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TMI-10-030

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U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

THREE MILE ISLAND NUCLEAR STATION UNITS 1 AND 2
RENEWED OPERATING LICENSE NO. DPR-50 AND POSSESSION ONLY LICENSE NO. DPR-73
DOCKET NOS. 50-289 AND 50-320

SUBJECT: 2009 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

In accordance with TMI-1 Technical Specification 6.9.3.1 and TMI-2 Technical Specification 6.8.1.1, enclosed is the Annual Radiological Environmental Operating Report covering the time-period of January 1 through December 31, 2009, for the Three Mile Island Nuclear Station.

Please contact Laura Weber of TMI-1 Chemistry at (717) 948-8947 if you have any questions regarding this submittal.

Sincerely,

Richard W. Libra
Plant Manager

RWL/dbn

Enclosure

cc: Region I Administrator
TMI-1 Senior Project Manager
TMI-2 Project Manager
TMI-1 Senior Resident Inspector
GPU Nuclear TMI-2 Cognizant Officer

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Docket No: 50-289
50-320

# THREE MILE ISLAND NUCLEAR STATION
# UNITS 1 and 2

Annual Radiological
Environmental Operating Report

1 January Through 31 December 2009

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Appendices

## I. Summary and Conclusions

This report on the Radiological Environmental Monitoring Program conducted for the Three Mile Island Nuclear Station (TMINS) by Exelon covers the period 1 January 2009 through 31 December 2009. During that time period, 1,715 analyses were performed on 1,320 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, effluent, and storm water samples were analyzed for concentrations of tritium and gamma emitting nuclides. Surface, drinking, and effluent water samples were also analyzed for concentrations of I-131. Drinking and effluent water samples were also analyzed for concentrations of gross beta. Effluent water samples were also analyzed for concentrations of Sr-89 and Sr-90. All groundwater results are now being reported in the ARGPPR, Appendix F. No Sr-89 and Sr-90 activities were detected. Iodine-131 and gross beta concentrations detected were consistent with those detected in previous years. Tritium activity in one drinking water sample and several monthly effluent water samples was due to TMINS activities or releases. No other fission or activation products potentially attributed to TMI liquid releases were detected.

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

Air particulate samples were analyzed for concentrations of gross beta and gamma emitting nuclides. Cosmogenic Be-7 was detected at levels consistent with those detected in previous years. Cobalt-58, Co-60, Nb-95, and Zr-95 were detected in air particulate samples from a release to the environment in November 2009. No Sr-90 activity was detected. The dose to a member of the public based on this environmental sample result was calculated as 0.02 mrem. 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.

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

Food Product samples were analyzed for concentrations of gamma emitting nuclides (including I-131) and Sr-90. Sr-90 activities were detected in both the

indicator and control samples. This was a result of plant uptake of Sr-90 in soil as a result of past nuclear weapons testing. Concentrations of naturally occurring Be-7 and K-40 were consistent with those detected in previous years. No other fission or activation products were detected.

Environmental gamma radiation measurements were performed quarterly using thermoluminescent dosimeters. Levels detected were consistent with those observed in previous years.

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 2009 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 2009 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 one-half of Three Mile Island in the Susquehanna River approximately 2.5 miles south of Middletown in Londonderry Township, Dauphin County, Pennsylvania. TMI-1 is owned and operated by Exelon and became operational in 1974. TMI-2 is operated by GPU Nuclear, Inc. and owned by Metropolitan Edison (50%), Pennsylvania Electric (25%) and Jersey Central Power & Light (25%). TMI-2 became operational in 1978 and was shut down following the 1979 accident. At the end of 1993, TMI-2 was placed in a condition called Post-Defueling Monitored Storage. TMI-2 is maintained by Exelon under contract with GPU Nuclear.

A Radiological Environmental Monitoring Program (REMP) for TMINS was initiated in 1974. This report covers those analyses performed by Teledyne Brown Engineering (TBE), Global Dosimetry Solutions, Inc., and Environmental Inc. (Midwest Labs) on samples collected during the period 1 January 2009 through 31 December 2009.

### A. Objective 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 inplant controls for the containment of radioactive materials.

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

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

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

B. Implementation of the Objectives

The implementation of the objectives is accomplished by:

1. Identifying significant exposure pathways.

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

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

III. Program Description

A. Sample Collection

Samples for the TMINS REMP were collected for Exelon by Normandeau Associates, RMC Environmental Services Division (RMC). This section describes the general collection methods used by RMC to obtain environmental samples for the TMINS REMP in 2009. 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 RMC 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, storm water, fish, and sediment. Two gallon water samples were collected monthly from continuous samplers located at three surface water locations (A3-2, J1-2 and Q9-1), three drinking water locations (G15-2, G15-3 and Q9-1), and one effluent water location (K1-1). Control locations were A3-2 and Q9-1. Monthly water samples composited quarterly for analysis were taken from one storm water runoff location (EDCB). All groundwater results are now being 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 (J2-1, K1-3 and A1-3). In addition, one sediment sample was collected annually

at the EDCB. Location A1-3 was the control.

Atmospheric Environment

The atmospheric environment was evaluated by performing radiological analyses on samples of air particulates, airborne iodine, milk, and food product. 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.

Milk samples were collected biweekly at six locations (K15-3, D2-1, E2-2, F4-1, G2-1 and P4-1) from March through November, and monthly from December through February. The control location was K15-3. All samples were collected in new unused two gallon plastic bottles from the bulk tank at each location, preserved with sodium bisulfite, and shipped promptly to the laboratory.

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

Ambient Gamma Radiation

Direct radiation measurements were made using Panasonic 814 calcium sulfate ($CaSO_4$) thermoluminescent dosimeters (TLD). The TLD locations are arranged in generally concentric rings on and around the TMINS site as follows:

A site boundary ring consisting of 19 locations (A1-4, B1-2, C1-2, D1-1, E1-4, F1-2, F1-4, G1-3, G1-5, G1-6, H1-1, J1-3, K1-4, L1-1, M1-1, N1-3, P1-2, Q1-2, and R1-1) near and within the site perimeter representing fence post doses (i.e., at locations where the doses will be potentially greater than maximum annual off–site doses) from TMINS release.

An indicator ring consisting of 60 locations (A3-1, A5-1, A9-3, B1-1, B2-1, B5-1, B10-1, C1-1, C2-1, C5-1, C8-1, D1-2, D2-2, D6-1, E1-2, E2-3, E5-1, E7-1, F1-1, F2-1, F5-1, F10-1, G1-2, G2-4, G5-1, H3-1, H5-1, H8-1, J1-1,

J3-1, J5-1, J7-1 K2-1, K3-1, K5-1, K8-1, L1-2, L2-1, L5-1, L8-1, M1-2, M2-1, M5-1, M9-1, N1-1, N2-1, N5-1, N8-1, P1-1, P2-1, P5-1, P8-1, Q1-1, Q2-1, Q5-1, Q9-1, R1-2, R3-1, R5-1, and R9-1) extending to approximately 10 miles from the site designed to measure possible exposures to close-in population.

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

The specific TLD 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–22 1/2 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 TLD station consists of two primary program TLD badges, each of which has three $CaSO_4$ thermoluminescent phosphors enclosed in plastic, placed at each location in a frame located approximately three to six feet above ground level. Since each TLD responds to radiation independently, this provides six independent detectors at each station. The TLDs were exchanged quarterly and sent to Global Dosimetry for analysis.

B. Sample Analysis

This section describes the general analytical methods used by TBE and Midwest Labs to analyze the environmental samples for radioactivity for the TMINS REMP in 2009. 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, effluent,

and storm water, air particulates, milk, fish, sediment, and food products.

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

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

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

6. Ambient gamma radiation levels at various site environs.

C. Data Interpretation

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

1. Lower Limit of Detection and Minimum Detectable Concentration

The lower limit of detection (LLD) was defined as the smallest concentration of radioactive material in a sample that would yield a net count (above background) that would be detected with only a 5% probability of falsely concluding that a blank observation represents a "real" signal. The LLD was intended as a before the fact estimate of a system (including instrumentation, procedure and sample type) and not as an after the fact criteria for the presence of activity. All analyses were designed to achieve the required TMINS detection capabilities for environmental sample analysis.

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

2. Net Activity Calculation and Reporting of Results

Net activity for a sample was calculated by subtracting background activity from the sample activity. Since the REMP measures extremely small changes in radioactivity in the environment, background variations may result in sample activity being lower than the background activity effecting 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, effluent, storm, and ground water 11 nuclides, Mn-54, Co-58, Fe-59, Co-60, Zn-65, Zr-95, Nb-95, Cs-134, Cs-137, Ba-140 and La-140 were reported.

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

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

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

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

For food products five nuclides, Be-7, K-40, I-131, Cs-134 and Cs-137 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 2009 the TMINS REMP had a sample recovery rate in excess of 99%. Exceptions are listed below:

AIR

1. On 04/08/09 these air sample stations were found not operating. Sample pumps were replaced, but it was determined to be an AC power problem. On 04/21/09 the samplers were returned to service after the First Energy electricians repaired the main power supply. IR 905491 describes the issue for the following samples:

   04/01/09 – 04/08/09, Locations E1-2, E1-2Q, LLDs not met

   04/08/09 – 04/16/09, Locations E1-2, E1-2Q, No samples due to AC power problems

04/16/09 – 04/21/09, Locations E1-2, E1-2Q, No samples due to AC power problems

2. Slightly lower than expected sample volumes were due to power outages for the following samples:

   08/05/09 – 08/12/09, Locations E1-2, E1-2Q, G2-1, H3-1
   10/07/09 – 10/14/09, Locations E1-2, E1-2Q, G2-1
   12/02/09 – 12/09/09, Location A3-1

3. "Noisy" vacuum pump was replaced for the following sampler:

   10/22/09, Location M2-1

WATER

1. Surface water - During the following weekly sampling periods some of the hourly composite samples were missed due to weather related conditions. IR 870904 describes this issue. Insufficient sample was available for sampling periods so grab samples were required, except as noted, for the following samples.

   12/30/08 – 01/06/09, Location J1-2, all samples missed
   01/06/09 – 01/13/09, Location J1-2, all samples missed
   01/13/08 – 01/20/09, Location J1-2, all samples missed
   01/20/09 – 01/27/09, Location J1-2, all samples missed
   01/27/09 – 02/03/09, Location J1-2, all samples missed
   02/03/09 – 02/10/09, Location A3-2, 22 samples missed, no grab sample required
   02/10/09 – 02/17/09, Location J1-2, 80 samples missed
   02/17/09 – 02/24/09, Location J1-2, 53 samples missed
   02/24/09 – 03/03/09, Location J1-2, 47 samples missed
   03/03/09 – 03/10/09, Location J1-2, 38 samples missed
   03/10/09 – 03/17/09, Location J1-2, 9 samples missed, no grab sample required
   04/15/09 – 04/21/09, Location J1-2, 5 samples missed, no grab sample required
   04/21/09 – 04/28/09, Location J1-2, 9 samples missed, no grab sample required
   10/27/09 – 11/03/09, Location J1-2, 3 samples missed, no grab sample required
   12/01/09 – 12/08/09, Location J1-2, 2 samples missed, no grab sample required
   12/08/09 – 12/15/09, Location J1-2, approximately 50 samples missed, no grab sample required

12/15/09 – 12/21/09, Location J1-2, approximately 75 samples missed
12/21/09 – 12/28/09, Location J1-2, approximately 70 samples missed

2. Surface water - During the sampling periods, the sampler had an error message stating that no sample was collected, but the collection bucket was half full. It was determined that a crimp in the line was causing air to become trapped in the sample stream fooling the liquid detector. The crimp was corrected. The following samples were affected:

   08/11/09 – 08/18/09, Location J2-1
   08/18/09 – 08/25/09, Location J2-1

3. Drinking water - During the weekly sampling periods, numerous samples were missed due to a pump jam error. The ISCO was calibrated and functioning normally. IR 1025964 describes this issue. Sufficient sample was available for sampling periods so no grab samples were required.

   12/09/09 – 12/15/09, Location Q9-1, approximately 60 samples missed

4. Effluent water - During the weekly sampling periods, the sampler liquid detector was malfunctioning and causing a missed sample message. The sampler was replaced. The malfunction affected the following samples:

   08/11/09 – 08/18/09, Location K1-1
   08/18/09 – 08/25/09, Location K1-1

5. Effluent water - During the weekly sampling period, insufficient sample was available for the sampling period so a grab sample was required. The ISCO was re-calibrated and returned to service. IR 1025964 describes this issue.

   12/15/09 – 12/21/09, Location K1-1

6. Effluent water - During the weekly sampling period, a refueling outage caused power interruptions. IR 1025964 describes this issue. Sufficient volume was available, so no grab sample was required for the following sample.

   12/21/09 – 12/28/09, Location K1-1, 13 samples missed

7. Drinking water - Maintenance and construction at the facility caused power interruptions. Sufficient sample was available for sampling

period, so no grab samples were required for the following sample.

09/15/09 – 09/22/09, Location G15-3

TLD

1. Frozen river condition made it unsafe to travel by boat to the TLDs located on the islands west of the plant. Therefore, the TLD stations were not changed out for the 4th quarter 2008. The TLDs were collected in the first quarter of 2009 with a six month exposure period for the following samples:

   10/10/08 – 04/23/09, Location K2-1
   10/10/08 – 04/23/09, Location L1-2
   10/10/08 – 04/23/09, Location M1-2
   10/10/08 – 04/23/09, Location N1-1
   10/10/08 – 04/23/09, Location P1-1
   10/10/08 – 04/23/09, Location Q1-1
   10/10/08 – 04/23/09, Location R1-2

2. During the second quarter sampling period, the TLD badges were found missing during collection. It appears that someone cut the plastic pouches and took the badges. IR 958396 describes this issue for the following sample:

   04/23/09 – 07/18/09, Location F10-1

3. During the fourth quarter sampling period, the 1 of 2 TLD badges were found missing during collection. It appears that someone cut the plastic pouch and took the badge. IR 1025964 describes this issue for the following sample:

   10/19/09 – 01/22/10, Location R15-1

4. Frozen river conditions made it unsafe to travel by boat to the TLDs located on the islands west of the plant. Therefore, the TLDs were not collected with other 4th quarter 2009 TLDs. The TLDs were successfully collected two weeks later when the river thawed. These seven TLD locations and their outer island control have significantly higher exposure levels than the remaining fourth quarter TLDs. This exposure is not related to TMI, but had to occur in transit to the vendor analysis lab because the control is kept in a shielded pig except for traveling to collect the badges and shipping to the vendor. In addition, other TLDs in the same sectors as these badges were located closer to the plant and received lower exposures more typical of historical

averages. The data from these badges is not considered valid and will not be included in this report. IR 1025964 describes this issue for the following samples:

10/19/09 – 01/22/10, Location K2-1
10/19/09 – 01/22/10, Location L1-2
10/19/09 – 01/22/10, Location M1-2
10/19/09 – 01/22/10, Location N1-1
10/19/09 – 01/22/10, Location P1-1
10/19/09 – 01/22/10, Location Q1-1
10/19/09 – 01/22/10, Location R1-2

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

The D2-1 farm sold their milk herd in November. A new milk farm, P4-1, was added to the REMP. IR 976028 describes this change.

## IV. Results and Discussion

### A. Aquatic Environment

#### 1. Surface Water

Samples were taken weekly from a continuous sampler at three locations (A3-2, J1-2, and Q9-1) and 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 eight of 12 samples at location J1-2 which is located immediately downstream of the TMINS effluent outfall. The

concentrations ranged from 227 to 9,250 pCi/l. The increased tritium concentrations detected were a result of TMINS releasing radwaste treatment system effluent water under permitted discharges in accordance with NRC regulations. The indicator surface water sample is taken just downstream of the liquid discharge outfall where mixing of liquid effluents with the river water is incomplete. More complete mixing is not achieved until liquid effluents pass over the York Haven Dam. This water is normally not consumed by humans. The concentrations detected were well below any regulatory limits. (Figures C–1 and C–2, Appendix C).

Iodine

Monthly samples from location A3-2 were analyzed for I-131 activity (Table C–I.2, Appendix C). 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. Iodine-131 was detected in two of 12 samples. The concentration ranged from 1.4 to 1.8 pCi/l.

Gamma Spectrometry

Samples from all locations 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 20 of 36 samples. The concentrations ranged from 2.0 to 5.5 pCi/l. Concentrations detected were consistent with those detected in previous years (Figures C–3, Appendix C).

Iodine

Monthly samples from all locations were analyzed for

concentrations of iodine (Tables C–II.2, Appendix C). Iodine activity was not detected in any samples.

Tritium

Monthly samples from all locations were analyzed for tritium activity (Table C–II.3, Appendix C). Tritium was detected in one sample at a concentration of 448 pCi/l (Figures C–4, Appendix C). The dose to a member of the public based on this environmental sample result was calculated as 0.0053 mrem.

Exelon specified that its laboratories achieve a lower limit of detection 10 times lower than that required by federal regulation.

Gamma Spectrometry

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

3. Effluent Water

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

Gross Beta

Monthly samples from location K1-1 were analyzed for concentrations of gross beta. (Tables C–III.1, Appendix C). Gross beta was detected in eleven of 12 samples. The concentrations ranged from 3.1 to 6.1 pCi/l. Concentrations detected were consistent with those detected in previous years.

Iodine-131

Monthly samples from location K1-1 were analyzed for concentrations of I-131. (Tables C–III.1, Appendix C). Iodine-131 was not detected. Historically, I-131 has been detected sporadically in effluent water and not in the control stations. No I-131 was identified in any tank effluent pre-release samples, and I-131 was not detected in any other downstream surface or drinking water samples. Effluent water is not consumed by humans.

Tritium

Monthly samples from location K1-1 were analyzed for tritium activity (Table C–III.1, Appendix C). Tritium activity was detected in eight of 12 samples. The concentrations ranged from 2,970 to 101,000 pCi/l. The elevated results were a result of TMI releasing radwaste treatment system effluent water under permitted discharges in accordance with NRC regulations. These results were from the liquid discharge mixing basin. The concentrations detected agree with those obtained from the TMINS Effluent Monitoring Program. The concentrations were well below any regulatory limits.

Strontium

Semiannual samples from location K1-1 were analyzed for Sr-89 and Sr-90 (Table C–III.1, Appendix C). No strontium activity was detected. The highest MDC was calculated at 2.2 pCi/l for Sr-89 and at 0.5 pCi/l for Sr-90.

Gamma Spectrometry

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

4. Storm Water

Monthly grabs from the storm water collection basin (EDCB) were composited quarterly. The following analyses were performed:

Tritium

All samples from location EDCB were analyzed for tritium activity (Table C–IV.1, Appendix C). Tritium activity was not detected.

Gamma Spectrometry

Samples from location EDCB were analyzed for gamma emitting nuclides (Table C–IV.1, Appendix C). All nuclides were less than the MDC.

5. Ground Water

During 2006, Exelon initiated a fleetwide Environmental

Assessment program. Comprehensive groundwater studies and reports were developed. As a result of this assessment and the NEI initiative on groundwater protection, TMI developed a new Radiological Groundwater Protection Program (RGPP) that was implemented by the end of the year. For 2009, this more comprehensive groundwater program replaced TMI's previous groundwater monitoring program. The results from these special investigations and studies are discussed in Appendix F.

6. Fish

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

Strontium

The edible portions of fish samples from both locations were analyzed for Sr-90. (Table C–V.1, Appendix C). No strontium activity was detected. The highest MDC was calculated at <5 pCi/kg wet for Sr-90.

Gamma Spectrometry

The edible portions of fish samples from both locations were analyzed for gamma emitting nuclides (Table C–V.2, Appendix C). Naturally occurring K-40 was found at all stations and ranged from 2,090 to 3,300 pCi/kg wet and was consistent with levels detected in previous years. No fission or activation products were found.

7. Sediment

Aquatic sediment samples were collected at three locations (A1-3, J2-1 and K1-3) semiannually. In addition, location EDCB was sampled annually. 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 four locations were analyzed for gamma emitting nuclides (Table C–VI.1, Appendix C). Potassium-40 was found at all stations and ranged from 9,960 to 17,600 pCi/kg dry. Cesuim-137 was detected in sediment samples at very low levels

(just above LLD) and are not distinguishable from background levels. No other fisson or activation products were found.

B. Atmospheric Environment

1. Airborne Particulates

a. Air Particulates

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

Gross Beta

Weekly samples were analyzed for concentrations of beta emitters (Table C–VII.1 and C–VII.2, Appendix C).

Detectable gross beta activity was observed at all locations. Comparison of results aid in determining the effects, if any, resulting from the operation of TMINS. The results from the closest to the site boundary locations (Group I) ranged from 8 to 30 E–3 pCi/$m^3$ with a mean of 17 E–3 pCi/$m^3$. The results from the intermediate offsite locations (Group II) ranged from 8 to 204 E–3 pCi/$m^3$ with a mean of 18 E–3 pCi/$m^3$. The results from the Control location (Group III) ranged from 9 to 28 E–3 pCi/$m^3$ with a mean of 18 E–3 pCi/$m^3$. Comparison of the 2009 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 2009 indicate no notable differences between indicator and control stations except for the sample period 11/18/09-11/24/09. The higher activity during this time is related to a release from TMI's temporary containment opening. The dose to a member of the public based on this environmental sample result was calculated to be 0.02 mrem. (Figure C–7, Appendix C).

Gamma Spectrometry

Weekly samples were composited quarterly and analyzed

for gamma emitting nuclides (Table C–VII.3, Appendix C). Naturally occurring Be-7 due to cosmic ray activity was detected in all 28 samples. These concentrations ranged from 56 to 125 E–3 pCi/$m^3$. Fourth quarter composite for G2-1 and F1-3 did not include the sample period 11/18/09-11/24/09 because an individual gamma scan was performed on these samples and the filter was needed for Sr-90 analysis. All other nuclides were less than the MDC.

Strontium

Samples collected during the time period of 11/18/09 – 11/24/09 were analyzed for concentrations of Sr-90. No Sr-90 was detected in any of the samples (Table C–VII.4, 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 (Table C–VIII.1, Appendix C). All results were less than the MDC.

2. Terrestrial

a. Milk

Samples were collected from six locations (K15-3, D2-1, E2-2, F4-1 G2-1 and P4-1) biweekly March through November and monthly December through February. The following analyses were performed:

Iodine–131

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

Strontium

Milk samples from all locations were composited quarterly and analyzed for Sr-89 and Sr-90 (Table C–IX.2, Appendix C). No Sr-89 activity was detected. Strontium-90 activity was detected in 10 of 21 samples. The concentrations ranged from 0.5 to 1.2 pCi/l. The activity detected was

consistent with those detected in the pre–operational years (Figure C–8, Appendix C).

Gamma Spectrometry

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

Naturally occurring K-40 activity was found in all samples. The concentrations ranged from 915 to 1,440 pCi/l. All other nuclides were less than the MDC.

b. Food Products

Samples were collected from two locations (B10-2 and H1-2) monthly, in lieu of milk sampling. Samples from the four food product groups were collected from two locations (B10-2 and E1-2) annually. The following analyses were performed:

Strontium

Twenty of 26 food product sample was analyzed for concentrations of Sr-90 (Table C–X.1, Appendix C). Strontium-90 activity was detected in 18 of 20 samples. The concentrations ranged from 2 to 49 pCi/kg wet.

Gamma Spectrometry

Each food product sample was analyzed for concentrations of gamma emitting nuclides (Table C–X.1, Appendix C). Naturally occurring Be-7 due to cosmic ray activity was detected in 11 of 26 samples. These concentrations ranged from 200 to 1,690 pCi/l. Naturally occurring K-40 activity was found in all samples. The concentrations ranged from 1,990 to 5,650 pCi/l. All other nuclides were less than the MDC.

C. Ambient Gamma Radiation

Ambient gamma radiation levels were measured utilizing Panasonic 814 ($CaSO_4$) thermoluminescent dosimeters. Ninety TLD locations were established around the site. Results of TLD measurements are listed in Tables C–XI.1 to C–XI.3, Appendix C.

All of the TLD measurements were below 10 mR/standard month, with a range of 2.7 to 7.7 mR/standard month. 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 were consistently higher. The historical ambient gamma radiation data from Locations D15-1, F25-1, G10-1, G15-1, H15-1, J15-1, K15-1, L15-1, N15-2, Q15-1, and R15-1 were plotted along with similar data from the Site, Indicator and Control Ring Locations (Figure C–9, Appendix C). 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, but tracked with the data from all three groups, this bias is most likely due to radon and other naturally occurring nuclides, e.g. K-40, emanating from the ground.

D. Land Use Survey

A Land Use Survey conducted in the September, October and November 2009 growing season around the Three Mile Island Nuclear Station (TMINS) was performed by Normandeau Associates, RMC Environmental Services Division for Exelon to comply with Sections 2.15 and 3.4.2 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 ft2 in each of the sixteen 22 ½ degree sectors around the site. There were no changes required to the TMINS REMP, as a result of this survey. Six gardens from the 2008 census were not established (or were not the closest) in 2009. As such, six new gardens were identified and included in the 2009 land use census. The locations where new gardens were identified include sectors B (NNE), C (NE), D (ENE), G (SE), N (W) and Q (NW). The results of this survey are summarized below.

| Distance in Miles from the TMINS Reactor Buildings | | | | |
|---|---|---|---|---|
| Sector | | Residence Miles | Garden Miles | Milk Farm Miles |
| 1 | N | 1.1 | 1.6 | 2.1 |
| 2 | NNE | 0.7 | 0.9 | - |
| 3 | NE | 0.5 | 1.5 | 4.1 |
| 4 | ENE | 0.5 | 0.5 | 1.1 |
| 5 | E | 0.4 | 0.5 | 1.1 |
| 6 | ESE | 1.1 | 1.2 | 3.2 |
| 7 | SE | 0.7 | 1.0 | 1.4 |
| 8 | SSE | 0.7 | 0.8 | - |
| 9 | S | 2.3 | 2.7 | - |
| 10 | SSW | 0.6 | 2.5 | 4.9, 14.5 |
| 11 | SW | 0.5 | 0.6 | |
| 12 | WSW | 0.5 | 1.3 | - |
| 13 | W | 0.7 | 1.3 | - |
| 14 | WNW | 0.4 | 2.2 | 3.7 |
| 15 | NW | 0.4 | 1.2 | - |
| 16 | NNW | 1.1 | 2.4 | - |

E. Radiological Impact of TMINS Operations

An assessment of potential radiological impact indicated that radiation doses to the public from 2009 operations at TMINS were well below all applicable regulatory limits and were significantly less than doses received from natural sources of radiation. The 2009 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 0.085 mrem. This dose is equivalent to <0.03% 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. Thermoluminescent dosimeters (TLDs) 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 an advanced "class A" dispersion model. This model incorporates the guidelines and methodology set forth by the USNRC in Regulatory Guide 1.109. 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. Once released, the dispersion of radionuclides in the environment is readily determined by computer modeling.

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 York Haven Hydroelectric Station.

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, and shoreline exposure. The exposure pathways considered for the discharge of TMINS airborne effluents are plume exposure, inhalation, cow milk consumption, goat milk consumption, fruit and vegetable consumption, meat consumption and land deposition.

Numerous data files are used in the calculations that describe the area around TMI in terms of population distribution and foodstuffs production. Data files include such information as the distance from

the plant stack to the site boundary in each sector, the population groupings, milk cows, milk goats, gardens of more than 500 square feet, meat animals, downstream drinking water users, and crop yields.

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).

Doses are calculated for what is termed the "maximum hypothetical individual". This individual is assumed to be affected by the combined maximum environmental concentrations wherever they occur.

For liquid releases, the maximum hypothetical individual would consume 193 gallons of Susquehanna River water per year from the first downstream drinking water supplier, eat 46 pounds of fish each year that reside in the plant discharge area and stand 67 hours per year on the shoreline influenced by the plant discharge.
For airborne releases, the maximum hypothetical individual would live at the location of highest radionuclide concentration for inhalation and direct plume exposure. Additionally, this individual each year would consume 106 gallons of cow milk, 141 pounds of leafy vegetables, 1389 pounds of non-leafy vegetables and fruits and 243 pounds of meat produced at the locations with the highest predicted radionuclide concentrations. Consumption of goat milk is not included, since this exposure pathway does not currently exist.

2. Result of Dose Calculations

The maximum hypothetical doses due to 2009 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 2009 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 100 mrem/yr (Ref. 5). Additionally, the average individual living in the United States receives an annual dose of about 2,400 mrem to the lung from natural radon gas. This lung dose is considered to be equivalent to a whole (or total) body dose of 200 mrem (Ref. 5). Therefore, the average person in the United States receives a whole body dose of about 300 mrem/yr from natural background radiation sources.

As shown on Table 2, the maximum hypothetical whole body dose received by an individual from 2009 TMI-1 and TMI-2 liquid and airborne effluents combined was conservatively calculated to be 0.085 mrem. This dose is equivalent to <0.03% percent of the dose that an individual living in the TMI area receives each year from natural background radiation (300 mrem).
The low doses calculated for 2009 TMINS operations were the result of efforts to maintain releases "as low as reasonably achievable" (ALARA).

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 2009 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 2009 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 2009 TMI-1 and TMI-2 Liquid and Airborne Effluents

| | Maximum Hypothetical Doses To An Individual | | |
|---|---|---|---|
| | USNRC 10 CFR 50 APP. I Guidelines (mrem/yr) | Calculated Dose (mrem/yr) TMI-1 | TMI-2 |
| From Radionuclides In Liquid Releases | 3 total body, or | 2.77E-2 | 3.28E-4 |
| | 10 any organ | 2.86E-2 | 5.22E-4 |
| From Radionuclides In Airborne Releases (Noble Gases) | 5 total body, or | 2.98E-5 | 0* |
| | 15 skin | 7.07E-5 | 0* |
| From Radionuclides In Airborne Releases (Iodines, Tritium and Particulates) | 15 any organ | 5.59E-2 | 4.38E-5 |

*No noble gases were released from TMI-2.

| | USEPA 40 CFR 190 Limits (mrem/yr) | Calculated Dose (mrem/yr) TMI-1 and TMI-2 Combined** |
|---|---|---|
| Total from Site | 75 thyroid | 0.43 |
| | 25 total body or other organs | 0.46 |

** *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 TLD data. For this calculation, exposure is assumed to be equal to dose.

The direct radiation dose from 2009 TMINS operations was 0.37 mrem. This dose was based on a maximum net fence-line exposure rate of 6.8 mR/std month and a shoreline/fence-line occupancy factor of 67 hours (Regulatory Guide 1.109). The combination of the maximum organ dose from TMI-1 and TMI-2 effluents (0.085 mrem) and the dose from direct radiation (0.37 mrem) yielded a maximum hypothetical dose of 0.46 mrem.

## TABLE 2

### Calculated Whole Body Doses to the Maximum Individual From 2009 TMI-1 and TMI-2 Liquid and Airborne Effluents

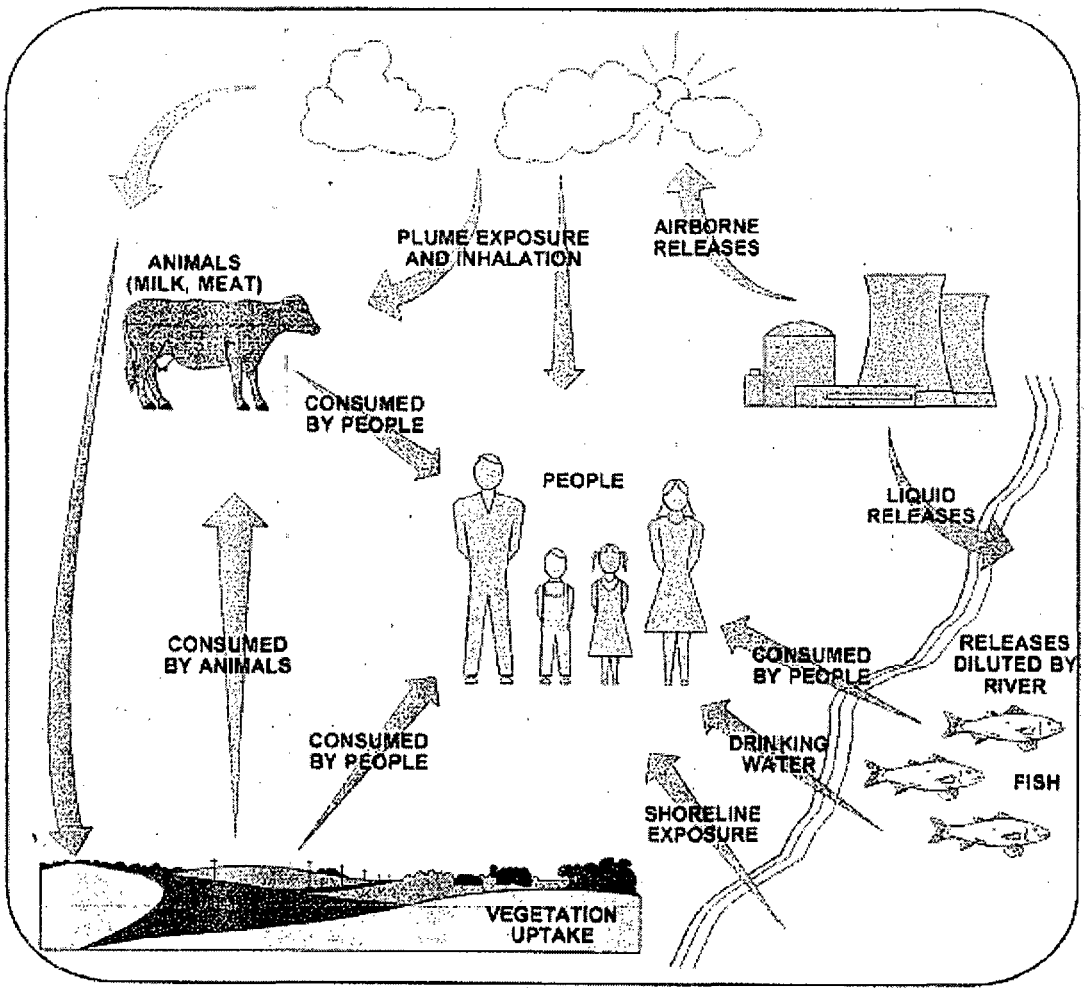
| | Calculated Maximum Individual Whole Body Dose (mrem/yr) | |
|---|---|---|
| | **TMI-1** | **TMI-2** |
| From Radionuclides In Liquid Releases | 2.77E-2 | 3.28E-4 |
| From Radionuclides in Airborne Releases (Noble Gases) | 2.98E-5 | 0* |
| From Radionuclides In Airborne Releases (Iodines, Tritium and Particulates) | 5.59E-2 | 4.38E-5 |

*No noble gases were released from TMI-2.

| | |
|---|---|
| **Individual Whole Body Dose Due to TMI-1 and TMI-2 Operations:** | **0.085 mrem/yr** |
| **Individual Whole Body Dose Due to Natural Background Radiation** | **300 mrem/yr** |

**Figure 1**

## Exposure Pathways For Radionuclides Routinely Released From TMINS




### PREDOMINANT RADIONUCLIDES

NOBLE GASES (Xe,Kr)
Plume exposure

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

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

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

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

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

F. Summary of Results – Inter-Laboratory Comparison Program

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

1. Analytics Evaluation Criteria

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

2. ERA Evaluation Criteria

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

3. DOE Evaluation Criteria

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

   The MAPEP defines three levels of performance: Acceptable (flag = "A"), Acceptable with Warning (flag = "W"), and Not Acceptable (flag = "N"). Performance is considered acceptable when a mean result for the specified analyte is ± 20% of the reference value. Performance is acceptable with warning when a mean result falls in the range from ±20% to ±30% of the reference value (i.e., 20% < bias < 30%). If the bias is greater than 30%, the results are deemed not acceptable.

1. For the primary laboratory, 17 out of 18 analytes met the specified acceptance criteria. One sample did not meet the specified acceptance criteria for the following reason:

1. Teledyne Brown Engineering's Analytics June 2009 Zn-65 in AP result of 137 pCi/L was higher than the known value of 101 pCi/L, resulting in a found to known ratio of 1.36. NCR 09-23 was initiated to investigate this failure. The failure appears to be a result of a slightly high bias on Detector 7. A recount on Detector 17 resulted in a Zn-65 result of 101 pCi/L. The detector has been tagged out-of-service until a recalibration can be performed. Detector 7 is not used for client samples.

For the secondary laboratory, Environmental, Inc., 11 out of 14 analytes met the specified acceptance criteria. Three samples did not meet the specified criteria for the following reasons:

1. Environmental Inc.'s ERA April 2009 Cs-137 in water result of 147.7 pCi/L exceeded the lower control limit of 151.0 pCi/L. All gamma emitters showed a low bias. A large plastic burr found on the base of the Marinelli kept the beaker from sitting directly on the detector. Recounting in a different beaker gave an acceptable result of 155.33 ± 14.55 pCi/L.
2. Environmental Inc.'s ERA April 2009 H-3 in water result of 22819 pCi/L exceeded the upper control limit of 22300 pCi/L. A recount of the original vials averaged 23,009 pCi/L. Reanalysis results were acceptable at 19,170 pCi/L. No cause could be found for the failure.
3. Environmental Inc.'s MAPEP January 2009 Sr-90 in AP result of 0.93 exceeded the upper control limit of 0.83. Reanalysis results were acceptable at 0.54 ± 0.12 Bq/filter. No cause could be found for the failure.
4. Environmental Inc.'s MAPEP July 2009 Sr-90 in soil result of 310.5 Bq/kg exceeded the lower control limit of 319 Bq/kg. Reanalysis results were acceptable at 363.3 Bq/kg. Incomplete separation of strontium from calcium could result in a higher recovery percentage and consequently lower reported activity.

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

## 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 - June5, 1974." RMC-TR-75-17, January 1975.

4. Exelon. "Three Mile Island Nuclear Station Offsite Dose Calculation Manual (ODCM)."

5. National Council of Radiation Protection and Measurements Report No. 93. "Ionizing Radiation Exposure of the Population of the United States." 1987.

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# APPENDIX A

# RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT SUMMARY

## TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR THE THREE MILE ISLAND NUCLEAR STATION, 2009

**Name of Facility:** THREE MILE ISLAND NUCLEAR STATION **DOCKET NUMBER:** 50-289 & 50-320
**Location of Facility:** MIDDLETOWN COUNTY PA **REPORTING PERIOD:** 2009

| 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 | 3271 (8/12) (227/9250) | <LLD | 3271 (8/12) (227/9250) | TM-SW-J1-2 INDICATOR WEST SHORE; TMI 0.5 MILES S OF SITE | 0 |
| | I-131 | 12 | 1 | NA | 1.6 (2/12) (1.4/1.8) | 1.6 (2/12) (1.4/1.8) | TM-SW-A3-2 CONTROL SWATARA CREEK 2.5 MILES N OF SITE | 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 |

THE MEAN AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUE
FRACTION OF DETECTABLE MEASUREMENT AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESIS (F)

## TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR THE THREE MILE ISLAND NUCLEAR STATION, 2009

**Name of Facility:** THREE MILE ISLAND NUCLEAR STATION **DOCKET NUMBER:** 50-289 & 50-320
**Location of Facility:** MIDDLETOWN COUNTY PA **REPORTING PERIOD:** 2009

| 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) | NB-95 | | 15 | <LLD | <LLD | - | | 0 |
| | ZR-95 | | 30 | <LLD | <LLD | - | | 0 |
| | CS-134 | | 15 | <LLD | <LLD | - | | 0 |
| | CS-137 | | 18 | <LLD | <LLD | - | | 0 |
| | BA-140 | | 60 | <LLD | <LLD | - | | 0 |
| | LA-140 | | 15 | <LLD | <LLD | - | | 0 |
| DRINKING WATER (PCI/LITER) | GR-B | 36 | 4 | 3.3 (14/24) (2.6/4.2) | 2.9 (6/12) (2.0/5.5) | 3.3 (9/12) (2.6/4.2) | TM-DW-G15-2 INDICATOR WRIGHTS WATER SUPPLY 13.6 MILES SE OF SITE | 0 |
| | I-131 | 36 | 1 | <LLD | <LLD | - | | 0 |

THE MEAN AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUE
FRACTION OF DETECTABLE MEASUREMENT AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESIS (F)

## TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR THE THREE MILE ISLAND NUCLEAR STATION, 2009

**Name of Facility:** THREE MILE ISLAND NUCLEAR STATION **DOCKET NUMBER:** 50-289 & 50-320
**Location of Facility:** MIDDLETOWN COUNTY PA **REPORTING PERIOD:** 2009

| 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 |
|---|---|---|---|---|---|---|---|---|
| DRINKING WATER (PCI/LITER) | H-3 | 36 | 2000 | 448 (1/24) | <LLD | 448 (1/12) | TM-DW-G15-3 INDICATOR LANCASTER WATER AUTHORITY 14.8 MILES SE OF SITE | 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 |

THE MEAN AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUE
FRACTION OF DETECTABLE MEASUREMENT AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESIS (F)

## TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR THE THREE MILE ISLAND NUCLEAR STATION, 2009

**Name of Facility:** THREE MILE ISLAND NUCLEAR STATION **DOCKET NUMBER:** 50-289 & 50-320
**Location of Facility:** MIDDLETOWN COUNTY PA **REPORTING PERIOD:** 2009

| 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 |
|---|---|---|---|---|---|---|---|---|
| DRINKING WATER (PCI/LITER) | ZR-95 | | 30 | <LLD | <LLD | - | | 0 |
| | CS-134 | | 15 | <LLD | <LLD | - | | 0 |
| | CS-137 | | 18 | <LLD | <LLD | - | | 0 |
| | BA-140 | | 60 | <LLD | <LLD | - | | 0 |
| | LA-140 | | 15 | <LLD | <LLD | - | | 0 |
| EFFLUENT WATER (PCI/LITER) | GR-B | 12 | 4 | 4.6 (11/12) (3.1/6.1) | NA | 4.6 (11/12) (3.1/6.1) | TM-EW-K1-1 INDICATOR MAIN STATION LIQ. DISCHARGE ONSITE | 0 |
| | I-131 | 12 | 1 | <LLD | NA | - | | 0 |

THE MEAN AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUE
FRACTION OF DETECTABLE MEASUREMENT AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESIS (F)

## TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR THE THREE MILE ISLAND NUCLEAR STATION, 2009

**Name of Facility:** THREE MILE ISLAND NUCLEAR STATION **DOCKET NUMBER:** 50-289 & 50-320
**Location of Facility:** MIDDLETOWN COUNTY PA **REPORTING PERIOD:** 2009

| 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 |
|---|---|---|---|---|---|---|---|---|
| EFFLUENT WATER (PCI/LITER) | H-3 | 12 | 2000 | 33789 (8/12) (2970/101000) | NA | 33789 (8/12) (2970/101000) | TM-EW-K1-1 INDICATOR MAIN STATION LIQ. DISCHARGE 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 |

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**Location of Facility:** MIDDLETOWN COUNTY PA **REPORTING PERIOD:** 2009

| 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 |
|---|---|---|---|---|---|---|---|---|
| EFFLUENT WATER (PCI/LITER) | 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 |
| STORM WATER (PCI/LITER) | H-3 | 4 | 200 | <LLD | NA | - | | 0 |

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**Name of Facility: THREE MILE ISLAND NUCLEAR STATION** **DOCKET NUMBER: 50-289 & 50-320**

**Location of Facility: MIDDLETOWN COUNTY PA** **REPORTING PERIOD: 2009**

| 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 |
|---|---|---|---|---|---|---|---|---|
| STORM WATER (PCI/LITER) | GAMMA | 4 | | | | | | |
| | 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 |

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**Name of Facility:** THREE MILE ISLAND NUCLEAR STATION **DOCKET NUMBER:** 50-289 & 50-320
**Location of Facility:** MIDDLETOWN COUNTY PA **REPORTING PERIOD:** 2009

| MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT) | TYPES OF ANALYSIS PERFORMED | NUMBER OF ANALYSIS PERFORMED | REQUIRED LOWER LIMIT OF DETECTION (LLD) | INDICATOR LOCATIONS MEAN (M) (F) RANGE | CONTROL LOCATION MEAN (M) (F) RANGE | LOCATION WITH HIGHEST ANNUAL MEAN (M) MEAN (M) (F) RANGE | LOCATION WITH HIGHEST ANNUAL MEAN (M) STATION # NAME DISTANCE AND DIRECTION | NUMBER OF NONROUTINE REPORTED MEASUREMENTS |
|---|---|---|---|---|---|---|---|---|
| STORM WATER (PCI/LITER) | 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/KG WET) | SR-90 | 4 | 10 | <LLD | <LLD | - | | 0 |
| | GAMMA | 4 | | | | | | |
| | K-40 | | NA | 3170 (2/2) (3120/3220) | 2775 (2/2) (2730/2820) | 3170 (2/2) (3120/3220) | INDB INDICATOR YORK HAVEN DAM DOWNSTREAM OF DISCHARGE | 0 |
| | MN-54 | | 130 | <LLD | <LLD | - | | 0 |

THE MEAN AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUE
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**Name of Facility: THREE MILE ISLAND NUCLEAR STATION** **DOCKET NUMBER: 50-289 & 50-320**
**Location of Facility: MIDDLETOWN COUNTY PA** **REPORTING PERIOD: 2009**

| 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 |
|---|---|---|---|---|---|---|---|---|
| BOTTOM FEEDER (PCI/KG WET) | CO-58 | | 130 | <LLD | <LLD | - | | 0 |
| | FE-59 | | 260 | <LLD | <LLD | - | | 0 |
| | CO-60 | | 130 | <LLD | <LLD | - | | 0 |
| | ZN-65 | | 260 | <LLD | <LLD | - | | 0 |
| | CS-134 | | 130 | <LLD | <LLD | - | | 0 |
| | CS-137 | | 150 | <LLD | <LLD | - | | 0 |
| PREDATOR (PCI/KG WET) | SR-90 | 4 | 10 | <LLD | <LLD | - | | 0 |

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## TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR THE THREE MILE ISLAND NUCLEAR STATION, 2009

**Name of Facility:** THREE MILE ISLAND NUCLEAR STATION **DOCKET NUMBER:** 50-289 & 50-320
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| MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT) | TYPES OF ANALYSIS PERFORMED | NUMBER OF ANALYSIS PERFORMED | REQUIRED LOWER LIMIT OF DETECTION (LLD) | INDICATOR LOCATIONS MEAN (M) (F) RANGE | CONTROL LOCATION MEAN (M) (F) RANGE | LOCATION WITH HIGHEST ANNUAL MEAN (M) MEAN (M) (F) RANGE | LOCATION WITH HIGHEST ANNUAL MEAN (M) STATION # NAME DISTANCE AND DIRECTION | NUMBER OF NONROUTINE REPORTED MEASUREMENTS |
|---|---|---|---|---|---|---|---|---|
| PREDATOR (PCI/KG WET) | GAMMA | 4 | | | | | | |
| | K-40 | | NA | 3190 (2/2) (3080/3300) | 2655 (2/2) (2090/3220) | 3190 (2/2) (3080/3300) | INDP 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 |

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**Name of Facility:** THREE MILE ISLAND NUCLEAR STATION **DOCKET NUMBER:** 50-289 & 50-320
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| MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT) | TYPES OF ANALYSIS PERFORMED | NUMBER OF ANALYSIS PERFORMED | REQUIRED LOWER LIMIT OF DETECTION (LLD) | INDICATOR LOCATIONS MEAN (M) (F) RANGE | CONTROL LOCATION MEAN (M) (F) RANGE | LOCATION WITH HIGHEST ANNUAL MEAN (M) MEAN (M) (F) RANGE | STATION # NAME DISTANCE AND DIRECTION | NUMBER OF NONROUTINE REPORTED MEASUREMENTS |
|---|---|---|---|---|---|---|---|---|
| PREDATOR (PCI/KG WET) | CS-137 | | 150 | <LLD | <LLD | - | | 0 |
| SEDIMENT (PCI/KG DRY) | GAMMA | 7 | | | | | | |
| | K-40 | | NA | 14232 (5/5) (9960/17600) | 12200 (2/2) (10200/14200) | 17500 (2/2) (17400/17600) | J2-1 INDICATOR YORK HAVEN DAM 1.5 MILES S OF SITE | 0 |
| | 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 | 129 (2/5) (128/130) | 346 (2/2) (336/355) | 346 (2/2) (336/355) | A1-3 CONTROL SUSQUEHANNA RIVER 0.5 MILES N OF SITE | 0 |

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|---|---|---|---|---|---|---|---|---|
| AIR PARTICULATE (E-3 PCI/CU.METER) | GR-B | 362 | 10 | 18 (302/310) (8/204) | 18 (52/52) (9/28) | 20 (50/52) (8/204) | TM-AP-G2-1 INDICATOR BECKER FARM 1.4 MILES SE OF SITE | 0 |
| | GAMMA | 28 | | | | | | |
| | BE-7 | | NA | 88 (24/24) (56/125) | 92 (4/4) (89/94) | 94 (4/4) (77/105) | TM-AP-E1-2 INDICATOR TMI VISITOR'S CENTER 0.4 MILES E OF SITE | 0 |
| | 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 |

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**Name of Facility:** THREE MILE ISLAND NUCLEAR STATION **DOCKET NUMBER:** 50-289 & 50-320
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|---|---|---|---|---|---|---|---|---|
| AIR PARTICULATE (E-3 PCI/CU.METER) | CS-137 | 362 | 60 | <LLD | <LLD | - | | 0 |
| AIR IODINE (E-3 PCI/CU.METER) | GAMMA I-131 | | 70 | <LLD | <LLD | - | | 0 |
| MILK (PCI/LITER) | I-131 | 115 | 1 | <LLD | <LLD | - | | 0 |
| | SR-89 | 21 | 5 | <LLD | <LLD | - | | 0 |
| | SR-90 | 21 | 2 | 0.7 (7/17) (0.5/1.0) | 0.8 (3/4) (0.5/1.2) | 0.8 (1/4) | TM-M-E2-2 INDICATOR NISSLEY FARM 1.1 MILES E OF SITE | 0 |
| | GAMMA K-40 | 115 | NA | 1270 (92/92) (915/1440) | 1259 (23/23) (1030/1430) | 1343 (23/23) (1170/1430) | TM-M-F4-1 INDICATOR TURNPIKE ROAD FARM 3.0 MILES ESE OF SITE | 0 |
| | CS-134 | | 15 | <LLD | <LLD | - | | 0 |

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|---|---|---|---|---|---|---|---|---|
| MILK (PCI/LITER) | CS-137 | | 18 | <LLD | <LLD | - | | 0 |
| | BA-140 | | 60 | <LLD | <LLD | - | | 0 |
| | LA-140 | | 15 | <LLD | <LLD | - | | 0 |
| VEGETATION (PCI/KG WET) | SR-90 | 20 | 10 | 20.5 (9/10) (2.2/49.4) | 18.2 (9/10) (3.4/37.9) | 21.6 (8/9) (2.2/49.4) | H1-2 INDICATOR RED HILL MARKET 1.0 MILES SSE OF SITE | 0 |
| | GAMMA | 26 | | | | | | |
| | BE-7 | | NA | 659 (6/13) (200/1690) | 725 (5/13) (332/1400) | 725 (5/13) (332/1400) | B10-2 CONTROL MILTON HERSHEY SCHOOL 10.1 MILES NNE OF SITE | 0 |
| | K-40 | | NA | 3773 (13/13) (2130/5300) | 3470 (13/13) (1990/5650) | 4074 (9/9) (2130/5300) | H1-2 INDICATOR RED HILL MARKET 1.0 MILES SSE OF SITE | 0 |
| | I-131 | | 60 | <LLD | <LLD | - | | 0 |

THE MEAN AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUE
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**Name of Facility: THREE MILE ISLAND NUCLEAR STATION** **DOCKET NUMBER: 50-289 & 50-320**

**Location of Facility: MIDDLETOWN COUNTY PA** **REPORTING PERIOD: 2009**

| MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT) | TYPES OF ANALYSIS PERFORMED | NUMBER OF ANALYSIS PERFORMED | REQUIRED LOWER LIMIT OF DETECTION (LLD) | INDICATOR LOCATIONS MEAN (M) (F) RANGE | CONTROL LOCATION MEAN (M) (F) RANGE | LOCATION WITH HIGHEST ANNUAL MEAN (M) MEAN (M) (F) RANGE | STATION # NAME DISTANCE AND DIRECTION | NUMBER OF NONROUTINE REPORTED MEASUREMENTS |
|---|---|---|---|---|---|---|---|---|
| VEGETATION (PCI/KG WET) | CS-134 | | 60 | <LLD | <LLD | - | | 0 |
| | CS-137 | | 80 | <LLD | <LLD | - | | 0 |
| DIRECT RADIATION (MILLI-ROENTGEN/STD.MO.) | TLD-QUARTERLY | 352 | NA | 4.5 (308/308) (2.7/7.7) | 5.1 (44/44) (4.1/7.0) | 7.3 (4/4) (6.9/7.7) | H8-1 INDICATOR SAGINAW ROAD 7.4 MILES SSE OF SITE | 0 |

THE MEAN AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUE
FRACTION OF DETECTABLE MEASUREMENT AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESIS (F)

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# APPENDIX B

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

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

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

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

YY - Radial Zone of Sampling Location in miles.

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

**TABLE B-2: Radiological Environmental Monitoring Program - Sampling Locations, Distance and Direction, Three Mile Island Nuclear Station, 2009**

| Sample Medium | Station Code | Map Number | Distance (miles) | Azimuth | Description |
|---|---|---|---|---|---|
| AQS | A1-3 | 1 | 0.5 | 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 | 23° | NNE of Reactor Building on top of dike, TMI |
| ID | B2-1 | 2 | 1.9 | 17° | NNE of site on Sunset Dr. (off Hillsdale Rd.) |
| ID | B5-1 | 2 | 4.9 | 19° | NNE of site at intersection of School House and Miller Roads |
| ID | B10-1 | 3 | 9.2 | 21° | NNE of site at intersection of West Areba Avenue and Mill Street, Hershey |
| FP | B10-2 | 3 | 10 | 31° | NNE of site at Milton Hershey School, Hershey |
| ID | C1-1 | 1 | 0.7 | 37° | NE of site along Route 441 N |
| ID | C1-2 | 1 | 0.3 | 50° | NE of Reactor Building on top of dike, TMI |
| ID | C2-1 | 2 | 1.5 | 44° | NE of site at Middletown Junction |
| ID | C5-1 | 2 | 4.7 | 43° | NE of site on Kennedy Lane |
| ID | C8-1 | 3 | 7.1 | 48° | NE of site at Schenk's Church on School House Road |
| AQF | Control | - | - | - | All locations where finfish are collected above Dock St. Dam, Harrisburg |
| ID | D1-1 | 1 | 0.2 | 76° | ENE of Reactor Building on top of dike, TMI |
| ID | D1-2 | 1 | 0.5 | 67° | ENE of site off Route 441 along lane between garden center and residence |
| M | D2-1 | 2 | 1.1 | 62° | ENE of site at farm on Gingrich Road |
| ID | D2-2 | 2 | 1.6 | 74° | ENE of site along Hillsdale Rd. (S of Zion Rd.) |
| ID | D6-1 | 3 | 5.2 | 66° | ENE of site off Beagle Road |
| ID | D15-1 | 3 | 10.8 | 64° | ENE of site along Route 241, Lawn |
| AP,AI,ID,FP | E1-2 | 1 | 0.4 | 97° | E of site at TMI Visitor's Center |
| ID | E1-4 | 1 | 0.2 | 97° | E of Reactor Building on top of dike, TMI |
| M | E2-2 | 2 | 1.1 | 96° | E of site at farm on Pecks Road |
| ID | E2-3 | 2 | 2.0 | 97° | E of site along Hillsdale Rd. (N of Creek Rd.) |
| ID | E5-1 | 2 | 4.7 | 82° | E of site at intersection of North Market Street (Route 230) and Zeager Road |
| ID | E7-1 | 3 | 6.7 | 88° | E of site along Hummelstown Street, Elizabethtown |
| ID | F1-1 | 1 | 0.5 | 117° | ESE of site near entrance to 500 kV Substation |
| ID | F1-2 | 1 | 0.2 | 112° | ESE of Reactor Building on top of dike midway within ISWSF, TMI |
| AP,AI | F1-3 | 1 | 0.6 | 112° | ESE of site in 500 kV Substation |
| ID | F1-4 | 1 | 0.2 | 122° | ESE of Reactor Building on top of dike, TMI |
| ID | F2-1 | 2 | 1.3 | 119° | ESE of site along Engle Road |
| M | F4-1 | 2 | 3.2 | 104° | ESE of site at farm on Turnpike Road |
| ID | F5-1 | 2 | 4.7 | 109° | ESE of site along Amosite Road |
| ID | F10-1 | 3 | 9.4 | 112° | ESE of site along Donegal Springs Road, Donegal Springs |
| ID | F25-1 | 3 | 22 | 106° | ESE of site at intersection of Steel Way and Loop Roads, Lancaster |
| ID | G1-2 | 1 | 0.7 | 145° | SE of site along Route 441 S |
| ID | G1-3 | 1 | 0.2 | 130° | SE of Reactor Building on top of dike, TMI |
| ID | G1-5 | 1 | 0.3 | 143° | SE of Reactor Building on top of dike, TMI |
| ID | G1-6 | 1 | 0.3 | 139° | SE of Reactor Building on top of dike, TMI |
| AI,AP,M | G2-1 | 2 | 1.4 | 126° | SE of site at farm on Becker Road |
| ID | G2-4 | 2 | 1.7 | 138° | SE of site on Becker Road |
| ID | G5-1 | 2 | 4.8 | 131° | SE of site at intersection of Bainbridge and Risser Roads |
| ID | G10-1 | 3 | 9.7 | 128° | SE of site at farm along Engles Tollgate Road, Marietta |
| ID | G15-1 | 3 | 14.4 | 126° | SE of site at Columbia Water Treatment Plant |
| DW | G15-2 | 3 | 13.3 | 129° | SE of site at Wrightsville Water Treatment Plant |
| DW | G15-3 | 3 | 15.7 | 124 | SE of site at Lancaster Water Treatment Plant |

**TABLE B-2: Radiological Environmental Monitoring Program - Sampling Locations, Distance and Direction, Three Mile Island Nuclear Station, 2009**

| Sample Medium | Station Code | Map Number | Distance (miles) | Azimuth | Description |
|---|---|---|---|---|---|
| ID | H1-1 | 1 | 0.5 | 167° | SSE of site, TMI |
| FP | H1-2 | 1 | 1.0 | 151° | SSE of site along Route 441, Red Hill Market |
| AP,AI,ID | H3-1 | 2 | 2.2 | 160° | SSE of site in Falmouth-Collins Substation |
| ID | H5-1 | 2 | 4.1 | 158° | SSE of site by Guard Shack at Brunner Island Steam Electric Station |
| ID | H8-1 | 3 | 7.4 | 163° | SSE of site along Saginaw Road, Starview |
| ID | H15-1 | 3 | 13.2 | 157° | SSE of site at intersection of Orchard and Stonewood Roads, Wilshire Hills |
| AQF | Indicator | - | - | - | All locations where finfish are collected downstream of the TMINS liquid discharge outfall |
| ID | J1-1 | 1 | 0.8 | 176° | S of site, TMI |
| SW | J1-2 | 1 | 0.5 | 188° | S of site downstream of the TMINS liquid discharge outfall in Susquehanna River |
| ID | J1-3 | 1 | 0.3 | 189° | S of Reactor Building just S of SOB, TMI |
| AQS | J2-1 | 2 | 1.4 | 179° | S of site in Susquehanna River just upstream of the York Haven Dam |
| ID | J3-1 | 2 | 2.7 | 179° | S of site at York Haven/Cly |
| ID | J5-1 | 2 | 4.9 | 181° | S of site along Canal Road, Conewago Heights |
| ID | J7-1 | 3 | 6.5 | 176° | S of site off of Maple Street, Manchester |
| ID | J15-1 | 3 | 12.6 | 183° | S of site in Met-Ed York Load Dispatch Station |
| EW | K1-1 | 1 | 0.2 | 210° | On site at RML-7 Main Station Discharge Building |
| AQS | K1-3 | 1 | 0.2 | 212° | SSW of site downstream of the TMINS liquid discharge outfall in the Susquehanna River |
| ID | K1-4 | 1 | 0.2 | 209° | SSW of Reactor Building on top of dike behind Warehouse 2, TMI |
| ID | K2-1 | 2 | 1.2 | 200° | SSW of site on S Shelley Island |
| ID | K3-1 | 2 | 2.0 | 206° | SSW of site along Rt. 262, N of Cly |
| ID | K5-1 | 2 | 4.9 | 202° | SSW of site along Conewago Creek Road, Strinestown |
| ID | K8-1 | 3 | 7.5 | 196° | SSW of site at intersection of Coppenhaffer Road and Route 295, Zions View |
| ID | K15-1 | 3 | 12.8 | 203° | SSW of site behind McDonald's and next to child care center, Weiglestown |
| M | K15-3 | 3 | 14.4 | 205° | SSW of site at farm along S Salem Church Rd, Dover |
| ID | L1-1 | 1 | 0.1 | 236° | SW of site on top of dike W of Mech. Draft Cooling Tower, TMI |
| ID | L1-2 | 1 | 0.5 | 221° | SW of site on Beech Island |
| ID | L2-1 | 2 | 1.8 | 224° | SW of site along Route 262 |
| ID | L5-1 | 2 | 4.1 | 228° | SW of site at intersection of Stevens and Wilson Roads |
| ID | L8-1 | 3 | 8.0 | 225° | SW of site along Rohlers Church Rd., Andersontown |
| ID | L15-1 | 3 | 11.8 | 226° | SW of site on W side of Route 74, rear of church, Mt. Royal |
| ID | M1-1 | 1 | 0.1 | 250° | WSW of Reactor Building on SE corner of U-2 Screenhouse fence, TMI |
| ID | M1-2 | 1 | 0.4 | 252° | WSW of site on E side of Shelley Island, Lot #157 |
| AP,AI,ID | M2-1 | 2 | 1.3 | 256° | WSW of site along Route 262 and adjacent to Fishing Creek, Goldsboro |
| ID | M5-1 | 2 | 4.3 | 249° | WSW of site at intersection of Lewisberry and Roxberry Roads, Newberrytown |
| ID | M9-1 | 3 | 8.7 | 243° | WSW of site along Alpine Road, Maytown |
| ID | N1-1 | 1 | 0.7 | 274° | W of site on W side of Shelley Island, between lots #13 and #14 |
| ID | N1-3 | 1 | 0.1 | 274° | W of Reactor Building on fence adjacent to Screenhouse entrance gate, TMI |
| ID | N2-1 | 2 | 1.2 | 261° | W of site at Goldsboro Marina |
| ID | N5-1 | 2 | 5.0 | 268° | W of site off of Old York Road along Robin Hood Drive |
| ID | N8-1 | 3 | 7.7 | 262° | W of site along Route 382, 1/2 mile north of Lewisberry |
| ID | N15-2 | 3 | 10.4 | 275° | W of site at intersection of Lisburn Road and Main Street, Lisburn |
| ID | P1-1 | 1 | 0.4 | 303° | WNW of site on Shelley Island |

**TABLE B-2: Radiological Environmental Monitoring Program - Sampling Locations, Distance and Direction, Three Mile Island Nuclear Station, 2009**

| Sample Medium | Station Code | Map Number | Distance (miles) | Azimuth | Description |
|---|---|---|---|---|---|
| ID | P1-2 | 1 | 0.1 | 292° | WNW of Reactor Building on fence N of Unit 1 Screenhouse, TMI |
| ID | P2-1 | 2 | 2.0 | 283° | WNW of site along Route 262 |
| M | P4-1 | 2 | 3.7 | 295 | WNW of site at farm on Valley Road |
| ID | P5-1 | 2 | 5.0 | 284° | WNW of site at intersection of Valley Road (Route 262) and Beinhower Road |
| ID | P8-1 | 3 | 8.0 | 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 | 3 | 0.2 | 335° | NNW of Reactor Building along W fence, TMI |
| ID | R1-2 | 1 | 0.7 | 334° | NNW of site on central Henry Island |
| ID | R3-1 | 2 | 2.6 | 341° | NNW of site at Crawford Station, Middletown |
| ID | R5-1 | 2 | 4.9 | 339° | NNW of site at intersection of Spring Garden Drive and Route 441 |
| ID | R9-1 | 3 | 8.0 | 341° | NNW of site at intersection of Derry and 66th Streets, Rutherford Heights |
| ID | R15-1 | 3 | 11.2 | 332° | NNW of site at intersection of Route 22 and Colonial Road, Colonial Park |

## IDENTIFICATION KEY

ID = Immersion Dose (TLD)
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)
AFT = Finfish
AQS = Aquatic Sediment

**TABLE B-3: Radiological Environmental Monitoring Program – Summary of Sample Collection and Analytical Methods, Three Mile Island Nuclear Station, 2009**

| Sample Medium | Analysis | Sampling Method | Collection Procedure Number | Sample Size | Analytical Procedure Number |
|---|---|---|---|---|---|
| Surface Water | Gamma Spectroscopy | Monthly composite from a continuous water compositor. | ER-TMI-06 Collection of water samples for radiological analysis (Three Mile Island Nuclear Station) | 2 gallon | TBE, TBE-2007 Gamma emitting radioisotope analysis<br><br>Env. Inc., GS-01 Determination of gamma emitters by gamma spectroscopy |
| Surface Water | Tritium | Monthly composite from a continuous water compositor. | ER-TMI-06 Collection of water samples for radiological analysis (Three Mile Island Nuclear Station) | 2 gallon | TBE, TBE-2010 Tritium and carbon-14 analysis by liquid scintillation<br><br>Env. Inc., T-02 Determination of tritium in water (direct method) |
| Surface Water | Iodine- 131 | Monthly composite from a continuous water compositor. | ER-TMI-06 Collection of water samples for radiological analysis (Three Mile Island Nuclear Station) | 2 gallon | TBE, TBE-2012 Radioiodine in various matrices<br><br>Env. Inc., I-131-01 Determination of I-131 in milk by anion exchange |
| Drinking Water | Gross Beta | Monthly composite from a continuous water compositor. | ER-TMI-06 Collection of water samples for radiological analysis (Three Mile Island Nuclear Station) | 2 gallon | TBE, TBE-2008 Gross alpha and/or gross beta activity in various matrices<br><br>Env. Inc., W(DS)-01 Determination of gross alpha and/or gross beta in water (dissolved solids or total residue) |
| Drinking Water | Gamma Spectroscopy | Monthly composite from a continuous water compositor. | ER-TMI-06 Collection of water samples for radiological analysis (Three Mile Island Nuclear Station) | 2 gallon | TBE, TBE-2007 Gamma emitting radioisotope analysis<br><br>Env. Inc., GS-01 Determination of gamma emitters by gamma spectroscopy |
| Drinking Water | Tritium | Monthly composite from a continuous water compositor. | ER-TMI-06 Collection of water samples for radiological analysis (Three Mile Island Nuclear Station) | 2 gallon | TBE, TBE-2010 Tritium and carbon-14 analysis by liquid scintillation<br><br>Env. Inc., T-02 Determination of tritium in water (direct method) |
| Drinking Water | Iodine-131 | Monthly composite from a continuous water compositor. | ER-TMI-06 Collection of water samples for radiological analysis (Three Mile Island Nuclear Station) | 2 gallon | TBE, TBE-2012 Radioiodine in various matrices<br><br>Env. Inc., I-131-01 Determination of I-131 in milk by anion exchange |
| Effluent Water | Iodine-131 | Monthly composite from a continuous water compositor. | ER-TMI-06 Collection of water samples for radiological analysis (Three Mile Island Nuclear Station) | 2 gallon | TBE, TBE-2012 Radioiodine in various matrices<br><br>Env. Inc., I-131-01 Determination of I-131 in milk by anion exchange |
| Effluent Water | Gross Beta | Monthly composite from a continuous water compositor. | ER-TMI-06 Collection of water samples for radiological analysis (Three Mile Island Nuclear Station) | 2 gallon | TBE, TBE-2008 Gross alpha and/or gross beta activity in various matrices<br><br>Env. Inc., W(DS)-01 Determination of gross alpha and/or gross beta in water (dissolved solids or total residue) |

**TABLE B-3: Radiological Environmental Monitoring Program – Summary of Sample Collection and Analytical Methods, Three Mile Island Nuclear Station, 2009**

| Sample Medium | Analysis | Sampling Method | Collection Procedure Number | Sample Size | Analytical Procedure Number |
|---|---|---|---|---|---|
| Effluent Water | Gamma Spectroscopy | Monthly composite from a continuous water compositor. | ER-TMI-06 Collection of water samples for radiological analysis (Three Mile Island Nuclear Station) | 2 gallon | TBE, TBE-2007 Gamma emitting radioisotope analysis<br><br>Env. Inc., GS-01 Determination of gamma emitters by gamma spectroscopy |
| Effluent Water | Tritium | Monthly composite from a continuous water compositor. | ER-TMI-06 Collection of water samples for radiological analysis (Three Mile Island Nuclear Station) | 2 gallon | TBE, TBE-2010 Tritium and carbon-14 analysis by liquid scintillation<br><br>Env. Inc., T-02 Determination of tritium in water (direct method) |
| Effluent Water | Strontium 89/90 | Semi-annual composite from monthly samples. | TBE, TBE-2023 Compositing of samples | 2 gallon | TBE, TBE-2019 Radiostrontium analysis by ion exchange |
| Storm Water | Gamma Spectroscopy | Quarterly composite of monthly grab samples | ER-TMI-06 Collection of water samples for radiological analysis (Three Mile Island Nuclear Station) | 1 gallon | TBE, TBE-2007 Gamma emitting radioisotope analysis<br><br>Env. Inc., GS-01 Determination of gamma emitters by gamma spectroscopy |
| Storm Water | Tritium | Quarterly composite of monthly grab samples | ER-TMI-06 Collection of water samples for radiological analysis (Three Mile Island Nuclear Station) | 1 gallon | TBE, TBE-2010 Tritium and carbon-14 analysis by liquid scintillation<br><br>Env. Inc., T-02 Determination of tritium in water (direct method) |
| Fish | Gamma Spectroscopy | Semi-annual samples collected via electroshocking or other techniques | ER-TMI-13 Collection of fish samples for radiological analysis (Three Mile Island Nuclear Station) | 1000 grams (wet) | TBE, TBE-2007 Gamma emitting radioisotope analysis<br><br>Env. Inc., GS-01 Determination of gamma emitters by gamma spectroscopy |
| Fish | Strontium 90 | Semi-annual samples collected via electroshocking or other techniques | ER-TMI-13 Collection of fish samples for radiological analysis (Three Mile Island Nuclear Station) | 1000 grams (wet) | TBE, TBE-2019 Radiostrontium analysis by ion exchange |

**TABLE B-3: Radiological Environmental Monitoring Program – Summary of Sample Collection and Analytical Methods, Three Mile Island Nuclear Station, 2009**

| Sample Medium | Analysis | Sampling Method | Collection Procedure Number | Sample Size | Analytical Procedure Number |
|---|---|---|---|---|---|
| Sediment | Gamma Spectroscopy | Semi-annual grab samples | ER-TMI-03 Collection of sediment samples for radiological analysis (Three Mile Island Nuclear Station) | 500 grams (dry) | TBE, TBE-2007 Gamma emitting radioisotope analysis<br><br>Env. Inc., GS-01 Determination of gamma emitters by gamma spectroscopy |
| Air Particulates | Gross Beta | One-week composite of continuous air sampling through glass fiber filter paper | ER-TMI-14 Collection of air particulate and air iodine samples for radiological analysis (Three Mile Island Nuclear Station) | 1 filter (approximately 280 cubic meters weekly) | TBE, TBE-2008 Gross alpha and/or gross beta activity in various matrices<br><br>Env. Inc., AP-02 Determination of gross alpha and/or gross beta in air particulate filters |
| Air Particulates | Gamma Spectroscopy | Quarterly composite of each station | TBE, TBE-2023 Compositing of samples<br><br>Env. Inc., AP-03 Procedure for compositing air particulate filters for gamma spectroscopic analysis | 13 filters (approximately 3600 cubic meters) | TBE, TBE-2007 Gamma emitting radioisotope analysis<br><br>Env. Inc., GS-01 Determination of gamma emitters by gamma spectroscopy |
| Air Iodine | Gamma Spectroscopy | One-week composite of continuous air sampling through charcoal filter | ER-TMI-14 Collection of air particulate and air iodine samples for radiological analysis (Three Mile Island Nuclear Station) | 1 filter (approximately 280 cubic meters weekly) | TBE, TBE-2007 Gamma emitting radioisotope analysis<br><br>Env. Inc., I-131-02 Determination of I-131 in charcoal canisters by gamma spectroscopy (batch method) |
| Milk | I-131 | Bi-weekly grab sample when cows are on pasture. Monthly all other times | ER-TMI-01 Collection of milk samples for radiological analysis (Three Mile Island Nuclear Station) | 2 gallon | TBE, TBE-2012 Radioiodine in various matrices<br><br>Env. Inc., I-131-01 Determination of I-131 in milk by anion exchange |
| Milk | Strontium-89/90 | Quarterly composite of Bi-weekly and monthly grab samples | ER-TMI-01 Collection of milk samples for radiological analysis (Three Mile Island Nuclear Station)<br><br>TBE, TBE-2023 Compositing of samples | 2 gallon | TBE, TBE-2019 Radiostrontium analysis by ion exchange |
| Milk | Gamma Spectroscopy | Bi-weekly grab sample when cows are on pasture. Monthly all other times | ER-TMI-01 Collection of milk samples for radiological analysis (Three Mile Island Nuclear Station) | 2 gallon | TBE, TBE-2007 Gamma emitting radioisotope analysis<br><br>Env. Inc., GS-01 Determination of gamma emitters by gamma spectroscopy |
| Vegetation | Gamma Spectroscopy | Monthly and annual grab sample | ER-TMI-04 Collection of vegetation samples for radiological analysis (Three Mile Island Nuclear Station) | 1000 grams | TBE, TBE-2007 Gamma emitting radioisotope analysis<br><br>Env. Inc., GS-01 Determination of gamma emitters by gamma spectroscopy |

**TABLE B-3: Radiological Environmental Monitoring Program – Summary of Sample Collection and Analytical Methods, Three Mile Island Nuclear Station, 2009**

| Sample Medium | Analysis | Sampling Method | Collection Procedure Number | Sample Size | Analytical Procedure Number |
|---|---|---|---|---|---|
| Vegetation | Gamma Spectroscopy | Monthly and annual grab sample | ER-TMI-04 Collection of vegetation samples for radiological analysis (Three Mile Island Nuclear Station) | 1000 grams | TBE, TBE-2007 Gamma emitting radioisotope analysis<br><br>Env. Inc., GS-01 Determination of gamma emitters by gamma spectroscopy |
| Vegetation | Strontium-89/90 | Monthly and annual grab sample | ER-TMI-04 Collection of vegetation samples for radiological analysis (Three Mile Island Nuclear Station) | 1000 grams | TBE, TBE-2019 Radiostrontium analysis by ion exchange |
| TLD | Thermoluminescence Dosimetry | Quarterly TLDs comprised of two Panasonic 814 (containing 4 each $CaSO_4$ elements) | ER-TMI-02 Collection of TLD samples for radiological analysis (Three Mile Island Nuclear Station) | 2 badges with 3 dosimeters | Global Dosimetry Solutions, Inc. |

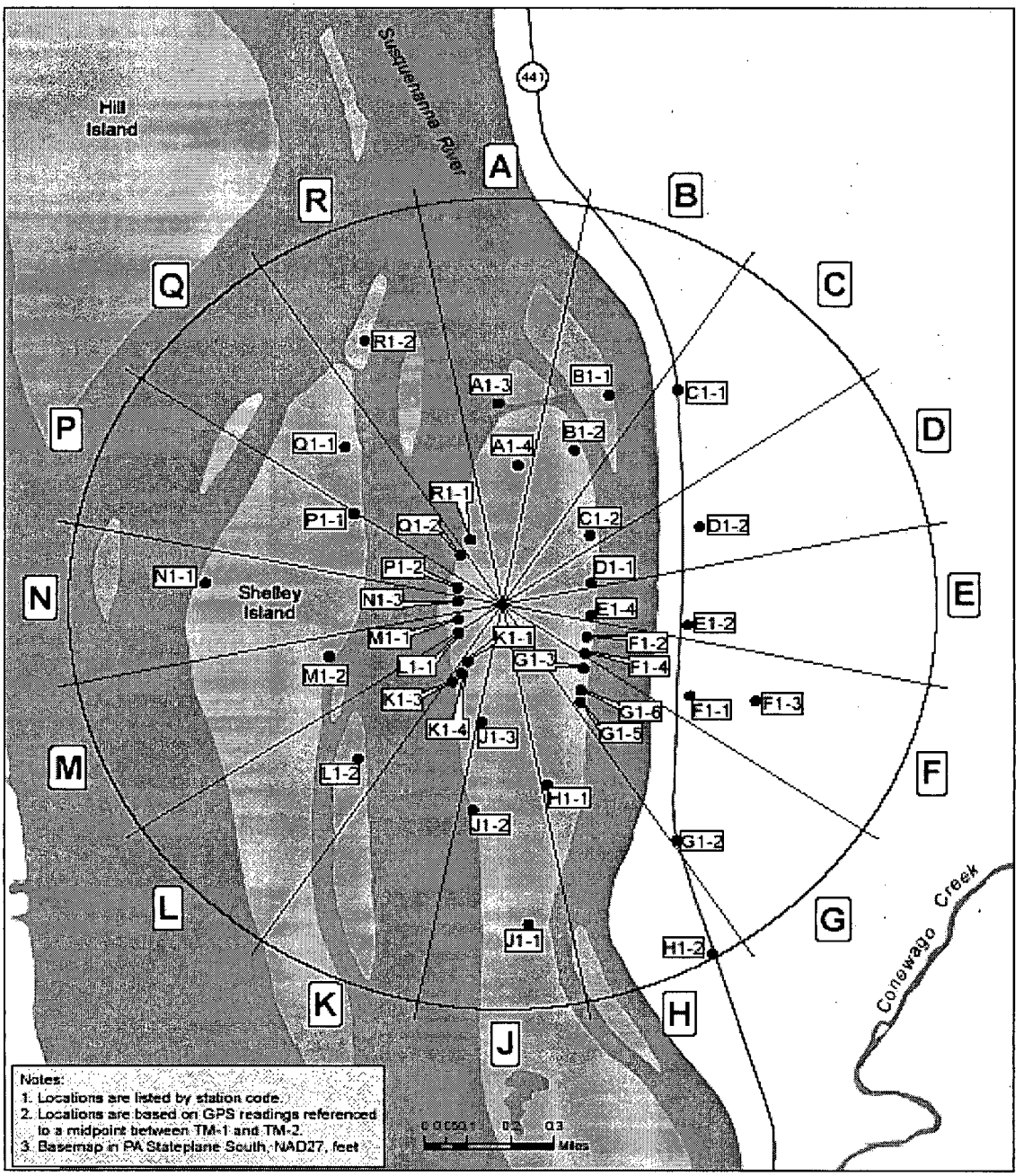


**Figure B-1**
**Environmental Sampling Locations Within One Mile of the Three Mile Island Nuclear Station, 2009**

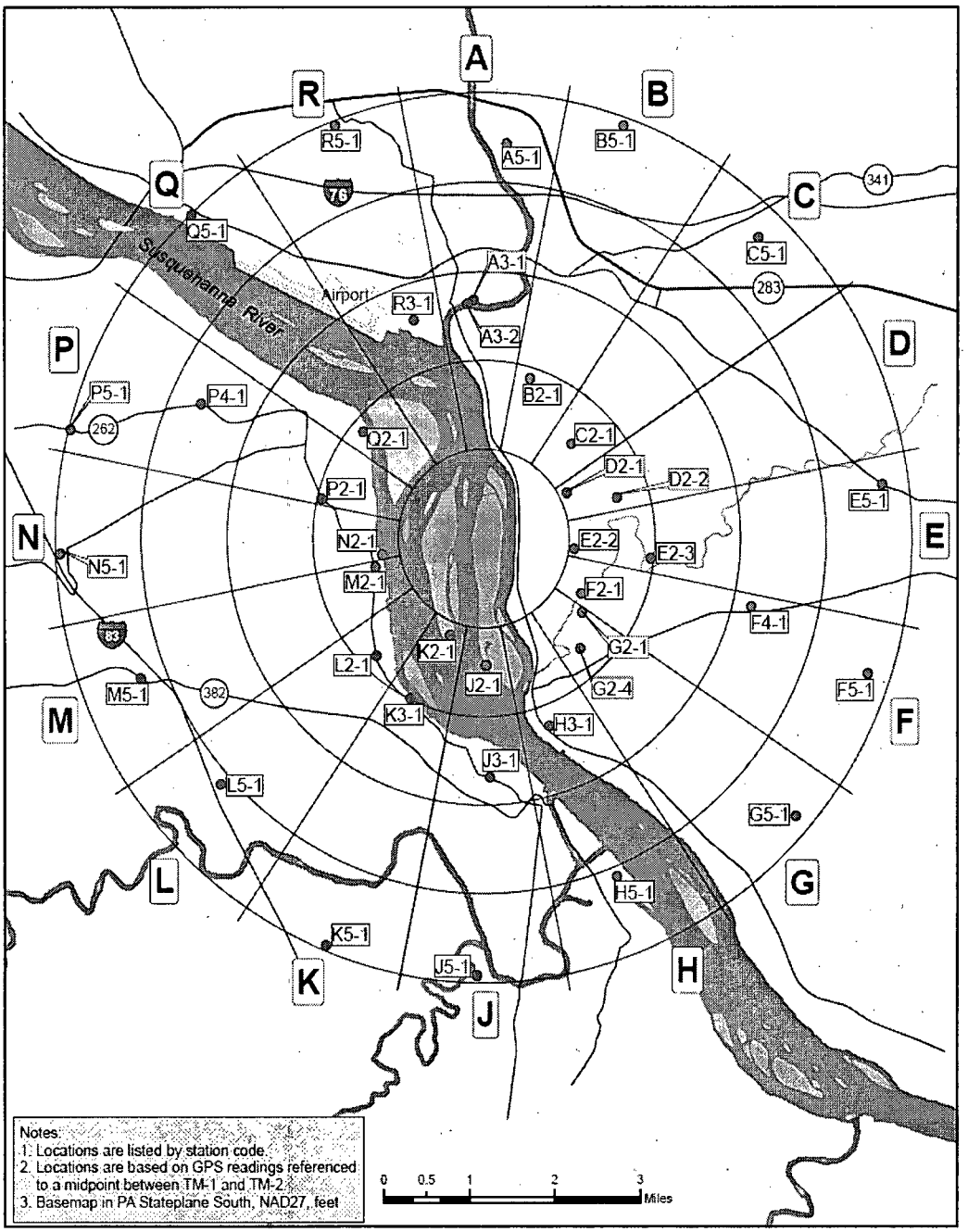


**Figure B-2**
**Environmental Sampling Locations Between One and Five Miles of the Three Mile Island Nuclear Station, 2009**

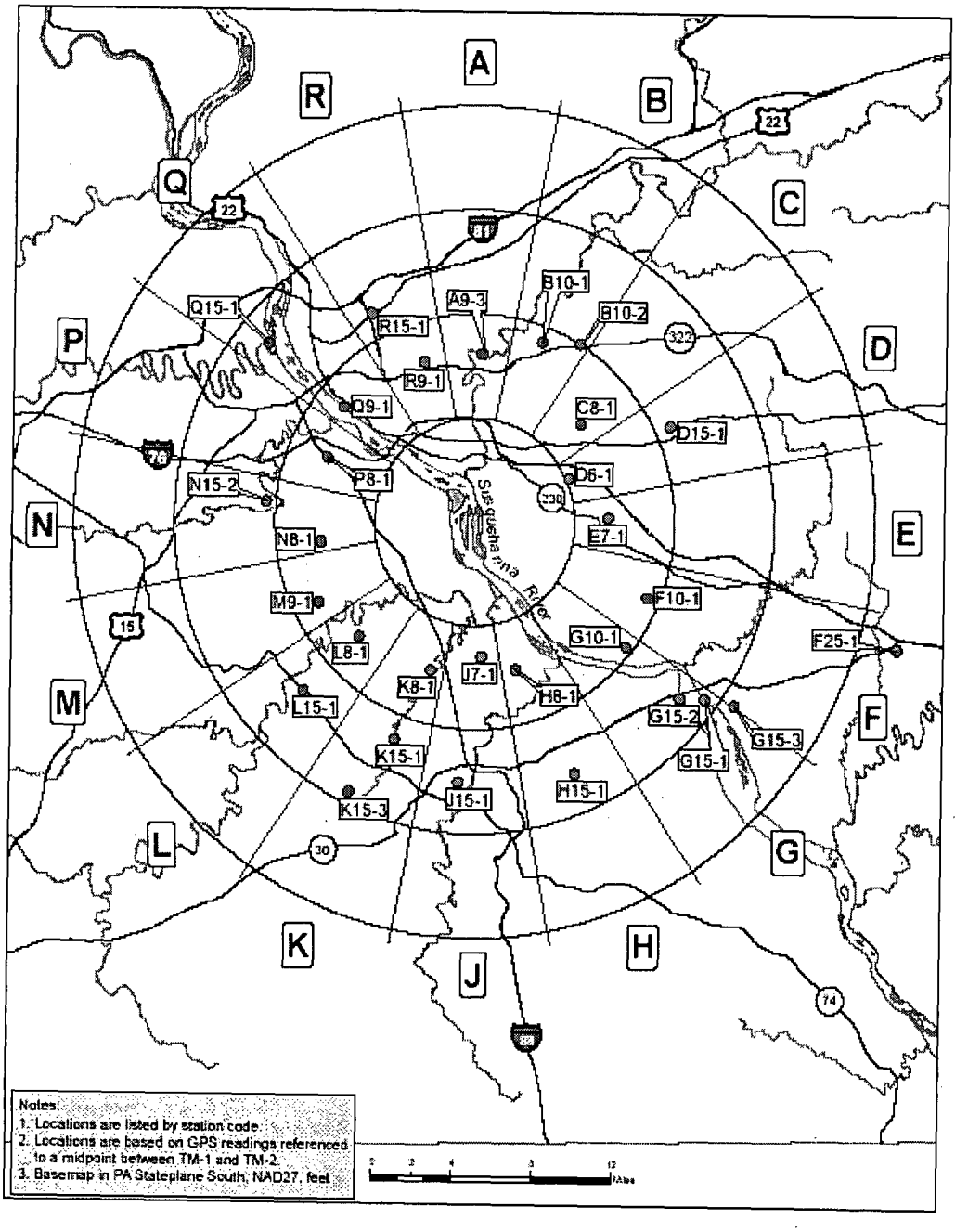


**Figure B-3**
**Environmental Sampling Locations Greater than Five Miles of the Three Mile Island Nuclear Station, 2009**

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# APPENDIX C

# DATA TABLES AND FIGURES - PRIMARY LABORATORY

**TABLE C-I.1 CONCENTRATIONS OF TRITIUM IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| COLLECTION PERIOD | J1-2 | | Q9-1 | |
|---|---|---|---|---|
| 12/30/08 - 02/03/09 | < 179 | (1) | < 179 | |
| 02/03/09 - 03/03/09 | 2880 ± 354 | (1) | < 187 | |
| 03/03/09 - 03/31/09 | 7540 ± 808 | (1) | < 190 | |
| 03/31/09 - 04/28/09 | < 159 | (1) | < 159 | |
| 04/28/09 - 06/02/09 | 1680 ± 204 | | < 113 | |
| 06/02/09 - 06/30/09 | 431 ± 96 | | < 111 | |
| 06/30/09 - 07/28/09 | 9250 ± 958 | | < 125 | |
| 07/28/09 - 08/31/09 | 227 ± 137 | (1) | < 198 | |
| 08/31/09 - 09/29/09 | 1820 ± 236 | | < 181 | |
| 09/29/09 - 11/03/09 | 2340 ± 292 | (1) | < 179 | |
| 11/03/09 - 12/01/09 | < 168 | | < 171 | |
| 12/01/09 - 12/28/09 | < 170 | (1) | < 169 | (1) |
| MEAN | 3271 ± 6632 | | - | |

**TABLE C-I.2 CONCENTRATIONS OF I-131 IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| COLLECTION PERIOD | A3-2 | |
|---|---|---|
| 12/30/08 - 02/03/09 | < 0.6 | (1) |
| 02/03/09 - 03/03/09 | 1.8 ± 0.6 | |
| 03/03/09 - 03/31/09 | < 0.5 | |
| 03/31/09 - 04/28/09 | 1.4 ± 0.5 | |
| 04/28/09 - 06/02/09 | < 0.5 | |
| 06/02/09 - 06/30/09 | < 0.6 | |
| 06/30/09 - 07/28/09 | < 0.8 | |
| 07/28/09 - 08/31/09 | < 0.7 | |
| 08/31/09 - 09/29/09 | < 0.7 | |
| 09/29/09 - 11/03/09 | < 0.7 | |
| 11/03/09 - 12/01/09 | < 0.7 | |
| 12/01/09 - 12/28/09 | < 0.5 | |
| MEAN | 1.6 ± 0.6 | |

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

(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

## TABLE C-I.3 CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| STC | 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 | 12/30/08 - 02/03/09 | < 3 | < 4 | < 8 | < 3 | < 7 | < 4 | < 6 | < 3 | < 3 | < 26 | < 9 |
| | 02/03/09 - 03/03/09 | < 4 | < 4 | < 11 | < 4 | < 7 | < 5 | < 8 | < 4 | < 4 | < 32 | < 11 |
| | 03/03/09 - 03/31/09 | < 2 | < 2 | < 5 | < 2 | < 4 | < 2 | < 4 | < 2 | < 2 | < 21 | < 6 |
| | 03/31/09 - 04/28/09 | < 1 | < 1 | < 2 | < 1 | < 2 | < 1 | < 2 | < 1 | < 1 | < 19 | < 6 |
| | 04/28/09 - 06/02/09 | < 4 | < 5 | < 7 | < 5 | < 9 | < 5 | < 9 | < 4 | < 5 | < 25 | < 4 |
| | 06/02/09 - 06/30/09 | < 4 | < 4 | < 9 | < 4 | < 10 | < 6 | < 7 | < 4 | < 4 | < 31 | < 12 |
| | 06/30/09 - 07/28/09 | < 2 | < 2 | < 5 | < 2 | < 4 | < 2 | < 4 | < 2 | < 2 | < 22 | < 8 |
| | 07/28/09 - 08/31/09 | < 2 | < 2 | < 5 | < 2 | < 3 | < 2 | < 4 | < 2 | < 2 | < 19 | < 6 |
| | 08/31/09 - 09/29/09 | < 4 | < 5 | < 10 | < 6 | < 9 | < 5 | < 10 | < 5 | < 6 | < 28 | < 8 |
| | 09/29/09 - 11/03/09 | < 2 | < 2 | < 6 | < 2 | < 4 | < 3 | < 4 | < 2 | < 2 | < 16 | < 5 |
| | 11/03/09 - 12/01/09 | < 3 | < 3 | < 7 | < 3 | < 6 | < 3 | < 6 | < 3 | < 3 | < 20 | < 7 |
| | 12/01/09 - 12/28/09 | < 1 | < 1 | < 3 | < 1 | < 3 | < 1 | < 3 | < 1 | < 1 | < 15 | < 5 |
| | MEAN | - | - | - | - | - | - | - | - | - | - | - |
| Q9-1 | 12/30/08 - 02/03/09 | < 3 | < 4 | < 8 | < 3 | < 7 | < 4 | < 6 | < 3 | < 3 | < 27 | < 8 |
| | 02/03/09 - 03/03/09 | < 3 | < 3 | < 7 | < 3 | < 6 | < 3 | < 6 | < 3 | < 3 | < 24 | < 7 |
| | 03/03/09 - 03/31/09 | < 2 | < 2 | < 5 | < 2 | < 4 | < 2 | < 4 | < 2 | < 2 | < 21 | < 7 |
| | 03/31/09 - 04/28/09 | < 1 | < 1 | < 2 | < 1 | < 2 | < 1 | < 2 | < 1 | < 1 | < 16 | < 7 |
| | 04/28/09 - 06/02/09 | < 4 | < 4 | < 8 | < 4 | < 9 | < 5 | < 7 | < 4 | < 4 | < 21 | < 6 |
| | 06/02/09 - 06/30/09 | < 4 | < 4 | < 9 | < 5 | < 8 | < 5 | < 8 | < 4 | < 4 | < 26 | < 12 |
| | 06/30/09 - 07/28/09 | < 1 | < 1 | < 4 | < 1 | < 3 | < 2 | < 3 | < 1 | < 1 | < 15 | < 5 |
| | 07/28/09 - 08/31/09 | < 2 | < 2 | < 6 | < 3 | < 4 | < 2 | < 4 | < 2 | < 2 | < 23 | < 8 |
| | 08/31/09 - 09/29/09 | < 4 | < 4 | < 9 | < 5 | < 9 | < 5 | < 9 | < 5 | < 4 | < 20 | < 8 |
| | 09/29/09 - 11/03/09 | < 2 | < 2 | < 4 | < 2 | < 4 | < 2 | < 3 | < 2 | < 2 | < 13 | < 5 |
| | 11/03/09 - 12/01/09 | < 3 | < 3 | < 7 | < 3 | < 5 | < 3 | < 6 | < 3 | < 3 | < 19 | < 7 |
| | 12/01/09 - 12/28/09 | < 1 | < 1 | < 3 | < 1 | < 2 | < 1 | < 2 | < 1 | < 1 | < 11 | < 3 |
| | MEAN | - | - | - | - | - | - | - | - | - | - | - |

**TABLE C-II.1 CONCENTRATIONS OF GROSS BETA IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| COLLECTION PERIOD | G15-2 | G15-3 | Q9-1 |
|---|---|---|---|
| 12/30/08 - 02/03/09 | 4.2 ± 1.6 | 2.7 ± 1.5 | 2.6 ± 1.4 |
| 02/03/09 - 03/03/09 | 3.3 ± 1.6 | 2.7 ± 1.5 | 2.6 ± 1.4 |
| 03/03/09 - 03/31/09 | 2.6 ± 1.5 | < 1.9 | 2.0 ± 1.3 |
| 03/31/09 - 04/28/09 | 2.7 ± 1.5 | < 2.0 | 2.3 ± 1.4 |
| 04/28/09 - 06/02/09 | 3.8 ± 1.6 | < 2.1 | < 2.0 |
| 06/02/09 - 06/30/09 | 4.2 ± 2.4 | < 2.6 | < 2.5 |
| 06/30/09 - 07/28/09 | < 2.6 | 3.1 ± 1.8 | < 2.4 |
| 07/28/09 - 08/31/09 | < 2.9 | < 2.9 | < 2.8 |
| 08/31/09 - 09/29/09 | 3.4 ± 1.7 | 4.1 ± 1.8 (1) | 2.5 ± 1.6 |
| 09/29/09 - 11/03/09 | 2.9 ± 1.7 | < 2.5 | < 2.4 |
| 11/03/09 - 12/01/09 | 3.2 ± 1.6 | 2.8 ± 1.6 | 5.5 ± 2.0 |
| 12/01/09 - 12/28/09 | < 2.5 | < 2.4 | < 2.3 |
| MEAN | 3.3 ± 1.2 | 3.1 ± 1.2 | 2.9 ± 2.5 |

**TABLE C-II.2 CONCENTRATIONS OF I-131 IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| COLLECTION PERIOD | G15-2 | G15-3 | Q9-1 |
|---|---|---|---|
| 12/30/08 - 02/03/09 | < 0.5 | < 0.5 | < 0.7 |
| 02/03/09 - 03/03/09 | < 0.7 | < 0.6 | < 0.8 |
| 03/03/09 - 03/31/09 | < 0.7 | < 0.7 | < 0.9 |
| 03/31/09 - 04/28/09 | < 0.8 | < 0.9 | < 0.8 |
| 04/28/09 - 06/02/09 | < 0.5 | < 0.5 | < 0.5 |
| 06/02/09 - 06/30/09 | < 0.8 | < 0.6 | < 0.6 |
| 06/30/09 - 07/28/09 | < 0.6 | < 0.6 | < 0.7 |
| 07/28/09 - 08/31/09 | < 0.8 | < 0.5 | < 0.5 |
| 08/31/09 - 09/29/09 | < 0.8 | < 0.9 | < 0.7 |
| 09/29/09 - 11/03/09 | < 0.6 | < 0.7 | < 0.6 |
| 11/03/09 - 12/01/09 | < 0.9 | < 0.7 | < 0.7 |
| 12/01/09 - 12/28/09 | < 0.5 | < 0.6 | < 0.6 |
| MEAN | - | - | - |

**TABLE C-II.3 CONCENTRATIONS OF TRITIUM IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| COLLECTION PERIOD | G15-2 | G15-3 | Q9-1 |
|---|---|---|---|
| 12/30/08 - 02/03/09 | < 180 | < 181 | < 182 |
| 02/03/09 - 03/03/09 | < 192 | < 189 | < 187 |
| 03/03/09 - 03/31/09 | < 189 | < 183 | < 190 |
| 03/31/09 - 04/28/09 | < 157 | < 161 | < 158 |
| 04/28/09 - 06/02/09 | < 112 | < 112 | < 111 |
| 06/02/09 - 06/30/09 | < 111 | < 110 | < 113 |
| 06/30/09 - 07/28/09 | < 122 | 448 ± 156 | < 115 |
| 07/28/09 - 08/31/09 | < 182 | < 180 | < 197 |
| 08/31/09 - 09/29/09 | < 187 | < 185 | < 182 |
| 09/29/09 - 11/03/09 | < 176 | < 176 | < 175 |
| 11/03/09 - 12/01/09 | < 163 | < 168 | < 169 |
| 12/01/09 - 12/28/09 | < 171 | < 171 | < 169 |
| MEAN | - | 448 | - |

* THE MEAN AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUES
(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

**TABLE C-II.4 CONCENTRATIONS OF GAMMA EMITTERS IN DRINKING WATER SAMPLES COLLECTED COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| STC | 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 | 12/30/08 - 02/03/09 | < 2 | < 2 | < 4 | < 2 | < 3 | < 2 | < 3 | < 2 | < 2 | < 13 | < 4 |
| | 02/03/09 - 03/03/09 | < 4 | < 4 | < 7 | < 4 | < 6 | < 5 | < 8 | < 4 | < 4 | < 26 | < 11 |
| | 03/03/09 - 03/31/09 | < 2 | < 2 | < 5 | < 2 | < 4 | < 2 | < 4 | < 2 | < 2 | < 19 | < 7 |
| | 03/31/09 - 04/28/09 | < 1 | < 1 | < 2 | < 1 | < 2 | < 1 | < 2 | < 1 | < 1 | < 13 | < 4 |
| | 04/28/09 - 06/02/09 | < 5 | < 5 | < 12 | < 7 | < 11 | < 5 | < 9 | < 5 | < 6 | < 26 | < 9 |
| | 06/02/09 - 06/30/09 | < 4 | < 4 | < 9 | < 5 | < 10 | < 5 | < 6 | < 5 | < 4 | < 30 | < 11 |
| | 06/30/09 - 07/28/09 | < 2 | < 2 | < 5 | < 2 | < 4 | < 2 | < 4 | < 2 | < 2 | < 24 | < 7 |
| | 07/28/09 - 08/31/09 | < 2 | < 2 | < 6 | < 2 | < 3 | < 3 | < 5 | < 2 | < 2 | < 21 | < 8 |
| | 08/31/09 - 09/29/09 | < 4 | < 4 | < 9 | < 6 | < 9 | < 6 | < 9 | < 4 | < 5 | < 22 | < 6 |
| | 09/29/09 - 11/03/09 | < 1 | < 2 | < 3 | < 2 | < 3 | < 2 | < 3 | < 1 | < 2 | < 11 | < 3 |
| | 11/03/09 - 12/01/09 | < 3 | < 4 | < 7 | < 3 | < 6 | < 4 | < 6 | < 3 | < 3 | < 22 | < 7 |
| | 12/01/09 - 12/28/09 | < 2 | < 3 | < 6 | < 2 | < 5 | < 3 | < 5 | < 2 | < 2 | < 24 | < 8 |
| | MEAN | - | - | - | - | - | - | - | - | - | - | - |
| G15-3 | 12/30/08 - 02/03/09 | < 2 | < 2 | < 5 | < 2 | < 4 | < 2 | < 4 | < 2 | < 2 | < 15 | < 5 |
| | 02/03/09 - 03/03/09 | < 4 | < 5 | < 11 | < 4 | < 8 | < 6 | < 8 | < 5 | < 5 | < 31 | < 8 |
| | 03/03/09 - 03/31/09 | < 2 | < 2 | < 5 | < 2 | < 4 | < 2 | < 4 | < 2 | < 2 | < 23 | < 7 |
| | 03/31/09 - 04/28/09 | < 1 | < 1 | < 2 | < 1 | < 2 | < 1 | < 2 | < 1 | < 1 | < 14 | < 5 |
| | 04/28/09 - 06/02/09 | < 4 | < 4 | < 7 | < 4 | < 10 | < 4 | < 6 | < 4 | < 4 | < 20 | < 7 |
| | 06/02/09 - 06/30/09 | < 5 | < 4 | < 11 | < 5 | < 11 | < 7 | < 9 | < 5 | < 6 | < 31 | < 11 |
| | 06/30/09 - 07/28/09 | < 2 | < 2 | < 5 | < 2 | < 4 | < 2 | < 4 | < 2 | < 2 | < 22 | < 7 |
| | 07/28/09 - 08/31/09 | < 2 | < 3 | < 5 | < 2 | < 5 | < 3 | < 5 | < 2 | < 3 | < 23 | < 9 |
| | 08/31/09 - 09/29/09 | < 5 | < 4 | < 9 | < 4 | < 9 | < 4 | < 7 | < 4 | < 5 | < 19 | < 6 |
| | 09/29/09 - 11/03/09 | < 2 | < 2 | < 5 | < 2 | < 4 | < 2 | < 4 | < 2 | < 2 | < 16 | < 5 |
| | 11/03/09 - 12/01/09 | < 3 | < 3 | < 8 | < 4 | < 7 | < 3 | < 6 | < 3 | < 3 | < 21 | < 7 |
| | 12/01/09 - 12/28/09 | < 1 | < 1 | < 2 | < 1 | < 2 | < 1 | < 2 | < 1 | < 1 | < 11 | < 4 |
| | MEAN | - | - | - | - | - | - | - | - | - | - | - |

**TABLE C-II.4 CONCENTRATIONS OF GAMMA EMITTERS IN DRINKING WATER SAMPLES COLLECTED COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| STC | COLLECTION PERIOD | Mn-54 | Co-58 | Fe-59 | Co-60 | Zn-65 | Nb-95 | Zr-95 | Cs-134 | Cs-137 | Ba-140 | La-140 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Q9-1 | 12/30/08 - 02/03/09 | < 4 | < 4 | < 10 | < 3 | < 7 | < 4 | < 7 | < 4 | < 4 | < 29 | < 9 |
| | 02/03/09 - 03/03/09 | < 4 | < 4 | < 10 | < 5 | < 11 | < 6 | < 9 | < 4 | < 5 | < 30 | < 11 |
| | 03/03/09 - 03/31/09 | < 2 | < 2 | < 4 | < 2 | < 3 | < 2 | < 3 | < 1 | < 2 | < 18 | < 6 |
| | 03/31/09 - 04/28/09 | < 1 | < 1 | < 2 | < 1 | < 2 | < 1 | < 2 | < 1 | < 1 | < 15 | < 5 |
| | 04/28/09 - 06/02/09 | < 5 | < 5 | < 9 | < 5 | < 11 | < 5 | < 9 | < 5 | < 5 | < 28 | < 8 |
| | 06/02/09 - 06/30/09 | < 3 | < 3 | < 5 | < 3 | < 6 | < 2 | < 3 | < 2 | < 3 | < 14 | < 7 |
| | 06/30/09 - 07/28/09 | < 2 | < 2 | < 5 | < 2 | < 4 | < 2 | < 4 | < 2 | < 2 | < 22 | < 7 |
| | 07/28/09 - 08/31/09 | < 2 | < 3 | < 6 | < 2 | < 5 | < 3 | < 5 | < 2 | < 2 | < 24 | < 9 |
| | 08/31/09 - 09/29/09 | < 4 | < 3 | < 7 | < 3 | < 8 | < 4 | < 7 | < 4 | < 4 | < 21 | < 7 |
| | 09/29/09 - 11/03/09 | < 2 | < 2 | < 5 | < 3 | < 5 | < 2 | < 4 | < 2 | < 2 | < 17 | < 6 |
| | 11/03/09 - 12/01/09 | < 2 | < 3 | < 6 | < 2 | < 6 | < 3 | < 5 | < 2 | < 3 | < 18 | < 6 |
| | 12/01/09 - 12/28/09 | < 1 | < 1 | < 3 | < 1 | < 2 | < 1 | < 2 | < 1 | < 1 | < 12 | < 4 |
| | MEAN | - | - | - | - | - | - | - | - | - | - | - |

**TABLE C-III.1 CONCENTRATIONS OF GROSS BETA, IODINE-131, TRITIUM, AND STRONTIUM IN EFFLUENT WATER SAMPLES FOR STATION K1-1 COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| COLLECTION PERIOD | GROSS BETA | | I-131 | H-3 | SR-89 | SR-90 |
|---|---|---|---|---|---|---|
| 12/30/08 - 02/03/09 | 4.8 ± 1.7 | | < 0.4 | < 183 | | |
| 02/03/09 - 03/03/09 | 4.5 ± 1.7 | | < 0.8 | 19800 ± 2040 | | |
| 03/03/09 - 03/31/09 | 4.0 ± 1.6 | | < 0.8 | 64700 ± 6500 | | |
| 03/31/09 - 04/28/09 | 3.6 ± 1.6 | | < 0.8 | < 156 | | |
| 04/28/09 - 06/02/09 | 5.9 ± 1.9 | | < 0.5 | 38300 ± 3850 | | |
| 06/02/09 - 06/30/09 | 4.4 ± 2.0 | | < 0.6 | 5140 ± 545 | < 1.8 | < 0.5 |
| 06/30/09 - 07/28/09 | 5.2 ± 2.1 | | < 0.7 | 101000 ± 10100 | | |
| 07/28/09 - 08/31/09 | 3.3 ± 2.1 | (1) | < 0.6 | 2970 ± 346 | | |
| 08/31/09 - 09/29/09 | 6.1 ± 2.1 | | < 0.7 | 17700 ± 1790 | | |
| 09/29/09 - 11/03/09 | 6.0 ± 2.0 | | < 0.7 | 20700 ± 2120 | | |
| 11/03/09 - 12/01/09 | 3.1 ± 1.6 | | < 0.6 | < 164 | | |
| 12/01/09 - 12/28/09 | < 2.3 | (1) | < 0.5 | < 170 | < 2.2 | < 0.5 |
| MEAN | 4.6 ± 2.1 | | - | 33789 ± 67144 | - | - |

* THE MEAN AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUES
(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

**TABLE C-III.2 CONCENTRATIONS OF GAMMA EMITTERS IN EFFLUENT WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| STC | 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 | 12/30/08 - 02/03/09 | < 4 | < 3 | < 8 | < 4 | < 6 | < 4 | < 6 | < 4 | < 3 | < 26 | < 8 |
| | 02/03/09 - 03/03/09 | < 2 | < 3 | < 5 | < 2 | < 5 | < 3 | < 5 | < 3 | < 3 | < 19 | < 6 |
| | 03/03/09 - 03/31/09 | < 2 | < 2 | < 4 | < 2 | < 3 | < 2 | < 3 | < 1 | < 2 | < 18 | < 6 |
| | 03/31/09 - 04/28/09 | < 1 | < 1 | < 3 | < 1 | < 2 | < 1 | < 2 | < 1 | < 1 | < 20 | < 5 |
| | 04/28/09 - 06/02/09 | < 5 | < 5 | < 11 | < 6 | < 10 | < 6 | < 9 | < 6 | < 6 | < 27 | < 9 |
| | 06/02/09 - 06/30/09 | < 4 | < 4 | < 10 | < 5 | < 8 | < 4 | < 8 | < 4 | < 4 | < 26 | < 8 |
| | 06/30/09 - 07/28/09 | < 1 | < 2 | < 4 | < 2 | < 3 | < 2 | < 3 | < 1 | < 1 | < 17 | < 6 |
| | 07/28/09 - 08/31/09 | < 2 | < 2 | < 5 | < 2 | < 4 | < 3 | < 4 | < 2 | < 2 | < 24 | < 8 |
| | 08/31/09 - 09/29/09 | < 5 | < 5 | < 8 | < 4 | < 9 | < 5 | < 9 | < 5 | < 6 | < 24 | < 8 |
| | 09/29/09 - 11/03/09 | < 2 | < 2 | < 4 | < 2 | < 4 | < 2 | < 4 | < 2 | < 2 | < 16 | < 4 |
| | 11/03/09 - 12/01/09 | < 3 | < 3 | < 6 | < 3 | < 5 | < 3 | < 5 | < 2 | < 3 | < 17 | < 6 |
| | 12/01/09 - 12/28/09 | < 1 | < 2 | < 3 | < 1 | < 2 | < 2 | < 3 | < 1 | < 1 | < 12 | < 4 |
| | MEAN | - | - | - | - | - | - | - | - | - | - | - |

**TABLE C-IV.1 CONCENTRATIONS OF TRITIUM AND GAMMA EMITTERS IN STORM WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| STC | COLLECTION PERIOD | H-3 | Mn-54 | Co-58 | Fe-59 | Co-60 | Zn-65 | Nb-95 | Zr-95 | Cs-134 | Cs-137 | Ba-140 | La-140 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EDCB | 02/03/09 - 03/31/09 | < 182 | < 1 | < 2 | < 3 | < 1 | < 3 | < 2 | < 3 | < 1 | < 1 | < 15 | < 4 |
| | 04/28/09 - 06/30/09 | < 111 | < 4 | < 5 | < 8 | < 4 | < 9 | < 4 | < 8 | < 3 | < 4 | < 29 | < 11 |
| | 07/28/09 - 09/29/09 | < 179 | < 4 | < 4 | < 7 | < 4 | < 8 | < 4 | < 7 | < 4 | < 4 | < 21 | < 6 |
| | 11/03/09 - 12/28/09 | < 172 | < 4 | < 4 | < 9 | < 4 | < 7 | < 5 | < 8 | < 3 | < 4 | < 29 | < 9 |
| | MEAN | - | - | - | - | - | - | - | - | - | - | - | - |

**TABLE C-V.1 CONCENTRATIONS OF STRONTIUM IN PREDATOR AND BOTTOM FEEDER (FISH) SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

| STC | COLLECTION PERIOD | Sr-90 |
|---|---|---|
| INDP | PREDATOR | |
| | 06/12/09 | < 4 |
| | 10/22/09 | < 5 |
| | MEAN | - |
| INDB | BOTTOM FEEDER | |
| | 06/12/09 | < 4 |
| | 11/02/09 | < 3 |
| | MEAN | - |
| BKGP | PREDATOR | |
| | 06/11/09 | < 2 |
| | 11/03/09 | < 3 |
| | MEAN | - |
| BKGB | BOTTOM FEEDER | |
| | 06/11/09 | < 3 |
| | 11/03/09 | < 5 |
| | MEAN | - |

**TABLE C-V.2** **CONCENTRATIONS OF GAMMA EMITTERS IN PREDATOR AND BOTTOM FEEDER (FISH) SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

| STC | COLLECTION PERIOD | K-40 | Mn-54 | Co-58 | Fe-59 | Co-60 | Zn-65 | Cs-134 | Cs-137 |
|---|---|---|---|---|---|---|---|---|---|
| BKGB | BOTTOM FEEDER | | | | | | | | |
| | 06/11/09 | 2820 ± 709 | < 33 | < 36 | < 49 | < 34 | < 58 | < 33 | < 34 |
| | 11/03/09 | 2730 ± 861 | < 60 | < 59 | < 108 | < 57 | < 127 | < 61 | < 65 |
| | MEAN | 2775 ± 127 | - | - | - | - | - | - | - |
| BKGP | PREDATOR | | | | | | | | |
| | 06/11/09 | 3220 ± 796 | < 44 | < 37 | < 97 | < 47 | < 91 | < 38 | < 53 |
| | 11/03/09 | 2090 ± 680 | < 34 | < 49 | < 98 | < 35 | < 99 | < 36 | < 43 |
| | MEAN | 2655 ± 1598 | - | - | - | - | - | - | - |
| INDB | BOTTOM FEEDER | | | | | | | | |
| | 06/12/09 | 3220 ± 661 | < 35 | < 49 | < 80 | < 37 | < 82 | < 35 | < 37 |
| | 11/02/09 | 3120 ± 777 | < 30 | < 41 | < 74 | < 42 | < 92 | < 43 | < 48 |
| | MEAN | 3170 ± 141 | - | - | - | - | - | - | - |
| INDP | PREDATOR | | | | | | | | |
| | 06/12/09 | 3080 ± 588 | < 39 | < 43 | < 104 | < 37 | < 89 | < 35 | < 41 |
| | 10/22/09 | 3300 ± 1220 | < 49 | < 56 | < 174 | < 66 | < 126 | < 52 | < 61 |
| | MEAN | 3190 ± 311 | - | - | - | - | - | - | - |

**TABLE C-VI.1 CONCENTRATIONS OF GAMMA EMITTERS IN SEDIMENT SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/KG DRY ± 2 SIGMA

| STC | COLLECTION PERIOD | K-40 | Mn-54 | Co-58 | Co-60 | Cs-134 | Cs-137 |
|---|---|---|---|---|---|---|---|
| A1-3 | 06/11/09 | 14200 ± 1580 | < 77 | < 69 | < 81 | < 61 | 336 ± 93 |
| | 11/23/09 | 10200 ± 1470 | < 72 | < 80 | < 58 | < 70 | 355 ± 90 |
| | MEAN | 12200 ± 5657 | - | - | - | - | 346 ± 27 |
| EDCB | 11/23/09 | 14800 ± 2010 | < 113 | < 117 | < 109 | < 103 | < 94 |
| | MEAN | 14800 | - | - | - | - | - |
| J2-1 | 06/11/09 | 17600 ± 1810 | < 94 | < 73 | < 74 | < 67 | < 99 |
| | 11/23/09 | 17400 ± 1840 | < 78 | < 92 | < 82 | < 73 | 128 ± 78 |
| | MEAN | 17500 ± 283 | - | - | - | - | 128 |
| K1-3 | 06/11/09 | 11400 ± 1420 | < 79 | < 91 | < 80 | < 70 | 130 ± 74 |
| | 11/23/09 | 9960 ± 2050 | < 102 | < 116 | < 91 | < 98 | < 93 |
| | MEAN | 10680 ± 2036 | - | - | - | - | 130 |

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

**TABLE C-VII.1 CONCENTRATIONS OF GROSS BETA IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION. 2009**

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

| | GROUP I | | GROUP II | | | | GROUP III |
|---|---|---|---|---|---|---|---|
| COLLECTION PERIOD | E1-2 | F1-3 | A3-1 | G2-1 | H3-1 | M2-1 | Q15-1 |
| 12/31/08 - 01/07/09 | 19 ± 5 | 23 ± 6 | 13 ± 5 | 17 ± 5 | 14 ± 5 | 17 ± 5 | 22 ± 6 |
| 01/07/09 - 01/14/09 | 18 ± 5 | 15 ± 5 | 18 ± 5 | 19 ± 5 | 18 ± 5 | 19 ± 5 | 18 ± 5 |
| 01/14/09 - 01/21/09 | 27 ± 6 | 21 ± 5 | 19 ± 5 | 21 ± 5 | 21 ± 6 | 24 ± 6 | 24 ± 6 |
| 01/21/09 - 01/28/09 | 20 ± 5 | 23 ± 5 | 24 ± 6 | 20 ± 5 | 18 ± 5 | 21 ± 5 | 19 ± 5 |
| 01/28/09 - 02/04/09 | 21 ± 5 | 20 ± 5 | 23 ± 5 | 27 ± 5 | 24 ± 5 | 25 ± 5 | 22 ± 5 |
| 02/04/09 - 02/11/09 | 27 ± 6 | 30 ± 6 | 26 ± 5 | 23 ± 5 | 27 ± 6 | 22 ± 5 | 27 ± 6 |
| 02/11/09 - 02/18/09 | 9 ± 5 | 8 ± 5 | < 7 | 11 ± 5 | 11 ± 5 | 8 ± 5 | 14 ± 5 |
| 02/18/09 - 02/25/09 | 16 ± 5 | 19 ± 5 | 16 ± 5 | 17 ± 5 | 15 ± 5 | 17 ± 5 | 18 ± 5 |
| 02/25/09 - 03/04/09 | 15 ± 5 | 26 ± 6 | 22 ± 5 | 17 ± 5 | 20 ± 5 | 20 ± 5 | 19 ± 5 |
| 03/04/09 - 03/11/09 | 16 ± 5 | 20 ± 5 | 20 ± 6 | 20 ± 6 | 20 ± 5 | 20 ± 6 | 22 ± 6 |
| 03/11/09 - 03/18/09 | 18 ± 5 | 25 ± 6 | 23 ± 6 | 23 ± 6 | 27 ± 6 | 19 ± 5 | 25 ± 6 |
| 03/18/09 - 03/25/09 | 20 ± 5 | 22 ± 5 | 20 ± 5 | 17 ± 5 | 16 ± 5 | 17 ± 5 | 18 ± 5 |
| 03/25/09 - 04/01/09 | 12 ± 5 | 10 ± 4 | 11 ± 5 | 14 ± 5 | 11 ± 5 | 12 ± 5 | 13 ± 5 |
| 04/01/09 - 04/08/09 | < 19 (1) | < 6 | 14 ± 5 | 11 ± 5 | 10 ± 5 | 14 ± 5 | 9 ± 5 |
| 04/08/09 - 04/16/09 | (1) | 20 ± 5 | 14 ± 4 | 17 ± 5 | 17 ± 5 | 17 ± 4 | 17 ± 5 |
| 04/16/09 - 04/22/09 | (1) | 15 ± 6 | 16 ± 6 | 12 ± 6 | 16 ± 6 | 17 ± 6 | 15 ± 6 |
| 04/22/09 - 04/29/09 | 20 ± 5 | 15 ± 5 | 21 ± 5 | 26 ± 6 | 19 ± 5 | 19 ± 5 | 17 ± 5 |
| 04/29/09 - 05/06/09 | 15 ± 5 | 14 ± 5 | 16 ± 5 | 14 ± 5 | 11 ± 5 | 19 ± 5 | 16 ± 5 |
| 05/06/09 - 05/13/09 | 14 ± 5 | 10 ± 5 | 12 ± 5 | 10 ± 5 | 12 ± 5 | 16 ± 5 | 13 ± 5 |
| 05/13/09 - 05/20/09 | 13 ± 5 | 12 ± 5 | 13 ± 5 | 11 ± 5 | 12 ± 5 | 12 ± 5 | 14 ± 5 |
| 05/20/09 - 05/27/09 | 10 ± 5 | 13 ± 5 | 13 ± 5 | 14 ± 5 | 14 ± 5 | 11 ± 5 | 17 ± 5 |
| 05/27/09 - 06/03/09 | 14 ± 5 | 9 ± 5 | 12 ± 5 | 8 ± 4 | 9 ± 5 | 13 ± 5 | 13 ± 5 |
| 06/03/09 - 06/10/09 | 14 ± 5 | 16 ± 5 | 12 ± 5 | 12 ± 5 | 11 ± 5 | 14 ± 5 | 16 ± 5 |
| 06/10/09 - 06/18/09 | 9 ± 4 | 19 ± 5 | 13 ± 5 | 11 ± 5 | 10 ± 4 | 13 ± 5 | 14 ± 5 |
| 06/18/09 - 06/24/09 | 11 ± 6 | 13 ± 6 | < 8 | < 8 | < 8 | < 8 | 11 ± 6 |
| 06/24/09 - 07/01/09 | 17 ± 6 | 17 ± 5 | 15 ± 5 | 14 ± 5 | 16 ± 5 | 13 ± 5 | 18 ± 6 |
| 07/01/09 - 07/07/09 | 15 ± 6 | 17 ± 6 | 15 ± 6 | < 8 | 12 ± 6 | 9 ± 6 | 12 ± 6 |
| 07/07/09 - 07/15/09 | 8 ± 4 | 10 ± 4 | 8 ± 4 | 14 ± 5 | 32 ± 6 | 9 ± 5 | 11 ± 5 |
| 07/15/09 - 07/22/09 | 19 ± 6 | 19 ± 6 | 17 ± 5 | 15 ± 5 | 20 ± 6 | 17 ± 5 | 17 ± 5 |
| 07/22/09 - 07/29/09 | 21 ± 5 | 19 ± 5 | 19 ± 5 | 16 ± 5 | 17 ± 5 | 19 ± 5 | 20 ± 5 |
| 07/29/09 - 08/05/09 | 22 ± 6 | 20 ± 6 | 19 ± 5 | 18 ± 5 | 18 ± 5 | 21 ± 6 | 17 ± 5 |
| 08/05/09 - 08/12/09 | 15 ± 5 | 17 ± 5 | 15 ± 5 | 16 ± 5 | 15 ± 5 | 20 ± 5 | 17 ± 5 |
| 08/12/09 - 08/19/09 | 21 ± 6 | 21 ± 6 | 20 ± 6 | 24 ± 6 | 14 ± 5 | 17 ± 6 | 20 ± 6 |
| 08/19/09 - 08/26/09 | 12 ± 5 | 13 ± 5 | 16 ± 5 | 16 ± 5 | 21 ± 6 | 15 ± 5 | 13 ± 5 |
| 08/26/09 - 09/02/09 | 20 ± 5 | 15 ± 5 | 19 ± 5 | 18 ± 5 | 20 ± 5 | 18 ± 5 | 23 ± 5 |
| 09/02/09 - 09/09/09 | 22 ± 6 | 22 ± 6 | 20 ± 6 | 22 ± 6 | 20 ± 6 | 15 ± 5 | 24 ± 6 |
| 09/09/09 - 09/16/09 | 21 ± 6 | 23 ± 6 | 20 ± 5 | 18 ± 5 | 18 ± 5 | 23 ± 6 | 19 ± 6 |
| 09/16/09 - 09/23/09 | 19 ± 5 | 12 ± 5 | 17 ± 5 | 15 ± 5 | 19 ± 5 | 18 ± 5 | 22 ± 6 |
| 09/23/09 - 09/30/09 | 19 ± 5 | 13 ± 5 | 19 ± 5 | 10 ± 5 | 13 ± 5 | 16 ± 5 | 17 ± 5 |
| 09/30/09 - 10/07/09 | 16 ± 5 | 13 ± 5 | 18 ± 5 | 13 ± 5 | 11 ± 5 | 19 ± 6 | 18 ± 6 |
| 10/07/09 - 10/14/09 | 13 ± 5 | 14 ± 5 | 10 ± 5 | 14 ± 5 | 16 ± 6 | 12 ± 5 | 13 ± 5 |
| 10/14/09 - 10/21/09 | 14 ± 5 | 15 ± 5 | 15 ± 5 | 16 ± 5 | 21 ± 5 | 17 ± 5 | 16 ± 5 |
| 10/21/09 - 10/28/09 | 18 ± 5 | 16 ± 5 | 21 ± 5 | 23 ± 5 | 18 ± 5 | 16 ± 5 | 18 ± 5 |
| 10/28/09 - 11/04/09 | 18 ± 5 | 15 ± 4 | 14 ± 4 | 16 ± 4 | 15 ± 4 | 15 ± 4 | 13 ± 4 |
| 11/04/09 - 11/11/09 | 28 ± 6 | 19 ± 6 | 27 ± 6 | 24 ± 6 | 20 ± 6 | 24 ± 6 | 26 ± 6 |
| 11/11/09 - 11/18/09 | 12 ± 5 | 9 ± 5 | 14 ± 5 | 14 ± 5 | 12 ± 5 | 12 ± 5 | 15 ± 6 |
| 11/18/09 - 11/24/09 | 19 ± 5 | 28 ± 6 | 25 ± 5 | 204 ± 10 | 23 ± 5 | 23 ± 5 | 19 ± 5 |
| 11/24/09 - 12/02/09 | 12 ± 4 | 19 ± 5 | 18 ± 5 | 14 ± 4 | 16 ± 5 | 19 ± 5 | 16 ± 5 |
| 12/02/09 - 12/09/09 | 17 ± 5 | 14 ± 5 | 17 ± 5 | 15 ± 5 | 13 ± 5 | 14 ± 5 | 15 ± 5 |
| 12/09/09 - 12/16/09 | 25 ± 6 | 22 ± 6 | 29 ± 6 | 22 ± 6 | 26 ± 6 | 23 ± 6 | 28 ± 6 |
| 12/16/09 - 12/22/09 | 26 ± 6 | 22 ± 5 | 21 ± 5 | 22 ± 6 | 21 ± 5 | 24 ± 6 | 20 ± 5 |
| 12/22/09 - 12/29/09 | 16 ± 4 | 18 ± 4 | 21 ± 4 | 20 ± 4 | 17 ± 4 | 26 ± 5 | 19 ± 5 |
| MEAN | 17 ± 10 | 17 ± 10 | 18 ± 9 | 20 ± 54 | 17 ± 10 | 17 ± 9 | 18 ± 9 |

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

**TABLE C-VII.2 MONTHLY AND YEARLY MEAN VALUES OF GROSS BETA CONCENTRATIONS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

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 |
| 12/31/08 - 01/28/09 | 15 | 27 | 21 ± 7 | 12/31/08 - 01/28/09 | 13 | 24 | 19 ± 6 | 12/31/08 - 01/28/09 | 18 | 24 | 21 ± 6 |
| 01/28/09 - 02/25/09 | 8 | 30 | 19 ± 15 | 01/28/09 - 02/25/09 | 8 | 27 | 19 ± 13 | 01/28/09 - 02/25/09 | 14 | 27 | 20 ± 12 |
| 02/25/09 - 04/01/09 | 10 | 26 | 18 ± 10 | 02/25/09 - 04/01/09 | 11 | 27 | 18 ± 8 | 02/25/09 - 04/01/09 | 13 | 25 | 19 ± 9 |
| 04/08/09 - 04/29/09 | 15 | 20 | 18 ± 5 | 04/08/09 - 04/29/09 | 10 | 17 | 15 ± 5 | 04/08/09 - 04/29/09 | 9 | 17 | 14 ± 9 |
| 04/22/09 - 06/03/09 | 9 | 15 | 13 ± 4 | 04/22/09 - 06/03/09 | 8 | 26 | 14 ± 8 | 04/22/09 - 06/03/09 | 13 | 17 | 15 ± 4 |
| 06/03/09 - 07/01/09 | 9 | 19 | 14 ± 7 | 06/03/09 - 07/01/09 | 10 | 16 | 13 ± 4 | 06/03/09 - 07/01/09 | 11 | 18 | 15 ± 6 |
| 07/01/09 - 07/29/09 | 8 | 21 | 16 ± 10 | 07/01/09 - 07/29/09 | 8 | 32 | 16 ± 11 | 07/01/09 - 07/29/09 | 11 | 20 | 15 ± 8 |
| 07/29/09 - 09/02/09 | 12 | 22 | 18 ± 7 | 07/29/09 - 09/02/09 | 14 | 24 | 18 ± 5 | 07/29/09 - 09/02/09 | 13 | 23 | 18 ± 7 |
| 09/02/09 - 09/30/09 | 12 | 23 | 19 ± 8 | 09/02/09 - 09/30/09 | 10 | 23 | 18 ± 6 | 09/02/09 - 09/30/09 | 17 | 24 | 20 ± 6 |
| 09/30/09 - 10/28/09 | 13 | 18 | 15 ± 3 | 09/30/09 - 10/28/09 | 10 | 23 | 16 ± 7 | 09/30/09 - 10/28/09 | 13 | 18 | 16 ± 5 |
| 10/28/09 - 12/02/09 | 9 | 28 | 18 ± 13 | 10/28/09 - 12/02/09 | 12 | 204 | 27 ± 84 | 10/28/09 - 12/02/09 | 13 | 26 | 18 ± 10 |
| 12/02/09 - 12/29/09 | 14 | 26 | 20 ± 9 | 12/02/09 - 12/29/09 | 13 | 29 | 21 ± 9 | 12/02/09 - 12/29/09 | 15 | 28 | 21 ± 11 |
| 12/31/08 - 12/29/09 | 8 | 30 | 17 ± 10 | 12/31/08 - 12/29/09 | 8 | 204 | 18 ± 28 | 12/31/08 - 12/29/09 | 9 | 28 | 18 ± 9 |

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

**TABLE C-VII.3** **CONCENTRATIONS OF GAMMA EMITTERS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

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

| STC | COLLECTION PERIOD | Be-7 | Mn-54 | Co-58 | Co-60 | Nb-95 | Zr-95 | Cs-134 | Cs-137 |
|---|---|---|---|---|---|---|---|---|---|
| A3-1 | 12/31/08 - 04/01/09 | 96 ± 34 | < 3 | < 5 | < 3 | < 5 | < 8 | < 4 | < 3 |
| | 04/01/09 - 07/01/09 | 94 ± 39 | < 5 | < 5 | < 3 | < 6 | < 10 | < 4 | < 5 |
| | 07/01/09 - 09/30/09 | 89 ± 40 | < 3 | < 4 | < 4 | < 4 | < 7 | < 3 | < 3 |
| | 09/30/09 - 12/29/09 | 67 ± 26 | < 3 | < 3 | < 4 | < 4 | < 7 | < 4 | < 3 |
| | MEAN | 87 ± 27 | - | - | - | - | - | - | - |
| E1-2 | 12/31/08 - 04/01/09 | 99 ± 28 | < 2 | < 3 | < 2 | < 4 | < 6 | < 3 | < 2 |
| | 04/01/09 - 07/01/09 | 105 ± 39 | < 6 | < 9 | < 6 | < 6 | < 15 | < 5 | < 4 |
| | 07/01/09 - 09/30/09 | 95 ± 46 | < 4 | < 5 | < 4 | < 7 | < 9 | < 5 | < 3 |
| | 09/30/09 - 12/29/09 | 77 ± 24 | < 4 | < 5 | < 3 | < 4 | < 6 | < 3 | < 3 |
| | MEAN | 94 ± 24 | - | - | - | - | - | - | - |
| F1-3 | 12/31/08 - 04/01/09 | 125 ± 39 | < 4 | < 7 | < 4 | < 6 | < 8 | < 3 | < 4 |
| | 04/01/09 - 07/01/09 | 75 ± 38 | < 3 | < 4 | < 5 | < 5 | < 10 | < 5 | < 4 |
| | 07/01/09 - 09/30/09 | 83 ± 29 | < 3 | < 4 | < 3 | < 3 | < 7 | < 3 | < 3 |
| | 09/30/09 - 12/29/09 | 64 ± 41 | < 6 | < 6 | < 6 | < 8 | < 11 | < 6 | < 3 |
| | MEAN | 87 ± 53 | - | - | - | - | - | - | - |
| G2-1 | 12/31/08 - 04/01/09 | 92 ± 26 | < 3 | < 5 | < 3 | < 5 | < 8 | < 4 | < 3 |
| | 04/01/09 - 07/01/09 | 114 ± 38 | < 5 | < 3 | < 6 | < 6 | < 9 | < 4 | < 4 |
| | 07/01/09 - 09/30/09 | 86 ± 45 | < 3 | < 5 | < 3 | < 5 | < 10 | < 4 | < 4 |
| | 09/30/09 - 12/29/09 | 61 ± 30 | < 3 | < 3 | < 4 | < 5 | < 9 | < 3 | < 3 |
| | MEAN | 88 ± 44 | - | - | - | - | - | - | - |
| H3-1 | 12/31/08 - 04/01/09 | 80 ± 39 | < 2 | < 5 | < 1 | < 4 | < 8 | < 3 | < 3 |
| | 04/01/09 - 07/01/09 | 123 ± 41 | < 5 | < 5 | < 6 | < 6 | < 11 | < 4 | < 3 |
| | 07/01/09 - 09/30/09 | 77 ± 33 | < 3 | < 5 | < 3 | < 5 | < 8 | < 4 | < 3 |
| | 09/30/09 - 12/29/09 | 56 ± 32 | < 4 | < 5 | < 6 | < 6 | < 12 | < 4 | < 4 |
| | MEAN | 84 ± 56 | - | - | - | - | - | - | - |
| M2-1 | 12/31/08 - 04/01/09 | 95 ± 42 | < 4 | < 6 | < 4 | < 6 | < 10 | < 4 | < 4 |
| | 04/01/09 - 07/01/09 | 106 ± 34 | < 4 | < 6 | < 4 | < 6 | < 11 | < 4 | < 3 |
| | 07/01/09 - 09/30/09 | 96 ± 43 | < 5 | < 6 | < 3 | < 8 | < 14 | < 5 | < 5 |
| | 09/30/09 - 12/29/09 | 59 ± 26 | < 3 | < 3 | < 3 | < 4 | < 9 | < 3 | < 3 |
| | MEAN | 89 ± 41 | - | - | - | - | - | - | - |
| Q15-1 | 12/31/08 - 04/01/09 | 94 ± 31 | < 3 | < 3 | < 3 | < 4 | < 6 | < 3 | < 3 |
| | 04/01/09 - 07/01/09 | 92 ± 40 | < 4 | < 4 | < 5 | < 5 | < 10 | < 3 | < 3 |
| | 07/01/09 - 09/30/09 | 93 ± 27 | < 3 | < 4 | < 3 | < 5 | < 8 | < 3 | < 3 |
| | 09/30/09 - 12/29/09 | 89 ± 28 | < 5 | < 7 | < 5 | < 6 | < 9 | < 4 | < 5 |
| | MEAN | 92 ± 4 | - | - | - | - | - | - | - |

**TABLE C-VII.4** **CONCENTRATIONS OF STRONTIUM AND GAMMA EMITTERS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION AS A RESULT OF THE NOVEMBER 2009 RELEASE**

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

| STC | COLLECTION PERIOD | | Sr-90 | Be-7 | Mn-54 | Co-58 | Co-60 | Nb-95 | Zr-95 | Cs-134 | Cs-137 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| E1-2 | 11/18/09 - 11/24/09 | (1) | | < 123 | < 11 | < 11 | < 11 | < 13 | < 25 | < 9 | < 10 |
| F1-3 | 11/18/09 - 11/24/09 | (1) | < 8 | 127 ± 86 | < 8 | 34 ± 12 | < 9 | < 10 | < 16 | < 8 | < 8 |
| G2-1 | 11/18/09 - 11/24/09 | (1) | < 2 | < 196 | < 18 | 52 ± 19 | 36 ± 15 | 346 ± 38 | 246 ± 35 | < 16 | < 18 |
| H3-1 | 11/18/09 - 11/24/09 | (1) | | 120 ± 83 | < 12 | < 13 | < 13 | < 15 | < 23 | < 12 | < 11 |



(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

**TABLE C-VIII.1 CONCENTRATIONS OF I-131 IN AIR IODINE SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

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

| COLLECTION PERIOD | GROUP I | | GROUP II | | | | GROUP III |
|---|---|---|---|---|---|---|---|
| | E2-1 | F1-3 | A3-1 | G2-1 | H3-1 | M2-1 | Q15-1 |
| 12/31/08 - 01/07/09 | < 63 | < 61 | < 43 | < 63 | < 63 | < 43 | < 43 |
| 01/07/09 - 01/14/09 | < 29 | < 22 | < 64 | < 29 | < 29 | < 64 | < 64 |
| 01/14/09 - 01/21/09 | < 27 | < 27 | < 45 | < 27 | < 27 | < 45 | < 45 |
| 01/21/09 - 01/28/09 | < 25 | < 40 | < 47 | < 41 | < 41 | < 47 | < 47 |
| 01/28/09 - 02/04/09 | < 43 | < 42 | < 67 | < 43 | < 43 | < 67 | < 68 |
| 02/04/09 - 02/11/09 | < 54 | < 52 | < 51 | < 32 | < 53 | < 51 | < 51 |
| 02/11/09 - 02/18/09 | < 50 | < 48 | < 48 | < 49 | < 49 | < 48 | < 49 |
| 02/18/09 - 02/25/09 | < 32 | < 31 | < 41 | < 32 | < 18 | < 32 | < 41 |
| 02/25/09 - 03/04/09 | < 50 | < 49 | < 44 | < 50 | < 50 | < 44 | < 44 |
| 03/04/09 - 03/11/09 | < 15 | < 14 | < 20 | < 15 | < 20 | < 8 | < 20 |
| 03/11/09 - 03/18/09 | < 41 | < 40 | < 49 | < 41 | < 41 | < 49 | < 49 |
| 03/18/09 - 03/25/09 | < 39 | < 38 | < 40 | < 38 | < 39 | < 40 | < 32 |
| 03/25/09 - 04/01/09 | < 65 | < 63 | < 31 | < 65 | < 66 | < 31 | < 32 |
| 04/01/09 - 04/08/09 | < 66 (1) | < 29 | < 34 | < 29 | < 63 | < 65 | < 64 |
| 04/08/09 - 04/16/09 | (1) | < 43 | < 48 | < 44 | < 44 | < 46 | < 47 |
| 04/16/09 - 04/22/09 | (1) | < 52 | < 63 | < 67 | < 67 | < 68 | < 65 |
| 04/22/09 - 04/29/09 | < 47 | < 53 | < 64 | < 54 | < 54 | < 64 | < 64 |
| 04/29/09 - 05/06/09 | < 37 | < 45 | < 61 | < 46 | < 46 | < 62 | < 62 |
| 05/06/09 - 05/13/09 | < 66 | < 65 | < 63 | < 66 | < 66 | < 63 | < 63 |
| 05/13/09 - 05/20/09 | < 66 | < 64 | < 59 | < 35 | < 65 | < 64 | < 58 |
| 05/20/09 - 05/27/09 | < 53 | < 51 | < 44 | < 52 | < 53 | < 44 | < 44 |
| 05/27/09 - 06/03/09 | < 36 | < 35 | < 38 | < 36 | < 20 | < 39 | < 39 |
| 06/03/09 - 06/10/09 | < 30 | < 29 | < 69 | < 30 | < 30 | < 34 | < 70 |
| 06/10/09 - 06/18/09 | < 8 | < 8 | < 15 | < 8 | < 8 | < 9 | < 15 |
| 06/18/09 - 06/24/09 | < 53 | < 52 | < 53 | < 53 | < 54 | < 53 | < 53 |
| 06/24/09 - 07/01/09 | < 65 | < 63 | < 65 | < 64 | < 66 | < 65 | < 35 |
| 07/01/09 - 07/07/09 | < 24 | < 24 | < 32 | < 24 | < 13 | < 24 | < 14 |
| 07/07/09 - 07/15/09 | < 59 | < 58 | < 59 | < 59 | < 67 | < 67 | < 68 |
| 07/15/09 - 07/22/09 | < 66 | < 66 | < 61 | < 67 | < 68 | < 61 | < 62 |
| 07/22/09 - 07/29/09 | < 38 | < 38 | < 15 | < 38 | < 38 | < 23 | < 17 |
| 07/29/09 - 08/05/09 | < 22 | < 22 | < 27 | < 22 | < 22 | < 27 | < 27 |
| 08/05/09 - 08/12/09 | < 42 (1) | < 41 | < 44 | < 43 (1) | < 43 (1) | < 44 | < 45 |
| 08/12/09 - 08/19/09 | < 32 | < 32 | < 31 | < 32 | < 33 | < 32 | < 32 |
| 08/19/09 - 08/26/09 | < 33 | < 33 | < 34 | < 21 | < 34 | < 34 | < 35 |
| 08/26/09 - 09/02/09 | < 35 | < 35 | < 43 | < 35 | < 36 | < 44 | < 44 |
| 09/02/09 - 09/09/09 | < 53 | < 53 | < 54 | < 54 | < 30 | < 53 | < 54 |
| 09/09/09 - 09/16/09 | < 62 | < 63 | < 48 | < 63 | < 64 | < 49 | < 49 |
| 09/16/09 - 09/23/09 | < 39 | < 39 | < 37 | < 39 | < 39 | < 37 | < 38 |
| 09/23/09 - 09/30/09 | < 37 | < 36 | < 22 | < 37 | < 21 | < 36 | < 16 |
| 09/30/09 - 10/07/09 | < 52 | < 52 | < 66 | < 52 | < 52 | < 66 | < 67 |
| 10/07/09 - 10/14/09 | < 61 (1) | < 61 | < 41 | < 62 (1) | < 63 | < 42 | < 42 |
| 10/14/09 - 10/21/09 | < 42 | < 41 | < 19 | < 45 | < 45 | < 45 | < 46 |
| 10/21/09 - 10/28/09 | < 50 | < 50 | < 61 | < 51 | < 51 | < 61 (1) | < 62 |
| 10/28/09 - 11/04/09 | < 64 | < 35 | < 69 | < 64 | < 64 | < 69 | < 70 |
| 11/04/09 - 11/11/09 | < 39 | < 39 | < 38 | < 39 | < 40 | < 39 | < 39 |
| 11/11/09 - 11/18/09 | < 17 | < 23 | < 59 | < 23 | < 23 | < 59 | < 59 |
| 11/18/09 - 11/24/09 | < 47 | < 47 | < 47 | < 26 | < 47 | < 47 | < 48 |
| 11/24/09 - 12/02/09 | < 35 | < 35 | < 50 | < 35 | < 36 | < 50 | < 50 |
| 12/02/09 - 12/09/09 | < 57 | < 57 | < 64 (1) | < 58 | < 59 | < 63 | < 65 |
| 12/09/09 - 12/16/09 | < 48 | < 48 | < 64 | < 49 | < 27 | < 64 | < 65 |
| 12/16/09 - 12/22/09 | < 55 | < 55 | < 68 | < 57 | < 57 | < 69 | < 70 |
| 12/22/09 - 12/29/09 | < 60 | < 60 | < 63 | < 60 | < 63 | < 63 | < 64 |
| MEAN | - | - | - | - | - | - | - |

(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

**TABLE C-IX.1 CONCENTRATIONS OF I-131 IN MILK SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| | CONTROL FARM | INDICATOR FARM | | | | |
|---|---|---|---|---|---|---|
| COLLECTION PERIOD | K15-3 | D2-1 | E2-2 | F4-1 | G2-1 | P4-1 |
| 01/07/09 | < 0.7 | < 0.7 | < 0.7 | < 0.6 | < 0.8 | |
| 02/04/09 | < 0.7 | < 0.6 | < 0.6 | < 0.5 | < 0.6 | |
| 03/04/09 | < 0.5 | < 0.7 | < 0.6 | < 0.5 | < 0.6 | |
| 03/18/09 | < 0.5 | < 0.5 | < 0.9 | < 0.5 | < 0.6 | |
| 04/01/09 | < 0.6 | < 0.6 | < 0.6 | < 0.4 | < 0.7 | |
| 04/15/09 | < 0.6 | < 0.6 | < 0.7 | < 0.4 | < 0.7 | |
| 04/29/09 | < 0.6 | < 0.8 | < 0.7 | < 0.5 | < 0.6 | |
| 05/13/09 | < 0.6 | < 0.5 | < 0.5 | < 0.5 | < 0.6 | |
| 05/27/09 | < 0.5 | < 0.5 | < 0.6 | < 0.5 | < 0.6 | |
| 06/10/09 | < 0.5 | < 0.5 | < 0.5 | < 0.5 | < 0.6 | |
| 06/24/09 | < 0.5 | < 0.5 | < 0.5 | < 0.5 | < 0.7 | |
| 07/08/09 | < 0.6 | < 0.5 | < 0.6 | < 0.6 | < 0.6 | |
| 07/22/09 | < 0.7 | < 0.6 | < 0.7 | < 0.7 | < 0.6 | |
| 08/05/09 | < 0.5 | < 0.5 | < 0.6 | < 0.5 | < 0.8 | |
| 08/19/09 | < 0.6 | < 0.6 | < 0.6 | < 0.5 | < 0.6 | |
| 09/02/09 | < 0.6 | < 0.6 | < 0.8 | < 0.8 | < 0.6 | |
| 09/16/09 | < 0.6 | < 0.6 | < 0.5 | < 0.6 | < 0.6 | |
| 09/30/09 | < 0.8 | < 0.6 | < 0.8 | < 0.4 | < 0.8 | |
| 10/14/09 | < 0.4 | < 0.4 | < 0.5 | < 0.4 | < 0.4 | |
| 10/28/09 | < 0.8 | < 0.6 | < 0.6 | < 0.8 | < 0.6 | |
| 11/11/09 | < 0.7 | < 0.7 | < 0.9 | < 0.9 | < 0.7 | |
| 11/24/09 | < 0.5 | | < 0.7 | < 0.4 | < 0.4 | < 0.4 (1) |
| 12/09/09 | < 0.8 | | < 0.7 | < 0.6 | < 0.7 | < 0.7 |
| MEAN | - | - | - | - | - | - |

(1) SEE PROGRAM CHANGES SECTION FOR EXPLANATION

**TABLE C-IX.2 CONCENTRATIONS OF STRONTIUM IN MILK SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| COLLECTION | CONTROL FARM | | INDICATOR FARMS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | K15-3 | | D2-1 | | E2-2 | | F4-1 | | G2-1 | | P4-1 | |
| PERIOD | SR-89 | SR-90 | SR-89 | SR-90 | SR-89 | SR-90 | SR-89 | SR-90 | SR-89 | SR-90 | SR-89 | SR-90 |
| 01/07/09 - 03/18/09 | < 2.3 | 1.2 ± 0.4 | < 2.3 | 0.6 ± 0.4 | < 2.4 | < 0.6 | < 2.6 | < 0.9 | < 2.3 | < 0.7 | | |
| 04/01/09 - 06/24/09 | < 1.8 | 0.5 ± 0.3 | < 2.1 | 0.5 ± 0.3 | < 2.6 | 0.8 ± 0.4 | < 1.8 | 0.8 ± 0.3 | < 2.0 | < 0.4 | | |
| 07/08/09 - 09/30/09 | < 3.2 | < 0.7 | < 3.5 | < 0.7 | < 3.0 | < 0.5 | < 2.2 | < 0.5 | < 2.0 | < 0.4 | | |
| 10/14/09 - 12/09/09 | < 1.7 | 0.7 ± 0.3 | < 3.9 | 1.0 ± 0.4 | < 2.5 | < 0.7 | < 2.2 | < 0.6 | < 2.7 | 0.8 ± 0.5 | < 1.7 (1) | 0.7 ± 0.3 |
| MEAN | - | 0.8 ± 0.7 | - | 0.7 ± 0.6 | - | 0.8 ± 0.0 | - | 0.8 ± 0.0 | - | 0.8 ± 0.0 | - | 0.7 ± 0.0 |



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

(1) SEE PROGRAM CHANGES SECTION FOR EXPLANATION

**TABLE C-IX.3 CONCENTRATIONS OF GAMMA EMITTERS IN MILK SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| STC | COLLECTION PERIOD | K-40 | Cs-134 | Cs-137 | Ba-140 | La-140 |
|---|---|---|---|---|---|---|
| D2-1 | 01/07/09 | 1260 ± 83 | < 3 | < 3 | < 33 | < 9 |
| | 02/04/09 | 1280 ± 106 | < 4 | < 4 | < 30 | < 8 |
| | 03/04/09 | 1090 ± 137 | < 6 | < 8 | < 42 | < 10 |
| | 03/18/09 | 1220 ± 94 | < 4 | < 4 | < 33 | < 11 |
| | 04/01/09 | 1290 ± 113 | < 4 | < 5 | < 33 | < 7 |
| | 04/15/09 | 1180 ± 106 | < 4 | < 5 | < 42 | < 14 |
| | 04/29/09 | 1270 ± 41 | < 1 | < 2 | < 33 | < 9 |
| | 05/13/09 | 1310 ± 39 | < 1 | < 1 | < 41 | < 12 |
| | 05/27/09 | 1220 ± 112 | < 5 | < 5 | < 33 | < 8 |
| | 06/10/09 | 1300 ± 140 | < 5 | < 6 | < 24 | < 9 |
| | 06/24/09 | 1280 ± 50 | < 2 | < 2 | < 27 | < 8 |
| | 07/08/09 | 1160 ± 101 | < 3 | < 4 | < 37 | < 10 |
| | 07/22/09 | 1270 ± 132 | < 6 | < 6 | < 29 | < 8 |
| | 08/05/09 | 1160 ± 143 | < 5 | < 7 | < 41 | < 15 |
| | 08/19/09 | 1270 ± 118 | < 4 | < 5 | < 32 | < 9 |
| | 09/02/09 | 1310 ± 110 | < 5 | < 5 | < 32 | < 9 |
| | 09/16/09 | 1140 ± 154 | < 6 | < 7 | < 30 | < 9 |
| | 09/30/09 | 1240 ± 79 | < 3 | < 3 | < 22 | < 7 |
| | 10/14/09 | 1270 ± 151 | < 6 | < 7 | < 28 | < 8 |
| | 10/28/09 | 1300 ± 96 | < 4 | < 5 | < 28 | < 7 |
| | 11/11/09 | 1220 ± 98 | < 4 | < 4 | < 19 | < 5 |
| | 11/24/09 | (1) | | | | |
| | 12/09/09 | (1) | | | | |
| | MEAN | 1240 ± 124 | - | - | - | - |
| E2-2 | 01/07/09 | 1340 ± 80 | < 3 | < 3 | < 34 | < 11 |
| | 02/04/09 | 1290 ± 129 | < 5 | < 7 | < 46 | < 9 |
| | 03/04/09 | 1430 ± 145 | < 6 | < 7 | < 39 | < 11 |
| | 03/18/09 | 1340 ± 96 | < 4 | < 4 | < 31 | < 11 |
| | 04/01/09 | 1290 ± 149 | < 6 | < 7 | < 44 | < 12 |
| | 04/15/09 | 1220 ± 109 | < 4 | < 5 | < 47 | < 15 |
| | 04/29/09 | 1390 ± 51 | < 2 | < 2 | < 46 | < 13 |
| | 05/13/09 | 1370 ± 44 | < 1 | < 2 | < 29 | < 8 |
| | 05/27/09 | 1240 ± 134 | < 5 | < 6 | < 37 | < 11 |
| | 06/10/09 | 1240 ± 174 | < 6 | < 8 | < 35 | < 14 |
| | 06/24/09 | 1350 ± 43 | < 1 | < 2 | < 23 | < 7 |
| | 07/08/09 | 1210 ± 135 | < 6 | < 6 | < 48 | < 15 |
| | 07/22/09 | 1390 ± 117 | < 4 | < 5 | < 26 | < 8 |
| | 08/05/09 | 1340 ± 150 | < 6 | < 6 | < 45 | < 11 |
| | 08/19/09 | 1430 ± 156 | < 6 | < 8 | < 48 | < 13 |
| | 09/02/09 | 1420 ± 133 | < 5 | < 5 | < 43 | < 14 |
| | 09/16/09 | 1420 ± 120 | < 5 | < 5 | < 21 | < 8 |
| | 09/30/09 | 1340 ± 92 | < 3 | < 4 | < 23 | < 8 |
| | 10/14/09 | 1420 ± 166 | < 5 | < 6 | < 25 | < 8 |
| | 10/28/09 | 1270 ± 114 | < 5 | < 5 | < 28 | < 10 |
| | 11/11/09 | 1230 ± 120 | < 4 | < 5 | < 21 | < 7 |
| | 11/24/09 | 1390 ± 136 | < 4 | < 5 | < 36 | < 10 |
| | 12/09/09 | 1280 ± 100 | < 4 | < 5 | < 33 | < 9 |
| | MEAN | 1332 ± 147 | - | - | - | - |

(1) SEE PROGRAMS CHANGES SECTION FOR EXPLANATION

**TABLE C-IX.3 CONCENTRATIONS OF GAMMA EMITTERS IN MILK SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| STC | COLLECTION PERIOD | K-40 | Cs-134 | Cs-137 | Ba-140 | La-140 |
|---|---|---|---|---|---|---|
| F4-1 | 01/07/09 | 1250 ± 81 | < 3 | < 3 | < 37 | < 10 |
| | 02/04/09 | 1360 ± 125 | < 4 | < 5 | < 42 | < 13 |
| | 03/04/09 | 1420 ± 134 | < 4 | < 6 | < 35 | < 9 |
| | 03/18/09 | 1360 ± 108 | < 4 | < 4 | < 41 | < 11 |
| | 04/01/09 | 1410 ± 147 | < 5 | < 5 | < 40 | < 13 |
| | 04/15/09 | 1410 ± 112 | < 4 | < 5 | < 43 | < 13 |
| | 04/29/09 | 1330 ± 51 | < 2 | < 2 | < 48 | < 12 |
| | 05/13/09 | 1330 ± 55 | < 2 | < 3 | < 49 | < 15 |
| | 05/27/09 | 1340 ± 126 | < 5 | < 4 | < 31 | < 10 |
| | 06/10/09 | 1260 ± 142 | < 6 | < 6 | < 25 | < 8 |
| | 06/24/09 | 1390 ± 46 | < 2 | < 2 | < 29 | < 8 |
| | 07/08/09 | 1370 ± 126 | < 5 | < 5 | < 50 | < 12 |
| | 07/22/09 | 1240 ± 122 | < 4 | < 4 | < 21 | < 6 |
| | 08/05/09 | 1240 ± 148 | < 5 | < 5 | < 38 | < 11 |
| | 08/19/09 | 1380 ± 136 | < 5 | < 6 | < 38 | < 12 |
| | 09/02/09 | 1410 ± 119 | < 4 | < 5 | < 36 | < 9 |
| | 09/16/09 | 1170 ± 117 | < 5 | < 6 | < 24 | < 7 |
| | 09/30/09 | 1390 ± 77 | < 3 | < 3 | < 21 | < 6 |
| | 10/14/09 | 1360 ± 156 | < 7 | < 8 | < 38 | < 10 |
| | 10/28/09 | 1340 ± 101 | < 4 | < 4 | < 28 | < 8 |
| | 11/11/09 | 1430 ± 117 | < 5 | < 6 | < 25 | < 7 |
| | 11/24/09 | 1390 ± 126 | < 5 | < 5 | < 36 | < 13 |
| | 12/09/09 | 1300 ± 102 | < 4 | < 4 | < 33 | < 10 |
| | MEAN | 1343 ± 138 | - | - | - | - |
| G2-1 | 01/07/09 | 1420 ± 92 | < 4 | < 3 | < 43 | < 11 |
| | 02/04/09 | 1440 ± 145 | < 5 | < 6 | < 46 | < 13 |
| | 03/04/09 | 1280 ± 147 | < 5 | < 7 | < 44 | < 13 |
| | 03/18/09 | 1300 ± 121 | < 3 | < 4 | < 36 | < 10 |
| | 04/01/09 | 1060 ± 135 | < 5 | < 7 | < 48 | < 15 |
| | 04/15/09 | 1380 ± 122 | < 5 | < 5 | < 45 | < 12 |
| | 04/29/09 | 1190 ± 46 | < 2 | < 2 | < 37 | < 12 |
| | 05/13/09 | 1280 ± 43 | < 2 | < 2 | < 37 | < 11 |
| | 05/27/09 | 1000 ± 131 | < 5 | < 7 | < 39 | < 14 |
| | 06/10/09 | 966 ± 159 | < 5 | < 7 | < 29 | < 9 |
| | 06/24/09 | 1230 ± 43 | < 2 | < 2 | < 27 | < 8 |
| | 07/08/09 | 1180 ± 132 | < 5 | < 6 | < 50 | < 12 |
| | 07/22/09 | 1010 ± 116 | < 4 | < 4 | < 19 | < 6 |
| | 08/05/09 | 1160 ± 115 | < 3 | < 3 | < 23 | < 7 |
| | 08/19/09 | 1140 ± 126 | < 6 | < 6 | < 36 | < 14 |
| | 09/02/09 | 934 ± 122 | < 5 | < 6 | < 37 | < 10 |
| | 09/16/09 | 915 ± 137 | < 6 | < 6 | < 31 | < 8 |
| | 09/30/09 | 1070 ± 76 | < 3 | < 4 | < 22 | < 7 |
| | 10/14/09 | 993 ± 148 | < 6 | < 7 | < 35 | < 9 |
| | 10/28/09 | 1030 ± 82 | < 4 | < 4 | < 25 | < 7 |
| | 11/11/09 | 1360 ± 124 | < 5 | < 6 | < 25 | < 6 |
| | 11/24/09 | 1310 ± 137 | < 6 | < 6 | < 45 | < 12 |
| | 12/09/09 | 1050 ± 97 | < 4 | < 5 | < 35 | < 11 |
| | MEAN | 1161 ± 326 | - | - | - | - |

**TABLE C-IX.3 CONCENTRATIONS OF GAMMA EMITTERS IN MILK SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| STC | COLLECTION PERIOD | K-40 | Cs-134 | Cs-137 | Ba-140 | La-140 |
|---|---|---|---|---|---|---|
| K15-3 | 01/07/09 | 1340 ± 104 | < 3 | < 4 | < 43 | < 13 |
| | 02/04/09 | 1310 ± 133 | < 5 | < 6 | < 44 | < 11 |
| | 03/04/09 | 1200 ± 140 | < 5 | < 6 | < 31 | < 8 |
| | 03/18/09 | 1200 ± 93 | < 4 | < 5 | < 34 | < 11 |
| | 04/01/09 | 1280 ± 112 | < 5 | < 5 | < 38 | < 10 |
| | 04/15/09 | 1370 ± 122 | < 4 | < 5 | < 47 | < 15 |
| | 04/29/09 | 1320 ± 56 | < 2 | < 2 | < 44 | < 14 |
| | 05/13/09 | 1380 ± 54 | < 2 | < 2 | < 39 | < 10 |
| | 05/27/09 | 1360 ± 130 | < 5 | < 6 | < 34 | < 11 |
| | 06/10/09 | 1030 ± 166 | < 6 | < 9 | < 30 | < 14 |
| | 06/24/09 | 1280 ± 89 | < 3 | < 3 | < 53 | < 13 |
| | 07/08/09 | 1060 ± 131 | < 5 | < 6 | < 44 | < 10 |
| | 07/22/09 | 1430 ± 130 | < 5 | < 6 | < 29 | < 9 |
| | 08/05/09 | 1240 ± 89 | < 4 | < 4 | < 26 | < 9 |
| | 08/19/09 | 1200 ± 150 | < 7 | < 7 | < 47 | < 14 |
| | 09/02/09 | 1030 ± 100 | < 4 | < 4 | < 31 | < 8 |
| | 09/16/09 | 1380 ± 142 | < 5 | < 5 | < 28 | < 7 |
| | 09/30/09 | 1260 ± 73 | < 3 | < 3 | < 20 | < 6 |
| | 10/14/09 | 1210 ± 117 | < 6 | < 7 | < 30 | < 9 |
| | 10/28/09 | 1390 ± 115 | < 5 | < 5 | < 30 | < 9 |
| | 11/11/09 | 1250 ± 98 | < 4 | < 4 | < 20 | < 6 |
| | 11/24/09 | 1170 ± 121 | < 4 | < 5 | < 38 | < 11 |
| | 12/09/09 | 1270 ± 89 | < 3 | < 4 | < 25 | < 8 |
| | MEAN | 1259 ± 225 | - | - | - | - |
| P4-1 | 01/07/09 | | | | | |
| | 02/04/09 | | | | | |
| | 03/04/09 | | | | | |
| | 03/18/09 | | | | | |
| | 04/01/09 | | | | | |
| | 04/15/09 | | | | | |
| | 04/29/09 | | | | | |
| | 05/13/09 | | | | | |
| | 05/27/09 | | | | | |
| | 06/10/09 | | | | | |
| | 06/24/09 | | | | | |
| | 07/08/09 | | | | | |
| | 07/22/09 | | | | | |
| | 08/05/09 | | | | | |
| | 08/19/09 | | | | | |
| | 09/02/09 | | | | | |
| | 09/16/09 | | | | | |
| | 09/30/09 | | | | | |
| | 10/14/09 | | | | | |
| | 10/28/09 | | | | | |
| | 11/11/09 | | | | | |
| | 11/24/09 | 1320 ± 129 (1) | < 6 | < 7 | < 44 | < 13 |
| | 12/09/09 | 1260 ± 117 | < 5 | < 6 | < 43 | < 12 |
| | MEAN | 1290 ± 85 | - | - | - | - |

(1) SEE PROGRAMS CHANGES SECTION FOR EXPLANATION

**TABLE C-X.1** **CONCENTRATIONS OF STRONTIUM AND GAMMA EMITTERS IN FOOD PRODUCT SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

| STC | COLLECTION PERIOD | | SR-90 | Be-7 | K-40 | I-131 | Cs-134 | Cs-137 |
|---|---|---|---|---|---|---|---|---|
| B10-2 | 07/07/09 | Cabbage | 28 ± 3 | < 194 | 4720 ± 451 | < 56 | < 17 | < 19 |
| | 07/07/09 | Yellow Squash Leaves | 38 ± 3 | 332 ± 140 | 5650 ± 347 | < 47 | < 14 | < 15 |
| | 07/07/09 | Zucchini Leaves | 38 ± 3 | 440 ± 154 | 4340 ± 353 | < 47 | < 14 | < 16 |
| | 07/29/09 | Cabbage | 4 ± 2 | < 95 | 2320 ± 185 | < 55 | < 9 | < 10 |
| | 08/12/09 | Cabbage | 9 ± 2 | < 77 | 1990 ± 151 | < 40 | < 7 | < 8 |
| | 08/12/09 | Sweet Corn | | < 67 | 3180 ± 150 | < 35 | < 6 | < 7 |
| | 08/12/09 | Tomatoes | | < 51 | 2390 ± 127 | < 25 | < 5 | < 5 |
| | 08/12/09 | Yellow Squash Leaves | 17 ± 2 | 1400 ± 124 | 4830 ± 262 | < 54 | < 10 | < 12 |
| | 08/12/09 | Zucchini Leaves | 22 ± 2 | 908 ± 111 | 3820 ± 258 | < 45 | < 9 | < 11 |
| | 09/09/09 | Broccoli Leaves | 3 ± 2 | < 126 | 2400 ± 236 | < 43 | < 12 | < 13 |
| | 09/09/09 | Cabbage | < 3 | < 154 | 2970 ± 330 | < 56 | < 16 | < 16 |
| | 09/09/09 | Pumpkin Leaves | 4 ± 1 | 547 ± 131 | 4240 ± 329 | < 53 | < 14 | < 15 |
| | 09/09/09 | Red Beets | | < 57 | 2270 ± 156 | < 25 | < 5 | < 6 |
| | MEAN | | 18 ± 28 | 725 ± 870 | 3471 ± 2397 | - | - | - |

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

**TABLE C-X.1** **CONCENTRATIONS OF STRONTIUM AND GAMMA EMITTERS IN FOOD PRODUCT SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

| STC | COLLECTION PERIOD | | SR-90 | Be-7 | K-40 | I-131 | Cs-134 | Cs-137 |
|---|---|---|---|---|---|---|---|---|
| E1-2 | 07/29/09 | Cabbage | 11 ± 1 | < 119 | 3100 ± 235 | < 54 | < 10 | < 10 |
| | 08/12/09 | Sweet Corn | | < 59 | 3090 ± 136 | < 33 | < 6 | < 6 |
| | 08/12/09 | Tomatoes | | < 43 | 2140 ± 118 | < 21 | < 4 | < 5 |
| | 09/09/09 | Radishes | | < 111 | 4060 ± 257 | < 50 | < 11 | < 11 |
| | MEAN | | 11 ± 0 | - | 3098 ± 1568 | - | - | - |
| H1-2 | 07/07/09 | Cucumber Leaves | 49 ± 4 | 614 ± 204 | 4200 ± 404 | < 54 | < 19 | < 18 |
| | 07/07/09 | Yellow Squash Leaves | 18 ± 2 | < 146 | 4650 ± 473 | < 51 | < 18 | < 20 |
| | 07/07/09 | Zucchini Leaves | 40 ± 3 | 273 ± 117 | 5300 ± 400 | < 46 | < 15 | < 19 |
| | 08/12/09 | Cabbage | 11 ± 2 | < 89 | 3610 ± 220 | < 46 | < 9 | < 10 |
| | 08/12/09 | Neck Pumpkin Leaves | 37 ± 3 | 770 ± 97 | 3350 ± 212 | < 38 | < 8 | < 9 |
| | 08/12/09 | Yellow Squash Leaves | 13 ± 2 | 407 ± 79 | 4050 ± 195 | < 31 | < 6 | < 7 |
| | 09/09/09 | Cabbage | < 2 | < 66 | 2130 ± 168 | < 27 | < 7 | < 7 |
| | 09/09/09 | Neck Pumpkin Leaves | 3 ± 1 | 1690 ± 158 | 5290 ± 309 | < 50 | < 14 | < 14 |
| | 09/09/09 | Zucchini Leaves | 2 ± 1 | 200 ± 103 | 4090 ± 357 | < 54 | < 15 | < 16 |
| | MEAN | | 22 ± 36 | 659 ± 1096 | 4074 ± 1981 | - | - | - |

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

## TABLE C-XI.1 QUARTERLY TLD RESULTS FOR THREE MILE ISLAND NUCLEAR STATION, 2009

RESULTS IN UNITS OF MILLI-ROENTGENS/STD. MONTH

| STATION CODE | MEAN ± 2 S.D. | JAN - MAR | APR - JUN | JUL - SEP | OCT - DEC |
|---|---|---|---|---|---|
| A1-4 | 4.3 ± 0.8 | 3.7 ± 0.5 | 4.6 ± 0.4 | 4.4 ± 1.1 | 4.3 ± 0.9 |
| A3-1 | 4.4 ± 1.0 | 3.7 ± 0.4 | 4.7 ± 0.3 | 4.7 ± 0.3 | 4.5 ± 0.4 |
| A5-1 | 5.3 ± 0.9 | 4.6 ± 1.0 | 5.6 ± 0.8 | 5.5 ± 0.3 | 5.3 ± 0.4 |
| A9-3 | 4.1 ± 0.8 | 3.7 ± 0.5 | 4.6 ± 0.4 | 4.0 ± 0.5 | 3.9 ± 0.5 |
| B10-1 | 4.6 ± 0.6 | 4.4 ± 0.5 | 4.2 ± 0.5 | 4.8 ± 0.2 | 4.8 ± 0.4 |
| B1-1 | 4.4 ± 0.7 | 3.9 ± 0.9 | 4.6 ± 0.3 | 4.4 ± 0.3 | 4.6 ± 0.8 |
| B1-2 | 4.2 ± 0.7 | 3.8 ± 0.3 | 3.9 ± 0.5 | 4.4 ± 0.5 | 4.5 ± 0.2 |
| B2-1 | 4.1 ± 0.5 | 3.9 ± 0.7 | 3.9 ± 0.4 | 4.2 ± 0.5 | 4.4 ± 0.3 |
| B5-1 | 4.8 ± 0.5 | 4.6 ± 1.0 | 4.6 ± 0.9 | 5.0 ± 0.4 | 5.0 ± 0.3 |
| C1-1 | 4.7 ± 0.7 | 4.3 ± 0.3 | 4.5 ± 0.8 | 4.9 ± 0.9 | 5.0 ± 0.4 |
| C1-2 | 4.2 ± 0.8 | 4.7 ± 2.0 | 3.7 ± 0.4 | 4.0 ± 0.8 | 4.2 ± 0.2 |
| C2-1 | 4.5 ± 0.6 | 4.5 ± 0.5 | 4.1 ± 0.2 | 4.8 ± 1.6 | 4.7 ± 0.4 |
| C5-1 | 5.1 ± 0.6 | 5.0 ± 0.5 | 4.8 ± 1.2 | 5.4 ± 0.8 | 5.3 ± 0.3 |
| C8-1 | 5.1 ± 0.7 | 4.7 ± 0.8 | 4.8 ± 0.5 | 5.5 ± 0.4 | 5.2 ± 0.7 |
| D1-1 | 4.0 ± 0.8 | 3.5 ± 0.4 | 3.7 ± 0.3 | 4.2 ± 0.3 | 4.4 ± 0.2 |
| D1-2 | 4.4 ± 0.3 | 4.4 ± 0.5 | 4.2 ± 0.8 | 4.5 ± 0.4 | 4.4 ± 0.4 |
| D15-1 | 4.8 ± 0.8 | 4.6 ± 0.5 | 4.3 ± 0.3 | 5.2 ± 0.5 | 5.0 ± 0.2 |
| D2-2 | 5.6 ± 0.9 | 5.5 ± 1.2 | 5.1 ± 0.6 | 6.2 ± 0.7 | 5.6 ± 0.5 |
| D6-1 | 5.2 ± 0.9 | 4.9 ± 0.6 | 4.8 ± 0.3 | 5.8 ± 0.5 | 5.4 ± 0.4 |
| E1-2 | 4.1 ± 0.6 | 3.9 ± 0.6 | 3.9 ± 0.5 | 4.5 ± 1.4 | 4.2 ± 0.3 |
| E1-4 | 4.0 ± 0.8 | 3.8 ± 0.6 | 3.6 ± 0.7 | 4.2 ± 0.3 | 4.5 ± 0.3 |
| E2-3 | 5.0 ± 0.7 | 4.9 ± 0.5 | 4.6 ± 0.5 | 5.4 ± 0.7 | 5.2 ± 0.4 |
| E5-1 | 4.7 ± 1.1 | 4.2 ± 0.5 | 4.4 ± 0.5 | 5.4 ± 0.9 | 4.9 ± 0.4 |
| E7-1 | 4.7 ± 0.4 | 4.5 ± 0.9 | 4.6 ± 0.5 | 4.9 ± 0.3 | 4.9 ± 0.3 |
| F10-1 | 6.0 ± 1.3 | 5.6 ± 1.3 | (1) | 6.7 ± 1.2 | 5.6 ± 0.4 |
| F1-1 | 4.5 ± 0.6 | 4.1 ± 0.9 | 4.6 ± 0.5 | 4.7 ± 0.8 | 4.7 ± 0.3 |
| F1-2 | 4.4 ± 0.6 | 4.1 ± 0.3 | 4.2 ± 0.3 | 4.3 ± 0.6 | 4.8 ± 0.4 |
| F1-4 | 4.1 ± 1.0 | 3.7 ± 0.3 | 3.7 ± 0.3 | 4.3 ± 0.4 | 4.7 ± 0.5 |
| F2-1 | 5.3 ± 0.6 | 5.1 ± 0.7 | 5.5 ± 1.7 | 5.6 ± 0.6 | 5.0 ± 0.6 |
| F25-1 | 4.9 ± 0.7 | 4.6 ± 0.5 | 5.0 ± 0.3 | 5.4 ± 0.9 | 4.7 ± 0.3 |
| F5-1 | 5.1 ± 0.5 | 4.9 ± 0.5 | 5.0 ± 0.7 | 5.5 ± 0.5 | 5.1 ± 0.4 |
| G10-1 | 6.6 ± 0.8 | 6.5 ± 0.6 | 6.7 ± 0.6 | 7.0 ± 0.7 | 6.1 ± 0.4 |
| G1-2 | 4.6 ± 0.8 | 4.1 ± 0.3 | 4.9 ± 0.7 | 4.9 ± 0.7 | 4.4 ± 0.3 |
| G1-3 | 4.0 ± 0.5 | 3.8 ± 0.3 | 3.8 ± 0.5 | 4.3 ± 0.7 | 4.0 ± 0.3 |
| G1-5 | 4.2 ± 0.6 | 3.9 ± 0.4 | 4.6 ± 1.0 | 4.1 ± 0.4 | 4.0 ± 0.3 |
| G15-1 | 6.1 ± 0.8 | 5.6 ± 0.3 | 6.3 ± 0.6 | 6.5 ± 0.6 | 5.8 ± 0.5 |
| G1-6 | 4.4 ± 0.3 | 4.2 ± 0.3 | 4.3 ± 0.4 | 4.5 ± 0.6 | 4.4 ± 0.5 |
| G2-4 | 5.6 ± 0.2 | 5.7 ± 0.3 | 5.7 ± 0.3 | 5.6 ± 0.4 | 5.5 ± 0.5 |
| G5-1 | 4.5 ± 1.2 | 3.9 ± 1.0 | 4.5 ± 0.6 | 5.3 ± 2.0 | 4.2 ± 0.5 |
| H1-1 | 4.8 ± 1.4 | 4.4 ± 0.5 | 4.5 ± 0.6 | 5.8 ± 1.7 | 4.4 ± 0.5 |
| H15-1 | 4.8 ± 0.5 | 4.9 ± 0.8 | 4.4 ± 0.3 | 5.0 ± 0.7 | 4.9 ± 0.1 |
| H3-1 | 3.7 ± 0.3 | 3.6 ± 0.4 | 3.5 ± 0.8 | 3.9 ± 0.3 | 3.6 ± 0.4 |
| H5-1 | 3.4 ± 0.6 | 3.0 ± 0.3 | 3.2 ± 0.3 | 3.5 ± 0.4 | 3.7 ± 0.5 |
| H8-1 | 7.3 ± 0.8 | 7.6 ± 0.7 | 6.9 ± 0.4 | 7.7 ± 0.7 | 7.1 ± 0.5 |
| J1-1 | 3.9 ± 0.5 | 3.6 ± 0.3 | 3.8 ± 0.3 | 4.1 ± 0.4 | 4.1 ± 0.5 |
| J1-3 | 3.8 ± 0.6 | 3.5 ± 0.4 | 3.7 ± 0.3 | 3.7 ± 0.5 | 4.2 ± 0.5 |

(1) SEE PROGRAMS EXCEPTIONS SECTION FOR EXPLANATION

## TABLE C-XI.1 QUARTERLY TLD RESULTS FOR THREE MILE ISLAND NUCLEAR STATION, 2009

RESULTS IN UNITS OF MILLI-ROENTGENS/STD. MONTH

| STATION CODE | MEAN ± 2 S.D. | JAN - MAR | APR - JUN | JUL - SEP | OCT - DEC | |
|---|---|---|---|---|---|---|
| J15-1 | 5.2 ± 0.4 | 5.0 ± 0.6 | 5.1 ± 0.5 | 5.5 ± 0.5 | 5.2 ± 0.5 | |
| J3-1 | 4.4 ± 0.3 | 4.5 ± 0.6 | 4.2 ± 0.3 | 4.4 ± 0.6 | 4.5 ± 0.4 | |
| J5-1 | 5.1 ± 0.3 | 5.0 ± 0.6 | 4.9 ± 0.5 | 5.3 ± 1.2 | 5.1 ± 0.4 | |
| J7-1 | 5.5 ± 0.9 | 6.1 ± 1.7 | 5.7 ± 0.4 | 5.2 ± 0.2 | 5.1 ± 0.5 | |
| K1-4 | 3.9 ± 0.4 | 3.8 ± 0.2 | 3.7 ± 0.2 | 4.2 ± 0.5 | 3.9 ± 0.3 | |
| K15-1 | 4.6 ± 0.7 | 4.3 ± 0.2 | 4.3 ± 0.2 | 4.7 ± 1.0 | 5.0 ± 0.6 | |
| K2-1 | 5.0 ± 1.0 | 4.9 ± 0.5 | 4.6 ± 0.4 | 5.6 ± 0.5 | | (1) |
| K3-1 | 3.9 ± 0.7 | 3.5 ± 0.4 | 4.2 ± 0.4 | 4.2 ± 0.3 | 3.8 ± 0.6 | |
| K5-1 | 4.9 ± 0.8 | 4.6 ± 0.9 | 4.9 ± 0.3 | 5.4 ± 0.6 | 4.5 ± 0.4 | |
| K8-1 | 4.6 ± 0.4 | 4.4 ± 0.5 | 4.9 ± 0.5 | 4.5 ± 0.3 | 4.5 ± 0.3 | |
| L1-1 | 4.0 ± 0.8 | 3.8 ± 0.5 | 3.9 ± 0.7 | 4.6 ± 0.9 | 3.8 ± 0.3 | |
| L1-2 | 3.8 ± 0.3 | 3.9 ± 0.3 | 3.6 ± 0.3 | 3.9 ± 0.5 | | (1) |
| L15-1 | 4.5 ± 0.5 | 4.6 ± 0.6 | 4.5 ± 0.4 | 4.6 ± 0.6 | 4.1 ± 0.4 | |
| L2-1 | 4.5 ± 0.3 | 4.4 ± 0.4 | 4.6 ± 1.0 | 4.4 ± 0.1 | 4.7 ± 1.1 | |
| L5-1 | 4.3 ± 0.4 | 4.1 ± 0.5 | 4.2 ± 0.4 | 4.4 ± 0.2 | 4.6 ± 0.7 | |
| L8-1 | 4.3 ± 0.4 | 4.1 ± 0.1 | 4.4 ± 0.3 | 4.6 ± 0.6 | 4.2 ± 0.6 | |
| M1-1 | 4.1 ± 1.6 | 3.4 ± 0.8 | 3.5 ± 0.3 | 4.2 ± 0.3 | 5.1 ± 0.7 | |
| M1-2 | 4.9 ± 0.3 | 5.1 ± 0.5 | 4.8 ± 0.8 | 4.8 ± 1.1 | | (1) |
| M2-1 | 3.7 ± 0.3 | 3.5 ± 0.5 | 3.6 ± 0.3 | 3.9 ± 0.5 | 3.6 ± 0.3 | |
| M5-1 | 4.7 ± 0.6 | 4.5 ± 1.4 | 4.3 ± 0.3 | 4.9 ± 0.6 | 4.9 ± 1.0 | |
| M9-1 | 5.5 ± 0.6 | 5.2 ± 0.6 | 5.8 ± 0.9 | 5.7 ± 0.5 | 5.4 ± 1.0 | |
| N1-1 | 4.6 ± 0.8 | 4.6 ± 0.3 | 4.2 ± 0.2 | 5.0 ± 0.7 | | (1) |
| N1-3 | 4.2 ± 1.1 | 3.8 ± 0.5 | 3.7 ± 0.3 | 4.3 ± 0.3 | 4.9 ± 0.8 | |
| N15-2 | 5.0 ± 0.1 | 4.9 ± 0.3 | 5.0 ± 0.4 | 5.0 ± 0.9 | 5.0 ± 0.7 | |
| N2-1 | 4.5 ± 1.1 | 4.2 ± 0.7 | 4.2 ± 0.4 | 5.3 ± 0.9 | 4.4 ± 0.2 | |
| N5-1 | 3.9 ± 0.7 | 3.6 ± 0.6 | 4.0 ± 0.8 | 4.3 ± 0.3 | 3.5 ± 0.5 | |
| N8-1 | 4.7 ± 0.4 | 4.5 ± 0.8 | 4.7 ± 0.5 | 4.9 ± 0.6 | 4.5 ± 0.4 | |
| P1-1 | 4.1 ± 0.4 | 4.3 ± 0.3 | 3.9 ± 0.2 | 4.0 ± 0.5 | | (1) |
| P1-2 | 4.7 ± 3.0 | 3.4 ± 0.4 | 3.9 ± 0.6 | 4.5 ± 1.8 | 6.8 ± 1.9 | |
| P2-1 | 5.3 ± 1.7 | 4.2 ± 0.3 | 5.2 ± 0.5 | 5.4 ± 0.8 | 6.3 ± 0.5 | |
| P5-1 | 4.4 ± 0.7 | 3.9 ± 0.3 | 4.6 ± 0.7 | 4.6 ± 0.5 | 4.4 ± 1.2 | |
| P8-1 | 3.7 ± 0.6 | 3.2 ± 0.5 | 3.9 ± 0.8 | 3.8 ± 1.0 | 3.7 ± 0.6 | |
| Q1-1 | 4.6 ± 0.3 | 4.7 ± 0.5 | 4.4 ± 0.5 | 4.6 ± 0.4 | | (1) |
| Q1-2 | 3.6 ± 1.3 | 2.7 ± 0.4 | 4.0 ± 0.8 | 3.7 ± 0.4 | 4.1 ± 0.5 | |
| Q15-1 | 5.0 ± 1.1 | 4.5 ± 0.2 | 5.3 ± 1.1 | 5.7 ± 0.9 | 4.6 ± 0.5 | |
| Q2-1 | 3.9 ± 0.8 | 3.7 ± 0.3 | 3.6 ± 0.2 | 4.5 ± 0.4 | 3.8 ± 0.2 | |
| Q5-1 | 4.1 ± 1.0 | 3.4 ± 0.1 | 4.2 ± 0.7 | 4.6 ± 0.6 | 4.1 ± 0.7 | |
| Q9-1 | 4.2 ± 0.9 | 3.8 ± 0.6 | 4.3 ± 0.3 | 4.7 ± 0.5 | 3.8 ± 0.5 | |
| R1-1 | 3.8 ± 0.5 | 3.5 ± 1.3 | 3.7 ± 0.6 | 4.0 ± 0.3 | 4.0 ± 0.4 | |
| R1-2 | 4.0 ± 0.7 | 4.4 ± 0.5 | 3.7 ± 0.3 | 4.0 ± 1.1 | | (1) |
| R15-1 | 4.6 ± 0.5 | 4.3 ± 0.2 | 4.6 ± 0.8 | 4.9 ± 0.7 | 4.4 ± 0.3 | (1) |
| R3-1 | 5.1 ± 0.9 | 4.7 ± 0.5 | 5.0 ± 0.5 | 5.7 ± 0.7 | 4.9 ± 0.4 | |
| R5-1 | 4.7 ± 1.0 | 4.0 ± 0.4 | 5.1 ± 0.6 | 5.1 ± 0.8 | 4.6 ± 0.3 | |
| R9-1 | 5.1 ± 0.3 | 4.9 ± 0.6 | 5.1 ± 0.5 | 5.2 ± 0.5 | 5.0 ± 0.7 | |

(1) SEE PROGRAMS EXCEPTIONS SECTION FOR EXPLANATION

**TABLE C-XI.2 MEAN QUARTERLY TLD RESULTS FOR THE SITE BOUNDARY, INDICATOR AND CONTROL LOCATIONS FOR THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF MILLI-ROENTGENS/MONTH ± 2 STANDARD DEVIATIONS OF THE STATION DATA

| COLLECTION PERIOD | SITE BOUNDARY ± 2 S.D. | INDICATOR | CONTROL |
|---|---|---|---|
| JAN-MAR | 3.8 ± 0.8 | 4.4 ± 1.5 | 4.9 ± 1.3 |
| APR-JUN | 3.9 ± 0.7 | 4.5 ± 1.3 | 5.0 ± 1.6 |
| JUL-SEP | 4.3 ± 0.9 | 4.9 ± 1.5 | 5.4 ± 1.5 |
| OCT-DEC | 4.5 ± 1.3 | 4.7 ± 1.4 | 5.0 ± 1.2 |

**TABLE C-XI.3 SUMMARY OF THE AMBIENT DOSIMETRY PROGRAM FOR THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF MILLI-ROENTGEN/STD. MONTH

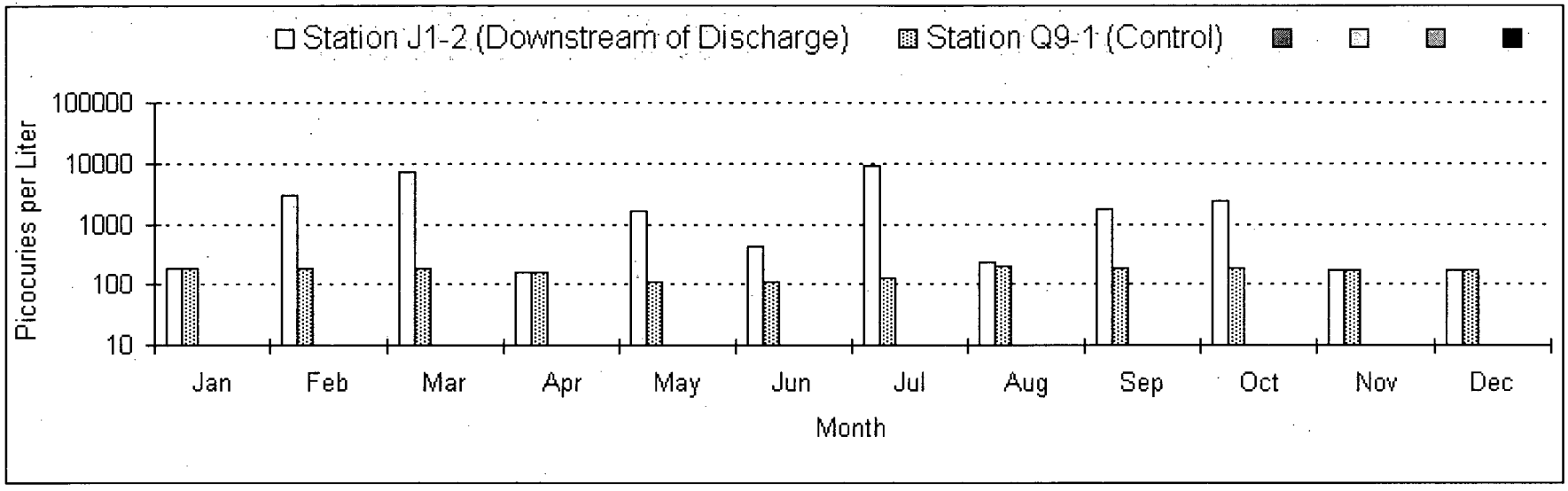
| LOCATION | SAMPLES ANALYZED | PERIOD MINIMUM | PERIOD MAXIMUM | PERIOD MEAN ± 2 S.D. | PRE-OP MEAN ± 2 S.D. |
|---|---|---|---|---|---|
| SITE BOUNDARY | 76 | 2.7 | 6.8 | 4.1 ± 1.1 | 4.8 ± 1.5 |
| INDICATOR | 232 | 3.0 | 7.7 | 4.6 ± 1.5 | 5.2 ± 1.5 |
| CONTROL | 44 | 4.1 | 7.0 | 5.1 ± 1.4 | 5.8 ± 1.7 |

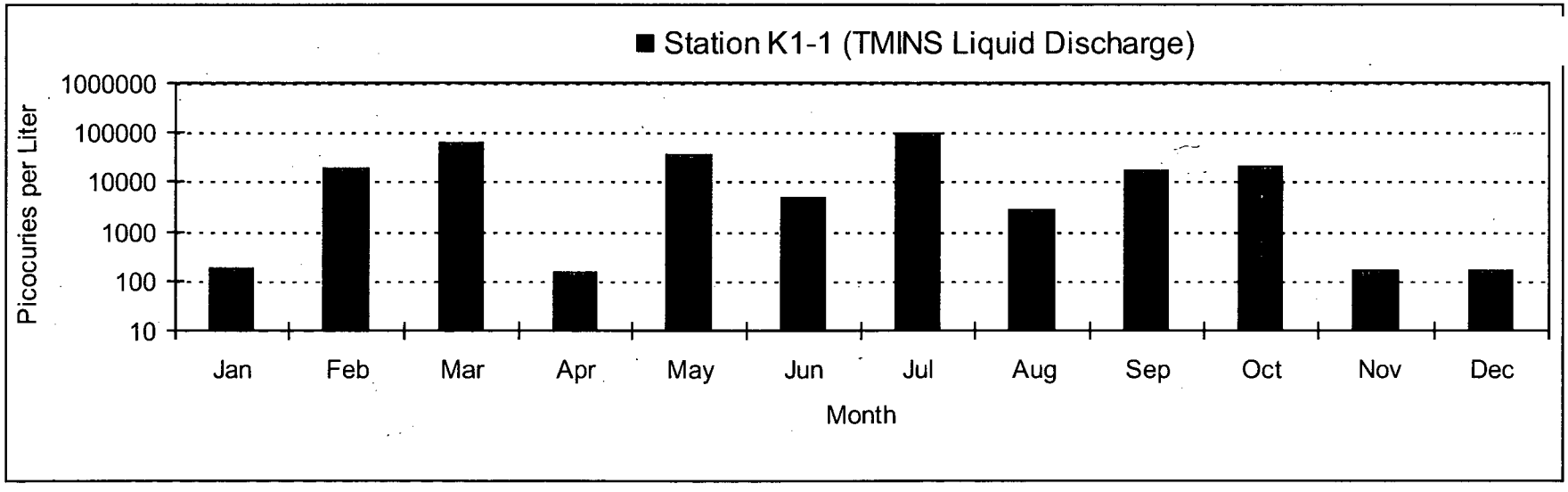
SITE BOUNDARY STATIONS - A1-4, B1-2, C1-2, D1-1, E1-4, F1-2, F1-4, G1-3, G1-5, G1-6, H1-1, J1-3, K1-4, L1-1, M1-1, N1-3, P1-2, Q1-2, R1-1

INDICATOR STATIONS - A3-1, A5-1, A9-3, B1-1, B10-1, B2-1, B5-1, C1-1, C2-1, C5-1, C8-1, D1-2, D2-2, D6-1, E1-2, E2-3, E5-1, E7-1, F1-1, F10-1, F2-1, F5-1, G1-2, G2-4, G5-1, H3-1, H5-1, H8-1, J1-1, J3-1, J5-1, J7-1, K2-1, K3-1, K5-1, K8-1, L1-2, L2-1, L5-1, L8-1, M1-2, M2-1, M5-1, M9-1, N1-1, N2-1, N5-1, N8-1, P1-1, P2-1, P5-1, P8-1, Q1-1, Q2-1, Q5-1, Q9-1, R1-2, R3-1, R5-1, R9-1

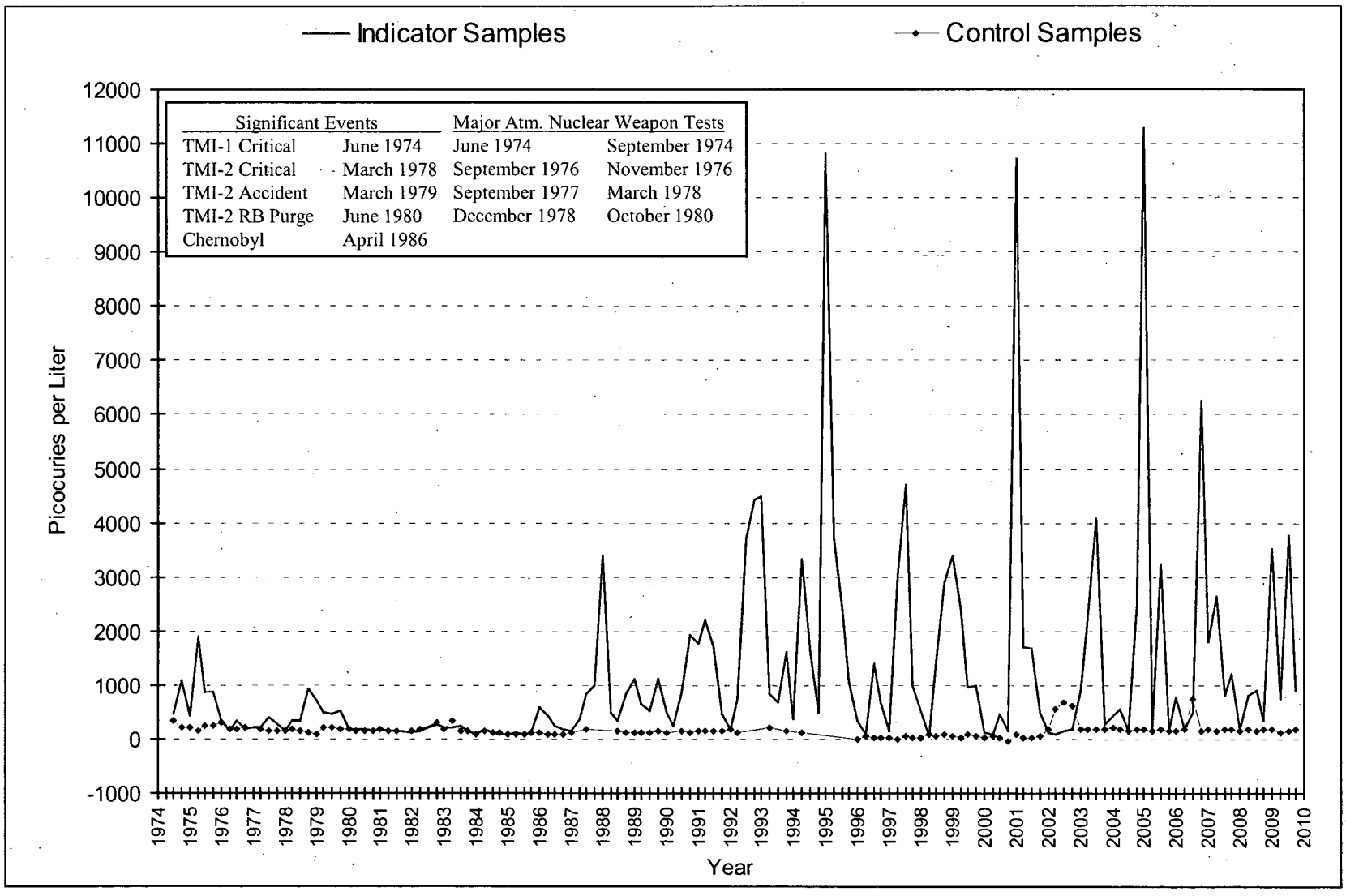
CONTROL STATIONS - D15-1, F25-1, G10-1, G15-1, H15-1, J15-1, K15-1, L15-1, N15-2, Q15-1, R15-1

# FIGURE C-1
## Monthly Tritium Concentrations in Surface Water and Effluent Water
### Three Mile Island Nuclear Station, 2009

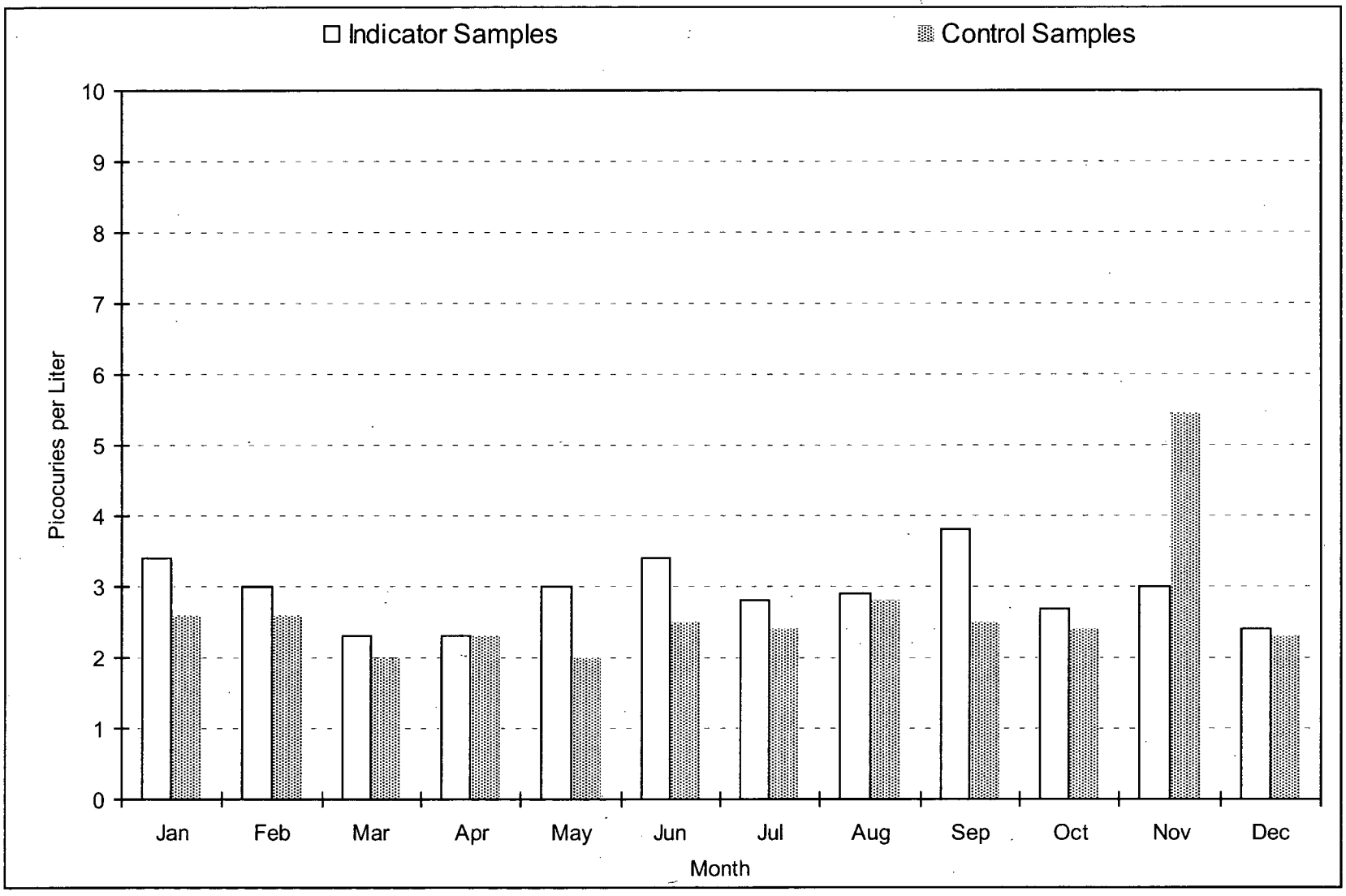


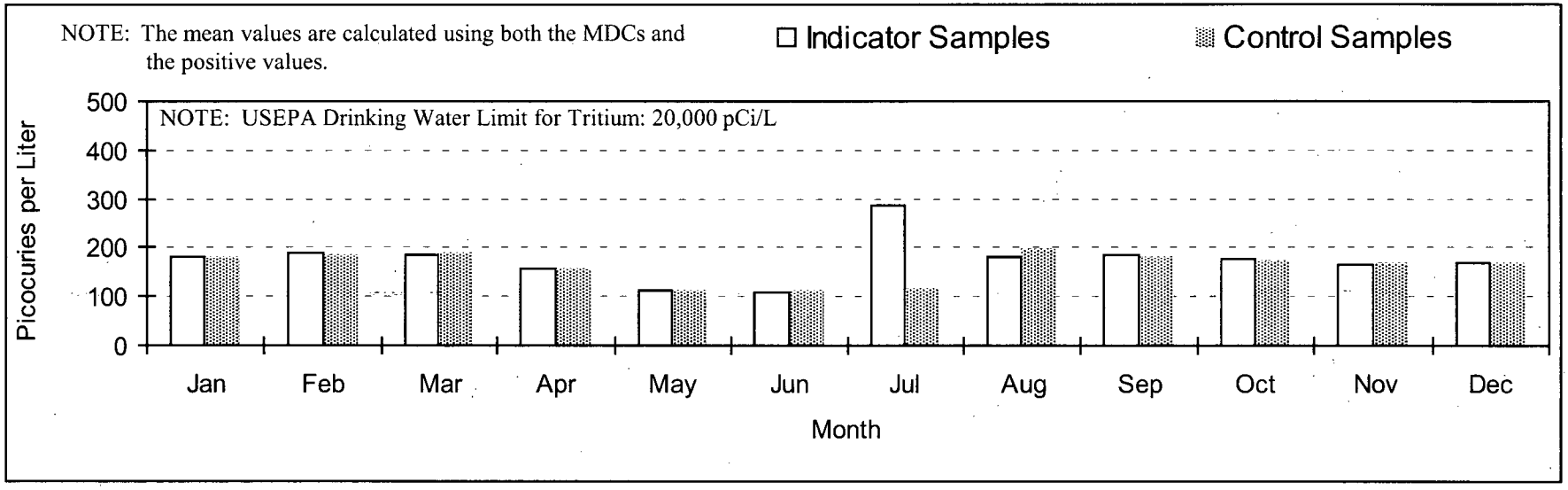
# FIGURE C-2
## Mean Quarterly Tritium Concentrations in Surface Water
## Three Mile Island Nuclear Station, 1974 - 2009

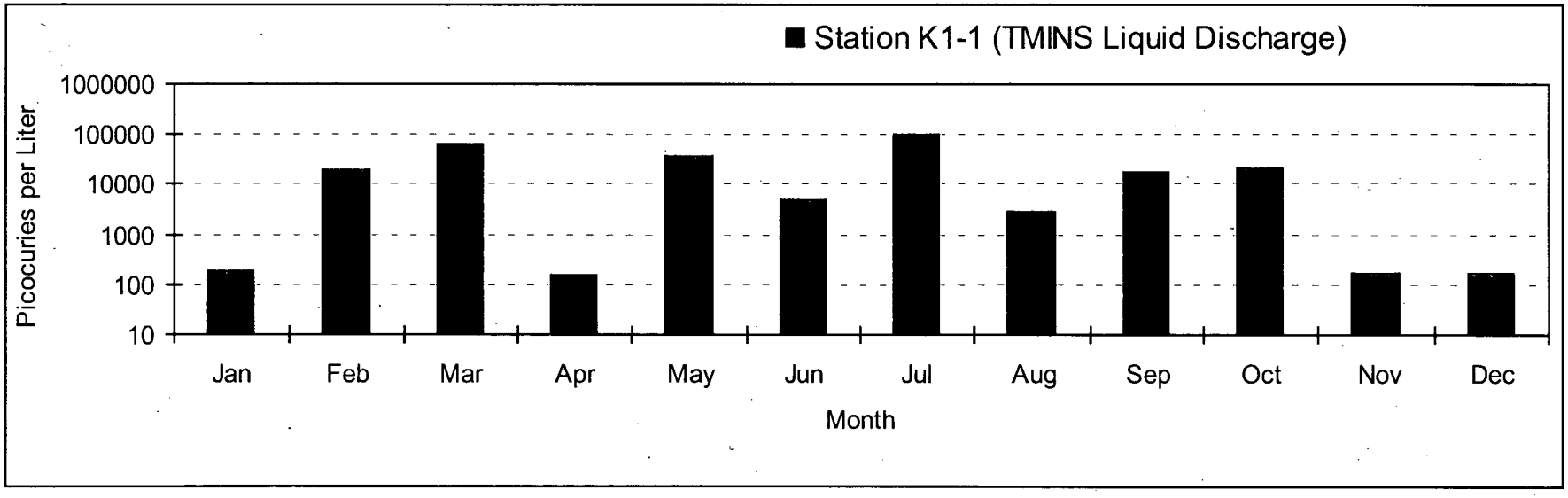


# FIGURE C-3
## Mean Monthly Gross Beta Concentrations in Drinking Water
## Three Mile Island Nuclear Station, 2009

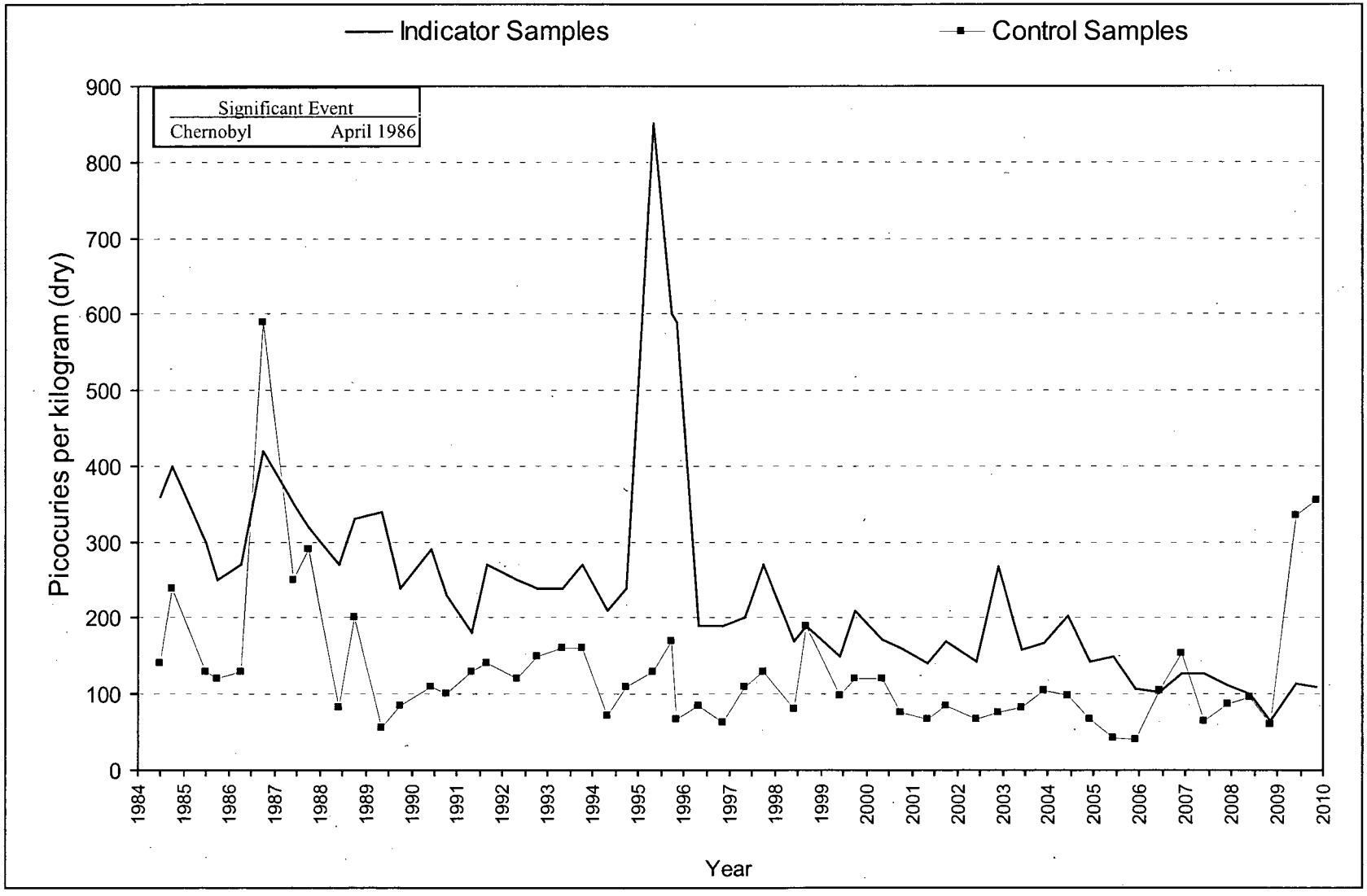


# FIGURE C-4
## Mean Monthly Tritium Concentrations in Drinking Water and Effluent Water
## Three Mile Island Nuclear Station, 2009

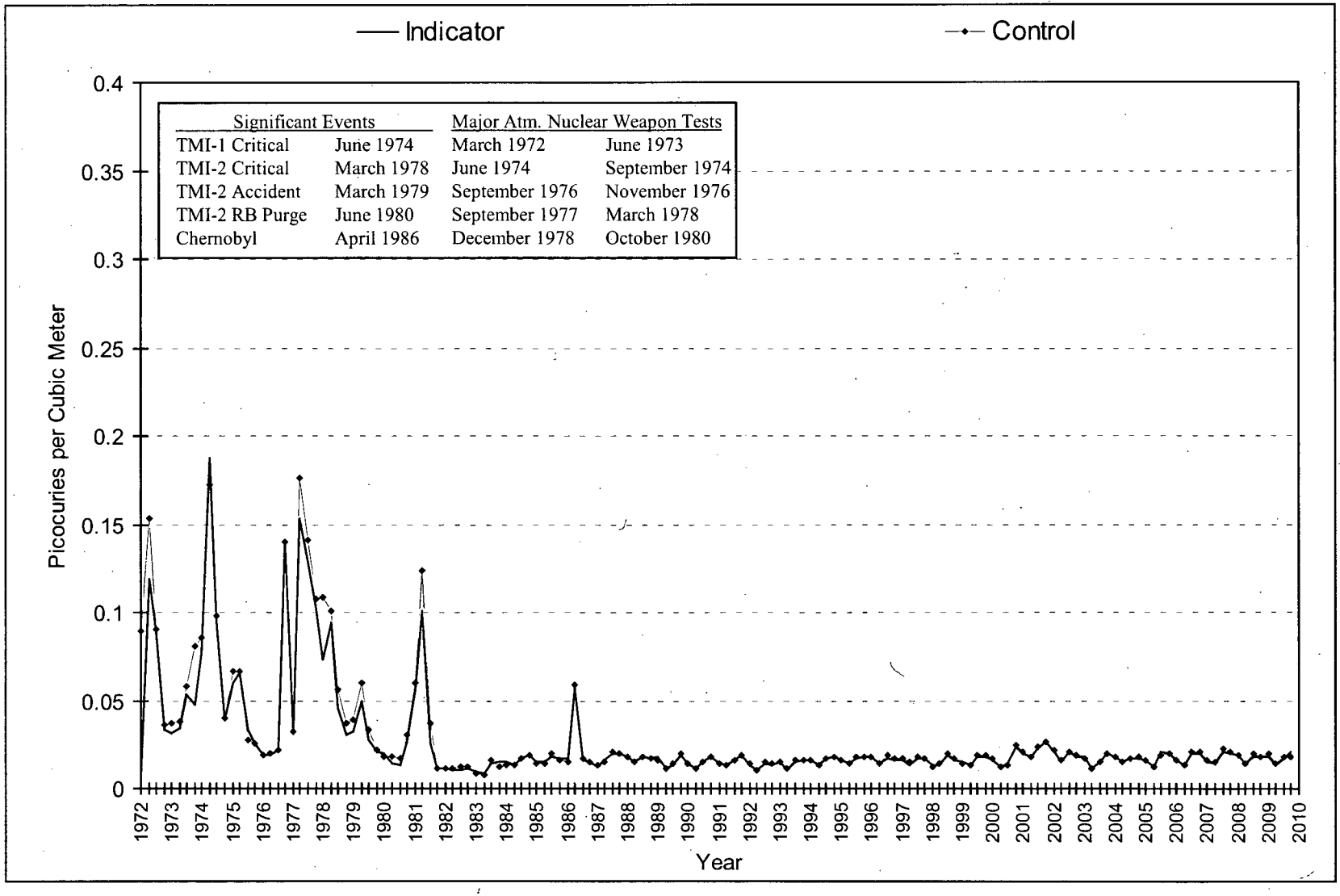


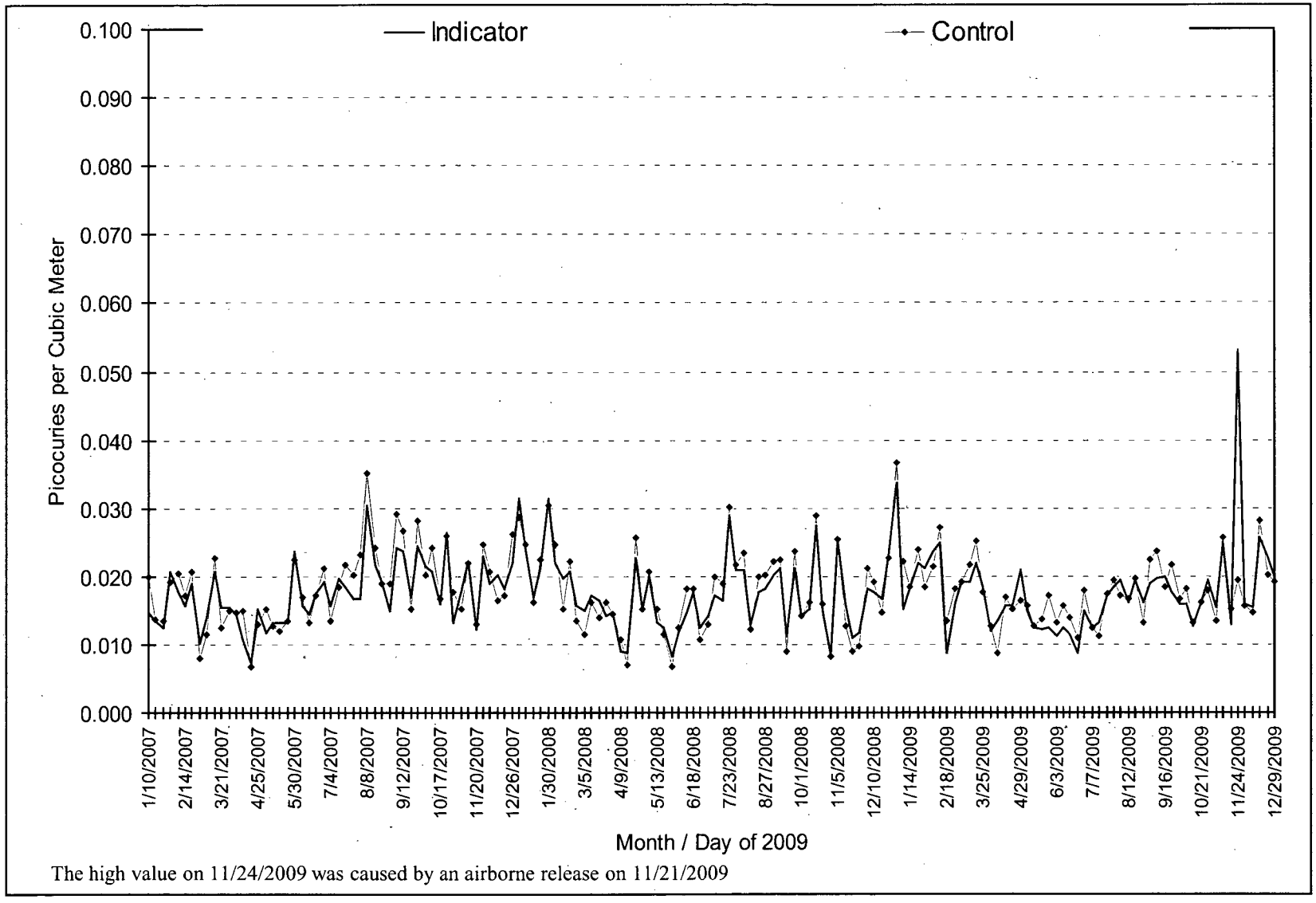
# FIGURE C-5
## Mean Cesium-137 Concentrations in Aquatic Sediments
### Three Mile Island Nuclear Station, 1984 - 2009



# FIGURE C-6
## Mean Quarterly Gross Beta Concentrations in Air Particulates
## Three Mile Island Nuclear Station, 1972 - 2009

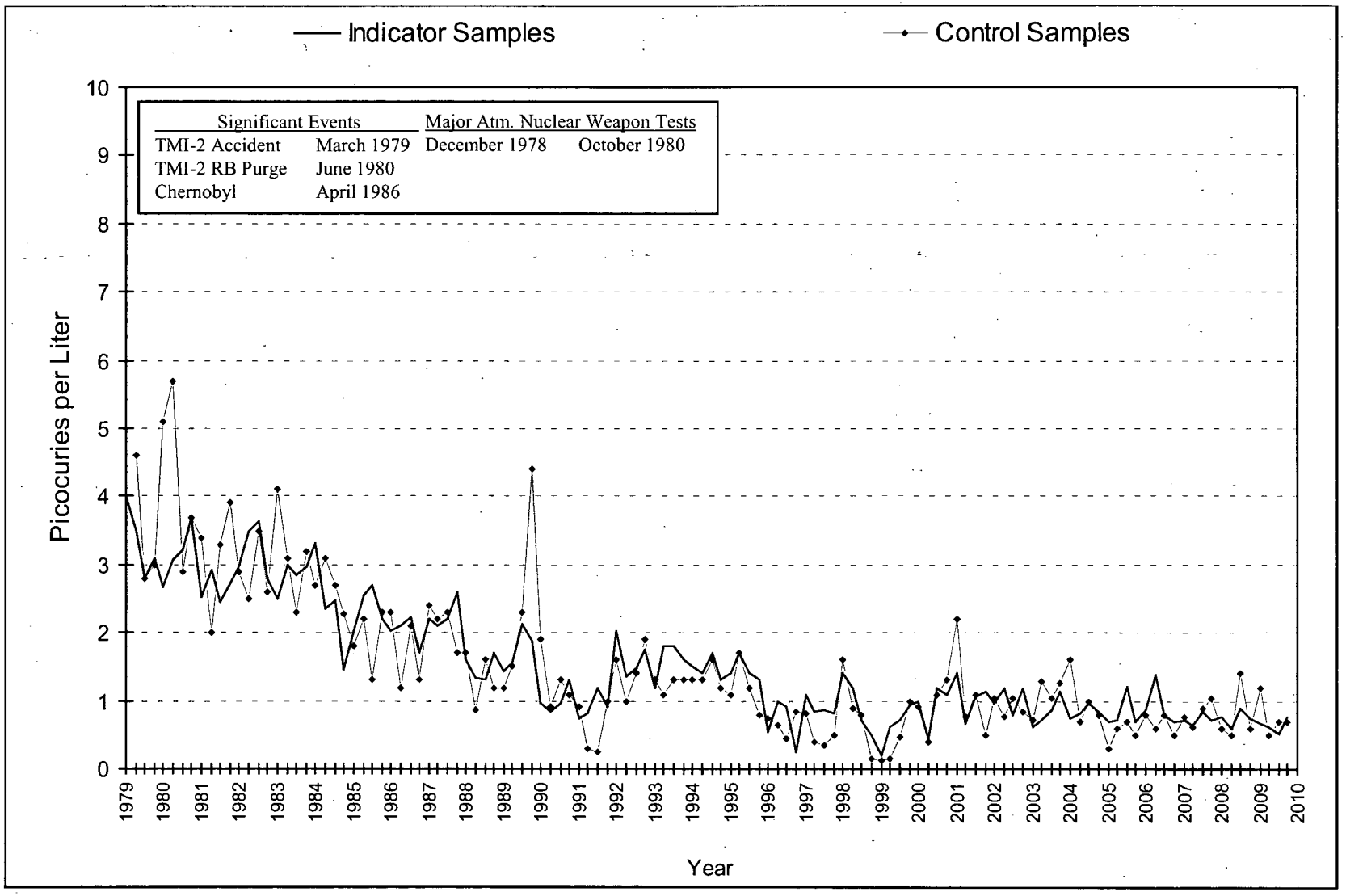


# FIGURE C-7
## Mean Weekly Gross Beta Concentrations in Air Particulates
### Three Mile Island Nuclear Station, 2009

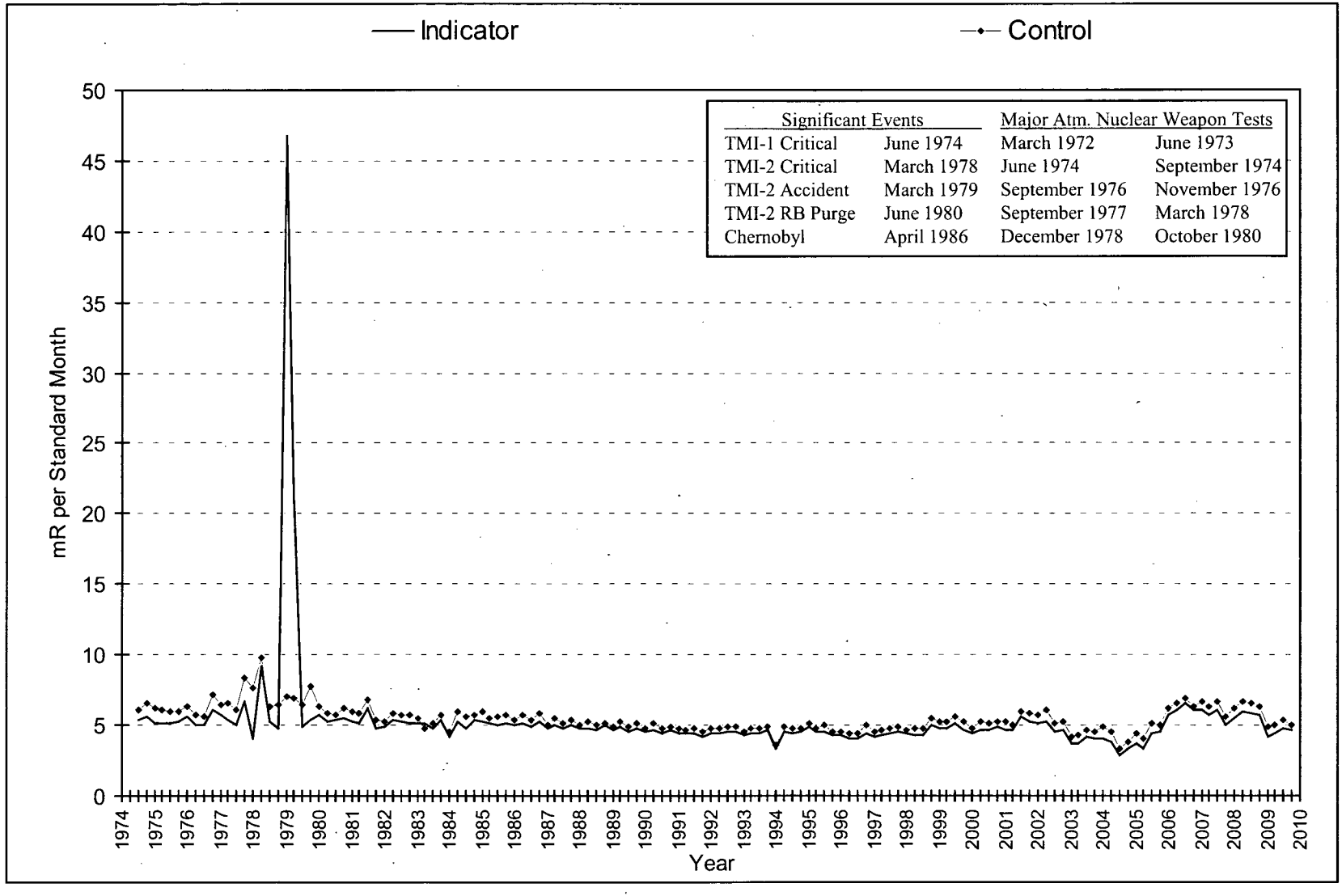



The high value on 11/24/2009 was caused by an airborne release on 11/21/2009

# FIGURE C-8
## Mean Quarterly Strontium-90 Concentrations in Cow Milk
## Three Mile Island Nuclear Station, 1979 - 2009



# FIGURE C-9
## Mean Quarterly Gamma Exposure Rates
## Three Mile Island Nuclear Station, 1974 - 2009




| Significant Events | | Major Atm. Nuclear Weapon Tests | |
|---|---|---|---|
| TMI-1 Critical | June 1974 | March 1972 | June 1973 |
| TMI-2 Critical | March 1978 | June 1974 | September 1974 |
| TMI-2 Accident | March 1979 | September 1976 | November 1976 |
| TMI-2 RB Purge | June 1980 | September 1977 | March 1978 |
| Chernobyl | April 1986 | December 1978 | October 1980 |

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# APPENDIX D

# DATA TABLES AND FIGURES
# COMPARISON LABORATORY

The following section contains data and figures illustrating the analyses performed by the quality control laboratory, Environmental Inc. (Env). Duplicate samples were obtained from several locations and media and split between the primary laboratory, Teledyne Brown Engineering (TBE) and Environmental Inc. (Env). 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, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| COLLECTION PERIOD | Q9-1Q |
|---|---|
| 12/30/08 - 02/03/09 | < 1.8 |
| 02/03/09 - 03/03/09 | 1.9 ± 1.0 |
| 03/03/09 - 03/31/09 | < 0.9 |
| 03/31/09 - 04/28/09 | < 0.9 |
| 04/28/09 - 06/02/09 | 0.9 ± 0.5 |
| 06/02/09 - 06/30/09 | < 1.2 |
| 06/30/09 - 07/28/09 | < 0.8 |
| 07/28/09 - 08/31/09 | < 0.6 |
| 08/31/09 - 09/29/09 | 1.6 ± 0.7 |
| 09/29/09 - 11/03/09 | < 1.2 |
| 11/03/09 - 12/01/09 | < 0.9 |
| 12/01/09 - 12/28/09 | 0.8 ± 0.4 |
| MEAN | 1.0 ± 0.7 |

**TABLE D-I.2** **CONCENTRATIONS OF TRITIUM IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| COLLECTION PERIOD | Q9-1Q |
|---|---|
| 12/30/08 - 02/03/09 | < 157 |
| 02/03/09 - 03/03/09 | < 151 |
| 03/03/09 - 03/31/09 | < 158 |
| 03/31/09 - 04/28/09 | < 167 |
| 04/28/09 - 06/02/09 | < 154 |
| 06/02/09 - 06/30/09 | < 148 |
| 06/30/09 - 07/28/09 | < 169 |
| 07/28/09 - 08/31/09 | < 142 |
| 08/31/09 - 09/29/09 | < 147 |
| 09/29/09 - 11/03/09 | < 155 |
| 11/03/09 - 12/01/09 | < 150 |
| 12/01/09 - 12/28/09 | < 152 |
| MEAN | - |

**TABLE D-I.3** **CONCENTRATIONS OF IODINE-131 IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| COLLECTION PERIOD | Q9-1Q |
|---|---|
| 12/30/08 - 02/03/09 | < 0.3 |
| 02/03/09 - 03/03/09 | < 0.5 |
| 03/03/09 - 03/31/09 | < 0.4 |
| 03/31/09 - 04/28/09 | < 0.3 |
| 04/28/09 - 06/02/09 | < 0.3 |
| 06/02/09 - 06/30/09 | < 0.3 |
| 06/30/09 - 07/28/09 | < 0.4 |
| 07/28/09 - 08/31/09 | < 0.2 |
| 08/31/09 - 09/29/09 | < 0.3 |
| 09/29/09 - 11/03/09 | < 0.3 |
| 11/03/09 - 12/01/09 | < 0.1 |
| 12/01/09 - 12/28/09 | < 0.3 |
| 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, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| STC | COLLECTION PERIOD | Mn-54 | Co-58 | Fe-59 | Co-60 | Zn-65 | Zr-95 | Nb-95 | Cs-134 | Cs-137 | Ba-140 | La-140 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Q9-1Q | 12/30/08 - 02/03/09 | < 5.0 | < 3.2 | < 9.2 | < 5.4 | < 5.5 | < 10.7 | < 3.8 | < 4.4 | < 4.8 | < 15 | < 4.0 |
| | 02/03/09 - 03/03/09 | < 1.9 | < 2.4 | < 3.8 | < 1.1 | < 5.4 | < 4.5 | < 1.9 | < 2.0 | < 2.3 | < 11 | < 2.5 |
| | 03/03/09 - 03/31/09 | < 2.4 | < 2.8 | < 6.9 | < 2.8 | < 3.7 | < 5.2 | < 2.5 | < 2.6 | < 1.9 | < 11 | < 2.4 |
| | 03/31/09 - 04/28/09 | < 1.9 | < 2.0 | < 4.1 | < 1.2 | < 3.8 | < 3.3 | < 2.4 | < 3.6 | < 1.8 | < 11 | < 1.6 |
| | 04/28/09 - 06/02/09 | < 2.2 | < 2.0 | < 7.6 | < 2.0 | < 2.9 | < 4.4 | < 3.0 | < 2.6 | < 2.9 | < 8.2 | < 3.5 |
| | 06/02/09 - 06/30/09 | < 2.4 | < 3.1 | < 4.6 | < 2.0 | < 5.2 | < 4.9 | < 2.4 | < 3.0 | < 3.0 | < 15 | < 2.3 |
| | 06/30/09 - 07/28/09 | < 2.8 | < 2.8 | < 9.0 | < 1.8 | < 4.1 | < 3.2 | < 1.5 | < 2.7 | < 2.2 | < 16 | < 5.2 |
| | 07/28/09 - 08/31/09 | < 3.6 | < 1.5 | < 6.8 | < 2.2 | < 3.5 | < 7.3 | < 2.1 | < 4.0 | < 2.0 | < 11 | < 1.4 |
| | 08/31/09 - 09/29/09 | < 1.9 | < 1.9 | < 6.0 | < 1.9 | < 2.5 | < 4.7 | < 3.0 | < 4.1 | < 1.6 | < 17 | < 3.8 |
| | 09/29/09 - 11/03/09 | < 4.1 | < 2.1 | < 5.4 | < 2.7 | < 6.4 | < 7.5 | < 4.2 | < 3.6 | < 4.5 | < 20 | < 4.5 |
| | 11/03/09 - 12/01/09 | < 2.8 | < 3.1 | < 2.2 | < 2.3 | < 4.7 | < 3.6 | < 2.1 | < 3.4 | < 2.4 | < 16 | < 1.9 |
| | 12/01/09 - 12/28/09 | < 2.2 | < 2.2 | < 3.8 | < 1.9 | < 3.0 | < 3.1 | < 2.6 | < 3.4 | < 2.3 | < 16 | < 2.3 |

**TABLE D-II.1** **CONCENTRATIONS OF STRONTIUM AND GAMMA EMITTERS IN FISH SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

| STC | COLLECTION PERIOD | Sr-89 | Sr-90 | K-40 | Mn-54 | Co-58 | Fe-59 | Co-60 | Zn-65 | Cs-134 | Cs-137 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| INDP | 10/22/09 | < 0.6 | < 0.4 | 3302 ± 3302 | < 7 | < 14 | < 35 | < 13 | < 13 | < 11 | < 8 |

**TABLE D-III.1 CONCENTRATIONS OF GAMMA EMITTERS IN SEDIMENT SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

| STC | COLLECTION PERIOD | K-40 | Cs-134 | Cs-137 |
|---|---|---|---|---|
| J2-1 | 11/23/09 | 16607 ± 1169 | 52 ± 29 | 110 ± 43 |

**TABLE D-IV.1 CONCENTRATIONS OF GAMMA EMITTERS AND STRONTIUM IN FOOD PRODUCT SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

| STC | COLLECTION PERIOD | K-40 | I-131 | Cs-134 | Cs-137 | Sr-89 | Sr-90 |
|---|---|---|---|---|---|---|---|
| H1-2Q | 07/07/09 | 4641 ± 393 | < 12 | < 13 | < 14 | < 20 | < 2 |
| B10-2Q | 07/29/09 | 1684 ± 216 | < 10 | < 10 | < 9 | < 10 | < 1 |
| MEAN | | 3163 ± 4182 | - | - | - | - | - |

**TABLE D-V.1 CONCENTRATIONS OF GROSS BETA IN AIR PARTICULATE AND I-131 IN AIR IODINE SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

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

| COLLECTION PERIOD | E1-2Q GROSS BETA | E1-2Q I-131 |
|---|---|---|
| 12/31/08 - 01/07/09 | 26 ± 4 | < 17 |
| 01/07/09 - 01/14/09 | 26 ± 4 | < 10 |
| 01/14/09 - 01/21/09 | 32 ± 4 | < 16 |
| 01/21/09 - 01/28/09 | 25 ± 4 | < 17 |
| 01/28/09 - 02/04/09 | 29 ± 4 | < 11 |
| 02/04/09 - 02/11/09 | 31 ± 4 | < 19 |
| 02/11/09 - 02/18/09 | 18 ± 4 | < 10 |
| 02/18/09 - 02/25/09 | 27 ± 4 | < 11 |
| 02/25/09 - 03/04/09 | 26 ± 4 | < 17 |
| 03/04/09 - 03/11/09 | 24 ± 4 | < 14 |
| 03/11/09 - 03/18/09 | 35 ± 4 | < 16 |
| 03/18/09 - 03/25/09 | 26 ± 4 | < 20 |
| 03/25/09 - 04/01/09 | 14 ± 4 | < 14 |
| 04/01/09 - 04/08/09 | 13 ± 4 | < 10 |
| 04/08/09 - 04/16/09 | (1) | (1) |
| 04/16/09 - 04/22/09 | (1) | (1) |
| 04/22/09 - 04/29/09 | 26 ± 4 | < 12 |
| 04/29/09 - 05/06/09 | 21 ± 4 | < 17 |
| 05/06/09 - 05/13/09 | 15 ± 4 | < 10 |
| 05/13/09 - 05/20/09 | 22 ± 4 | < 22 |
| 05/20/09 - 05/27/09 | 23 ± 4 | < 16 |
| 05/27/09 - 06/03/09 | 14 ± 4 | < 2 |
| 06/03/09 - 06/10/09 | 18 ± 4 | < 13 |
| 06/10/09 - 06/18/09 | 15 ± 3 | < 15 |
| 06/18/09 - 06/24/09 | 12 ± 4 | < 14 |
| 06/24/09 - 07/01/09 | 20 ± 4 | < 15 |
| 07/01/09 - 07/07/09 | 21 ± 4 | < 27 |
| 07/07/09 - 07/15/09 | 20 ± 3 | < 14 |
| 07/15/09 - 07/22/09 | 23 ± 4 | < 18 |
| 07/22/09 - 07/29/09 | 22 ± 4 | < 10 |
| 07/29/09 - 08/05/09 | 29 ± 4 | < 13 |
| 08/05/09 - 08/12/09 | 25 ± 4 | < 13 |
| 08/12/09 - 08/19/09 | 33 ± 4 | < 9 |
| 08/19/09 - 08/26/09 | 20 ± 4 | < 11 |
| 08/26/09 - 09/02/09 | 25 ± 4 | < 13 |
| 09/02/09 - 09/09/09 | 31 ± 4 | < 14 |
| 09/09/09 - 09/16/09 | 23 ± 4 | < 16 |
| 09/16/09 - 09/23/09 | 27 ± 4 | < 10 |
| 09/23/09 - 09/30/09 | 18 ± 4 | < 19 |
| 09/30/09 - 10/07/09 | 17 ± 4 | < 12 |
| 10/07/09 - 10/14/09 | 16 ± 4 | < 12 |
| 10/14/09 - 10/21/09 | 20 ± 4 | < 10 |
| 10/21/09 - 10/28/09 | 20 ± 4 | < 16 |
| 10/28/09 - 11/04/09 | 16 ± 4 | < 16 |
| 11/04/09 - 11/11/09 | 35 ± 4 | < 9 |
| 11/11/09 - 11/18/09 | 18 ± 4 | < 10 |
| 11/18/09 - 11/24/09 | 27 ± 5 | < 12 |
| 11/24/09 - 12/02/09 | 14 ± 3 | < 8 |
| 12/02/09 - 12/09/09 | 20 ± 4 | < 13 |
| 12/09/09 - 12/16/09 | 30 ± 4 | < 14 |
| 12/16/09 - 12/22/09 | 32 ± 5 | < 17 |
| 12/22/09 - 12/29/09 | 15 ± 4 | < 12 |
| MEAN | 23 ± 12 | - |

(1) NO SAMPLE DUE TO AC POWER PROBLEMS

**TABLE D-V.2 CONCENTRATIONS OF GAMMA EMITTERS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

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

| STC | COLLECTION PERIOD | Be-7 | Cs-134 | Cs-137 |
|---|---|---|---|---|
| E1-2Q | 12/31/08 - 04/01/09 | 72 ± 13 | < 1.1 | < 0.8 |
| | 04/01/09 - 07/01/09 | 100 ± 18 | < 0.7 | < 0.8 |
| | 07/01/09 - 09/30/09 | 97 ± 20 | < 0.5 | < 0.5 |
| | 09/30/09 - 12/29/09 | 73 ± 13 | < 0.9 | < 0.5 |
| | MEAN | 86 ± 30 | - | - |

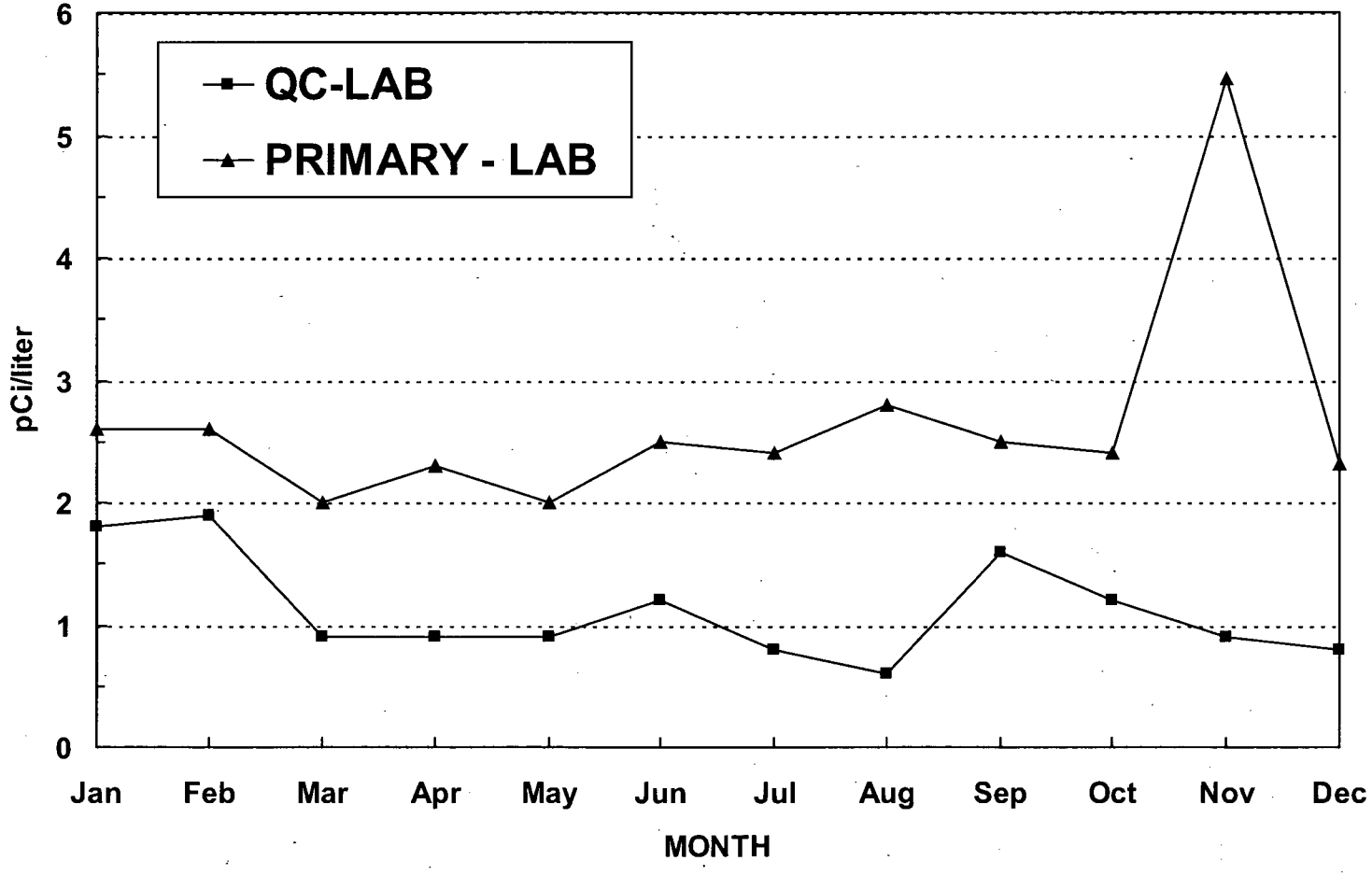
**TABLE D-VI.1 CONCENTRATIONS OF I-131 BY CHEMICAL SEPARATION, GAMMA EMITTERS, AND STRONTIUM IN MILK SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

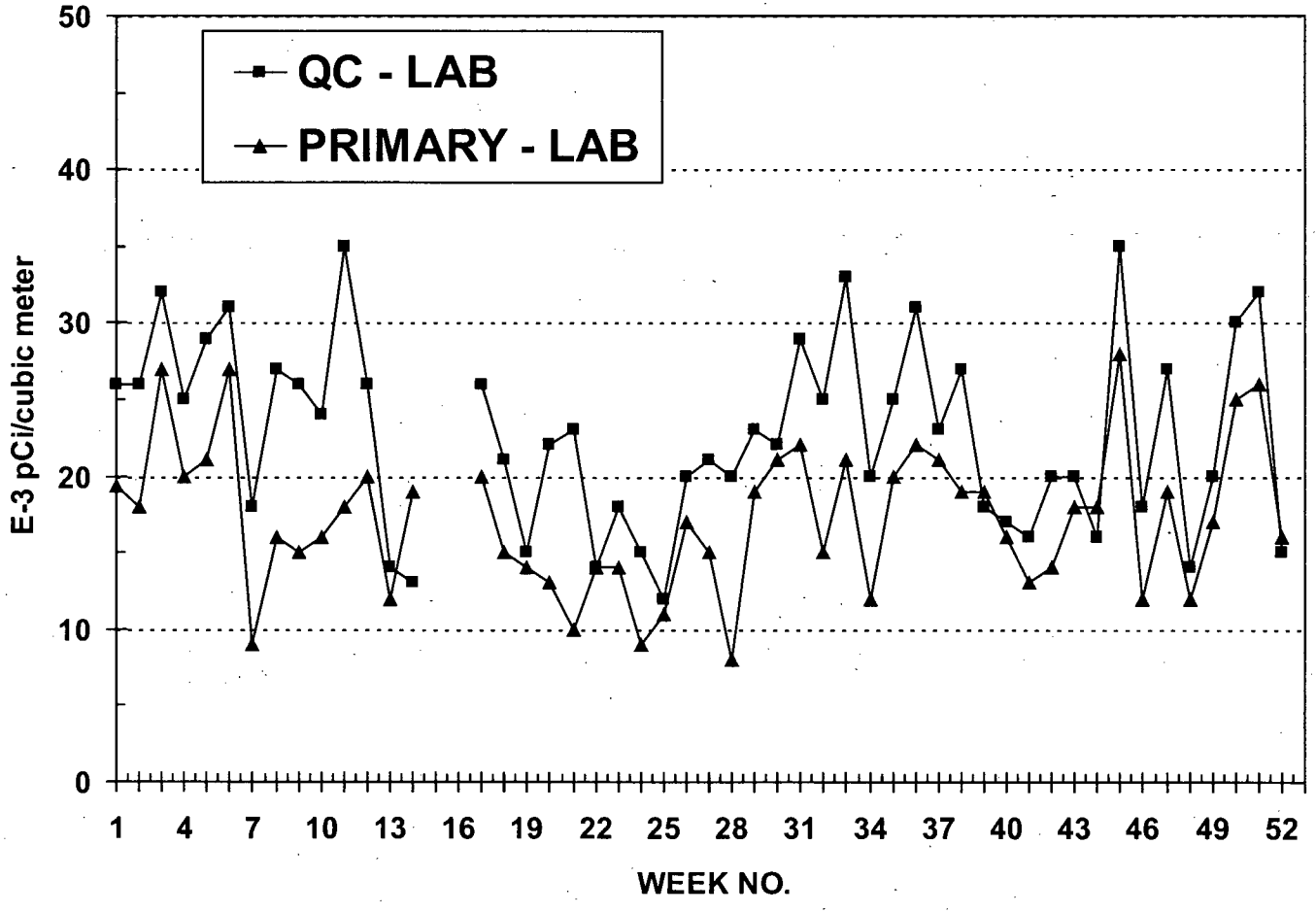
| STC | COLLECTION PERIOD | I-131 | K-40 | Cs-134 | Cs-137 | Ba-140 | La-140 | Sr-89 | Sr-90 |
|---|---|---|---|---|---|---|---|---|---|
| G2-1Q | 01/07/09 | < 0.3 | 1351 ± 122 | < 3.6 | < 2.9 | < 17 | < 2.3 | | |
| | 02/04/09 | < 0.4 | 1537 ± 120 | < 4.6 | < 3.7 | < 15 | < 2.5 | | |
| | 03/04/09 | < 0.3 | 1331 ± 106 | < 2.8 | < 4.1 | < 12 | < 3.9 | | |
| | 03/18/09 | < 0.4 | 1267 ± 107 | < 3.8 | < 3.9 | < 13 | < 1.4 | < 0.6 | 0.8 ± 0.3 |
| | 04/01/09 | < 0.4 | 1061 ± 104 | < 3.3 | < 3.3 | < 14 | < 3.1 | | |
| | 04/15/09 | < 0.4 | 1335 ± 114 | < 2.2 | < 3.7 | < 12 | < 1.2 | | |
| | 04/29/09 | < 0.1 | 1296 ± 109 | < 4.0 | < 3.4 | < 10 | < 2.5 | | |
| | 05/13/09 | < 0.4 | 1263 ± 112 | < 4.7 | < 4.0 | < 17 | < 2.4 | | |
| | 05/27/09 | < 0.2 | 1095 ± 117 | < 5.3 | < 2.0 | < 24 | < 5.0 | | |
| | 06/10/09 | < 0.3 | 1101 ± 105 | < 2.2 | < 2.9 | < 12 | < 1.9 | | |
| | 06/24/09 | < 0.3 | 1369 ± 108 | < 3.4 | < 3.5 | < 12 | < 4.4 | < 0.6 | 0.6 ± 0.3 |
| | 07/08/09 | < 0.3 | 1097 ± 111 | < 3.5 | < 3.6 | < 10 | < 3.6 | | |
| | 07/22/09 | < 0.3 | 1061 ± 115 | < 5.0 | < 4.8 | < 16 | < 1.9 | | |
| | 08/05/09 | < 0.3 | 1302 ± 113 | < 3.7 | < 2.8 | < 13 | < 2.2 | | |
| | 08/19/09 | < 0.3 | 1381 ± 118 | < 3.9 | < 3.6 | < 17 | < 2.4 | | |
| | 09/02/09 | < 0.3 | 990 ± 106 | < 3.9 | < 3.3 | < 18 | < 5.3 | | |
| | 09/16/09 | < 0.3 | 892 ± 96 | < 5.1 | < 4.7 | < 15 | < 5.5 | | |
| | 09/30/09 | < 0.2 | 1174 ± 107 | < 4.2 | < 3.2 | < 21 | < 3.8 | < 0.9 | < 0.4 |
| | 10/14/09 | < 0.3 | 1350 ± 110 | < 3.9 | < 3.7 | < 20 | < 3.1 | | |
| | 10/28/09 | < 0.2 | 1173 ± 128 | < 2.9 | < 4.7 | < 17 | < 3.8 | | |
| | 11/11/09 | < 0.3 | 1414 ± 109 | < 3.1 | < 3.6 | < 16 | < 3.2 | | |
| | 11/24/09 | < 0.4 | 1352 ± 113 | < 4.2 | < 3.5 | < 15 | < 3.2 | | |
| | 12/09/09 | < 0.3 | 1228 ± 103 | < 3.2 | < 3.5 | < 21 | < 3.0 | < 0.8 | 0.6 ± 0.4 |
| | MEAN | | 1236 ± 312 | - | - | - | - | - | 0.7 ± 0.2 |

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

# FIGURE D-1
# MONTHLY GROSS BETA CONCENTRATIONS IN DRINKING WATER SAMPLES COLLECTED FROM TMINS LOCATION Q9-1Q, 2009



## FIGURE D-2
## WEEKLY GROSS BETA CONCENTRATIONS IN AIR PARTICULATE SAMPLES COLLECTED FROM TMINS LOCATION E1-2Q, 2009



# APPENDIX E

# INTER-LABORATORY COMPARISON PROGRAM

**TABLE E-1** **ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM**
**TELEDYNE BROWN ENGINEERING, 2009**
**(PAGE 1 OF 3)**

| Month/Year | Identification Number | Matrix | Nuclide | Units | Reported Value (a) | Known Value (b) | Ratio (c) TBE/Analytics | Evaluation (d) |
|---|---|---|---|---|---|---|---|---|
| March 2009 | E6533-396 | Milk | Sr-89 | pCi/L | 102 | 97.7 | 1.04 | A |
| | | | Sr-90 | pCi/L | 14.9 | 15.6 | 0.96 | A |
| | E6534-396 | Milk | I-131 | pCi/L | 66.7 | 79.3 | 0.84 | A |
| | | | Ce-141 | pCi/L | 87.5 | 94.9 | 0.92 | A |
| | | | Cr-51 | pCi/L | 275 | 305 | 0.90 | A |
| | | | Cs-134 | pCi/L | 82.0 | 93.7 | 0.88 | A |
| | | | Cs-137 | pCi/L | 111 | 111 | 1.00 | A |
| | | | Co-58 | pCi/L | 114 | 119 | 0.96 | A |
| | | | Mn-54 | pCi/L | 136 | 128 | 1.06 | A |
| | | | Fe-59 | pCi/L | 112 | 99.9 | 1.12 | A |
| | | | Zn-65 | pCi/L | 160 | 156 | 1.03 | A |
| | | | Co-60 | pCi/L | 142 | 142 | 1.00 | A |
| | E6536-396 | AP | Ce-141 | pCi | 120 | 115 | 1.04 | A |
| | | | Cr-51 | pCi | 385 | 371 | 1.04 | A |
| | | | Cs-134 | pCi | 113 | 114 | 0.99 | A |
| | | | Cs-137 | pCi | 149 | 135 | 1.10 | A |
| | | | Co-58 | pCi | 153 | 145 | 1.06 | A |
| | | | Mn-54 | pCi | 155 | 155 | 1.00 | A |
| | | | Fe-59 | pCi | 118 | 121 | 0.98 | A |
| | | | Zn-65 | pCi | 195 | 189 | 1.03 | A |
| | | | Co-60 | pCi | 190 | 173 | 1.10 | A |
| | E6535-396 | Charcoal | I-131 | pCi | 82.8 | 79.4 | 1.04 | A |
| June 2009 | E6742-396 | Milk | Sr-89 | pCi/L | 107 | 112 | 0.96 | A |
| | | | Sr-90 | pCi/L | 19.0 | 16.7 | 1.14 | A |
| | E6743-396 | Milk | I-131 | pCi/L | 98.1 | 102.0 | 0.96 | A |
| | | | Ce-141 | pCi/L | 260 | 284 | 0.92 | A |
| | | | Cr-51 | pCi/L | 389 | 400 | 0.97 | A |
| | | | Cs-134 | pCi/L | 144.0 | 166 | 0.87 | A |
| | | | Cs-137 | pCi/L | 185 | 192 | 0.96 | A |
| | | | Co-58 | pCi/L | 86.9 | 91.9 | 0.95 | A |
| | | | Mn-54 | pCi/L | 133 | 137 | 0.97 | A |
| | | | Fe-59 | pCi/L | 126 | 122 | 1.03 | A |
| | | | Zn-65 | pCi/L | 173 | 175 | 0.99 | A |
| | | | Co-60 | pCi/L | 298 | 312 | 0.96 | A |
| | E6745-396 | AP | Ce-141 | pCi | 186 | 163 | 1.14 | A |
| | | | Cr-51 | pCi | 262 | 231 | 1.13 | A |
| | | | Cs-134 | pCi | 101 | 95 | 1.06 | A |
| | | | Cs-137 | pCi | 135 | 111 | 1.22 | W |
| | | | Co-58 | pCi | 61 | 53 | 1.16 | A |
| | | | Mn-54 | pCi | 83.1 | 79 | 1.05 | A |
| | | | Fe-59 | pCi | 84 | 70 | 1.19 | A |
| | | | Zn-65 | pCi | 137 | 101 | 1.36 | N (1) |
| | | | Co-60 | pCi | 202 | 180 | 1.12 | A |
| | E6744-396 | Charcoal | I-131 | pCi | 92.2 | 95.8 | 0.96 | A |

**TABLE E-1 ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM**
**TELEDYNE BROWN ENGINEERING, 2009**
**(PAGE 2 OF 3)**

| Month/Year | Identification Number | Matrix | Nuclide | Units | Reported Value (a) | Known Value (b) | Ratio (c) TBE/Analytics | Evaluation (d) |
|---|---|---|---|---|---|---|---|---|
| September 2009 | E6897-396 | Milk | Sr-89 | pCi/L | 113 | 107 | 1.06 | A |
| | | | Sr-90 | pCi/L | 17.4 | 18.8 | 0.93 | A |
| | E6898-396 | Milk | I-131 | pCi/L | 89.2 | 98.6 | 0.90 | A |
| | | | Ce-141 | pCi/L | 249 | 275 | 0.91 | A |
| | | | Cr-51 | pCi/L | 213 | 221 | 0.96 | A |
| | | | Cs-134 | pCi/L | 104.0 | 123 | 0.85 | A |
| | | | Cs-137 | pCi/L | 172 | 185 | 0.93 | A |
| | | | Co-58 | pCi/L | 96.3 | 99.4 | 0.97 | A |
| | | | Mn-54 | pCi/L | 201 | 206 | 0.98 | A |
| | | | Fe-59 | pCi/L | 154 | 147 | 1.05 | A |
| | | | Zn-65 | pCi/L | 213 | 204 | 1.04 | A |
| | | | Co-60 | pCi/L | 154 | 160 | 0.96 | A |
| | E6900-396 | AP | Ce-141 | pCi | 181 | 161 | 1.12 | A |
| | | | Cr-51 | pCi | 145 | 130 | 1.12 | A |
| | | | Cs-134 | pCi | 71.8 | 72 | 0.99 | A |
| | | | Cs-137 | pCi | 115 | 109 | 1.06 | A |
| | | | Co-58 | pCi | 62 | 58 | 1.06 | A |
| | | | Mn-54 | pCi | 129 | 121 | 1.07 | A |
| | | | Fe-59 | pCi | 97 | 98 | 0.98 | A |
| | | | Zn-65 | pCi | 110 | 120 | 0.92 | A |
| | | | Co-60 | pCi | 98.7 | 94.1 | 1.05 | A |
| | E6899-396 | Charcoal | I-131 | pCi | 89.5 | 92.3 | 0.97 | A |
| December 2009 | E6946-396 | Milk | Sr-89 | pCi/L | 131 | 131 | 1.00 | A |
| | | | Sr-90 | pCi/L | 19.3 | 17.9 | 1.08 | A |
| | E6947-396 | Milk | I-131 | pCi/L | 79.2 | 87.3 | 0.91 | A |
| | | | Ce-141 | pCi/L | 193 | 202 | 0.96 | A |
| | | | Cr-51 | pCi/L | 512 | 548 | 0.93 | A |
| | | | Cs-134 | pCi/L | 222 | 253 | 0.88 | A |
| | | | Cs-137 | pCi/L | 163 | 179 | 0.91 | A |
| | | | Co-58 | pCi/L | 200 | 211 | 0.95 | A |
| | | | Mn-54 | pCi/L | 178 | 178 | 1.00 | A |
| | | | Fe-59 | pCi/L | 176 | 178 | 0.99 | A |
| | | | Zn-65 | pCi/L | 326 | 345 | 0.94 | A |
| | | | Co-60 | pCi/L | 240 | 256 | 0.94 | A |
| | E6949-396 | AP | Ce-141 | pCi | 103 | 103 | 1.00 | A |
| | | | Cr-51 | pCi | 290 | 280 | 1.04 | A |
| | | | Cs-134 | pCi | 116 | 129 | 0.90 | A |
| | | | Cs-137 | pCi | 93.4 | 91.5 | 1.02 | A |
| | | | Co-58 | pCi | 111 | 108 | 1.03 | A |
| | | | Mn-54 | pCi | 81.0 | 90.8 | 0.89 | A |
| | | | Fe-59 | pCi | 106 | 90.8 | 1.17 | A |
| | | | Zn-65 | pCi | 155 | 176 | 0.88 | A |
| | | | Co-60 | pCi | 135 | 131 | 1.03 | A |

**TABLE E-1 ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM**
**TELEDYNE BROWN ENGINEERING, 2009**
**(PAGE 3 OF 3)**

| Month/Year | Identification Number | Matrix | Nuclide | Units | Reported Value (a) | Known Value (b) | Ratio (c) TBE/Analytics | Evaluation (d) |
|---|---|---|---|---|---|---|---|---|
| December 2009 | E6948-396 | Charcoal | I-131 | pCi | 93.3 | 93.9 | 0.99 | A |

*(1) Detector 7 appears to have a slightly high bias. Detector 7 was removed from service until it can be recalibrated. NCR 09-23*

*(a) Teledyne Brown Engineering reported result.*

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

*(c) Ratio of Teledyne Brown Engineering to Analytics results.*

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

**TABLE E-2** **ERA ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM**
**TELEDYNE BROWN ENGINEERING, 2009**



| Month/Year | Identification Number | Media | Nuclide | Units | Reported Value (a) | Known Value (b) | Control Limits | Evaluation (c) |
|---|---|---|---|---|---|---|---|---|
| April 2009 | RAD 77 | Water | Sr-89 | pCi/L | 57.4 | 48.3 | 37.8 - 55.7 | N (1) |
| | | | Sr-90 | pCi/L | 30.6 | 31.4 | 22.9 - 36.4 | A |
| | | | Ba-133 | pCi/L | 55.2 | 52.7 | 43.4 - 58.3 | A |
| | | | Cs-134 | pCi/L | 65.8 | 72.9 | 59.5 - 80.2 | A |
| | | | Cs-137 | pCi/L | 157 | 168 | 151 - 187 | A |
| | | | Co-60 | pCi/L | 86.4 | 88.9 | 80.0 - 100 | A |
| | | | Zn-65 | pCi/L | 85.5 | 84.4 | 76.0 - 101 | A |
| | | | Gr-A | pCi/L | 47.7 | 54.2 | 28.3 - 67.7 | A |
| | | | Gr-B | pCi/L | 45.2 | 43.5 | 29.1 - 50.8 | A |
| | | | I-131 | pCi/L | 25.2 | 26.1 | 21.7 - 30.8 | A |
| | | | H-3 | pCi/L | 19733 | 20300 | 17800 - 22300 | A |
| October 2009 | RAD 79 | Water | Sr-89 | pCi/L | 64.75 | 62.2 | 50.2 - 70.1 | A |
| | | | Sr-90 | pCi/L | 30.30 | 30.7 | 22.4 - 35.6 | A |
| | | | Ba-133 | pCi/L | 97.9 | 92.9 | 78.3 - 102 | A |
| | | | Cs-134 | pCi/L | 76.8 | 79.4 | 65.0 - 87.3 | A |
| | | | Cs-137 | pCi/L | 59.9 | 54.6 | 49.1 - 62.9 | A |
| | | | Co-60 | pCi/L | 121 | 117 | 105 - 131 | A |
| | | | Zn-65 | pCi/L | 115 | 99.5 | 89.6 - 119 | A |
| | | | Gr-A | pCi/L | 19.6 | 23.2 | 11.6 - 31.1 | A |
| | | | Gr-B | pCi/L | 28.5 | 26.0 | 16.2 - 33.9 | A |
| | | | I-131 | pCi/L | 22.1 | 22.2 | 18.4 - 26.5 | A |
| | | | H-3 | pCi/L | 16133 | 16400 | 14300 - 18000 | A |

*(1) Calculation did not allow for Y-90 ingrowth on the Sr-89 mount. NCR 09-14*

*(a) Teledyne Brown Engineering reported result.*

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

*(c) ERA evaluation: A=acceptable. Reported result falls within the Warning Limits. NA=not acceptable. Reported result falls outside of the Control Limits. CE=check for Error. Reported result falls within the Control Limits and outside of the Warning Limit.*

**TABLE E-3 DOE'S MIXED ANALYTE PERFORMANCE EVALUATION PROGRAM (MAPEP)**
**TELEDYNE BROWN ENGINEERING, 2009**
**(PAGE 1 OF 2)**

| Month/Year | Identification Number | Media | Nuclide | Units | Reported Value (a) | Known Value (b) | Acceptance Range | Evaluation (c) |
|---|---|---|---|---|---|---|---|---|
| March 2009 | 09-MaW20 | Water | Cs-134 | Bq/L | 18.8 | 22.5 | 18.5 - 29.3 | A |
| | | | Cs-137 | Bq/L | 0.0601 | | (1) | A |
| | | | Co-57 | Bq/L | 17.0 | 18.9 | 13.2 - 24.6 | A |
| | | | Co-60 | Bq/L | 16.1 | 17.21 | 12.05 - 22.37 | A |
| | | | H-3 | Bq/L | 332 | 330.9 | 231.6 - 430.2 | A |
| | | | Mn-54 | Bq/L | 13.8 | 14.7 | 10.26 - 19.06 | A |
| | | | Sr-90 | Bq/L | 6.88 | 7.21 | 5.05- 9.37 | A |
| | | | Zn-65 | Bq/L | 13.2 | 13.6 | 9.5 - 17.7 | A |
| | 09-GrW20 | Water | Gr-A | Bq/L | 0.529 | 0.635 | >0.0 - 1.270 | A |
| | | | Gr-B | Bq/L | 1.87 | 1.27 | 0.64 - 1.91 | A |
| | 09-MaS20 | Soil | Cs-134 | Bq/kg | 433 | 467 | 327 - 607 | A |
| | | | Cs-137 | Bq/kg | 649 | 605 | 424 - 787 | A |
| | | | Co-57 | Bq/kg | -0.120 | | (1) | A |
| | | | Co-60 | Bq/kg | 3.91 | 4.113 | (2) | A |
| | | | Mn-54 | Bq/kg | 339 | 307 | 215 - 399 | A |
| | | | K-40 | Bq/kg | 644 | 570 | 399 - 741 | A |
| | | | Sr-90 | Bq/kg | 245 | 257 | 180 - 334 | A |
| | | | Zn-65 | Bq/kg | 272 | 242 | 169 - 315 | A |
| | 09-RdF20 | AP | Cs-134 | Bq/sample | 2.77 | 2.93 | 2.05 - 3.81 | A |
| | | | Cs-137 | Bq/sample | 1.41 | 1.52 | 1.06 - 1.98 | A |
| | | | Co-57 | Bq/sample | 1.24 | 1.30 | 0.91 - 1.69 | A |
| | | | Co-60 | Bq/sample | 1.33 | 1.22 | 0.85 - 1.59 | A |
| | | | Mn-54 | Bq/sample | 2.42 | 2.2709 | 1.5898 - 2.9522 | A |
| | | | Sr-90 | Bq/sample | 0.713 | 0.64 | 0.448 - 0.832 | A |
| | | | Zn-65 | Bq/sample | 1.30 | 1.36 | 0.95 - 1.77 | A |
| | 09-GrF20 | AP | Gr-A | Bq/sample | 0.188 | 0.348 | >0.0 - 0.696 | A |
| | | | Gr-B | Bq/sample | 0.313 | 0.279 | 0.140 - 0.419 | A |
| March 2009 | 09-RdV20 | Vegetation | Cs-134 | Bq/sample | 3.48 | 3.40 | 2.38 - 4.42 | A |
| | | | Cs-137 | Bq/sample | 1.15 | 0.93 | 0.65 - 1.21 | W |
| | | | Co-57 | Bq/sample | 3.12 | 2.36 | 1.65 - 3.07 | N (3) |
| | | | Co-60 | Bq/sample | -0.0105 | | (1) | A |
| | | | Mn-54 | Bq/sample | 2.98 | 2.3 | 1.61 - 2.99 | W |
| | | | K-40 | Bq/sample | 64.1 | | (4) | |
| | | | Sr-90 | Bq/sample | 1.09 | 1.260 | 0.882 - 1.638 | A |
| | | | Zn-65 | Bq/sample | 1.73 | 1.3540 | 0.948 - 1.760 | W |
| September 2009 | 09-MaW21 | Water | Cs-134 | Bq/L | 26.5 | 32.2 | 22.5 - 41.9 | A |
| | | | Cs-137 | Bq/L | 37.2 | 41.2 | 28.8 - 53.6 | A |
| | | | Co-57 | Bq/L | 32.2 | 36.6 | 25.6 - 47.6 | A |
| | | | Co-60 | Bq/L | 14.0 | 15.40 | 10.8 - 20.0 | A |
| | | | H-3 | Bq/L | 705 | 634.1 | 443.9 - 824.3 | A |
| | | | Mn-54 | Bq/L | -0.1015 | | (1) | A |
| | | | Sr-90 | Bq/L | 13.9 | 12.99 | 9.09- 16.89 | A |
| | | | Zn-65 | Bq/L | 26.2 | 26.9 | 18.8 - 35.0 | A |
| | 09-GrW21 | Water | Gr-A | Bq/L | 1.27 | 1.047 | >0.0 - 2.094 | A |
| | | | Gr-B | Bq/L | 9.70 | 7.53 | 3.77 - 11.30 | A |

**TABLE E-3 DOE'S MIXED ANALYTE PERFORMANCE EVALUATION PROGRAM (MAPEP)**
**TELEDYNE BROWN ENGINEERING, 2009**
**(PAGE 2 OF 2)**

| Month/Year | Identification Number | Media | Nuclide | Units | Reported Value (a) | Known Value (b) | Acceptance Range | Evaluation (c) |
|---|---|---|---|---|---|---|---|---|
| September 2009 | 09-MaS21 | Soil | Am-241 | Bq/kg | 74.7 | 89.8 | 62.9 - 116.7 | A |
| | | | Cs-134 | Bq/kg | 0.554 | | (1) | A |
| | | | Cs-137 | Bq/kg | 706 | 669 | 468 - 870 | A |
| | | | Co-57 | Bq/kg | 606 | 586 | 410 - 762 | A |
| | | | Co-60 | Bq/kg | 350 | 327.000 | 229 - 425 | A |
| | | | Mn-54 | Bq/kg | 876 | 796 | 557 - 1035 | A |
| | | | K-40 | Bq/kg | 425 | 375 | 263 - 488 | A |
| | | | Sr-90 | Bq/kg | 505 | 455 | 319 - 592 | A |
| | | | Zn-65 | Bq/kg | 1370 | 1178 | 825 - 1531 | A |
| | 09-RdF21 | AP | Cs-134 | Bq/sample | -0.02 | | (1) | A |
| | | | Cs-137 | Bq/sample | 1.4 | 1.4 | 0.98 - 1.82 | A |
| | | | Co-57 | Bq/sample | 5.98 | 6.48 | 4.54 - 8.42 | A |
| | | | Co-60 | Bq/sample | 1.01 | 1.03 | 0.72 - 1.34 | A |
| | | | Mn-54 | Bq/sample | 5.16 | 5.49 | 3.84 - 7.14 | A |
| | | | Sr-90 | Bq/sample | 0.925 | 0.0835 | 0.585 - 1.086 | A |
| | | | Zn-65 | Bq/sample | 4.39 | 3.93 | 2.75 - 5.11 | A |
| | 09-GrF21 | AP | Gr-A | Bq/sample | 0.357 | 0.659 | >0.0 - 1.318 | A |
| | | | Gr-B | Bq/sample | 1.403 | 1.320 | 0.66 - 1.98 | A |
| | 09-RdV21 | Vegetation | Cs-134 | Bq/sample | -0.0027 | | (1) | A |
| | | | Cs-137 | Bq/sample | 2.36 | 2.43 | 1.70 - 3.16 | A |
| | | | Co-60 | Bq/sample | 2.58 | 2.57 | 1.80 - 3.34 | A |
| | | | Mn-54 | Bq/sample | 8.36 | 7.9 | 5.5 - 10.3 | A |
| | | | K-40 | Bq/sample | 57.8 | | (4) | |
| | | | Sr-90 | Bq/sample | 1.73 | 1.78 | 1.25 - 2.31 | A |
| | | | Zn-65 | Bq/sample | -0.59 | | (1) | A |

*(1) False positive test.*

*(2) Sensativity evaluation.*

*(3) Homogeniety problem. MAPEP requires using entire sample but due to geometry limitations we can only use part of the sample. NCR 09-13*

*(4) Not evaluated by MAPEP.*

*(a) Teledyne Brown Engineering reported result.*

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

*(c) DOE/MAPEP evaluation: A=acceptable, W=acceptable with warning, N=not acceptable.*

**TABLE E-4** **ERA (a) STATISTICAL SUMMARY PROFICIENCY TESTING PROGRAM ENVIRONMENTAL, INC., 2009**



| Lab Code | Date | Analysis | Concentration (pCi/L) Laboratory Result[b] | ERA Result[c] | Control Limits | Acceptance |
|---|---|---|---|---|---|---|
| STW-1181 | 04/06/09 | Sr-89 | 41.0 ± 5.8 | 48.3 | 37.8 - 55.7 | Pass |
| STW-1181 | 04/06/09 | Sr-90 | 32.4 ± 2.4 | 31.4 | 22.9 - 36.4 | Pass |
| STW-1182 | 04/06/09 | Ba-133 | 44.6 ± 3.1 | 52.7 | 43.4 - 58.3 | Pass |
| STW-1182 | 04/06/09 | Co-60 | 81.0 ± 3.1 | 88.9 | 80.0 - 100.0 | Pass |
| STW-1182 | 04/06/09 | Cs-134 | 65.6 ± 5.2 | 72.9 | 59.5 - 80.2 | Pass |
| STW-1182 [d] | 04/06/09 | Cs-137 | 147.7 ± 5.3 | 168.0 | 151.0 - 187.0 | Fail |
| STW-1182 | 04/06/09 | Zn-65 | 79.8 ± 7.5 | 84.4 | 76.0 - 101.0 | Pass |
| STW-1183 | 04/06/09 | Gr. Alpha | 47.6 ± 2.1 | 54.2 | 28.3 - 67.7 | Pass |
| STW-1183 | 04/06/09 | Gr. Beta | 38.5 ± 1.3 | 43.5 | 29.1 - 50.8 | Pass |
| STW-1184 | 04/06/09 | I-131 | 24.4 ± 2.5 | 26.1 | 21.7 - 30.8 | Pass |
| STW-1186 [e] | 04/06/09 | H-3 | 22819.0 ± 453.0 | 20300.0 | 17800.0 - 22300.0 | Fail |
| STW-1193 | 10/05/09 | Sr-89 | 53.0 ± 6.0 | 62.2 | 50.2 - 70.1 | Pass |
| STW-1193 | 10/05/09 | Sr-90 | 31.1 ± 2.2 | 30.7 | 22.4 - 35.6 | Pass |
| STW-1194 | 10/05/09 | Ba-133 | 82.5 ± 3.5 | 92.9 | 78.3 - 102.0 | Pass |
| STW-1194 | 10/05/09 | Co-60 | 116.8 ± 3.3 | 117.0 | 105.0 - 131.0 | Pass |
| STW-1194 | 10/05/09 | Cs-134 | 78.8 ± 5.7 | 78.8 | 65.0 - 87.3 | Pass |
| STW-1194 | 10/05/09 | Cs-137 | 54.2 ± 3.7 | 54.6 | 49.1 - 62.9 | Pass |
| STW-1194 | 10/05/09 | Zn-65 | 102.5 ± 6.2 | 99.5 | 89.6 - 119.0 | Pass |
| STW-1195 | 10/05/09 | Gr. Alpha | 20.3 ± 2.0 | 23.2 | 11.6 - 31.1 | Pass |
| STW-1195 | 10/05/09 | Gr. Beta | 23.7 ± 1.4 | 26.0 | 16.2 - 33.9 | Pass |
| STW-1196 | 10/05/09 | I-131 | 22.4 ± 1.4 | 22.2 | 18.4 - 26.5 | Pass |
| STW-1198 | 10/05/09 | H-3 | 17228.0 ± 694.0 | 16400.0 | 14300.0 - 18000.0 | Pass |

[a] *Results obtained by Environmental, Inc., Midwest Laboratory as a participant in the crosscheck program for proficiency testing in drinking water conducted by Environmental Resources Assc (ERA).*

[b] *Unless otherwise indicated, the laboratory result is given as the mean ± standard deviation for three determinations.*

[c] *Results are presented as the known values, expected laboratory precision (1 sigma, 1 determination) and control limits as provided by ERA.*

[d] *All gamma -emitters showed a low bias. A large plastic burr found on the base of the Marinelli kept the beaker from sitting directly on the detector. Result of recount in a different beaker, Cs-137, 155.33 ± 14.55 pCi/L.*

[e] *Samples were recounted and also reanalyzed. A recount of the original vials averaged 23,009 pCi/L. Reanalysis results were acceptable, 19,170 pCi/L.*

**TABLE E-5 DOE'S MIXED ANALYTE PERFORMANCE EVALUATION PROGRAM (MAPEP)[a] ENVIRONMENTAL, INC., 2009**



| | | | Concentration [b] | | | |
|---|---|---|---|---|---|---|
| Lab Code [c] | Date | Analysis | Laboratory result | Known Activity | Control Limits [d] | Acceptance |
| STW-1170 | 01/01/09 | Co-57 | 19.60 ± 0.40 | 18.90 | 13.20 - 24.60 | Pass |
| STW-1170 | 01/01/09 | Co-60 | 16.60 ± 0.30 | 17.21 | 12.05 - 22.37 | Pass |
| STW-1170 | 01/01/09 | Cs-134 | 20.40 ± 0.50 | 22.50 | 15.80 - 29.30 | Pass |
| STW-1170 [e] | 01/01/09 | Cs-137 | 0.10 ± 0.20 | 0.00 | 0.00 - 1.00 | Pass |
| STW-1170 | 01/01/09 | H-3 | 359.90 ± 33.90 | 330.90 | 231.60 - 430.20 | Pass |
| STW-1170 | 01/01/09 | Mn-54 | 15.00 ± 0.40 | 14.66 | 10.26 - 19.06 | Pass |
| STW-1170 | 01/01/09 | Sr-90 | 7.87 ± 1.39 | 7.21 | 5.05 - 9.37 | Pass |
| STW-1170 | 01/01/09 | Zn-65 | 14.00 ± 0.70 | 13.60 | 9.50 - 17.70 | Pass |
| STW-1171 | 01/01/09 | Gr. Alpha | 0.56 ± 0.06 | 0.64 | 0.00 - 1.27 | Pass |
| STW-1171 | 01/01/09 | Gr. Beta | 1.29 ± 0.05 | 1.27 | 0.64 - 1.91 | Pass |
| STSO-1172 [e] | 01/01/09 | Co-57 | 0.00 ± 0.00 | 0.00 | 0.00 - 1.00 | Pass |
| STSO-1172 | 01/01/09 | Cs-134 | 458.60 ± 7.40 | 467.00 | 327.00 - 607.00 | Pass |
| STSO-1172 | 01/01/09 | Cs-137 | 652.30 ± 3.50 | 605.00 | 424.00 - 787.00 | Pass |
| STSO-1172 | 01/01/09 | K-40 | 636.40 ± 9.50 | 570.00 | 360.40 - 669.40 | Pass |
| STSO-1172 | 01/01/09 | Mn-54 | 346.40 ± 3.10 | 307.00 | 215.00 - 399.00 | Pass |
| STSO-1172 | 01/01/09 | Sr-90 | 180.60 ± 12.10 | 257.00 | 180.00 - 334.00 | Pass |
| STSO-1172 | 01/01/09 | Zn-65 | 268.30 ± 4.00 | 242.00 | 169.00 - 315.00 | Pass |
| STVE-1173 | 01/01/09 | Co-57 | 2.75 ± 0.11 | 2.36 | 1.65 - 3.07 | Pass |
| STVE-1173 [e] | 01/01/09 | Co-60 | 0.06 ± 0.09 | 0.00 | 0.00 - 1.00 | Pass |
| STVE-1173 | 01/01/09 | Cs-134 | 3.49 ± 0.22 | 3.40 | 2.38 - 4.42 | Pass |
| STVE-1173 | 01/01/09 | Cs-137 | 1.01 ± 0.11 | 0.93 | 0.65 - 1.21 | Pass |
| STVE-1173 | 01/01/09 | Mn-54 | 2.52 ± 0.14 | 2.30 | 1.61 - 2.99 | Pass |
| STVE-1173 | 01/01/09 | Zn-65 | 1.52 ± 0.18 | 1.35 | 0.95 - 1.76 | Pass |
| STAP-1174 | 01/01/09 | Co-57 | 1.25 ± 0.05 | 1.30 | 0.91 - 1.69 | Pass |
| STAP-1174 | 01/01/09 | Co-60 | 1.17 ± 0.06 | 1.22 | 0.85 - 1.59 | Pass |
| STAP-1174 | 01/01/09 | Cs-134 | 2.67 ± 0.14 | 2.93 | 2.05 - 3.81 | Pass |
| STAP-1174 | 01/01/09 | Cs-137 | 1.53 ± 0.08 | 1.52 | 1.06 - 1.98 | Pass |
| STAP-1174 | 01/01/09 | Mn-54 | 2.34 ± 0.09 | 2.27 | 1.59 - 2.95 | Pass |
| STAP-1174 [f] | 01/01/09 | Sr-90 | 0.93 ± 0.14 | 0.64 | 0.45 - 0.83 | Fail |
| STAP-1174 | 01/01/09 | Zn-65 | 1.44 ± 0.14 | 1.36 | 0.95 - 1.77 | Pass |
| STAP-1175 | 01/01/09 | Gr. Alpha | 0.22 ± 0.03 | 0.35 | 0.00 - 0.70 | Pass |
| STAP-1175 | 01/01/09 | Gr. Beta | 0.36 ± 0.04 | 0.28 | 0.14 - 0.42 | Pass |
| STW-1192 | 07/01/09 | Co-57 | 37.20 ± 1.50 | 36.60 | 25.60 - 47.60 | Pass |
| STW-1192 | 07/01/09 | Co-60 | 15.10 ± 0.90 | 15.40 | 10.80 - 20.00 | Pass |
| STW-1192 | 07/01/09 | Cs-134 | 30.30 ± 2.10 | 32.20 | 22.50 - 41.90 | Pass |
| STW-1192 | 07/01/09 | Cs-137 | 41.90 ± 1.80 | 41.20 | 28.80 - 53.60 | Pass |
| STW-1192 | 07/01/09 | H-3 | 680.30 ± 33.60 | 634.10 | 443.90 - 824.30 | Pass |
| STW-1192 [e] | 07/01/09 | Mn-54 | 0.01 ± 0.26 | 0.00 | 0.00 - 1.00 | Pass |
| STW-1192 | 07/01/09 | Sr-90 | 12.90 ± 1.70 | 12.99 | 9.09 - 16.89 | Pass |
| STW-1192 | 07/01/09 | Zn-65 | 28.50 ± 2.40 | 26.90 | 18.80 - 35.00 | Pass |

**TABLE E-5 DOE'S MIXED ANALYTE PERFORMANCE EVALUATION PROGRAM (MAPEP)[a] ENVIRONMENTAL, INC., 2009**



| | | | Concentration [b] | | | |
|---|---|---|---|---|---|---|
| Lab Code [c] | Date | Analysis | Laboratory result | Known Activity | Control Limits [d] | Acceptance |
| STW-1191 | 07/01/09 | Gr. Alpha | 0.88 ± 0.07 | 1.05 | 0.00 - 2.09 | Pass |
| STW-1191 | 07/01/09 | Gr. Beta | 7.29 ± 0.10 | 7.53 | 3.77 - 11.30 | Pass |
| STSO-1188 | 07/01/09 | Co-57 | 674.60 ± 9.00 | 586.00 | 410.00 - 762.00 | Pass |
| STSO-1188 | 07/01/09 | Co-60 | 356.40 ± 6.30 | 327.00 | 229.00 - 425.00 | Pass |
| STSO-1188 | 07/01/09 | Cs-134 | 0.20 ± 1.90 | 0.00 | 0.00 - 1.00 | Pass |
| STSO-1188 | 07/01/09 | Cs-137 | 767.50 ± 12.00 | 669.00 | 468.00 - 870.00 | Pass |
| STSO-1188 | 07/01/09 | K-40 | 433.00 ± 37.20 | 375.00 | 263.00 - 488.00 | Pass |
| STSO-1188 | 07/01/09 | Mn-54 | 931.60 ± 14.10 | 796.00 | 557.00 - 1035.00 | Pass |
| STSO-1188 [g] | 07/01/09 | Sr-90 | 310.50 ± 12.20 | 455.00 | 319.00 - 592.00 | Fail |
| STSO-1188 | 07/01/09 | Zn-65 | 1433.90 ± 25.20 | 1178.00 | 825.00 - 1531.00 | Pass |
| STVE-1190 | 07/01/09 | Co-57 | 8.90 ± 0.60 | 8.00 | 5.60 - 10.40 | Pass |
| STVE-1190 | 07/01/09 | Co-60 | 2.50 ± 0.36 | 2.57 | 1.80 - 3.34 | Pass |
| STVE-1190 | 07/01/09 | Cs-134 | 0.01 ± 0.11 | 0.00 | 0.00 - 0.10 | Pass |
| STVE-1190 | 07/01/09 | Cs-137 | 2.42 ± 0.16 | 2.43 | 1.70 - 3.16 | Pass |
| STVE-1190 | 07/01/09 | Mn-54 | 8.35 ± 0.70 | 7.90 | 5.50 - 10.30 | Pass |
| STVE-1190 | 07/01/09 | Zn-65 | 0.01 ± 0.26 | 0.00 | 0.00 - 0.10 | Pass |
| STAP-1189 | 07/01/09 | Gr. Alpha | 0.33 ± 0.04 | 0.66 | 0.00 - 1.32 | Pass |
| STAP-1189 | 07/01/09 | Gr. Beta | 1.57 ± 0.07 | 1.32 | 0.66 - 1.98 | Pass |
| STAP-1190 | 07/01/09 | Co-57 | 6.78 ± 0.27 | 6.48 | 4.54 - 8.42 | Pass |
| STAP-1190 | 07/01/09 | Co-60 | 1.06 ± 0.18 | 1.03 | 0.72 - 1.34 | Pass |
| STAP-1190 | 07/01/09 | Cs-134 | 0.01 ± 0.06 | 0.00 | 0.01 - 0.05 | Pass |
| STAP-1190 | 07/01/09 | Cs-137 | 1.49 ± 0.27 | 1.40 | 0.98 - 1.82 | Pass |
| STAP-1190 | 07/01/09 | Mn-54 | 6.00 ± 0.45 | 5.49 | 3.84 - 7.14 | Pass |
| STAP-1190 | 07/01/09 | Sr-90 | 0.79 ± 0.13 | 0.84 | 0.59 - 1.09 | Pass |
| STAP-1190 | 07/01/09 | Zn-65 | 4.55 ± 0.66 | 3.93 | 2.75 - 5.11 | Pass |

[a] *Results obtained by Environmental, Inc., Midwest Laboratory as a participant in the Department of Energy's Mixed Analyte Performance Evaluation Program, Idaho Operations office, Idaho Falls, Idaho*

[b] *Results are reported in units of Bq/kg (soil), Bq/L (water) or Bq/total sample (filters, vegetation).*

[c] *Laboratory codes as follows: STW (water), STAP (air filter), STSO (soil), STVE (vegetation).*

[d] *MAPEP results are presented as the known values and expected laboratory precision (1 sigma, 1 determination) and control limits as defined by the MAPEP.*

[e] *Included in the testing series as a "false positive".*

[f] *No reason was determined for the initial high results. The analysis was repeated; result of reanalysis; 0.54 ± 0.12 Bq/filter.*

[g] *Incomplete separation of strontium from calcium could result in a higher recovery percentage and consequently lower reported activity. The analysis was repeated; result of reanalysis 363.3 ± 28.6 Bq/kg.*

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# APPENDIX F

# ANNUAL RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM REPORT (ARGPPR)

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 2009

**Prepared By**

Teledyne Brown Engineering
Environmental Services

Exelon SM
Nuclear

Three Mile Island Nuclear Station
Middletown, PA 17057

**April 2010**

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Appendices

## I. Summary and Conclusions

In 2006, Exelon instituted a comprehensive program to evaluate the impact of station operations on groundwater and surface water in the vicinity of Three Mile Island Nuclear Station. At Three Mile Island Nuclear, 31 new permanent groundwater monitoring wells were installed in 2006. The results of the special investigations for all TMI wells are included in this report. This report covers groundwater and surface water samples, collected from the environment, both on and off station property in 2009. During that time period, 517 analyses were performed on 368 samples from 67 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, and there were no known active releases at the end of 2009 into the groundwater at Three Mile Island Nuclear Station.

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

Strontium-89/90 was not detected at a concentration greater than the LLD of 2.0 picoCuries per liter (pCi/L) in the groundwater samples tested.

Tritium was not detected in any groundwater or surface 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 41 of 64 groundwater monitoring locations. The groundwater tritium concentrations ranged from 154 ± 102 pCi/L to 8,510 ± 904 pCi/L. Tritium that was detected in groundwater at the Station is believed to be the result of historical releases, the recapture of gaseous tritium releases via rainwater and/or background from external sources greater than 200 pCi/L.

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## II. Introduction

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

Conestoga Rovers & Associates (CRA) performed the initial assessment. CRA prepared a Hydrogeologic Investigation Report (HIR) for Exelon to determine whether groundwater at and near TMINS has been adversely impacted by any releases of radionuclides. The CRA report documents the results of the May 2006 Hydrogeologic Investigation Work Plan. CRA assessed groundwater quality at the Station in locations designated as Areas for Further Evaluation. The results and conclusions of this Phase 1 study were made available to state and federal regulators as well as the public on an Exelon web site in 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 Environmental Inc. (Midwest Labs) on well water and surface water samples collected in 2009. All wells that were established were located in the owner controlled areas of the site. No offsite wells were established because the groundwater movement is to the Susquehanna River.

This report covers those analyses performed by Teledyne Brown Engineering (TBE) and Environmental Inc. (Midwest Labs) on samples collected in 2009.

### A. Objective of the RGPP

The long-term objectives of the 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 new procedures to identify and report new leaks, spills, or other detections with potential radiological significance in a timely manner.

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

C. Program Description

1. Sample Collection

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

<u>Groundwater and Surface Water</u>

Samples of water are collected, managed, transported and analyzed in accordance with approved procedures. Both groundwater and surface water 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 Midwest Labs 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 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 Midwest Labs to analyze the environmental samples for radioactivity for the Three Mile Island Nuclear Station RGPP in 2009.

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

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

2. Concentrations of strontium in groundwater and surface water.

3. Concentrations of tritium in groundwater and surface water.

### B. Data Interpretation

1. <u>Lower Limit of Detection and Minimum Detectable Concentration</u>

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

2. Laboratory Measurements Uncertainty

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

Statistically, the exact value of a measurement is expressed as a range with a stated level of confidence. The convention is to report results with a 95% level of confidence. The uncertainty comes from calibration standards, sample volume or weight measurements, sampling uncertainty and other factors. Exelon reports the uncertainty of a measurement created by statistical process (counting error)

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

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

For groundwater and surface 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 were reported.

The radio-analytical laboratory is counting 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 throughout the year in accordance with the station radiological groundwater protection program. Analytical results and anomalies are discussed below.

Tritium

Samples from 64 locations were analyzed for tritium activity (Table B–I.1, Appendix B). Tritium values ranged from the detection limit to 8,510 pCi/l. One of the locations was offsite drinking water wells

with no detectable concentration of tritium.

Tritium Split Samples

Tritium values ranged from detection limit to 6,054 (Table C–1.1, Appendix C).

Strontium

Strontium-90 was not detected above the required detection limit of 2.0 pCi/liter. (Table B–I.1, Appendix B)

Strontium Split Samples

Strontium-90 was not detected above the required detection limit of 2.0 pCi/liter (Table C–1.1, Appendix C).

Gamma Emitters

Potassium-40 was detected in one of 66 samples. The concentration was 74 pCi/liter. No other gamma emitting nuclides were detected (Table B–I.2, Appendix B).

Gamma Emitters Split Samples

Potassium-40 was detected in six of 8 samples. The concentration ranged from 74 to 163 pCi/liter. No other gamma emitting nuclides were detected (Table C–I.2, Appendix C).

B. Surface Water Results

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

Tritium

Tritium was not detected above the required detection limit of 200 pCi/liter. (Table B-II.1, Appendix B).

Strontium

Strontium-90 was not detected above the required detection limit of 2.0 pCi/liter. (Table B–II.1, Appendix B).

Gamma Emitters

No gamma emitting nuclides were detected. (Table B–II.2, Appendix B).

C. Leaks, Spills, and Releases

No new active leaks were identified at the TMI in 2009. TMI continues to monitor tritium plumes from previous years and reports the dose to the public in the AREOR. No spills were determined to be reportable under voluntary reporting requirements for the NEI Groundwater Protection Initiative (GPI) as implemented in Exelon's Reportability procedure LS-AA-1120, RAD 1.34.

D. Actions Taken

1. Compensatory Actions

TMI continues to monitor groundwater radioactivity as part of natural monitored attenuation of historical leaks.

# APPENDIX A

# LOCATION DESIGNATION

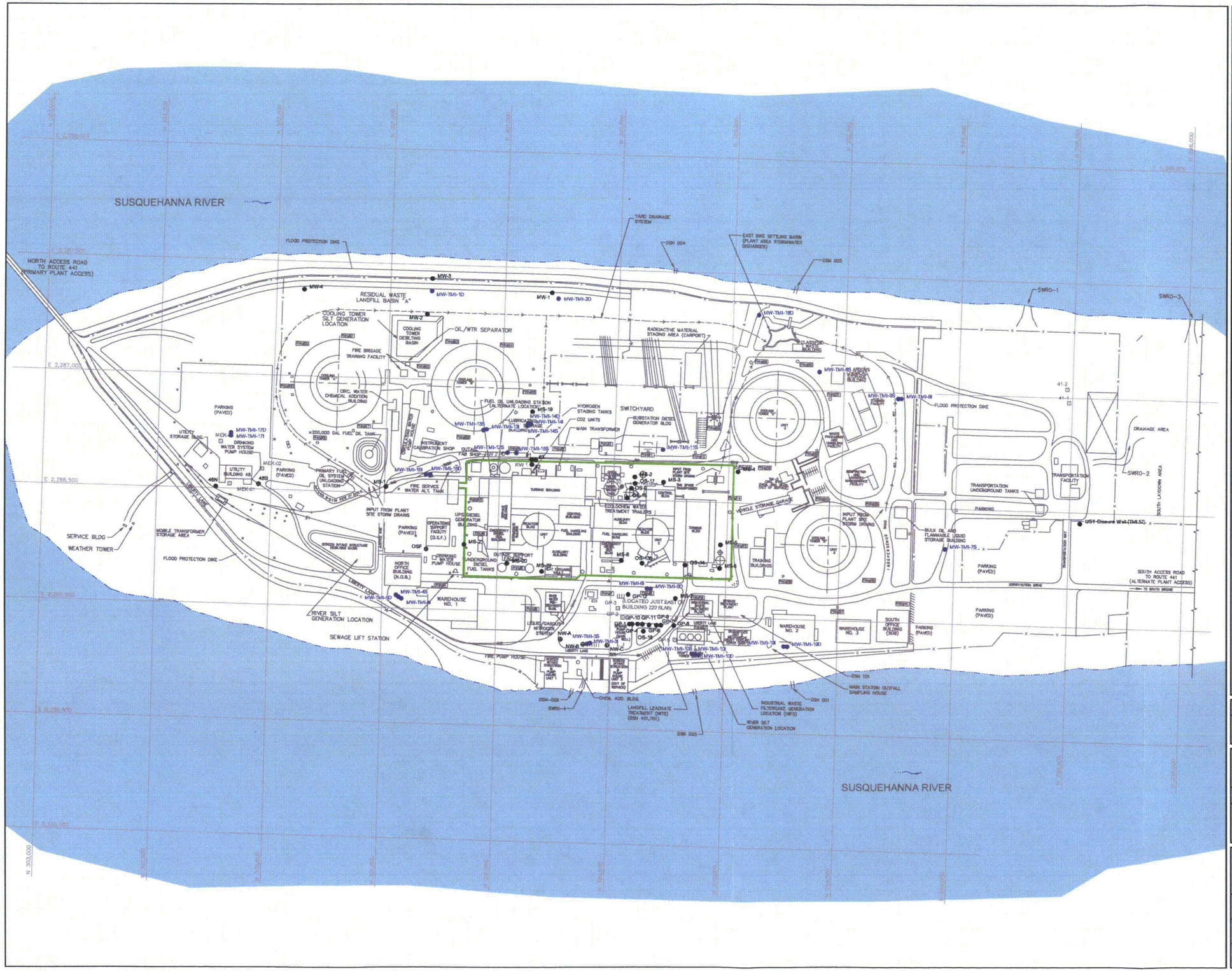
**TABLE A-1:** **Radiological Groundwater Protection Program - Sampling Locations and Distance, Three Mile Island Nuclear Station, 2009**

| Site | Site Type |
|---|---|
| #3 | Monitoring Well |
| 48N | Monitoring Well |
| 48S | Production Potable Well |
| E1-2 | Monitoring Well, Offsite |
| GP-12 | Monitoring Well |
| GP-6 | Monitoring Well |
| GP-8 | Monitoring Well |
| GP-9 | Monitoring Well |
| J1-3 | Precipitation |
| MS-1 | Monitoring Well, Precipitation |
| MS-19 | Monitoring Well, Precipitation |
| MS-2 | Monitoring Well, Precipitation |
| MS-20 | Monitoring Well, Precipitation |
| MS-21 | Monitoring Well |
| MS-22 | Monitoring Well |
| MS-3 | Monitoring Well |
| MS-4 | Monitoring Well |
| MS-5 | Monitoring Well |
| MS-6 | Monitoring Well |
| MS-7 | Monitoring Well |
| MS-8 | Monitoring Well |
| MW-1 | Monitoring Well |
| MW-2 | Monitoring Well |
| MW-3 | Monitoring Well |
| MW-4 | Monitoring Well |
| N2-1 | Monitoring Well, Offsite |
| NW-A | Production Well |
| NW-B | Production Well, Precipitation |
| NW-C | Production Well |
| NW-CW | Clearwell |
| OS-13B | Monitoring Well |
| OS-14 | Monitoring Well |
| OS-16 | Monitoring Well |
| OS-17 | Monitoring Well |
| OS-18 | Monitoring Well |
| OSF | Production Potable Well |
| RW-1 | Monitoring Well |
| RW-2 | Monitoring Well |
| SW-E-1 | Surface Water |
| SW-E-2 | Surface Water |
| SW-E-3 | Surface Water |
| MW-TMI-9S* | Monitoring Well |
| MW-TMI-10D | Monitoring Well |
| MW-TMI-10I | Monitoring Well |
| MW-TMI-10S | Monitoring Well |
| MW-TMI-11S* | Monitoring Well |
| MW-TMI-12S | Monitoring Well |
| MW-TMI-13I | Monitoring Well |
| MW-TMI-13S | Monitoring Well |
| MW-TMI-14D | Monitoring Well |
| MW-TMI-14I | Monitoring Well |
| MW-TMI-14S | Monitoring Well |
| MW-TMI-16D | Monitoring Well |
| MW-TMI-16I | Monitoring Well |

* NO WATER PRESENT TO SAMPLE

**TABLE A-1:** **Radiological Groundwater Protection Program - Sampling Locations and Distance, Three Mile Island Nuclear Station, 2009**

| Site | Site Type |
|---|---|
| MW-TMI-17D | Monitoring Well |
| MW-TMI-17I | Monitoring Well |
| MW-TMI-18D | Monitoring Well |
| MW-TMI-19D | Monitoring Well |
| MW-TMI-19I | Monitoring Well |
| MW-TMI-1D | Monitoring Well |
| MW-TMI-2D | Monitoring Well |
| MW-TMI-3I | Monitoring Well |
| MW-TMI-4I | Monitoring Well |
| MW-TMI-4S | Monitoring Well |
| MW-TMI-5D | Monitoring Well |
| MW-TMI-6D | Monitoring Well |
| MW-TMI-6I | Monitoring Well |
| MW-TMI-7S | Monitoring Well |
| MW-TMI-8S | Monitoring Well |
| MW-TMI-9I | Monitoring Well |
| TRAINING CENTER | Monitoring Well |




LEGEND

- EDGE OF WATER
- FENCE LINE
- SITE GRID
- RAILROAD
- SURFACE WATER FLOW DIRECTION
- SUPPLY WELL LOCATION
- RECOVERY WELL LOCATION
- ABANDONED MONITORING WELL LOCATION
- ABANDONED TEST WELL LOCATION
- EXISTING MONITORING WELL LOCATION
- CRA MONITORING WELL LOCATION
- PROTECTED AREA

NOTES:

1). CLOSED TMI CONSTRUCTION LANDFILL
- SOUTH TMI AREA PVC PIE "DITCH WELLS".

2). OS-15 LOCATED IN THE SOUTH END OF THE ISLAND, OFF-MAP. WELLS OS-11 AND OS-12 WERE NEVER COMPLETED, SUBSEQUENTLY THEY ARE NOT SHOWN ON THIS FIGURE.

# DRAFT

PRIVILEGED AND CONFIDENTIAL
ATTORNEY-CLIENT COMMUNICATION
ATTORNEY WORK PRODUCT

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

EXELON GENERATION COMPANY, LLC

FLEETWIDE ASSESSMENT

GROUNDWATER MONITORING WELL LOCATIONS
THREE MILE ISLAND GENERATING STATION
MIDDLETOWN, PENNSYLVANIA

Exelon. CRA CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

| Project Manager: | Reviewed By: | Date: | |
|---|---|---|---|
| S. QUIGLEY | M. KELLY | AUGUST 2006 | |
| Scale: AS SHOWN | Project N°: 45136-29 | Report N°: 021 | Drawing N°: figure 4.2 |

45136-29(021)GN-WA028 AUG 11/2006

# APPENDIX B

# DATA TABLES

**TABLE B-I.1** **CONCENTRATIONS OF TRITIUM AND STRONTIUM IN WELL WATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM - THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| SITE | | COLLECTION DATE | H-3 | SR-90 |
|---|---|---|---|---|
| #3 | | 05/13/09 | < 167 | |
| #3 | | 10/15/09 | < 142 | < 0.5 |
| 48N | | 05/14/09 | < 147 | |
| 48N | | 10/15/09 | < 182 | < 0.5 |
| 48S | ORIGINAL | 03/18/09 | 268 ± 130 | |
| 48S | RERUN | 03/18/09 | < 173 | |
| 48S | ORIGINAL | 05/18/09 | 213 ± 113 | |
| 48S | RERUN | 05/18/09 | 255 ± 133 | |
| 48S | | 08/11/09 | < 184 | |
| 48S | | 10/16/09 | < 185 | < 0.5 |
| 48S | | 10/16/09 | < 175 | < 0.5 |
| GP-6 | | 05/15/09 | 154 ± 102 | |
| GP-9 | | 05/14/09 | 184 ± 105 | |
| MS-1 | | 01/13/09 | 246 ± 117 | |
| MS-1 | | 02/17/09 | 250 ± 126 | |
| MS-1 | | 03/17/09 | < 179 | |
| MS-1 | | 04/22/09 | 233 ± 121 | |
| MS-1 | | 04/29/09 | < 179 | |
| MS-1 | | 05/13/09 | < 161 | |
| MS-1 | | 10/14/09 | < 158 | < 0.5 |
| MS-19 | | 05/15/09 | < 141 | |
| MS-19 | | 10/15/09 | < 182 | < 0.5 |
| MS-2 | | 05/12/09 | < 169 | |
| MS-2 | | 05/12/09 | < 167 | |
| MS-2 | | 10/14/09 | 415 ± 121 | < 0.9 |
| MS-2 | | 10/14/09 | 437 ± 128 | < 0.5 |
| MS-20 | | 04/22/09 | 357 ± 127 | |
| MS-20 | | 05/07/09 | 352 ± 115 | |
| MS-20 | | 05/12/09 | 483 ± 128 | |
| MS-20 | | 05/19/09 | 427 ± 114 | |
| MS-20 | | 05/19/09 | 388 ± 112 | |
| MS-20 | | 06/18/09 | 622 ± 128 | |
| MS-20 | | 07/16/09 | 692 ± 133 | |
| MS-20 | | 08/12/09 | 575 ± 135 | |
| MS-20 | | 09/10/09 | 404 ± 149 | |
| MS-20 | | 10/15/09 | 597 ± 133 | < 0.7 |
| MS-21 | | 05/12/09 | 748 ± 143 | |
| MS-21 | | 05/12/09 | 781 ± 144 | |
| MS-22 | | 03/18/09 | 798 ± 165 | |
| MS-22 | | 05/14/09 | 1680 ± 216 | |
| MS-22 | | 08/10/09 | 608 ± 134 | |
| MS-3 | | 05/12/09 | 476 ± 140 | |
| MS-3 | | 10/14/09 | 192 ± 104 | < 0.5 |
| MS-4 | | 05/13/09 | 216 ± 122 | |
| MS-4 | | 10/20/09 | 166 ± 103 | < 0.4 |
| MS-5 | | 05/12/09 | < 170 | |
| MS-5 | | 10/14/09 | < 140 | < 0.8 |
| MS-6 | | 05/12/09 | < 171 | |
| MS-6 | | 10/14/09 | 200 ± 104 | < 0.5 |
| MS-6 | | 10/14/09 | < 171 | < 0.5 |
| MS-7 | | 05/12/09 | < 145 | |

**TABLE B-I.1** **CONCENTRATIONS OF TRITIUM AND STRONTIUM IN WELL WATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM - THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| SITE | | COLLECTION DATE | H-3 | SR-90 |
|---|---|---|---|---|
| MS-7 | | 10/14/09 | < 196 | < 0.9 |
| MS-8 | | 05/12/09 | 380 ± 125 | |
| MS-8 | | 10/14/09 | < 178 | < 0.5 |
| MW-1 | | 05/12/09 | < 167 | |
| MW-1 | | 10/20/09 | < 178 | < 0.7 |
| MW-1 | | 10/20/09 | < 173 | < 0.5 |
| MW-2 | | 05/12/09 | < 173 | |
| MW-2 | | 05/12/09 | < 172 | |
| MW-2 | | 10/20/09 | < 182 | < 0.6 |
| MW-3 | | 05/12/09 | < 167 | |
| MW-3 | | 10/20/09 | < 179 | < 0.6 |
| MW-4 | | 05/12/09 | < 167 | |
| MW-4 | | 10/20/09 | < 186 | < 0.7 |
| MW-TMI-10D | | 05/12/09 | 290 ± 115 | |
| MW-TMI-10D | | 10/14/09 | 302 ± 114 | < 0.7 |
| MW-TMI-10I | | 03/17/09 | 2070 ± 280 | |
| MW-TMI-10I | | 05/15/09 | 2510 ± 291 | |
| MW-TMI-10I | | 08/11/09 | 1780 ± 241 | |
| MW-TMI-10I | | 08/11/09 | 1950 ± 259 | |
| MW-TMI-10I | | 10/14/09 | 1170 ± 179 | < 1.0 |
| MW-TMI-10I | | 10/14/09 | 1300 ± 191 | < 0.7 |
| MW-TMI-10S | | 03/17/09 | 4710 ± 541 | |
| MW-TMI-10S | | 05/15/09 | 4430 ± 477 | |
| MW-TMI-10S | | 05/15/09 | 4820 ± 518 | |
| MW-TMI-10S | | 08/11/09 | 8510 ± 904 | |
| MW-TMI-10S | | 10/15/09 | 4560 ± 507 | < 0.9 |
| MW-TMI-12S | | 01/13/09 | < 174 | |
| MW-TMI-12S | | 01/20/09 | < 175 | |
| MW-TMI-12S | | 01/27/09 | < 185 | |
| MW-TMI-12S | | 02/03/09 | 285 ± 115 | |
| MW-TMI-12S | | 02/10/09 | < 186 | |
| MW-TMI-12S | | 02/17/09 | 501 ± 135 | |
| MW-TMI-12S | ORIGINAL | 03/18/09 | 3020 ± 363 | |
| MW-TMI-12S | RERUN | 03/18/09 | 3240 ± 398 | |
| MW-TMI-12S | ORIGINAL | 04/16/09 | 6010 ± 657 | |
| MW-TMI-12S | RERUN | 04/16/09 | 6880 ± 759 | |
| MW-TMI-12S | | 04/22/09 | 5210 ± 582 | |
| MW-TMI-12S | | 04/22/09 | 5130 ± 574 | |
| MW-TMI-12S | | 04/29/09 | 838 ± 158 | |
| MW-TMI-12S | | 05/07/09 | 481 ± 121 | |
| MW-TMI-12S | | 05/13/09 | < 162 | |
| MW-TMI-12S | | 05/19/09 | 308 ± 109 | |
| MW-TMI-12S | | 06/18/09 | 332 ± 114 | |
| MW-TMI-12S | | 07/16/09 | 215 ± 110 | |
| MW-TMI-12S | | 08/12/09 | < 184 | |
| MW-TMI-12S | | 09/10/09 | < 187 | |
| MW-TMI-12S | | 10/20/09 | < 147 | < 0.8 |
| MW-TMI-12S | | 11/19/09 | < 178 | |
| MW-TMI-13I | | 01/13/09 | 2370 ± 300 | |
| MW-TMI-13I | | 01/20/09 | 1850 ± 245 | |
| MW-TMI-13I | | 02/03/09 | 2050 ± 252 | |

**TABLE B-I.1** **CONCENTRATIONS OF TRITIUM AND STRONTIUM IN WELL WATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM - THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| SITE | COLLECTION DATE | H-3 | SR-90 |
|---|---|---|---|
| MW-TMI-13I | 02/17/09 | 1950 ± 264 | |
| MW-TMI-13I | 03/17/09 | 1500 ± 218 | |
| MW-TMI-13I | 03/17/09 | 1450 ± 208 | |
| MW-TMI-13I | 04/16/09 | 1520 ± 219 | |
| MW-TMI-13I | 04/29/09 | 1380 ± 209 | |
| MW-TMI-13I | 05/07/09 | 1390 ± 186 | |
| MW-TMI-13I | 05/13/09 | 1460 ± 205 | |
| MW-TMI-13I | 05/19/09 | 1710 ± 224 | |
| MW-TMI-13I | 06/18/09 | 1460 ± 200 | |
| MW-TMI-13I | 07/16/09 | 984 ± 154 | |
| MW-TMI-13I | 07/16/09 | 1310 ± 186 | |
| MW-TMI-13I | 08/11/09 | 991 ± 168 | |
| MW-TMI-13I | 09/10/09 | 1050 ± 168 | |
| MW-TMI-13I | 10/22/09 | 828 ± 150 | < 0.9 |
| MW-TMI-13I | 11/19/09 | 841 ± 152 | |
| MW-TMI-13I | 11/19/09 | 775 ± 148 | |
| MW-TMI-13S | 01/13/09 | 405 ± 125 | |
| MW-TMI-13S | 01/20/09 | 247 ± 122 | |
| MW-TMI-13S | 02/03/09 | 376 ± 119 | |
| MW-TMI-13S | 02/17/09 | 366 ± 125 | |
| MW-TMI-13S | 03/17/09 | 577 ± 145 | |
| MW-TMI-13S | 04/16/09 | < 176 | |
| MW-TMI-13S | 04/16/09 | < 181 | |
| MW-TMI-13S | 04/29/09 | < 191 | |
| MW-TMI-13S | 05/07/09 | < 147 | |
| MW-TMI-13S | 05/13/09 | < 162 | |
| MW-TMI-13S | 05/19/09 | < 153 | |
| MW-TMI-13S | 06/18/09 | < 160 | |
| MW-TMI-13S | 07/16/09 | 174 ± 110 | |
| MW-TMI-13S | 08/11/09 | < 179 | |
| MW-TMI-13S | 09/10/09 | < 178 | |
| MW-TMI-13S | 10/22/09 | 157 ± 99 | < 0.8 |
| MW-TMI-13S | 11/19/09 | < 180 | |
| MW-TMI-14D | 01/13/09 | 1150 ± 183 | |
| MW-TMI-14D | 01/27/09 | 1160 ± 192 | |
| MW-TMI-14D | 02/10/09 | 973 ± 167 | |
| MW-TMI-14D | 02/17/09 | 1260 ± 203 | |
| MW-TMI-14D | 03/18/09 | 900 ± 164 | |
| MW-TMI-14D | 04/16/09 | 1230 ± 196 | |
| MW-TMI-14D | 04/22/09 | 1190 ± 193 | |
| MW-TMI-14D | 04/29/09 | 906 ± 163 | |
| MW-TMI-14D | 05/07/09 | 798 ± 138 | |
| MW-TMI-14D | 05/07/09 | 1140 ± 164 | |
| MW-TMI-14D | 05/13/09 | 876 ± 153 | |
| MW-TMI-14D | 05/19/09 | 1050 ± 162 | |
| MW-TMI-14D | 06/18/09 | 1080 ± 164 | |
| MW-TMI-14D | 07/16/09 | 1020 ± 161 | |
| MW-TMI-14D | 08/11/09 | 723 ± 142 | |
| MW-TMI-14D | 09/10/09 | 814 ± 150 | |
| MW-TMI-14D | 09/10/09 | 753 ± 144 | |
| MW-TMI-14D | 10/15/09 | 616 ± 145 | < 0.7 |

**TABLE B-I.1** **CONCENTRATIONS OF TRITIUM AND STRONTIUM IN WELL WATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM - THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| SITE | | COLLECTION DATE | H-3 | SR-90 |
|---|---|---|---|---|
| MW-TMI-14D | | 11/19/09 | 702 ± 141 | |
| MW-TMI-14I | | 01/13/09 | 266 ± 114 | |
| MW-TMI-14I | | 01/27/09 | 259 ± 125 | |
| MW-TMI-14I | | 02/10/09 | < 179 | |
| MW-TMI-14I | | 02/17/09 | < 179 | |
| MW-TMI-14I | | 02/17/09 | 248 ± 125 | |
| MW-TMI-14I | | 03/18/09 | < 183 | |
| MW-TMI-14I | | 04/16/09 | < 180 | |
| MW-TMI-14I | | 04/22/09 | 256 ± 120 | |
| MW-TMI-14I | | 04/29/09 | 252 ± 120 | |
| MW-TMI-14I | | 04/29/09 | 214 ± 118 | |
| MW-TMI-14I | | 05/07/09 | 237 ± 107 | |
| MW-TMI-14I | | 05/13/09 | 177 ± 106 | |
| MW-TMI-14I | | 05/19/09 | 228 ± 106 | |
| MW-TMI-14I | | 06/18/09 | 269 ± 108 | |
| MW-TMI-14I | | 07/16/09 | 264 ± 115 | |
| MW-TMI-14I | | 08/11/09 | < 179 | |
| MW-TMI-14I | | 09/10/09 | 248 ± 122 | |
| MW-TMI-14I | | 10/15/09 | < 182 | < 0.8 |
| MW-TMI-14I | | 11/19/09 | < 177 | |
| MW-TMI-14S | | 01/13/09 | < 173 | |
| MW-TMI-14S | | 01/27/09 | 232 ± 121 | |
| MW-TMI-14S | | 02/10/09 | 208 ± 126 | |
| MW-TMI-14S | | 02/17/09 | 307 ± 127 | |
| MW-TMI-14S | | 03/18/09 | 232 ± 130 | |
| MW-TMI-14S | | 04/16/09 | < 175 | |
| MW-TMI-14S | | 04/22/09 | < 181 | |
| MW-TMI-14S | | 04/29/09 | 426 ± 128 | |
| MW-TMI-14S | | 05/07/09 | < 149 | |
| MW-TMI-14S | | 05/13/09 | < 159 | |
| MW-TMI-14S | | 05/19/09 | < 154 | |
| MW-TMI-14S | | 06/18/09 | < 157 | |
| MW-TMI-14S | | 07/16/09 | 235 ± 112 | |
| MW-TMI-14S | | 08/11/09 | < 182 | |
| MW-TMI-14S | | 09/10/09 | < 182 | |
| MW-TMI-14S | | 10/15/09 | < 183 | < 0.5 |
| MW-TMI-14S | | 11/19/09 | < 177 | |
| MW-TMI-16D | | 01/13/09 | 1810 ± 246 | |
| MW-TMI-16D | | 01/20/09 | 1630 ± 224 | |
| MW-TMI-16D | | 01/27/09 | 1710 ± 245 | |
| MW-TMI-16D | | 02/03/09 | 1500 ± 201 | |
| MW-TMI-16D | | 02/10/09 | 1180 ± 188 | |
| MW-TMI-16D | | 02/17/09 | 1320 ± 207 | |
| MW-TMI-16D | | 03/18/09 | 955 ± 170 | |
| MW-TMI-16D | ORIGINAL | 04/16/09 | 1550 ± 227 | |
| MW-TMI-16D | RERUN | 04/16/09 | 1580 ± 243 | |
| MW-TMI-16D | | 04/22/09 | 1580 ± 229 | |
| MW-TMI-16D | | 04/29/09 | 1700 ± 240 | |
| MW-TMI-16D | | 05/07/09 | 1010 ± 151 | |
| MW-TMI-16D | | 05/13/09 | 987 ± 161 | |
| MW-TMI-16D | | 05/13/09 | 1090 ± 171 | |

**TABLE B-I.1** **CONCENTRATIONS OF TRITIUM AND STRONTIUM IN WELL WATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM - THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| SITE | COLLECTION DATE | H-3 | SR-90 |
|---|---|---|---|
| MW-TMI-16D | 05/19/09 | 1050 ± 162 | |
| MW-TMI-16D | 06/18/09 | 1560 ± 209 | |
| MW-TMI-16D | 07/16/09 | 1220 ± 178 | |
| MW-TMI-16D | 08/12/09 | 1230 ± 192 | |
| MW-TMI-16D | 09/10/09 | 773 ± 147 | |
| MW-TMI-16D | 10/14/09 | 693 ± 150 | < 0.8 |
| MW-TMI-16I | 01/13/09 | 563 ± 132 | |
| MW-TMI-16I | 01/20/09 | 586 ± 142 | |
| MW-TMI-16I | 01/20/09 | 542 ± 139 | |
| MW-TMI-16I | 01/27/09 | 513 ± 137 | |
| MW-TMI-16I | 02/03/09 | 457 ± 123 | |
| MW-TMI-16I | 02/10/09 | < 190 | |
| MW-TMI-16I | 02/17/09 | 280 ± 123 | |
| MW-TMI-16I | 03/18/09 | 218 ± 128 | |
| MW-TMI-16I | 04/16/09 | < 184 | |
| MW-TMI-16I | 04/22/09 | 332 ± 123 | |
| MW-TMI-16I | 04/29/09 | 433 ± 129 | |
| MW-TMI-16I | 05/07/09 | 654 ± 132 | |
| MW-TMI-16I | 05/13/09 | 606 ± 129 | |
| MW-TMI-16I | 05/19/09 | 542 ± 118 | |
| MW-TMI-16I | 06/18/09 | 856 ± 146 | |
| MW-TMI-16I | 07/16/09 | 625 ± 129 | |
| MW-TMI-16I | 08/12/09 | 660 ± 135 | |
| MW-TMI-16I | 08/12/09 | 623 ± 138 | |
| MW-TMI-16I | 09/10/09 | 682 ± 140 | |
| MW-TMI-16I | 10/14/09 | 474 ± 137 | < 0.5 |
| MW-TMI-17D | 05/14/09 | < 139 | |
| MW-TMI-17D | 10/15/09 | < 135 | < 0.6 |
| MW-TMI-17I | 05/14/09 | 181 ± 101 | |
| MW-TMI-17I | 10/15/09 | < 142 | < 0.9 |
| MW-TMI-18D | 05/14/09 | < 168 | |
| MW-TMI-18D | 10/15/09 | 171 ± 107 | < 0.9 |
| MW-TMI-19D | 05/14/09 | < 166 | |
| MW-TMI-19D | 10/15/09 | < 131 | < 0.6 |
| MW-TMI-19I | 05/14/09 | < 168 | |
| MW-TMI-19I | 10/14/09 | < 151 | < 0.8 |
| MW-TMI-19I | 10/14/09 | < 170 | < 1.0 |
| MW-TMI-1D | 05/12/09 | 556 ± 132 | |
| MW-TMI-1D | 10/20/09 | 286 ± 115 | < 0.5 |
| MW-TMI-2D | 03/17/09 | 439 ± 142 | |
| MW-TMI-2D | 05/15/09 | 356 ± 136 | |
| MW-TMI-2D | 08/11/09 | 393 ± 127 | |
| MW-TMI-2D | 10/20/09 | 390 ± 124 | < 0.6 |
| MW-TMI-3I | 05/12/09 | 293 ± 115 | |
| MW-TMI-3I | 10/14/09 | < 151 | < 0.7 |
| MW-TMI-4I | 05/12/09 | < 142 | |
| MW-TMI-4I | 05/12/09 | < 165 | |
| MW-TMI-4I | 10/14/09 | < 144 | < 0.7 |
| MW-TMI-4S | 05/12/09 | < 137 | |
| MW-TMI-4S | 10/14/09 | < 145 | < 0.7 |
| MW-TMI-4S | 11/19/09 | < 165 | |

**TABLE B-I.1** **CONCENTRATIONS OF TRITIUM AND STRONTIUM IN WELL WATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM - THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| SITE | COLLECTION DATE | H-3 | SR-90 |
|---|---|---|---|
| MW-TMI-5D | 05/12/09 | < 189 | |
| MW-TMI-5D | 10/14/09 | < 153 | < 0.7 |
| MW-TMI-6D | 05/12/09 | 247 ± 110 | |
| MW-TMI-6D | 05/12/09 | 233 ± 108 | |
| MW-TMI-6D | 10/14/09 | < 192 | < 0.7 |
| MW-TMI-6D | 10/14/09 | < 172 | < 0.6 |
| MW-TMI-6I | 05/12/09 | 210 ± 107 | |
| MW-TMI-6I | 10/14/09 | < 186 | < 0.7 |
| MW-TMI-7S | 05/14/09 | < 165 | |
| MW-TMI-7S | 10/20/09 | < 146 | < 0.7 |
| MW-TMI-8S | 05/14/09 | < 166 | |
| MW-TMI-8S | 10/15/09 | < 144 | < 0.4 |
| MW-TMI-9I | 05/15/09 | < 144 | |
| MW-TMI-9I | 10/22/09 | < 184 | < 0.6 |
| N2-1 | 05/13/09 | < 147 | |
| N2-1 | 10/14/09 | < 173 | < 0.9 |
| NW-A | 05/16/09 | 1080 ± 161 | |
| NW-A | 10/18/09 | 934 ± 159 | < 0.7 |
| NW-B | 05/16/09 | 905 ± 147 | |
| NW-B | 10/18/09 | 675 ± 137 | < 0.7 |
| NW-C | 05/16/09 | 1910 ± 238 | |
| NW-C | 10/18/09 | 3210 ± 375 | < 0.7 |
| NW-CW | 05/16/09 | 943 ± 151 | |
| NW-CW | 10/18/09 | 915 ± 156 | < 0.7 |
| OS-13B | 05/12/09 | 294 ± 120 | |
| OS-14 | 05/12/09 | < 171 | |
| OS-14 | 10/14/09 | < 139 | < 0.7 |
| OS-16 | 05/13/09 | 176 ± 114 | |
| OS-16 | 10/14/09 | 183 ± 100 | < 0.7 |
| OS-17 | 05/13/09 | < 173 | |
| OS-17 | 10/14/09 | 173 ± 105 | < 0.7 |
| OS-18 | 03/17/09 | 849 ± 165 | |
| OS-18 | 03/17/09 | 815 ± 164 | |
| OS-18 | 04/16/09 | 957 ± 171 | |
| OS-18 | 05/12/09 | 200 ± 104 | |
| OS-18 | 08/10/09 | 1120 ± 179 | |
| OS-18 | 08/10/09 | 1030 ± 167 | |
| OS-18 | 10/20/09 | 191 ± 108 | < 0.7 |
| OSF | 03/18/09 | 349 ± 135 | |
| OSF | 03/18/09 | 440 ± 135 | |
| OSF | 05/18/09 | 827 ± 145 | |
| OSF | 08/11/09 | 559 ± 134 | |
| OSF | 10/16/09 | 596 ± 135 | < 0.9 |
| RW-1 | 04/22/09 | < 180 | |
| RW-1 | 05/07/09 | < 149 | |
| RW-1 | 05/13/09 | < 171 | |
| RW-1 | 05/19/09 | < 154 | |
| RW-1 | 09/10/09 | < 191 | |
| RW-1 | 10/15/09 | < 145 | < 0.5 |
| RW-2 | 01/13/09 | 651 ± 140 | |
| RW-2 | 01/13/09 | 836 ± 157 | |

**TABLE B-I.1** **CONCENTRATIONS OF TRITIUM AND STRONTIUM IN WELL WATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM - THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| SITE | | COLLECTION DATE | H-3 | SR-90 |
|---|---|---|---|---|
| RW-2 | | 01/20/09 | 618 ± 139 | |
| RW-2 | | 01/27/09 | 663 ± 149 | |
| RW-2 | | 02/03/09 | 438 ± 121 | |
| RW-2 | | 02/10/09 | 260 ± 128 | |
| RW-2 | | 02/17/09 | 327 ± 128 | |
| RW-2 | ORIGINAL | 03/18/09 | 2360 ± 301 | |
| RW-2 | RERUN | 03/18/09 | 2170 ± 281 | |
| RW-2 | | 04/16/09 | 2250 ± 294 | |
| RW-2 | | 04/22/09 | 1720 ± 241 | |
| RW-2 | | 04/29/09 | 730 ± 149 | |
| RW-2 | | 05/07/09 | 320 ± 115 | |
| RW-2 | | 05/13/09 | 212 ± 108 | |
| RW-2 | | 05/19/09 | 240 ± 106 | |
| RW-2 | | 06/18/09 | 299 ± 112 | |
| RW-2 | | 06/18/09 | 353 ± 116 | |
| RW-2 | | 07/16/09 | 284 ± 114 | |
| RW-2 | | 08/12/09 | 251 ± 120 | |
| RW-2 | | 09/10/09 | < 191 | |
| RW-2 | | 10/20/09 | < 144 | < 0.6 |
| RW-2 | | 11/19/09 | < 158 | |
| TRAINING CENTER | | 05/18/09 | < 165 | |
| TRAINING CENTER | | 10/16/09 | < 173 | < 0.9 |

**TABLE B-I.2** **CONCENTRATIONS OF GAMMA EMITTERS IN WELL WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| STC | COLLECTION PERIOD | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| #3 | 10/15/09 | < 29 | < 45 | < 3 | < 3 | < 6 | < 3 | < 7 | < 3 | < 6 | < 3 | < 3 | < 22 | < 7 |
| 48N | 10/15/09 | < 19 | < 41 | < 2 | < 2 | < 5 | < 2 | < 4 | < 2 | < 4 | < 2 | < 2 | < 19 | < 6 |
| 48S | 10/16/09 | < 15 | < 15 | < 1 | < 2 | < 4 | < 2 | < 3 | < 2 | < 3 | < 1 | < 2 | < 13 | < 4 |
| 48S | 10/16/09 | < 18 | < 15 | < 2 | < 2 | < 4 | < 2 | < 3 | < 2 | < 3 | < 2 | < 2 | < 18 | < 5 |
| MS-1 | 10/14/09 | < 18 | < 15 | < 2 | < 2 | < 4 | < 2 | < 3 | < 2 | < 3 | < 2 | < 2 | < 18 | < 5 |
| MS-19 | 10/15/09 | < 19 | < 32 | < 2 | < 2 | < 5 | < 2 | < 4 | < 2 | < 4 | < 2 | < 2 | < 16 | < 6 |
| MS-2 | 10/14/09 | < 39 | < 74 | < 4 | < 4 | < 10 | < 4 | < 8 | < 4 | < 8 | < 4 | < 4 | < 29 | < 9 |
| MS-2 | 10/14/09 | < 20 | < 59 | < 2 | < 2 | < 5 | < 2 | < 4 | < 2 | < 4 | < 2 | < 2 | < 18 | < 6 |
| MS-20 | 10/15/09 | < 31 | < 30 | < 3 | < 4 | < 8 | < 4 | < 6 | < 4 | < 7 | < 3 | < 4 | < 25 | < 7 |
| MS-3 | 10/14/09 | < 30 | < 60 | < 3 | < 3 | < 7 | < 3 | < 7 | < 4 | < 6 | < 3 | < 3 | < 19 | < 7 |
| MS-4 | 10/20/09 | < 35 | < 31 | < 4 | < 4 | < 8 | < 6 | < 10 | < 4 | < 7 | < 4 | < 4 | < 21 | < 6 |
| MS-5 | 10/14/09 | < 33 | < 77 | < 4 | < 4 | < 8 | < 3 | < 7 | < 4 | < 7 | < 3 | < 4 | < 25 | < 7 |
| MS-6 | 10/14/09 | < 37 | < 73 | < 4 | < 3 | < 9 | < 3 | < 7 | < 4 | < 6 | < 3 | < 3 | < 24 | < 9 |
| MS-6 | 10/14/09 | < 19 | < 16 | < 2 | < 2 | < 4 | < 2 | < 4 | < 2 | < 4 | < 2 | < 2 | < 20 | < 5 |
| MS-7 | 10/14/09 | < 22 | < 31 | < 2 | < 2 | < 5 | < 2 | < 4 | < 3 | < 4 | < 2 | < 2 | < 19 | < 5 |
| MS-8 | 10/14/09 | < 28 | < 33 | < 3 | < 3 | < 7 | < 3 | < 6 | < 4 | < 5 | < 3 | < 3 | < 23 | < 7 |
| MW-1 | 10/20/09 | < 13 | < 13 | < 1 | < 2 | < 3 | < 1 | < 3 | < 2 | < 3 | < 1 | < 1 | < 10 | < 3 |
| MW-1 | 10/20/09 | < 12 | < 12 | < 1 | < 1 | < 3 | < 1 | < 3 | < 1 | < 3 | < 1 | < 1 | < 9 | < 3 |
| MW-2 | 10/20/09 | < 17 | < 33 | < 2 | < 2 | < 4 | < 2 | < 3 | < 2 | < 3 | < 1 | < 2 | < 12 | < 3 |
| MW-3 | 10/20/09 | < 13 | < 31 | < 1 | < 1 | < 3 | < 1 | < 3 | < 2 | < 2 | < 1 | < 1 | < 10 | < 3 |
| MW-4 | 10/20/09 | < 14 | < 12 | < 1 | < 1 | < 3 | < 1 | < 3 | < 2 | < 3 | < 1 | < 2 | < 10 | < 3 |
| MW-TMI-10D | 10/14/09 | < 31 | < 41 | < 4 | < 4 | < 8 | < 6 | < 7 | < 4 | < 8 | < 3 | < 4 | < 27 | < 9 |
| MW-TMI-10I | 10/14/09 | < 22 | < 39 | < 2 | < 2 | < 5 | < 2 | < 4 | < 2 | < 4 | < 2 | < 2 | < 23 | < 7 |
| MW-TMI-10I | 10/14/09 | < 20 | < 16 | < 2 | < 2 | < 5 | < 2 | < 4 | < 2 | < 4 | < 2 | < 2 | < 20 | < 6 |
| MW-TMI-10S | 10/15/09 | < 10 | < 15 | < 1 | < 1 | < 2 | < 1 | < 2 | < 1 | < 2 | < 1 | < 1 | < 10 | < 3 |
| MW-TMI-12S | 04/29/09 | < 41 | < 110 | < 5 | < 5 | < 10 | < 5 | < 11 | < 6 | < 8 | < 5 | < 6 | < 22 | < 9 |
| MW-TMI-12S | 10/20/09 | < 37 | < 80 | < 4 | < 4 | < 9 | < 4 | < 8 | < 4 | < 7 | < 4 | < 4 | < 21 | < 7 |
| MW-TMI-13I | 10/22/09 | < 15 | < 29 | < 2 | < 2 | < 4 | < 2 | < 3 | < 2 | < 3 | < 1 | < 2 | < 12 | < 4 |
| MW-TMI-13S | 10/22/09 | < 35 | < 79 | < 4 | < 4 | < 9 | < 4 | < 8 | < 5 | < 7 | < 3 | < 4 | < 20 | < 9 |
| MW-TMI-14D | 10/15/09 | < 18 | < 29 | < 2 | < 2 | < 4 | < 2 | < 4 | < 2 | < 3 | < 2 | < 2 | < 15 | < 5 |
| MW-TMI-14I | 10/15/09 | < 21 | < 43 | < 2 | < 2 | < 5 | < 2 | < 4 | < 2 | < 4 | < 2 | < 2 | < 18 | < 6 |
| MW-TMI-14S | 10/15/09 | < 13 | < 22 | < 1 | < 1 | < 3 | < 1 | < 3 | < 2 | < 3 | < 1 | < 1 | < 12 | < 3 |
| MW-TMI-16D | 10/14/09 | < 17 | < 33 | < 2 | < 2 | < 4 | < 2 | < 4 | < 2 | < 3 | < 2 | < 2 | < 17 | < 5 |
| MW-TMI-16I | 10/14/09 | < 12 | < 10 | < 1 | < 1 | < 3 | < 1 | < 2 | < 1 | < 2 | < 1 | < 1 | < 12 | < 3 |
| MW-TMI-17D | 10/15/09 | < 41 | < 91 | < 4 | < 5 | < 10 | < 4 | < 9 | < 4 | < 8 | < 4 | < 5 | < 28 | < 11 |

**TABLE B-I.2** **CONCENTRATIONS OF GAMMA EMITTERS IN WELL WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| STC | COLLECTION PERIOD | 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-17I | 10/15/09 | < 39 | < 32 | < 4 | < 4 | < 8 | < 3 | < 7 | < 4 | < 8 | < 4 | < 4 | < 28 | < 9 |
| MW-TMI-18D | 10/15/09 | < 36 | < 35 | < 4 | < 4 | < 8 | < 4 | < 7 | < 4 | < 6 | < 4 | < 4 | < 29 | < 8 |
| MW-TMI-19D | 10/15/09 | < 34 | < 34 | < 4 | < 4 | < 9 | < 3 | < 8 | < 5 | < 8 | < 3 | < 4 | < 29 | < 9 |
| MW-TMI-19I | 10/14/09 | < 30 | < 34 | < 3 | < 4 | < 7 | < 4 | < 7 | < 4 | < 6 | < 3 | < 4 | < 23 | < 9 |
| MW-TMI-19I | 10/14/09 | < 20 | < 18 | < 2 | < 2 | < 5 | < 2 | < 4 | < 2 | < 4 | < 2 | < 2 | < 20 | < 7 |
| MW-TMI-1D | 10/20/09 | < 22 | < 19 | < 2 | < 2 | < 5 | < 2 | < 4 | < 2 | < 4 | < 2 | < 2 | < 16 | < 5 |
| MW-TMI-2D | 10/20/09 | < 13 | < 13 | < 1 | < 2 | < 3 | < 1 | < 3 | < 2 | < 3 | < 1 | < 1 | < 11 | < 3 |
| MW-TMI-3I | 10/14/09 | < 32 | < 34 | < 3 | < 3 | < 6 | < 3 | < 6 | < 4 | < 5 | < 3 | < 3 | < 25 | < 6 |
| MW-TMI-4I | 10/14/09 | < 39 | < 74 | < 4 | < 4 | < 9 | < 5 | < 9 | < 4 | < 7 | < 3 | < 4 | < 31 | < 9 |
| MW-TMI-4S | 10/14/09 | < 36 | < 76 | < 4 | < 4 | < 8 | < 4 | < 7 | < 4 | < 6 | < 3 | < 4 | < 28 | < 9 |
| MW-TMI-5D | 10/14/09 | < 41 | < 47 | < 3 | < 4 | < 9 | < 2 | < 9 | < 4 | < 8 | < 4 | < 4 | < 32 | < 11 |
| MW-TMI-6D | 10/14/09 | < 26 | < 23 | < 3 | < 3 | < 6 | < 2 | < 5 | < 3 | < 6 | < 2 | < 3 | < 23 | < 7 |
| MW-TMI-6D | 10/14/09 | < 18 | < 16 | < 2 | < 2 | < 4 | < 2 | < 4 | < 2 | < 3 | < 2 | < 2 | < 19 | < 7 |
| MW-TMI-6I | 10/14/09 | < 23 | < 21 | < 2 | < 3 | < 5 | < 2 | < 4 | < 3 | < 4 | < 2 | < 2 | < 22 | < 7 |
| MW-TMI-7S | 10/20/09 | < 33 | < 37 | < 4 | < 4 | < 7 | < 4 | < 7 | < 5 | < 7 | < 3 | < 4 | < 22 | < 6 |
| MW-TMI-8S | 10/15/09 | < 35 | < 29 | < 3 | < 4 | < 7 | < 3 | < 7 | < 4 | < 6 | < 3 | < 4 | < 25 | < 8 |
| MW-TMI-9I | 10/22/09 | < 37 | < 43 | < 4 | < 5 | < 10 | < 5 | < 9 | < 6 | < 8 | < 5 | < 5 | < 20 | < 7 |
| N2-1 | 10/14/09 | < 15 | < 29 | < 1 | < 2 | < 4 | < 1 | < 3 | < 2 | < 3 | < 1 | < 1 | < 16 | < 5 |
| NW-A | 10/18/09 | < 32 | < 47 | < 3 | < 4 | < 8 | < 3 | < 8 | < 4 | < 6 | < 4 | < 3 | < 29 | < 10 |
| NW-B | 10/18/09 | < 20 | < 18 | < 2 | < 2 | < 5 | < 2 | < 4 | < 2 | < 4 | < 2 | < 2 | < 18 | < 5 |
| NW-C | 10/18/09 | < 24 | < 20 | < 2 | < 2 | < 5 | < 2 | < 4 | < 3 | < 4 | < 2 | < 2 | < 19 | < 6 |
| NW-CW | 10/18/09 | < 22 | < 21 | < 2 | < 2 | < 6 | < 2 | < 4 | < 3 | < 4 | < 2 | < 2 | < 20 | < 7 |
| OS-14 | 10/14/09 | < 31 | < 29 | < 3 | < 3 | < 6 | < 3 | < 6 | < 3 | < 5 | < 3 | < 3 | < 19 | < 6 |
| OS-16 | 10/14/09 | < 36 | < 89 | < 4 | < 4 | < 8 | < 4 | < 7 | < 4 | < 7 | < 4 | < 4 | < 28 | < 9 |
| OS-17 | 10/14/09 | < 45 | < 44 | < 4 | < 5 | < 11 | < 4 | < 9 | < 5 | < 8 | < 4 | < 4 | < 30 | < 9 |
| OS-18 | 10/20/09 | < 41 | < 77 | < 4 | < 5 | < 10 | < 4 | < 9 | < 4 | < 7 | < 5 | < 5 | < 23 | < 8 |
| OSF | 10/16/09 | < 15 | < 13 | < 1 | < 2 | < 3 | < 1 | < 3 | < 2 | < 3 | < 1 | < 1 | < 15 | < 4 |
| RW-1 | 10/15/09 | < 43 | < 38 | < 4 | < 5 | < 10 | < 4 | < 8 | < 5 | < 8 | < 4 | < 5 | < 30 | < 10 |
| RW-2 | 04/29/09 | < 47 | < 52 | < 5 | < 5 | < 8 | < 6 | < 14 | < 7 | < 8 | < 5 | < 6 | < 24 | < 8 |
| RW-2 | 10/20/09 | < 31 | 78 ± 49 | < 4 | < 3 | < 7 | < 4 | < 8 | < 4 | < 7 | < 3 | < 5 | < 22 | < 7 |
| TRAINING CENTER | 10/16/09 | < 13 | < 24 | < 1 | < 1 | < 3 | < 1 | < 2 | < 1 | < 2 | < 1 | < 1 | < 13 | < 4 |

**TABLE B-II.1 CONCENTRATIONS OF TRITIUM AND STRONTIUM IN SURFACE WATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM - THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| SITE | COLLECTION DATE | H-3 | SR-90 |
|---|---|---|---|
| SW-E-1 | 03/17/09 | < 192 | |
| SW-E-1 | 05/18/09 | < 164 | |
| SW-E-1 | 08/11/09 | < 175 | |
| SW-E-1 | 10/16/09 | < 153 | < 0.9 |
| SW-E-2 | 03/17/09 | < 176 | |
| SW-E-2 | 05/18/09 | < 162 | |
| SW-E-2 | 08/11/09 | < 183 | |
| SW-E-2 | 10/16/09 | < 154 | < 0.7 |
| SW-E-3 | 03/17/09 | < 194 | |
| SW-E-3 | 05/18/09 | < 162 | |
| SW-E-3 | 08/11/09 | < 178 | |
| SW-E-3 | 10/16/09 | < 156 | < 0.7 |

**TABLE B-II.2** **CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| STC | COLLECTION PERIOD | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TM-SW-E-1 | 10/16/09 | < 34 | < 66 | < 3 | < 4 | < 8 | < 3 | < 7 | < 4 | < 6 | < 3 | < 3 | < 24 | < 8 |
| TM-SW-E-2 | 10/16/09 | < 29 | < 29 | < 3 | < 3 | < 7 | < 3 | < 6 | < 4 | < 6 | < 3 | < 4 | < 23 | < 8 |
| TM-SW-E-3 | 10/16/09 | < 34 | < 32 | < 4 | < 4 | < 8 | < 4 | < 7 | < 4 | < 6 | < 3 | < 4 | < 26 | < 9 |

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# APPENDIX C

# DATA TABLES

**TABLE C-I.1** **CONCENTRATIONS OF TRITIUM AND STRONTIUM IN WELL WATER SPLIT SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| SITE | | COLLECTION DATE | H-3 | SR-90 |
|---|---|---|---|---|
| 48S | | 10/16/09 | < 155 | < 0.5 |
| MS-2 | | 05/12/09 | < 158 | |
| MS-2 | | 10/14/09 | 325 ± 97 | < 0.6 |
| MS-20 | | 05/19/09 | 446 ± 100 | |
| MS-21 | | 05/12/09 | 737 ± 114 | |
| MS-6 | ORIGINAL | 10/14/09 | < 155 | < 0.5 |
| MS-6 | DUPLICATE | 10/14/09 | < 155 | < 0.5 |
| MW-1 | | 10/20/09 | < 155 | < 0.8 |
| MW-2 | | 05/12/09 | < 163 | |
| MW-TMI-10I | | 08/11/09 | 1891 ± 146 | |
| MW-TMI-10I | | 10/14/09 | 1373 ± 134 | < 0.5 |
| MW-TMI-10S | | 05/15/09 | 5737 ± 237 | |
| MW-TMI-12S | | 04/22/09 | 6054 ± 244 | |
| MW-TMI-13I | | 03/17/09 | 2201 ± 162 | |
| MW-TMI-13I | ORIGINAL | 07/16/09 | 1362 ± 127 | |
| MW-TMI-13I | DUPLICATE | 07/16/09 | 1312 ± 125 | |
| MW-TMI-13I | | 11/18/09 | 1004 ± 119 | |
| MW-TMI-13S | | 04/16/09 | 174 ± 87 | |
| MW-TMI-14D | | 05/07/09 | 1113 ± 134 | |
| MW-TMI-14D | | 09/10/09 | 937 ± 116 | |
| MW-TMI-14I | ORIGINAL | 02/17/09 | 173 ± 84 | |
| MW-TMI-14I | DUPLICATE | 02/17/09 | 223 ± 86 | |
| MW-TMI-14I | | 04/29/09 | 271 ± 113 | |
| MW-TMI-16D | | 05/13/09 | 1221 ± 130 | |
| MW-TMI-16I | | 01/20/09 | 614 ± 101 | |
| MW-TMI-16I | | 08/12/09 | 693 ± 107 | |
| MW-TMI-19I | | 10/14/09 | < 155 | < 0.8 |
| MW-TMI-4I | | 05/12/09 | < 158 | |
| MW-TMI-6D | | 05/12/09 | 265 ± 94 | |
| MW-TMI-6D | | 10/14/09 | 196 ± 91 | < 0.6 |
| OS-18 | | 03/17/09 | 909 ± 122 | |
| OS-18 | | 08/10/09 | 1097 ± 122 | |
| RW-2 | | 01/13/09 | 726 ± 101 | |
| RW-2 | | 06/18/09 | 229 ± 89 | |

**TABLE C-I.2**

**CONCENTRATIONS OF GAMMA EMITTERS IN WELL WATER SPLIT SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, THREE MILE ISLAND NUCLEAR STATION, 2009**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

| STC | COLLECTION PERIOD | | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MS-2 | 10/14/09 | | < 27 | 110 ± 31 | < 2 | < 3 | < 2 | < 1 | < 5 | < 3 | < 5 | < 3 | < 3 | < 26 | < 5 |
| MW-TMI-19I | 10/14/09 | | < 36 | < 61 | < 3 | < 3 | < 4 | < 3 | < 2 | < 2 | < 2 | < 3 | < 2 | < 28 | < 3 |
| MW-TMI-6D | 10/14/09 | | < 32 | 74 ± 30 | < 2 | < 3 | < 4 | < 2 | < 5 | < 3 | < 4 | < 3 | < 3 | < 26 | < 3 |
| 48S | 10/16/09 | | < 30 | 163 ± 60 | < 3 | < 4 | < 8 | < 3 | < 5 | < 5 | < 7 | < 4 | < 4 | < 31 | < 5 |
| MS-6 | 10/14/09 | ORIGINAL | < 21 | 95 ± 31 | < 2 | < 3 | < 4 | < 3 | < 4 | < 2 | < 6 | < 3 | < 3 | < 14 | < 3 |
| MS-6 | 10/14/09 | DUPLICATE | < 30 | < 62 | < 3 | < 2 | < 8 | < 3 | < 4 | < 4 | < 5 | < 4 | < 3 | < 20 | < 4 |
| MW-TMI-10I | 10/14/09 | | < 18 | 89 ± 32 | < 3 | < 4 | < 6 | < 2 | < 6 | < 2 | < 7 | < 2 | < 2 | < 15 | < 3 |
| MW-1 | 10/20/09 | | < 18 | 135 ± 35 | < 2 | < 3 | < 3 | < 3 | < 5 | < 3 | < 5 | < 3 | < 3 | < 21 | < 2 |