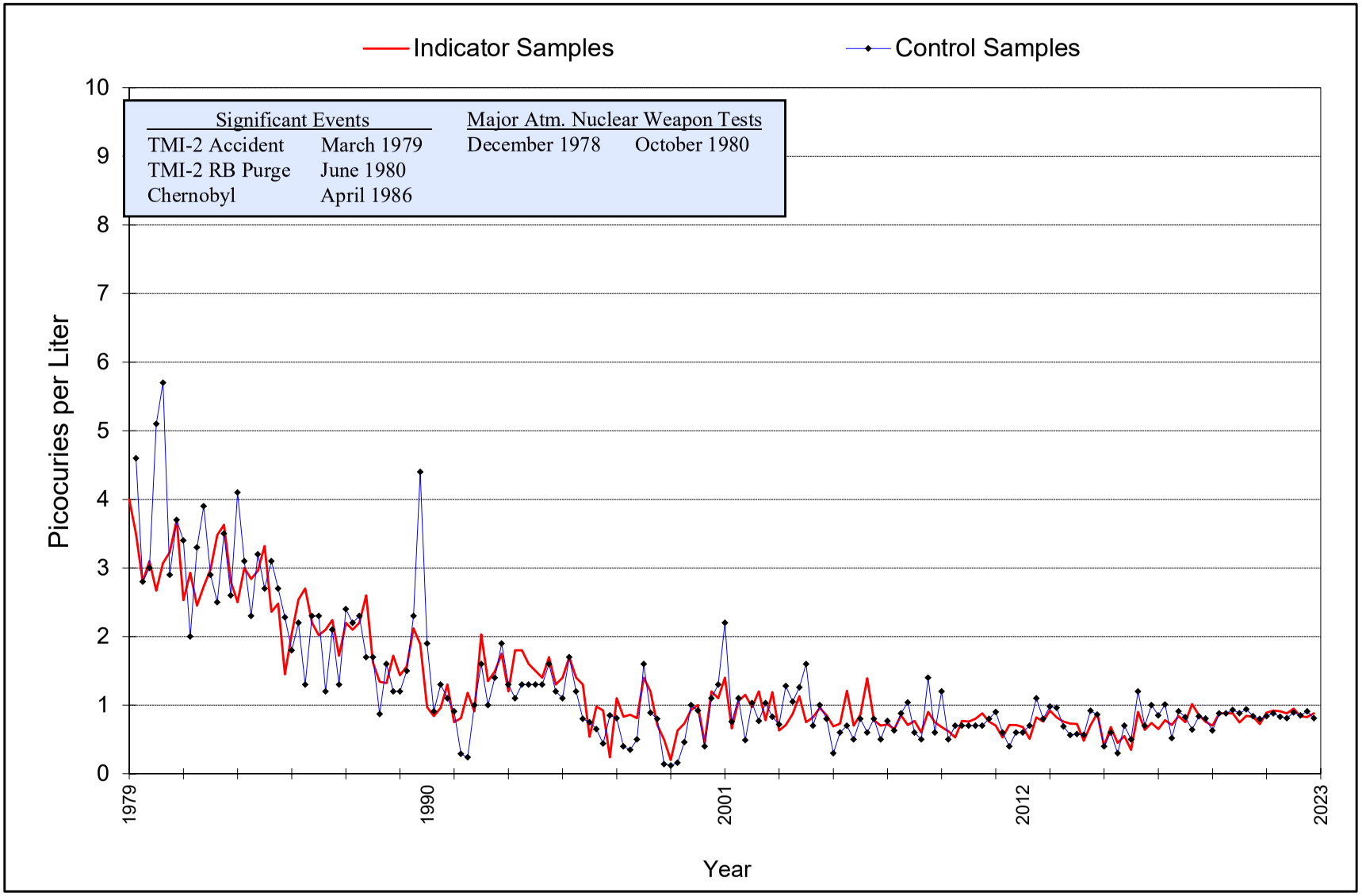


FIGURE C-7
Mean Weekly Gross Beta Concentrations in Air Particulates
Three Mile Island Nuclear Station, 2007 - 2022



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 - 2022



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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, Constellation Energy Group (CEG) 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, 2022

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

LAB	COLLECTION PERIOD	Q9-1Q
CGS	12/29/21 - 02/03/22	17.7 ± 1.5
	02/03/22 - 03/03/22	2.0 ± 0.8
	03/03/22 - 03/30/22	2.1 ± 0.8
	03/30/22 - 04/27/22	< 1.2
	04/27/22 - 06/02/22	1.1 ± 0.7
	06/02/22 - 06/30/22	1.5 ± 0.8
	06/30/22 - 07/27/22	1.4 ± 0.8
	07/27/22 - 09/01/22	3.5 ± 0.3
	09/01/22 - 09/29/22	2.1 ± 0.8
	09/29/22 - 11/03/22	2.8 ± 0.8
	11/03/22 - 11/30/22	2.1 ± 0.7
	11/30/22 - 12/29/22	2.8 ± 0.8
	MEAN ± 2 STD DEV	3.3 ± 9.1

TABLE D-I.2 CONCENTRATIONS OF TRITIUM IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2022

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

LAB	COLLECTION PERIOD	Q9-1Q
GEL	12/29/21 - 03/30/22	< 146
	03/30/22 - 06/30/22	< 143
	06/30/22 - 09/29/22	< 139
	09/29/22 - 12/29/22	< 188
	MEAN	-

TABLE D-I.3 CONCENTRATIONS OF IODINE-131 IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2022

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

LAB	COLLECTION PERIOD	Q9-1Q
CGS	12/29/21 - 02/03/22	< 0.4
	02/03/22 - 03/03/22	< 0.9
	03/03/22 - 03/30/22	< 0.6
	03/30/22 - 04/27/22	< 0.4
	04/27/22 - 06/02/22	< 0.4
	06/02/22 - 06/30/22	< 0.4
	06/30/22 - 07/27/22	< 0.3
	07/27/22 - 09/01/22	< 0.3
	09/01/22 - 09/29/22	< 0.5
	09/29/22 - 11/03/22	< 0.4
	11/03/22 - 11/30/22	< 0.4
	11/30/22 - 12/29/22	< 0.5
	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, 2022

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
CGS	Q9-1Q	12/29/21 - 02/03/22	< 6	< 6	< 12	< 7	< 15	< 6	< 10	< 7	< 7	< 23	< 8
		02/03/22 - 03/03/22	< 6	< 7	< 13	< 7	< 14	< 7	< 11	< 7	< 7	< 33	< 11
		03/03/22 - 03/30/22	< 6	< 6	< 12	< 6	< 13	< 6	< 11	< 6	< 6	< 40	< 14
		03/30/22 - 04/27/22	< 4	< 3	< 10	< 4	< 8	< 5	< 7	< 5	< 5	< 17	< 5
		04/27/22 - 06/02/22	< 4	< 6	< 10	< 4	< 10	< 5	< 7	< 3	< 5	< 23	< 8
		06/02/22 - 06/30/22	< 4	< 4	< 6	< 4	< 9	< 5	< 5	< 4	< 5	< 26	< 10
		06/30/22 - 07/27/22	< 3	< 3	< 6	< 3	< 5	< 4	< 5	< 3	< 4	< 16	< 7
		07/27/22 - 09/01/22	< 3	< 3	< 6	< 3	< 5	< 4	< 1	< 3	< 4	< 17	< 6
		09/01/22 - 09/29/22	< 5	< 3	< 6	< 3	< 8	< 4	< 6	< 4	< 3	< 13	< 7
		09/29/22 - 11/03/22	< 3	< 2	< 5	< 1	< 7	< 4	< 5	< 3	< 4	< 12	< 4
		11/03/22 - 11/30/22	< 3	< 2	< 8	< 4	< 7	< 4	< 5	< 2	< 4	< 14	< 7
		11/30/22 - 12/29/22	< 3	< 2	< 7	< 4	< 8	< 4	< 5	< 3	< 2	< 13	< 6
		MEAN	-	-	-	-	-	-	-	-	-	-	-

TABLE D-II.1

CONCENTRATIONS OF STRONTIUM AND GAMMA EMITTERS IN FISH SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2022

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
CGS	INDP	10/06/22			2950 ± 246	< 8	< 8	< 33	< 9	< 22	< 6	< 7
GEL	INDP	10/06/22	< 43	< 25								

TABLE D-III.1 CONCENTRATIONS OF GAMMA EMITTERS IN SEDIMENT SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2022

LAB	SITE	COLLECTION PERIOD	K-40	Cs-134	Cs-137
CGS	J2-1	11/21/22	12100 ± 2140	< 91	< 127

TABLE D-IV.1 CONCENTRATIONS OF GAMMA EMITTERS AND STRONTIUM IN FOOD PRODUCT SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2022

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
GEL	B10-2	Cabbage	08/17/22						56.3 ± 18.4	56.9 ± 8.9
CGS	H1-2Q	Cabbage	08/17/22	634 ± 95	3700 ± 227	< 25	< 18	< 21		
CGS	H1-2Q	Pumpkin	07/20/22	534 ± 88	5330 ± 289	< 20	< 21	< 26		
CGS	H1-2Q	Zucchini	08/17/22	1330 ± 157	3440 ± 272	< 31	< 20	< 22		
CGS	H1-2Q	Pumpkin	09/20/22	3050 ± 314	4540 ± 575	< 20	< 18	< 26		

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, 2022

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

LAB	COLLECTION PERIOD	E1-2Q GROSS BETA	E1-2Q I-131
CGS	12/29/21 - 01/05/22	24 ± 2	< 14
	01/05/22 - 01/12/22	32 ± 2	< 18
	01/12/22 - 01/19/22	33 ± 2	< 15
	01/19/22 - 01/27/22	25 ± 2	< 18
	01/27/22 - 02/03/22	23 ± 2	< 12
	02/03/22 - 02/10/22	25 ± 2	< 13
	02/10/22 - 02/16/22	18 ± 2	< 17
	02/16/22 - 02/24/22	23 ± 2	< 14
	02/24/22 - 03/03/22	25 ± 2	< 14
	03/03/22 - 03/11/22	16 ± 2	< 16
	03/11/22 - 03/16/22	23 ± 3	< 49
	03/16/22 - 03/24/22	19 ± 2	< 17
	03/24/22 - 03/30/22	11 ± 2	< 32
	03/30/22 - 04/06/22	16 ± 2	< 26
	04/06/22 - 04/13/22	9 ± 2	< 10
	04/13/22 - 04/20/22	15 ± 2	< 13
	04/20/22 - 04/27/22	23 ± 2	< 22
	04/27/22 - 05/06/22	19 ± 2	< 9
	05/06/22 - 05/12/22	16 ± 2	< 26
	05/12/22 - 05/19/22	10 ± 2	< 21
	05/19/22 - 05/26/22	20 ± 2	< 16
	05/26/22 - 06/02/22	20 ± 2	< 17
	06/02/22 - 06/08/22	15 ± 3	< 14
	06/08/22 - 06/16/22	18 ± 2	< 7
	06/16/22 - 06/23/22	21 ± 2	< 18
	06/23/22 - 06/30/22	16 ± 3	< 20
	06/30/22 - 07/07/22	26 ± 1	< 21
	07/07/22 - 07/15/22	21 ± 3	< 10
	07/15/22 - 07/21/22	26 ± 2	< 11
	07/21/22 - 07/27/22	32 ± 2	< 18
	07/27/22 - 08/04/22	24 ± 3	< 11
	08/04/22 - 08/11/22	28 ± 4	< 21
	08/11/22 - 08/19/22	15 ± 1	< 18
	08/19/22 - 08/25/22	24 ± 2	< 12
	08/25/22 - 09/01/22	21 ± 2	< 19
	09/01/22 - 09/07/22	21 ± 2	< 12
	09/07/22 - 09/15/22	20 ± 2	< 8
	09/15/22 - 09/22/22	45 ± 3	< 15
	09/22/22 - 09/29/22	20 ± 2	< 10
	09/29/22 - 10/06/22	15 ± 2	< 11
	10/06/22 - 10/12/22	36 ± 3	< 15
	10/12/22 - 10/21/22	25 ± 2	< 12
	10/21/22 - 10/27/22	24 ± 2	< 27
	10/27/22 - 11/03/22	26 ± 2	< 13
	11/03/22 - 11/10/22	21 ± 2	< 13
	11/10/22 - 11/17/22	17 ± 2	< 10
	11/17/22 - 11/23/22	29 ± 3	< 16
	11/23/22 - 11/30/22	41 ± 3	< 17
	11/30/22 - 12/07/22	34 ± 3	< 14
	12/07/22 - 12/15/22	22 ± 2	< 6
	12/15/22 - 12/21/22	23 ± 3	< 17
	12/21/22 - 12/29/22	28 ± 3	< 23
	MEAN ± 2 STD DEV	23 ± 14	-

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, 2022

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

LAB	SITE	COLLECTION PERIOD	Be-7	Mn-54	Co-58	Co-60
CGS	E1-2Q	12/29/21 - 03/30/22	72 ± 18	< 2	< 2	< 3
		03/30/22 - 06/30/22	82 ± 6	< 1	< 1	< 1
		06/30/22 - 09/29/22	68 ± 13	< 1	< 1	< 1
		09/29/22 - 12/29/22	49 ± 14	< 1	< 1	< 1
		MEAN ± 2 STD DEV	68 ± 28	-	-	-

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, 2022

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
CGS	G2-1Q	01/19/22	< 0.4	1290 ± 135	< 7	< 7	< 28	< 9		
CGS		02/16/22	< 0.5	967 ± 123	< 6	< 7	< 33	< 9		
CGS		03/16/22	< 0.8	1450 ± 143	< 6	< 7	< 3	< 10		
CGS		03/30/22	< 0.8	1280 ± 143	< 9	< 9	< 41	< 15		
GEL		01/19/22 - 03/30/22							< 5.1	< 1.8
CGS		04/13/22	< 0.2	1180 ± 137	< 6	< 7	< 23	< 7		
CGS		04/27/22	< 0.5	1490 ± 145	< 3	< 4	< 24	< 7		
CGS		05/11/22	< 0.4	1230 ± 131	< 3	< 4	< 16	< 5		
CGS		05/26/22	< 0.4	1380 ± 139	< 3	< 4	< 18	< 5		
CGS		06/08/22	< 0.3	1410 ± 77	< 5	< 6	< 26	< 8		
CGS		06/22/22	< 0.4	961 ± 62	< 5	< 5	< 16	< 6		
GEL		04/13/22 - 06/22/22							< 4.2	< 1.4
CGS		07/07/22	< 0.4	1460 ± 95	< 4	< 5	< 22	< 10		
CGS		07/20/22	< 0.3	792 ± 56	< 5	< 5	< 27	< 7		
CGS		08/03/22	< 0.4	1180 ± 64	< 4	< 3	< 19	< 8		
CGS		08/17/22	< 0.3	1390 ± 71	< 4	< 3	< 21	< 6		
CGS		08/31/22	< 0.4	1090 ± 62	< 3	< 4	< 12	< 1		
CGS		09/15/22	< 0.4	1100 ± 122	< 5	< 5	< 17	< 8		
CGS		09/29/22	< 0.3	1490 ± 144	< 3	< 4	< 19	< 4		
GEL		07/07/22 - 09/29/22							< 3.7	< 2.0
CGS		10/12/22	< 0.3	1340 ± 140	< 4	< 4	< 19	< 8		
CGS		10/27/22	< 0.3	1480 ± 144	< 3	< 4	< 16	< 5		
CGS		11/10/22	< 0.4	1330 ± 137	< 4	< 4	< 25	< 7		
CGS		11/23/22	< 0.5	1510 ± 143	< 4	< 4	< 20	< 6		
CGS		12/07/22	< 0.4	1290 ± 134	< 4	< 5	< 22	< 7		
GEL		10/12/22 - 12/07/22							< 2.7	< 1.2
		MEAN ± 2 STD DEV		1277 ± 394	-	-	-	-	-	-

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, 2022

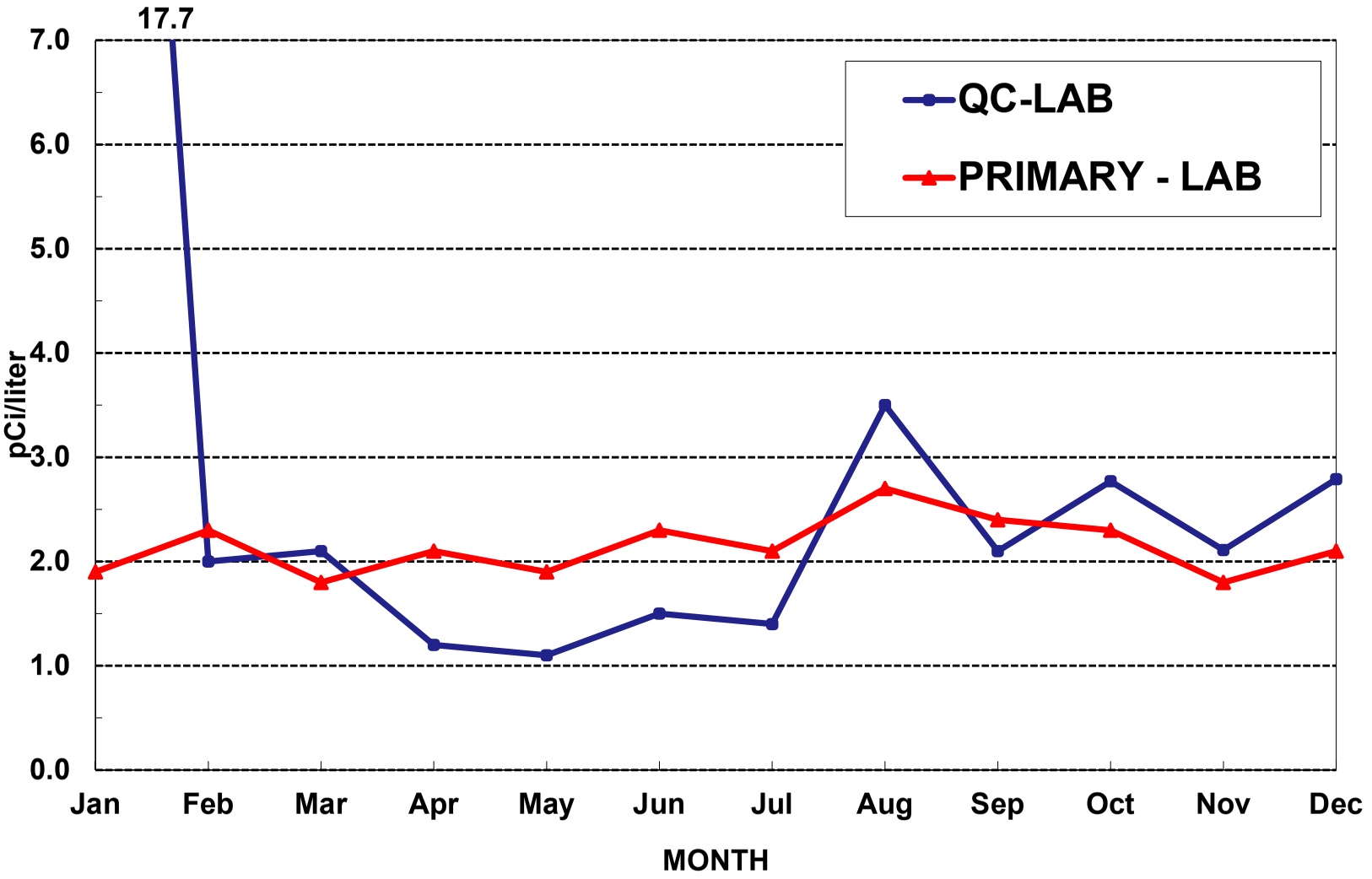
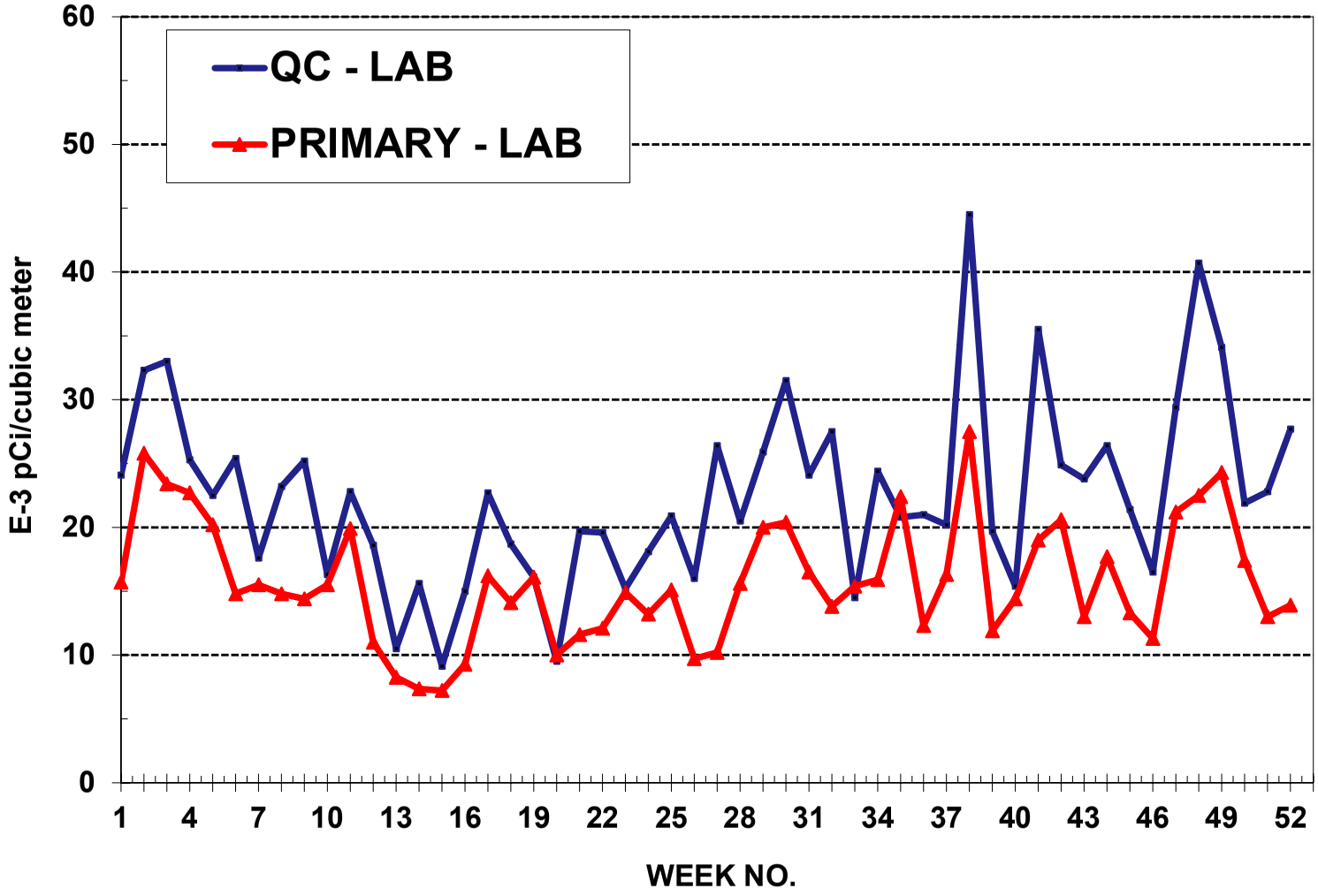


FIGURE D-2
WEEKLY GROSS BETA CONCENTRATIONS IN AIR PARTICULATE SAMPLES COLLECTED FROM TMINS LOCATION E1-2Q, 2022



APPENDIX E

INTER-LABORATORY COMPARISON PROGRAM

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Analytics Environmental Radioactivity Cross Check Program

Table E.1 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 2022	E13706	Milk	Sr-89	pCi/L	80.3	96.8	0.83	A
			Sr-90	pCi/L	12.7	12.6	1.01	A
	E13707	Milk	Ce-141	pCi/L	62.3	65	0.96	A
			Co-58	pCi/L	158	164	0.96	A
			Co-60	pCi/L	286	302	0.95	A
			Cr-51	pCi/L	314	339	0.93	A
			Cs-134	pCi/L	155	182	0.85	A
			Cs-137	pCi/L	210	223	0.94	A
			Fe-59	pCi/L	211	185	1.14	A
			I-131	pCi/L	88.0	96.7	0.91	A
			Mn-54	pCi/L	169	164	1.03	A
			Zn-65	pCi/L	238	246	0.97	A
	E13708	Charcoal	I-131	pCi	79.9	87.1	0.92	A
	E13709	AP	Ce-141	pCi	60.9	42.0	1.45	N[1]
			Co-58	pCi	118	107	1.11	A
			Co-60	pCi	218	196	1.11	A
			Cr-51	pCi	251	221	1.14	A
			Cs-134	pCi	129	118	1.09	A
			Cs-137	pCi	156	145.0	1.07	A
			Fe-59	pCi	124	120.0	1.03	A
			Mn-54	pCi	120	107	1.12	A
			Zn-65	pCi	162	160	1.01	A
	E13710	Soil	Ce-141	pCi/g	0.123	0.103	1.19	A
			Co-58	pCi/g	0.254	0.263	0.97	A
			Co-60	pCi/g	0.493	0.483	1.02	A
			Cr-51	pCi/g	0.603	0.543	1.11	A
			Cs-134	pCi/g	0.268	0.292	0.92	A
			Cs-137	pCi/g	0.399	0.431	0.93	A
			Fe-59	pCi/g	0.320	0.296	1.08	A
			Mn-54	pCi/g	0.263	0.263	1.00	A
			Zn-65	pCi/g	0.407	0.395	1.03	A
	E13711	AP	Sr-89	pCi	83.2	97.4	0.85	A
			Sr-90	pCi	12.7	12.7	1.00	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 22-04***

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 2022	E13712	Milk	Sr-89	pCi/L	71.1	89.1	0.80	A
			Sr-90	pCi/L	12.0	13.6	0.88	A
	E13713	Milk	Ce-141	pCi/L	148	161	0.92	A
			Co-58	pCi/L	178	189	0.94	A
			Co-60	pCi/L	229	260	0.88	A
			Cr-51	pCi/L	486	456	1.07	A
			Cs-134	pCi/L	220	252	0.87	A
			Cs-137	pCi/L	203	222	0.92	A
			Fe-59	pCi/L	174	173	1.01	A
			I-131	pCi/L	75.9	94.2	0.81	A
			Mn-54	pCi/L	269	282	0.95	A
			Zn-65	pCi/L	364	373	0.97	A
	E13714	Charcoal	I-131	pCi	81.4	83.6	0.97	A
	E13715	AP	Ce-141	pCi	102	91	1.12	A
			Co-58	pCi	118	107	1.11	A
			Co-60	pCi	207	147	1.41	N[(2)]
			Cr-51	pCi	310	257	1.21	W
			Cs-134	pCi	148	142	1.04	A
			Cs-137	pCi	137	125	1.10	A
			Fe-59	pCi	115	98	1.18	A
			Mn-54	pCi	168	159	1.05	A
			Zn-65	pCi	240	211	1.14	A
	E13716	Soil	Ce-141	pCi/g	0.288	0.284	1.01	A
			Co-58	pCi/g	0.320	0.334	0.96	A
			Co-60	pCi/g	0.445	0.459	0.97	A
			Cr-51	pCi/g	0.883	0.805	1.10	A
			Cs-134	pCi/g	0.410	0.446	0.92	A
			Cs-137	pCi/g	0.447	0.465	0.96	A
			Fe-59	pCi/g	0.314	0.305	1.03	A
			Mn-54	pCi/g	0.489	0.499	0.98	A
			Zn-65	pCi/g	0.666	0.660	1.01	A
	E13717	AP	Sr-89	pCi	87.5	98.3	0.89	A
			Sr-90	pCi	12.6	15.0	0.84	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

*(2) See **NCR 22-21***

DOE's Mixed Analyte Performance Evaluation Program (MAPEP)

Table E.2 Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Acceptance Range	Evaluation [b]
February 2022	22-GrF46	AP	Gross Alpha	Bq/sample	0.402	1.20	0.36 - 2.04	A
			Gross Beta	Bq/sample	0.669	0.68	0.341 - 1.022	A
	22-MaS46	Soil	Ni-63	Bq/kg	645	780	546 - 1014	A
			Tc-99	Bq/kg	526	778	545 - 1011	N(3)
	22-MaSU46	Urine	Cs-134	Bq/L	1.67	1.77	1.24 - 2.30	A
			Cs-137	Bq/L	1.50	1.56	1.09 - 2.03	A
			Co-57	Bq/L	4.93	5.39	3.77 - 7.01	A
			Co-60	Bq/L	2.13	2.06	1.44 - 2.68	A
			Mn-54	Bq/L	4.83	5.08	3.56 - 6.60	A
			U-234	Bq/L	0.142	0.0074	0.0052 - 0.0096	N(4)
			U-238	Bq/L	0.0254	0.0103	0.0072 - 0.0134	N(4)
			Zn-65	Bq/L	4.71	4.48	3.14 - 5.82	A
	22-MaW46	Water	Ni-63	Bq/L	28.6	34.0	23.8 - 44.2	A
			Tc-99	Bq/L	8.59	7.90	5.5 - 10.3	A
	22-RdV46	Vegetation	Cs-134	Bq/sample	6.61	7.61	5.33 - 9.89	A
			Cs-137	Bq/sample	1.50	1.52	1.06 - 1.98	A
			Co-57	Bq/sample	5.11	5.09	3.56 - 6.62	A
			Co-60	Bq/sample	0.0162		*(1)*	A
			Mn-54	Bq/sample	2.42	2.59	1.81 - 3.37	A
			Sr-90	Bq/sample	0.684	0.789	0.552 - 1.026	A
			Zn-65	Bq/sample	1.44	1.47	1.03 - 1.91	A
August 2022	22-MaS47	Soil	Ni-63	Bq/kg	14.6		*(1)*	A
			Tc-99	Bq/kg	994	1000	700 - 1300	A
	22-MaW47	Water	Ni-63	Bq/L	24.4	32.9	23.0 - 42.8	A
			Tc-99	Bq/L	1.9		*(1)*	N(5)
	25-RdV47	Vegetation	Cs-134	Bq/sample	0.032		*(1)*	A
			Cs-137	Bq/sample	0.891	1.08	0.758 - 1.408	A
			Co-57	Bq/sample	0.006		*(1)*	A
			Co-60	Bq/sample	4.04	4.62	3.23 - 6.01	A
			Mn-54	Bq/sample	2.01	2.43	1.70 - 3.16	A
			Sr-90	Bq/sample	1.25	1.60	1.12 - 2.08	W
			Zn-65	Bq/sample	6.16	7.49	5.24 - 9.74	A

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

(b) DOE/MAPEP evaluation:

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

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

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

(1) False positive test

(2) Sensitivity evaluation

(3) Tc-99 soil cross-checks done for TBE information only - not required

*(4) See **NCR 22-05***

*(5) See **NCR 22-22***

ERA Environmental Radioactivity Cross Check Program

Table E.3 **Teledyne Brown Engineering Environmental Services**

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Acceptance Limits	Evaluation [b]
March 2022	MRAD-36	Water	Am-241	pCi/L	68.3	74.6	51.2 - 95.4	A
			Fe-55	pCi/L	797	1140	670 - 1660	A
			Pu-238	pCi/L	146	147	88.4 - 190	A
			Pu-239	pCi/L	69.9	71.9	44.5 - 88.6	A
		Soil	Sr-90	pCi/kg	8050	6720	2090 - 10500	A
		AP	Fe-55	pCi/filter	148	127	46.4 - 203	A
			Pu-238	pCi/filter	29.9	29.6	22.3 - 36.4	A
			Pu-239	pCi/filter	51.6	49.7	37.2 - 60.0	A
			U-234	pCi/filter	59.9	67.3	49.9 - 78.9	A
			U-238	pCi/filter	59.0	66.7	50.4 - 79.6	A
			GR-A	pCi/filter	95.6	94.2	49.2 - 155	A
			GR-B	pCi/filter	71.2	66.8	40.5 - 101	A
April 2022	RAD-129	Water	Ba-133	pCi/L	61.7	62.9	52.3 - 69.2	A
			Cs-134	pCi/L	80.9	81.6	68.8 - 89.8	A
			Cs-137	pCi/L	37.4	36.6	32.1 - 43.3	A
			Co-60	pCi/L	103	97.4	87.7 - 109	A
			Zn-65	pCi/L	318	302	272 - 353	A
			GR-A	pCi/L	26.9	20.8	10.4 - 28.3	A
			GR-B	pCi/L	49.7	51.0	34.7 - 58.1	A
			U-Nat	pCi/L	56.3	68.9	56.3 - 75.8	A
			H-3	pCi/L	17,000	18,100	15,800 - 19,000	A
			Sr-89	pCi/L	65.3	67.9	55.3 - 76.1	A
			Sr-90	pCi/L	42.1	42.7	31.5 - 49.0	A
			I-131	pCi/L	25.7	26.2	21.8 - 30.9	A
September 2022	MRAD-37	Water	Am-241	pCi/L	111	96.2	66.0 - 123	A
			Fe-55	pCi/L	850	926	544 - 1350	A
			Pu-238	pCi/L	62.1	52.6	31.6 - 68.2	A
			Pu-239	pCi/L	139.5	117	72.5 - 144	A
		Soil	Sr-90	pCi/kg	3350	6270	1950 - 9770	A
			U-234	pCi/kg	1684	3350	1570 - 4390	A
			U-238	pCi/kg	1658	3320	1820 - 4460	N(2)
		AP	Fe-55	pCi/filter	71.9	122	44.5 - 195	A
			Pu-238	pCi/filter	38.8	29.9	22.6 - 36.7	N(1)
			Pu-239	pCi/filter	14.5	13.0	9.73 - 15.7	A
			U-234	pCi/filter	78.0	71.5	53.0 - 83.8	A
			U-238	pCi/filter	79.7	70.9	53.5 - 84.6	A
			GR-A	pCi/filter	62.8	55.5	29.0 - 91.4	A
			GR-B	pCi/filter	70.9	64.8	39.3 - 97.9	A
October 2022	RAD-131	Water	Ba-133	pCi/L	76.2	79.4	66.6 - 87.3	A
			Cs-134	pCi/L	28.0	30.5	23.9 - 33.6	A
			Cs-137	pCi/L	202	212	191 - 235	A
			Co-60	pCi/L	52.4	51.4	46.3 - 59.1	A
			Zn-65	pCi/L	216	216	194 - 253	A
			GR-A	pCi/L	19.7	16.9	8.28 - 23.7	A
			GR-B	pCi/L	49.8	53.0	36.1 - 60.0	A
			U-Nat	pCi/L	10.54	8.53	6.60 - 9.88	N(3)
			H-3	pCi/L	13,900	15,100	13,200 - 16,600	A
			Sr-89	pCi/L	59.7	64.5	52.3 - 72.5	A
			Sr-90	pCi/L	32.9	37.3	27.4 - 43.0	A
			I-131	pCi/L	26.9	24.4	20.2 - 28.9	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 22-19***

(2) U soil cross-checks done for TBE information only - not required

*(3) See **NCR 22-20***

TABLE E.4 **Analytics Environmental Radioactivity Cross Check Program**
Constellation Generation Solutions (2022)

Month/Year	Identification Number	Matrix	Nuclide	Units	EIS Reported Value	Known Value [a]	Ratio of Analytics to EIS Result	Evaluation [b]
March 2022	E13643	Milk	I-131	pCi/L	98.9	96.7	102	Pass
	Detector 4		Ce-141	pCi/L	58.6	64.6	90.7	Pass
			Co-58	pCi/L	160	164	97.6	Pass
			Co-60	pCi/L	313	302	104	Pass
			Cr-51	pCi/L	390	339	115	Pass
			Cs-134	pCi/L	168	182	92.3	Pass
			Cs-137	pCi/L	222	223	100	Pass
			Fe-59	pCi/L	185	185	100	Pass
			Mn-54	pCi/L	157	164	95.7	Pass
			Zn-65	pCi/L	231	246	93.9	Pass
	E13643	Milk	I-131	pCi/L	96.2	96.7	99.5	Pass
	Detector 5		Ce-141	pCi/L	71.6	64.6	111	Pass
			Co-58	pCi/L	164	164	100	Pass
			Co-60	pCi/L	302	302	100	Pass
			Cr-51	pCi/L	398	339	117	Pass
			Cs-134	pCi/L	168	182	92.3	Pass
			Cs-137	pCi/L	212	223	95.1	Pass
			Fe-59	pCi/L	207	185	112	Pass
			Mn-54	pCi/L	166	164	101	Pass
			Zn-65	pCi/L	230	246	93.5	Pass
	E13644 (S5E)	Water	Gr-B	pCi/L	224	222	101	Pass
	E13645 (D2)	Charcoal	I-131	pCi	81.9	88.2	92.9	Pass
	Detector 3				84.7	88.2	96.0	Pass
	Detector 4				82.0	88.2	93.0	Pass
June 2022	E13647	Water	I-131	pCi/L	112	91.2	123	Pass
	Detector 3		Ce-141	pCi/L	141	139	101	Pass
			Co-58	pCi/L	126	128	98.4	Pass
			Co-60	pCi/L	244	242	101	Pass
			Cr-51	pCi/L	314	344	91.3	Pass
			Cs-134	pCi/L	163	172	94.8	Pass
			Cs-137	pCi/L	213	204	104	Pass
			Fe-59	pCi/L	170	157	108	Pass
			Mn-54	pCi/L	243	229	106	Pass
			Zn-65	pCi/L	302	296	102	Pass
	E13647	Water	I-131	pCi/L	86.2	91.2	94.5	Pass
	Detector 4		Ce-141	pCi/L	126	139	90.6	Pass
			Co-58	pCi/L	124	128	96.9	Pass
			Co-60	pCi/L	248	242	102	Pass
			Cr-51	pCi/L	358	344	104	Pass
			Cs-134	pCi/L	163	172	94.8	Pass
			Cs-137	pCi/L	217	204	106	Pass
			Fe-59	pCi/L	180	157	115	Pass
			Mn-54	pCi/L	253	229	110	Pass
			Zn-65	pCi/L	253	296	85.5	Pass
	E13649	AP	Gr-B	pCi	276	242	114	Pass
	S5E		Gr-B	pCi	276	242	114	Pass
			Gr-B	pCi	275	242	114	Pass
	E13648	AP	Ce-141	pCi	96.7	96.6	100	Pass
	Detector 4		Co-58	pCi	89.2	89.3	100	Pass
			Co-60	pCi	171	168	102	Pass
			Cr-51	pCi	265	239	111	Pass
			Cs-134	pCi	104	119	87.4	Pass
			Cs-137	pCi	147	142	104	Pass
			Fe-59	pCi	136	109	125	Pass
			Mn-54	pCi	170	159	107	Pass
			Zn-65	pCi	198	206	96.1	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**
Constellation Generation Solutions (2022)

Month/Year	Identification Number	Matrix	Nuclide	Units	EIS Reported Value	Known Value [(a)]	Ratio of Analytics to EIS Result	Evaluation [(b)]
June 2022	E13648	AP	Ce-141	pCi	101	96.6	105	Pass
	Detector 5		Co-58	pCi	89.3	89.3	100	Pass
			Co-60	pCi	169	168	101	Pass
			Cr-51	pCi	252	239	105	Pass
			Cs-134	pCi	100	119	84.0	Pass
			Cs-137	pCi	142	142	100	Pass
			Fe-59	pCi	129	109	118	Pass
			Mn-54	pCi	168	159	106	Pass
			Zn-65	pCi	211	206	102	Pass
September 2022	E13650A	AP	Gr-B	pCi	242	224	108	Pass
December 2022	E13651	AP	Ce-141	pCi	144	140	103	Pass
	Detector 4		Co-58	pCi	143	144	99.3	Pass
			Co-60	pCi	174	181	96.1	Pass
			Cr-51	pCi	287	290	99.0	Pass
			Cs-134	pCi	93.0	120	77.5	Pass
			Cs-137	pCi	134	137	97.8	Pass
			Fe-59	pCi	142	124	115	Pass
			Mn-54	pCi	162	158	103	Pass
			Zn-65	pCi	192	191	101	Pass
	E13651	AP	Ce-141	pCi	146	140	104	Pass
	Detector 5		Co-58	pCi	140	144	97.2	Pass
			Co-60	pCi	180	181	99.4	Pass
			Cr-51	pCi	286	290	98.6	Pass
			Cs-134	pCi	94.5	120	78.8	Pass
			Cs-137	pCi	125	137	91.2	Pass
			Fe-59	pCi	148	124	119	Pass
			Mn-54	pCi	172	158	109	Pass
			Zn-65	pCi	199	191	104	Pass
	E13652 (S5E)	Water	Gr-B	pCi/L	308	283	109	Pass
	E13653 (D2)	Charcoal	I-131	pCi	88.7	91.6	96.8	Pass
	Detector 3				88.5	91.6	96.6	Pass
	Detector 4				93.5	91.6	102.1	Pass
	Detector 5				89.8	91.6	98.0	Pass
	E13654	Milk	I-131	pCi/L	104	95.1	109	Pass
	Detector 4		Ce-141	pCi/L	223	225	99.1	Pass
			Co-58	pCi/L	222	230	96.5	Pass
			Co-60	pCi/L	281	290	96.9	Pass
			Cr-51	pCi/L	433	464	93.3	Pass
			Cs-134	pCi/L	182	191	95.3	Pass
			Cs-137	pCi/L	214	219	97.7	Pass
			Fe-59	pCi/L	220	198	111	Pass
			Mn-54	pCi/L	252	252	100	Pass
			Zn-65	pCi/L	274	305	89.8	Pass
	E13654	Milk	I-131	pCi/L	102	95.1	107	Pass
	Detector 5		Ce-141	pCi/L	228	225	101	Pass
			Co-58	pCi/L	226	230	98.3	Pass
			Co-60	pCi/L	285	290	98.3	Pass
			Cr-51	pCi/L	494	464	106	Pass
			Cs-134	pCi/L	179	191	93.7	Pass
			Cs-137	pCi/L	231	219	105	Pass
			Fe-59	pCi/L	214	198	108	Pass
			Mn-54	pCi/L	252	252	100	Pass
			Zn-65	pCi/L	282	305	92.5	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
Constellation Generation Solutions (2022)

Month/Year	ID Number	Matrix	Nuclide	Units	EIS Reported Value	Known Value [(a)]	Acceptance Ratio of ERA to EIS Result	Evaluation [(b)]
April 2022	RAD-129	Water	Ba-133	pCi/L	56.6	62.9	90.0	Pass
	Detector 4		Cs-134	pCi/L	81.0	81.6	99.3	Pass
			Cs-137	pCi/L	37.8	36.6	103	Pass
			Co-60	pCi/L	97.6	97.4	100	Pass
			Zn-65	pCi/L	293	302	97.0	Pass
			I-131	pCi/L	27.1	26.2	103	Pass
	S5E	Water	GR-B	pCi/L	35.8	51.0	70.2	Fail[(1)]
September 2022	MRAD-37	AP	Cs-134	pCi	270	325	83.1	Pass
	Detector 4		Cs-137	pCi	706	795	88.8	Pass
			Co-60	pCi	198	191	104	Pass
			Zn-65	pCi	125	120	104	Pass
October 2022	RAD-131	Water	Ba-133	pCi/L	75.0	79.4	94.5	Pass
	Detector 4		Cs-134	pCi/L	29.0	30.5	95.1	Pass
			Cs-137	pCi/L	212	212	100	Pass
			Co-60	pCi/L	50.4	51.4	98.1	Pass
			Zn-65	pCi/L	212	216	98.1	Pass
			I-131	pCi/L	25.4	24.4	104	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

(1) Passed vendor acceptance criteria, but failed NRC Resolution Test criteria

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

Quarter/Year	Identification Number	Matrix	Nuclide	Units	Reported Value	Known Value [a]	Acceptance Range	Evaluation [b]
2nd/2022	22-MaW46	Water	Gr-A	Bq/L	0.782	0.87	0.26 - 1.48	A
			Co-57	Bq/L	37	36.0	25.2 - 46.8	A
			Co-60	Bq/L	9.64	9.3	6.5 - 12.1	A
			Cs-134	Bq/L	-0.0355		False Positive Test	A
			Cs-137	Bq/L	7.9	7.64	5.35 - 9.93	A
			Mn-54	Bq/L	19.8	18.9	13.2 - 24.6	A
			Zn-65	Bq/L	29.3	26.2	18.3 - 34.1	A
			H-3	Bq/L	303	300	210 - 390	A
			Sr-90	Bq/L	14.9	12.9	5.5 - 10.3	A
	22-RdV46	Veg	Sr-90	Bq/kg	1.12	0.789	0.552 - 1.026	N(1)
4th/2022	22-MaW47	Water	Gr-A	Bq/L	0.978	0.871	0.261 - 1.481	A
			Co-57	Bq/L	30.4	30.0	21.0 - 39.0	A
			Co-60	Bq/L	17.8	17.0	11.9 - 22.1	A
			Cs-134	Bq/L	15.9	17	12.0 - 22.2	A
			Cs-137	Bq/L	17.8	16.80	11.8 - 21.8	A
			Mn-54	Bq/L	-0.0317		False Positive Test	A
			Zn-65	Bq/L	12.6	11.3	7.9 - 14.7	A
			H-3	Bq/L	350	395	277 - 514	A
			Sr-90	Bq/L	7.49	7.73	5.41 - 10.05	A
	22-RdV47	Veg	Sr-90	Bq/kg	1.78	1.600	1.12 - 2.08	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) Correactive Action information in IV Results & Discussion, Section G

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

Quarter/Year	Identification Number	Matrix	Nuclide	Units	Reported Value	Known Value [a]	Acceptance Limits	Evaluation [b]
2nd/2022	MRAD-36	Water	Co-60	pCi/L	2,880	2,710	2,340 - 3,110	A
			Cs-134	pCi/L	1,620	1,720	1,300 - 1,890	A
			Cs-137	pCi/L	1,130	1,120	959 - 1,270	A
			Mn-54	pCi/L	<8.37	<71.0	<71.0	A
			Zn-65	pCi/L	1,320	1,220	1,090 - 1,540	A
			H-3	pCi/L	28,000	28,200	21,300 - 34,300	A
			Sr-90	pCi/L	639	628	452 - 776	A
			Gr-A	pCi/L	74.5	79.4	29.0 - 109	A
		Veg	Sr-90	pCi/kg	5,170	4,340	2450 - 5660	A
	RAD-129	Water	Sr-89	pCi/L	67.6	67.9	55.3 - 76.1	A
3rd/2022	RAD-130	Water	Co-60	pCi/L	79.0	72.4	65.2 - 82.1	A
			Cs-134	pCi/L	84.7	88.6	72.7 - 97.5	A
			Cs-137	pCi/L	177	170	153 - 189	A
			Zn-65	pCi/L	363	326	293 - 380	A
			H-3	pCi/L	20,200	22,100	19,400 - 24,300	A
			Sr-89	pCi/L	48.4	49.6	39.0 - 57.0	A
			Sr-89	pCi/L	47.4	49.6	39.0 - 57.0	A
			Sr-90	pCi/L	12.8	11.2	7.62 - 13.8	A
			Sr-90	pCi/L	11.9	11.2	7.62 - 13.8	A
			Gr-A	pCi/L	54.3	60.2	31.5 - 74.8	A
			Gr-A	pCi/L	58.8	60.2	31.5 - 74.8	A
4th/2022	MRAD-37	Water	Co-60	pCi/L	1,500	1,420	1,220 - 1,630	A
			Cs-134	pCi/L	452	483	365 - 531	A
			Cs-137	pCi/L	1,220	1,250	1,070 - 1,420	A
			Mn-54	pCi/L	<5.46	<71.0	<71.0	A
			Zn-65	pCi/L	145	122	109 - 154	A
			H-3	pCi/L	16,900	18,800	14,200 - 22,900	A
			Sr-90	pCi/L	283	224	161 - 277	N [1]
			Gr-A	pCi/L	46.6	42.7	15.6 - 58.9	A
		Veg	Sr-90	pCi/kg	4,560	2,960	1670 - 3860	N [1]

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

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

(1) Correactive Action information in IV Results & Discussion, Section G

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

Quarter/Year	Identification Number	Matrix	Nuclide	Units	Reported Value	Known Value [(a)]	Acceptance Limits	Evaluation [(b)]
1st/2022	E13656	Milk	Sr-89	pCi/L	93.0	96.8	1.03	A
			Sr-90	pCi/L	8.4	12.6	0.67	A
	E13658	Water	Co-58	pCi/L	205	193	1.06	A
			Co-60	pCi/L	379	355	1.07	A
			Cs-134	pCi/L	200	214	0.93	A
			Cs-137	pCi/L	265	263	1.01	A
			Fe-59	pCi/L	239	218	1.10	A
			Mn-54	pCi/L	207	193	1.07	A
			Zn-65	pCi/L	325	290	1.12	A
2nd/2022	E13660	Milk	Sr-89	pCi/L	67.6	87.2	0.78	A
			Sr-90	pCi/L	10.7	14.5	0.74	A
	E13662	Water	Co-58	pCi/L	138	128	1.07	A
			Co-60	pCi/L	258	242	1.07	A
			Cs-134	pCi/L	168	172	0.98	A
			Cs-137	pCi/L	212	204	1.04	A
			Fe-59	pCi/L	171	157	1.09	A
			Mn-54	pCi/L	257	229	1.12	A
			Zn-65	pCi/L	309	296	1.04	A
3rd/2022	E13664	Milk	Sr-89	pCi/L	95.4	89.1	1.07	A
			Sr-90	pCi/L	8.87	13.6	0.65	A
	E13666	Water	Co-58	pCi/L	149	148	1.01	A
			Co-60	pCi/L	217	204	1.07	A
			Cs-134	pCi/L	184	198	0.93	A
			Cs-137	pCi/L	179	174	1.03	A
			Fe-59	pCi/L	157	136	1.16	A
			Mn-54	pCi/L	230	221	1.04	A
			Zn-65	pCi/L	342	293	1.17	A
4th/2022	E13668	Milk	Sr-89	pCi/L	99.3	90.4	1.10	A
			Sr-90	pCi/L	12.8	15.0	0.86	A
	E13670	Water	Co-58	pCi/L	254	229	1.07	A
			Co-60	pCi/L	297	2,898	1.03	A
			Cs-134	pCi/L	171	191	0.90	A
			Cs-137	pCi/L	217	218	1.00	A
			Fe-59	pCi/L	232	197	1.18	A
			Mn-54	pCi/L	272	251	1.08	A
			Zn-65	pCi/L	336	304	1.11	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 2022

Prepared By
Teledyne Brown Engineering
Environmental Services

Three Mile Island Nuclear Station
Middletown, PA 17057

April 2023

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Appendices

I. Summary and Conclusions

In 2006, Constellation (formerly 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 2022. During that time period 341 analyses were performed on 165 samples from 58 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 storm water samples. In the case of tritium, Constellation 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, 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 19 of 49 groundwater monitoring locations. The groundwater tritium concentrations ranged from 181 ± 116 pCi/L to 1,670 ± 245 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**.** One stormwater tritium sample was detected just above the LLD at a concentration 212 ± 135 pCi/L. Tritium was detected in 2 of 8 precipitation water locations. The concentrations ranged from 195 ± 115 to 575 ± 146 pCi/L.

Hard-To-Detect analyses, including Am-241, Cm-242, Cm-243/244, Pu-238, Pu-239/240, U-234, U-235, U-238, Fe-55 and Ni-63 were analyzed in 2022. Action levels trigger monitoring requirements for these analyses. Uranium-234 and U-238 were detected in one sample at concentrations of 1.44 ± 0.51 pCi/L and 0.73 ± 0.37 pCi/L respectively. No other nuclides were detected.

II. Introduction

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

Conestoga Rovers & Associates (CRA) performed the initial assessment. CRA prepared a Hydrogeologic Investigation Report (HIR) for Constellation 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 a Constellation website 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 Constellation Energy Group (CEG)/GEL Laboratories on well water, surface water, storm water, and precipitation water samples collected in 2022. TMINS groundwater movement is into the Susquehanna River which surrounds the station on all sides.

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

- None of the 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.

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 Area of Further Evaluation (AFE)

This report covers those analyses performed by Teledyne Brown Engineering (TBE) and Gel Laboratories (subcontracted from Constellation) on samples collected in 2022.

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

Sample Collection

Sample locations can be found in Table A-1 and Figure A-1, Appendix A.

Groundwater, Storm Water, and Precipitation

Samples of water are collected, managed, transported and analyzed in accordance with approved procedures. Groundwater, 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 CES/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 Constellation (CES)/GEL Laboratories to analyze the environmental samples for radioactivity for the Three Mile Island Nuclear Station RGPP in 2022.

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

1. Concentrations of gamma-emitters in groundwater and storm water
2. Concentrations of strontium in groundwater
3. Concentrations of tritium in groundwater, 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

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. Constellation 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 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 radioanalytical 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 49 locations were analyzed for tritium activity. Tritium values ranged from the detection limit to 1,670 pCi/L. (Table B-I.1, Appendix B)

Tritium Split Samples

Samples from 9 locations were analyzed for tritium activity. Tritium values ranged from the detection limit to 216 pCi/L. (Table C-I.1, Appendix C)

Strontium

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

Strontium Split Samples

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

Gamma Emitters

Samples from 49 locations were analyzed for gamma-emitting nuclides. No gamma-emitting nuclides were detected above the detection limits. (Table B-I.2, Appendix B)

Gamma Emitters Split Samples

Samples from 5 locations were analyzed for gamma-emitting nuclides. No gamma-emitting nuclides were detected above the detection limits. (Table C-I.2, Appendix C)

Hard-To-Detect

One sample was analyzed for Hard-To-Detect analyses, which included Am-241, Cm-242, Cm-243/244, Pu-238, Pu-239/240, U-234, U-235, and U-238. Uranium-234 and U-238 were detected at 1.44 pCi/L and 0.73 pCi/L respectively. Seven locations were analyzed for Fe-55 and Ni-63. Neither Fe-55 nor Ni-63 were detected in any sample. (Table B-I.3, Appendix B)

Hard-To-Detect Split Samples

Hard to detects were not analyzed on any split samples in 2022. (Table C-I.3, Appendix C)

B. Surface Water Results

No samples were collected from surface water locations in 2022.

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

Four samples from one location analyzed for tritium. Tritium activity was detected just above the detection limit in 1 of the 4 samples at a concentration of 212 pCi/L. (Table B–II.1, Appendix B)

Gamma Emitters

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

D. Precipitation Water Results

Samples were collected at 8 locations. The following analyses were performed:

Tritium

Samples from 8 locations were analyzed for tritium activity. Tritium activity was detected at 2 of 8 locations. The concentrations ranged from 195 to 575 pCi/L. (Table B–III.1, Appendix B)

Tritium Split Samples

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

E. Leaks, Spills, and Releases

There were no leaks, spills or releases in 2022.

F. Actions Taken

There were no compensatory/corrective actions taken in 2022.

G. Missed Samples

There were no missed samples in 2022.

APPENDIX A

LOCATION DESIGNATION & DISTANCE

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TABLE A-1: Radiological Groundwater Protection Program - Sampling Locations, Three Mile Island Nuclear Station, 2022

Site	Site Type
48S	Production Potable Well
EDCB	Storm Water
MS-1	Monitoring Well
MS-2	Monitoring Well
MS-3	Monitoring Well
MS-4	Monitoring Well
MS-5	Monitoring Well
MS-7	Monitoring Well
MS-8	Monitoring Well
MS-20	Monitoring Well
MS-21	Monitoring Well
MS-22	Monitoring Well
MW-1	Monitoring Well
MW-2	Monitoring Well
MW-TMI-1D	Monitoring Well
MW-TMI-2D	Monitoring Well
MW-TMI-3I	Monitoring Well
MW-TMI-4I	Monitoring Well
MW-TMI-4S	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
MW-TMI-9S	Monitoring Well
MW-TMI-10D	Monitoring Well
MW-TMI-10I	Monitoring Well
MW-TMI-10S	Monitoring Well
MW-TMI-12S	Monitoring Well
MW-TMI-13I	Monitoring Well
MW-TMI-14D	Monitoring Well
MW-TMI-14I	Monitoring Well
MW-TMI-16D	Monitoring Well
MW-TMI-18D	Monitoring Well
MW-TMI-19I	Monitoring Well
MW-TMI-20I	Monitoring Well
MW-TMI-21D	Monitoring Well
MW-TMI-21I	Monitoring Well
MW-TMI-21S	Monitoring Well
MW-TMI-22D	Monitoring Well
MW-TMI-22I	Monitoring Well
MW-TMI-22S	Monitoring Well
NW-A	Production Well
NW-B	Production Well
NW-C	Production Well
OS-14	Monitoring Well
OS-16	Monitoring Well
OS-18	Monitoring Well
OSF	Production Potable Well
RW-1	Monitoring Well
TM-PR-EDCB	Precipitation Water
TM-PR-ESE	Precipitation Water
TM-PR-MS-1	Precipitation Water
TM-PR-MS-2	Precipitation Water
TM-PR-MS-4	Precipitation Water
TM-PR-MS-8	Precipitation Water
TM-PR-MW-22S	Precipitation Water
TM-PR-RW-1	Precipitation Water

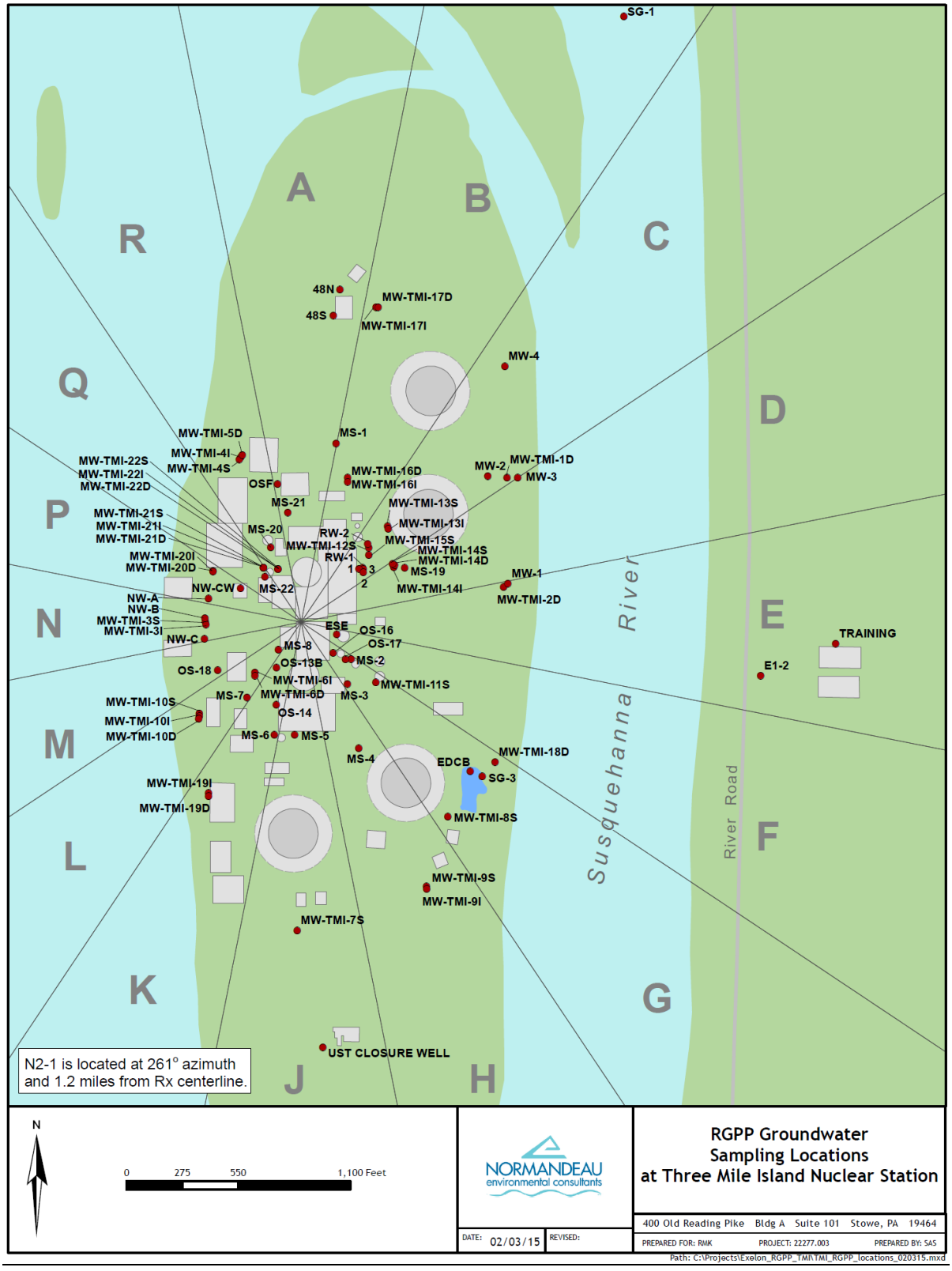

Figure A – 1
Sampling Locations at the Three Mile Island Nuclear Station, 2022

TABLE B-I.1 CONCENTRATIONS OF TRITIUM AND STRONTIUM IN GROUNDWATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICALGROUNDWATER PROTECTION PROGRAM, THREE MILE ISLAND NUCLEAR STATION, 2022

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE		H-3	Sr-89	Sr-90	Gr-A (Dis)	Gr-A (Sus)
48S	02/24/22		< 180				
48S	06/01/22		< 182				
48S	08/31/22		< 193	< 8.6	< 0.9	< 2.0	< 0.8
48S	11/10/22		< 185				
MS-1	05/17/22		< 192				
MS-2	02/23/22		< 192				
MS-2	05/18/22		< 179	< 8.6	< 0.8	< 0.5	< 0.6
MS-2	08/24/22		< 182				
MS-2	11/01/22		< 190				
MS-3	02/23/22		< 180				
MS-3	05/18/22		< 178	< 6.4	< 0.7	< 0.6	< 0.6
MS-3	08/24/22		236 ± 125				
MS-3	11/01/22		< 193				
MS-4	05/20/22		< 185				
MS-4	11/01/22		215 ± 126				
MS-5	02/23/22		< 174				
MS-5	05/18/22		< 192	< 5.4	< 0.7	< 0.9	< 0.6
MS-5	08/24/22		< 175				
MS-5	11/01/22		< 189				
MS-7	02/22/22		212 ± 119				
MS-7	05/18/22		< 191	< 6.3	< 0.8	< 0.7	< 0.8
MS-7	05/18/22	*DUP*	< 181	< 7.3	< 0.7	< 0.7	< 0.8
MS-7	08/24/22		< 195				
MS-7	11/01/22		< 189				
MS-7	11/01/22	*DUP*	249 ± 133				
MS-8	02/23/22		363 ± 131				
MS-8	05/20/22		< 184	< 5.1	< 0.6	< 0.4	1.6 ± 0.8
MS-8	08/24/22		273 ± 124				
MS-8	11/01/22		277 ± 131				
MS-20	02/23/22		238 ± 123				
MS-20	05/20/22		< 182	< 6.3	< 0.9	< 0.7	3.3 ± 1.2
MS-20	08/23/22		340 ± 130			< 1.0	< 0.8
MS-20	11/01/22		424 ± 139				
MS-21	02/23/22		< 175				
MS-21	05/20/22		< 182	< 7.7	< 0.6	< **8.7**	< 4.6
MS-21	08/23/22		203 ± 132			< 0.5	< 1.7
MS-21	11/01/22		< 192				
MS-22	02/23/22		871 ± 165				
MS-22	05/24/22		451 ± 129	< 9.9	< 0.9	< 0.9	< 1.2
MS-22	08/23/22		426 ± 133				
MS-22	11/02/22		334 ± 129				
MW-1	05/17/22		< 187				
MW-2	05/24/22		< 189				
MW-TMI-1D	05/24/22		< 194				
MW-TMI-2D	05/17/22		< 189				
MW-TMI-2D	05/17/22	*DUP*	< 187				
MW-TMI-3I	02/22/22		< 188				
MW-TMI-3I	05/24/22		< 187	< 5.0	< 0.6	< 0.9	< 1.3
MW-TMI-3I	05/24/22	*DUP*	< 189	< 5.8	< 0.6	< 0.9	< 1.2
MW-TMI-3I	08/24/22		205 ± 124				

BOLD Values = Unable to meet detection limis due to high solids content

TABLE B-I.1 CONCENTRATIONS OF TRITIUM AND STRONTIUM IN GROUNDWATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICALGROUNDWATER PROTECTION PROGRAM, THREE MILE ISLAND NUCLEAR STATION, 2022

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE		H-3	Sr-89	Sr-90	Gr-A (Dis)	Gr-A (Sus)
MW-TMI-3I	11/01/22		< 197				
MW-TMI-4I	05/17/22		< 187				
MW-TMI-4S	05/17/22		< 192				
MW-TMI-6D	02/22/22		< 168				
MW-TMI-6D	05/18/22		< 192	< 6.1	< 0.7	< 0.9	< 1.3
MW-TMI-6D	08/24/22		< 192				
MW-TMI-6D	11/01/22		323 ± 131				
MW-TMI-6I	02/22/22		233 ± 124				
MW-TMI-6I	05/18/22		221 ± 130	< 6.5	< 0.8	< 0.5	< 0.8
MW-TMI-6I	08/24/22		< 191				
MW-TMI-6I	11/01/22		339 ± 134				
MW-TMI-7S	05/20/22		< 172				
MW-TMI-8S	05/17/22		< 189				
MW-TMI-9I	05/17/22		< 187				
MW-TMI-9S	05/17/22		< 191				
MW-TMI-10D	05/18/22		< 181				
MW-TMI-10I	05/18/22		415 ± 129				
MW-TMI-10I	11/01/22		436 ± 131				
MW-TMI-10S	05/18/22		< 180				
MW-TMI-10S	05/18/22	*DUP*	193 ± 122				
MW-TMI-10S	11/01/22		276 ± 131				
MW-TMI-12S	02/23/22		< 176				
MW-TMI-12S	05/20/22		< 183	< 5.9	< 0.8	< 0.4	< 1.0
MW-TMI-12S	08/24/22		< 186				
MW-TMI-12S	11/01/22		< 187				
MW-TMI-13I	05/17/22		< 195				
MW-TMI-13I	11/01/22		445 ± 140				
MW-TMI-14D	05/17/22		205 ± 124				
MW-TMI-14D	11/01/22		323 ± 135				
MW-TMI-14D	11/01/22	*DUP*	306 ± 133				
MW-TMI-14I	05/17/22		< 191				
MW-TMI-14I	11/01/22		< 200				
MW-TMI-16D	05/17/22		361 ± 126				
MW-TMI-18D	05/17/22		204 ± 130				
MW-TMI-19I	05/24/22		< 185				
MW-TMI-19I	05/24/22	*DUP*	< 185				
MW-TMI-20I	05/18/22		< 186				
MW-TMI-21D	05/24/22		1310 ± 198				
MW-TMI-21D	11/02/22		1660 ± 242				
MW-TMI-21I	05/24/22		285 ± 129				
MW-TMI-21I	11/02/22		302 ± 140				
MW-TMI-21S	02/23/22		342 ± 125				
MW-TMI-21S	05/24/22		341 ± 129	< 9.5	< 0.9	< 1.2	< 1.1
MW-TMI-21S	08/23/22		205 ± 130				
MW-TMI-21S	11/02/22		363 ± 134				
MW-TMI-22D	05/24/22		1300 ± 216				
MW-TMI-22D	11/02/22		1670 ± 245				
MW-TMI-22I	05/24/22		505 ± 141				
MW-TMI-22I	11/02/22		329 ± 132				
MW-TMI-22S	02/23/22		395 ± 127				

BOLD Values = Unable to meet detection limis due to high solids content

TABLE B-I.1 CONCENTRATIONS OF TRITIUM AND STRONTIUM IN GROUNDWATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICALGROUNDWATER PROTECTION PROGRAM, THREE MILE ISLAND NUCLEAR STATION, 2022

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE		H-3	Sr-89	Sr-90	Gr-A (Dis)	Gr-A (Sus)
MW-TMI-22S	05/24/22		395 ± 133	< 9.5	< 0.9	6.8 ± 1.5	< 1.1
MW-TMI-22S	08/23/22		251 ± 114			< 1.4	< 0.6
MW-TMI-22S	11/02/22		297 ± 125				
NW-A	06/01/22		< 171				
NW-A	11/16/22		312 ± 125				
NW-B	03/01/22		< 184				
NW-B	08/31/22		256 ± 125	< 9.7	< 0.9	< 1.3	< 0.8
NW-B	11/16/22		< 171				
NW-C	06/01/22		476 ± 133				
NW-C	11/16/22		436 ± 128				
OS-14	02/23/22		181 ± 116				
OS-14	05/20/22		< 182	< 2.7	< 0.8	< 0.7	< 1.0
OS-14	08/24/22		< 169				
OS-14	08/24/22	*DUP*	< 183				
OS-14	11/01/22		189 ± 123				
OS-16	02/23/22		260 ± 125				
OS-16	05/18/22		< 174	< 5.4	< 0.6	< 0.4	< 1.0
OS-16	08/24/22		< 175				
OS-16	11/01/22		248 ± 131				
OS-18	05/24/22		< 179				
OSF	02/24/22		202 ± 126				
OSF	06/01/22		< 193	< 7.7	< 1.0	< 1.9	< 0.7
OSF	08/31/22		< 175				
OSF	11/10/22		< 174				
RW-1	02/23/22		< 173				
RW-1	05/18/22		< 196	< 6.4	< 0.7	< 0.7	< 0.6
RW-1	08/23/22		< 181				
RW-1	08/23/22	*DUP*	< 190				
RW-1	11/01/22		< 188				

BOLD Values = Unable to meet detection limis due to high solids content

TABLE B-I.2

CONCENTRATIONS OF GAMMA EMITTERS IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2022

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		06/01/22	< 16	< 29	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 9	< 3
MS-1		05/17/22	< 17	< 35	< 2	< 2	< 4	< 2	< 4	< 2	< 4	< 2	< 2	< 11	< 4
MS-2		05/18/22	< 15	< 19	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 2	< 2	< 8	< 3
MS-3		05/18/22	< 18	< 23	< 2	< 2	< 5	< 3	< 5	< 2	< 4	< 2	< 2	< 10	< 4
MS-4		05/20/22	< 16	< 38	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 2	< 2	< 9	< 3
MS-5		05/18/22	< 16	< 37	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 2	< 2	< 9	< 3
MS-7		05/18/22	< 15	< 16	< 2	< 2	< 3	< 2	< 3	< 2	< 3	< 2	< 2	< 8	< 3
MS-7	*DUP*	05/18/22	< 18	< 43	< 2	< 2	< 4	< 2	< 4	< 2	< 4	< 2	< 2	< 9	< 3
MS-8		05/20/22	< 11	27 ± 18	< 1	< 1	< 3	< 1	< 3	< 1	< 2	< 1	< 1	< 8	< 2
MS-20		05/20/22	< 16	< 15	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 11	< 3
MS-21		05/20/22	< 17	< 34	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 2	< 2	< 11	< 4
MS-22		05/24/22	< 16	< 16	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 12	< 4
MW-1		05/17/22	< 17	< 33	< 2	< 2	< 4	< 2	< 4	< 2	< 4	< 2	< 2	< 11	< 4
MW-2		05/24/22	< 18	< 33	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 10	< 4
MW-TMI-1D		05/24/22	< 16	< 17	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 2	< 2	< 10	< 4
MW-TMI-2D		05/17/22	< 14	< 32	< 2	< 2	< 3	< 2	< 3	< 2	< 3	< 2	< 2	< 9	< 3
MW-TMI-2D	*DUP*	05/17/22	< 14	< 15	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 8	< 3
MW-TMI-3I		05/24/22	< 11	< 19	< 1	< 1	< 2	< 1	< 2	< 1	< 2	< 1	< 1	< 7	< 2
MW-TMI-3I	*DUP*	05/24/22	< 16	< 16	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 10	< 3
MW-TMI-4I		05/17/22	< 14	< 17	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 9	< 3
MW-TMI-4S		05/17/22	< 15	< 31	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 9	< 3
MW-TMI-6D		05/18/22	< 25	< 49	< 3	< 4	< 6	< 3	< 6	< 3	< 6	< 3	< 3	< 15	< 5
MW-TMI-6I		05/18/22	< 16	< 32	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 2	< 2	< 9	< 3
MW-TMI-7S		05/20/22	< 16	< 37	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 2	< 2	< 11	< 4
MW-TMI-8S		05/17/22	< 16	< 37	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 2	< 2	< 10	< 4
MW-TMI-9I		05/17/22	< 18	< 31	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 2	< 2	< 11	< 4
MW-TMI-9S		05/17/22	< 14	< 15	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 9	< 3
MW-TMI-10D		05/18/22	< 14	< 16	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 8	< 3
MW-TMI-10I		05/18/22	< 26	< 29	< 3	< 3	< 5	< 3	< 6	< 4	< 5	< 3	< 3	< 14	< 5
MW-TMI-10S		05/18/22	< 16	< 16	< 2	< 2	< 3	< 2	< 3	< 2	< 3	< 2	< 2	< 8	< 2
MW-TMI-10S	*DUP*	05/18/22	< 16	< 18	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 2	< 2	< 8	< 3
MW-TMI-12S		05/20/22	< 16	< 19	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 10	< 3
MW-TMI-13I		05/17/22	< 17	< 29	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 2	< 2	< 10	< 4
MW-TMI-14D		05/17/22	< 11	< 20	< 1	< 1	< 2	< 1	< 2	< 1	< 2	< 1	< 1	< 7	< 3
MW-TMI-14I		05/17/22	< 11	< 17	< 1	< 1	< 2	< 1	< 2	< 1	< 2	< 1	< 1	< 6	< 2
MW-TMI-16D		05/17/22	< 14	< 14	< 2	< 2	< 3	< 2	< 3	< 2	< 3	< 2	< 2	< 8	< 3
MW-TMI-18D		05/17/22	< 14	< 24	< 2	< 1	< 3	< 2	< 3	< 2	< 3	< 2	< 2	< 8	< 3

TABLE B-I.2

CONCENTRATIONS OF GAMMA EMITTERS IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2022

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-19I		05/24/22	< 15	< 17	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 9	< 3
MW-TMI-19I	*DUP*	05/24/22	< 16	< 16	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 2	< 2	< 10	< 3
MW-TMI-20I		05/18/22	< 14	< 28	< 1	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 8	< 3
MW-TMI-21D		05/24/22	< 15	< 15	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 13	< 4
MW-TMI-21I		05/24/22	< 17	< 35	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 2	< 2	< 13	< 5
MW-TMI-21S		05/24/22	< 12	< 11	< 1	< 1	< 3	< 1	< 2	< 1	< 2	< 1	< 1	< 10	< 3
MW-TMI-22D		05/24/22	< 17	< 21	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 14	< 5
MW-TMI-22I		05/24/22	< 17	< 30	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 2	< 2	< 13	< 5
MW-TMI-22S		05/24/22	< 15	< 16	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 2	< 2	< 12	< 5
MW-TMI-22S		08/23/22	< 13	< 26	< 1	< 2	< 3	< 2	< 3	< 2	< 3	< 2	< 2	< 8	< 3
NW-A		06/01/22	< 16	< 33	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 2	< 2	< 9	< 4
NW-B		08/31/22	< 17	< 17	< 2	< 2	< 4	< 2	< 4	< 2	< 4	< 2	< 2	< 13	< 4
NW-C		06/01/22	< 13	< 27	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 8	< 3
OS-14		05/20/22	< 14	< 15	< 2	< 2	< 3	< 2	< 3	< 2	< 3	< 2	< 2	< 9	< 3
OS-16		05/18/22	< 13	< 13	< 1	< 1	< 3	< 1	< 3	< 2	< 3	< 2	< 1	< 10	< 3
OS-18		05/24/22	< 14	< 16	< 2	< 2	< 3	< 2	< 3	< 2	< 3	< 2	< 2	< 9	< 3
OSF		06/01/22	< 16	< 38	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 2	< 2	< 9	< 3
RW-1		05/18/22	< 12	< 15	< 1	< 1	< 3	< 2	< 3	< 2	< 3	< 2	< 2	< 7	< 2

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, 2022**

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
48S	02/24/22	< 0.19	< 0.04	< 0.13	< 0.19	< 0.05	1.44 ± 0.51	< 0.16	0.73 ± 0.37		
MS-3	05/18/22									< 163	< 4.1
MS-5	05/18/22									< 87	< 4.1
MS-8	05/20/22									< 182	< 4.5
MW-TMI-6D	05/18/22									< 196	< 3.5
MW-TMI-6I	05/18/22									< 129	< 4.2
OS-14	05/20/22									< 80	< 4.2
OS-16	05/18/22									< 196	< 4.3

TABLE B-II.1 CONCENTRATIONS OF TRITIUM IN STORM WATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, THREE MILE ISLAND NUCLEAR STATION, 2022

RESULTS IN UNITS OF PCI/LITER + 2 SIGMA

SITE	COLLECTION DATES	H-3
EDCB	02/03/22 - 03/30/22	212 ± 135
EDCB	04/27/22 - 06/30/22	< 183
EDCB	07/27/22 - 09/29/22	< 171
EDCB	11/03/22 - 12/29/22	< 169

TABLE B-II.2

CONCENTRATIONS OF GAMMA EMITTERS IN STORM WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2022

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	02/03/22 - 03/30/22	< 27	< 52	< 3	< 3	< 8	< 4	< 8	< 3	< 5	< 4	< 4	< 13	< 5
EDCB	04/27/22 - 06/30/22	< 14	< 15	< 2	< 2	< 3	< 2	< 3	< 2	< 3	< 2	< 2	< 8	< 3
EDCB	07/27/22 - 09/29/22	< 18	< 33	< 2	< 2	< 4	< 2	< 5	< 2	< 4	< 2	< 2	< 9	< 3
EDCB	11/03/22 - 12/29/22	< 18	< 38	< 2	< 2	< 4	< 2	< 4	< 2	< 4	< 2	< 2	< 9	< 3

TABLE B-III.1 CONCENTRATIONS OF TRITIUM IN PRECIPITATION WATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, THREE MILE ISLAND NUCLEAR STATION, 2022

SITE	COLLECTION DATE	H-3
TM-PR-EDCB	03/11/22	< 194
TM-PR-EDCB	06/29/22	< 174
TM-PR-EDCB	09/22/22	< 189
TM-PR-EDCB	12/21/22	< 169
TM-PR-ESE	02/22/22	< 187
TM-PR-ESE	05/17/22	< 190
TM-PR-ESE	08/23/22	< 193
TM-PR-ESE	11/01/22	< 164
TM-PR-MS-1	02/22/22	< 187
TM-PR-MS-1	05/17/22	< 184
TM-PR-MS-1	08/23/22	< 199
TM-PR-MS-1	11/01/22	< 169
TM-PR-MS-2	02/22/22	< 187
TM-PR-MS-2	05/17/22	< 187
TM-PR-MS-2	08/23/22	< 196
TM-PR-MS-2	11/01/22	< 159
TM-PR-MS-4	02/22/22	< 193
TM-PR-MS-4	05/17/22	< 181
TM-PR-MS-4	08/23/22	< 192
TM-PR-MS-4	11/01/22	< 165
TM-PR-MS-8	02/22/22	< 195
TM-PR-MS-8	05/17/22	195 ± 115
TM-PR-MS-8	08/23/22	< 194
TM-PR-MS-8	11/01/22	< 180
TM-PR-MW-22S	02/22/22	575 ± 146
TM-PR-MW-22S	05/17/22	346 ± 122
TM-PR-MW-22S	08/23/22	264 ± 123
TM-PR-MW-22S	11/01/22	289 ± 118
TM-PR-RW-1	02/22/22	< 187
TM-PR-RW-1	05/17/22	< 180
TM-PR-RW-1	08/23/22	< 184
TM-PR-RW-1	11/01/22	< 169

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APPENDIX C

DATA TABLES

COMPARISON LAB

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TABLE C-I.1 CONCENTRATIONS OF TRITIUM AND STRONTIUM IN GROUNDWATER SPLIT SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, THREE MILE ISLAND NUCLEAR STATION, 2022

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

LAB	SITE	COLLECTION DATE	H-3	Sr-89	Sr-90	Gr-A
GEL	MS-7	02/22/22	< 126			
	MS-7	05/18/22	< 149	< 0.8	< 0.6	< 3.1
	MS-7	11/01/22	< 139			
	MW-TMI-2D	05/17/22	< 158			
	MW-TMI-3I	05/24/22	184 ± 102	< 1.1	< 0.7	< 3.3
	MW-TMI-6I	02/22/22	216 ± 96			
	MW-TMI-10S	05/18/22	198 ± 113			
	MW-TMI-14D	11/01/22	< 137			
	MW-TMI-19I	05/24/22	< 142			
	OS-14	08/24/22	< 126			
	RW-1	08/23/22	< 137			

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, 2022

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	MS-7	05/18/22	< 5	< 18	< 7	< 8	< 12	< 16	< 8	< 7	< 6	< 11	< 28
	MW-TMI-2D	05/17/22	< 10	< 22	< 10	< 8	< 15	< 20	< 10	< 8	< 8	< 11	< 35
	MW-TMI-3I	05/24/22	< 6	< 19	< 6	< 8	< 14	< 12	< 7	< 7	< 7	< 65	< 23
	MW-TMI-10S	05/18/22	< 7	< 25	< 7	< 9	< 17	< 12	< 10	< 7	< 8	< 11	< 35
	MW-TMI-19I	05/24/22	< 6	< 11	< 5	< 6	< 12	< 8	< 6	< 5	< 5	< 63	< 19

TABLE C-I.3 CONCENTRATIONS OF HARD-TO-DETECTS IN GROUNDWATER SPLIT SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, THREE MILE ISLAND NUCLEAR STATION, 2022

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

No samples collected or analyzed for hard to detects in 2022

TABLE C-II.1 CONCENTRATIONS OF TRITIUM IN PRECIPITATION WATER SPLIT SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, THREE MILE ISLAND NUCLEAR STATION, 2022

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

LAB	SITE	COLLECTION DATE	H-3
GEL	TM-PR-MS-2Q	03/11/22	< 113
		06/29/22	< 172
		09/22/22	< 148
		12/21/22	< 169