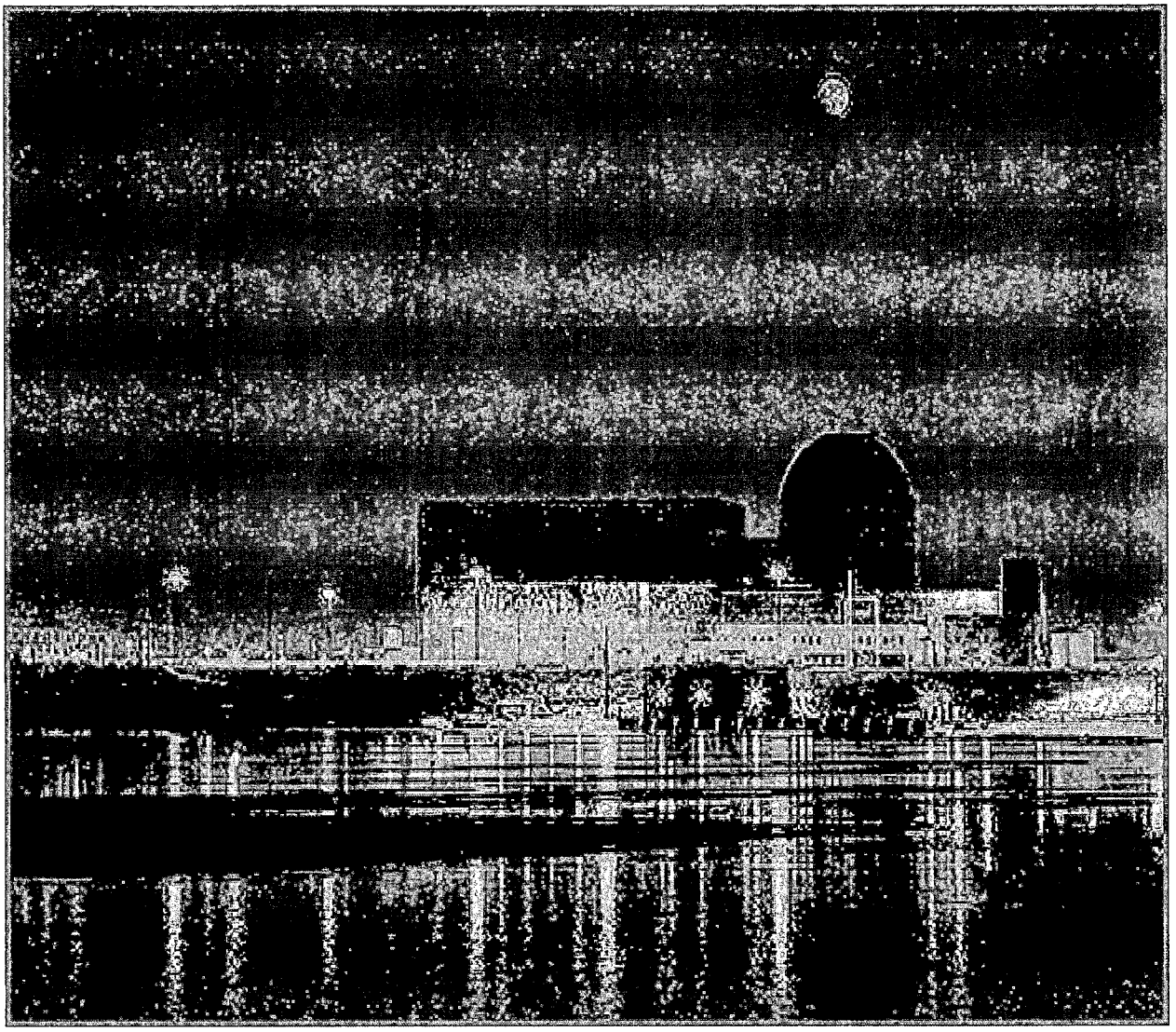

Exelon Generation.

January 01, 2019 – December 31, 2019

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

CLINTON POWER STATION – DOCKET NUMBER 50-461

Prepared by:

Teledyne Brown Engineering Environmental Services
April 2020

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Appendices

I. Summary and Conclusions

This report on the Radiological Environmental Monitoring Program (REMP) conducted for the Clinton Power Station (CPS) by Exelon Generation Company, LLC (Exelon) covers the period January 1, 2019 through December 31, 2019. During that time period, 1,591 analyses were performed on 1,464 samples. In assessing all the data gathered for this report and comparing these results with preoperational data, it was concluded that the operation of CPS had no adverse radiological impact on the environment.

There were zero (0) radioactive liquid releases from CPS during 2019. Releases of gaseous radioactive materials were accurately measured in plant effluents. There were no gaseous effluent releases that approached the limits specified in the CPS Offsite Dose Calculation Manual (ODCM). The highest calculated offsite dose received by a member of the public in 2019 due to the release of gaseous effluents from CPS was 3.89E-02 or 0.0389 mRem.

Surface, drinking, and well water samples were analyzed for concentrations of tritium and gamma-emitting nuclides. Drinking water samples were also analyzed for concentrations of gross beta and Iodine-131 (I-131). No fission or activation products were detected. No tritium or gross beta activity was detected and the required lower limit of detection (LLD) was met.

Fish and shoreline sediment samples were analyzed for concentrations of gamma-emitting nuclides. No fission or activation products were detected in fish or shoreline sediment samples.

Air particulate samples were analyzed for concentrations of gross beta and gamma-emitting nuclides. No fission or activation products were detected.

Iodine-131 analyses were performed on weekly air samples. All results were less than the lower limit of detection for I-131.

High sensitivity I-131 analyses and gamma analyses were performed on cow milk samples. All results were below the required LLDs for I-131. Concentrations of naturally-occurring K-40 were consistent with those detected in previous years. No fission or activation products were found.

Food product samples were analyzed for concentrations of gamma-emitting nuclides. No fission or activation products were detected.

Grass samples were analyzed for concentrations of gamma-emitting nuclides. No fission or activation products were detected.

Environmental gamma radiation measurements were performed quarterly using Dosimeters of Legal Record (DLR). Levels detected were consistent with those observed in previous years.

II. Introduction

The Clinton Power Station (CPS), consisting of one approximately 1,140 MW gross electrical power output boiling water reactor is located in Harp Township, DeWitt County, Illinois. CPS is owned and operated by Exelon and became operational in 1987. Unit No. 1 went critical on February 27, 1987. The site encloses approximately 13,730 acres. This includes the 4,895 acre, man-made cooling lake and about 452 acres of property not owned by Exelon. The plant is situated on approximately 150 acres. The cooling water discharge flume – which discharges to the eastern arm of the lake – occupies an additional 130 acres. Although the nuclear reactor, supporting equipment and associated electrical generation and distribution equipment lie in Harp Township, portions of the aforementioned 13,730 acre plot reside within Wilson, Rutledge, DeWitt, Creek, Nixon and Santa Anna Townships.

A Radiological Environmental Monitoring Program (REMP) for CPS was initiated in 1987. The preoperational period for most media covers the periods May 1980 through February 27, 1987 and was summarized in a separate report. This report covers those analyses performed by Teledyne Brown Engineering (TBE) and Landauer on samples collected during the period January 1, 2019 through December 31, 2019.

A. Objectives of the REMP

The objectives of the REMP are to:

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

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

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

This section describes the general collection methods used by Environmental Inc. Midwest Labs (EIML) to obtain environmental samples for the CPS REMP in 2019. Sample locations and descriptions can be found in Tables B–1 and B–2, and Figures B–1 through B–4, Appendix B. The sampling methods used by Environmental Inc. (Midwest Labs) are listed in Table B-2.

Aquatic Environment

The aquatic environment was evaluated by performing radiological analyses on samples of surface water, drinking water, well water, fish, and shoreline sediment. Two gallon water samples were collected monthly from composite samplers located at three surface water locations (CL-90, CL-91 and CL-99) and one drinking water location (CL-14). A monthly grab sample was obtained from one surface water location (CL-13). Quarterly samples were obtained from two well water locations (CL-7D and CL-12). All samples were collected in new unused plastic bottles, which were rinsed at least twice with source water prior to collection. Fish samples comprising the flesh of largemouth bass, channel catfish, bluegill, carp, white crappie and white bass, the species most commonly harvested from the lakes by sporting fishermen, were collected semiannually at two locations, CL-19 and CL-105. CL-105 was the control location, which is located about 50 miles upwind of the station. Shoreline sediment samples composed of recently deposited substrate were collected at two locations semiannually (CL-07B and CL-105 (control)).

Atmospheric Environment

The atmospheric environment was evaluated by performing radiological analyses on samples of air particulate, airborne iodine, milk, food produce and grass. Airborne iodine and particulate samples were collected and analyzed weekly at ten locations (CL-1, CL-2, CL-3, CL-4, CL-6, CL-7, CL-8, CL-11, CL-15 and CL-94). CL-11 was the control location, which is located 16 miles upwind of the station. 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 an independent laboratory for analysis.

Milk samples were collected biweekly at one location (CL-116) from May through October to coincide with the grazing season, and monthly from

November through April. All samples were collected in new unused plastic bottles from the bulk tank at the dairy farm, preserved with sodium bisulfite and shipped promptly to the laboratory.

Food products were collected once a month from June through September at four locations (CL-114, CL-115, CL-117 and CL-118). The control location was CL-114, which is located 12.5 miles upwind of the station. Various broadleaf vegetable samples were collected and placed in new unused plastic bags, and sent to the laboratory for analysis.

Grass samples were collected biweekly at four locations (CL-01, CL-02, CL-08 and CL-116) from May through October. CL-116 was the control location, which is located 14 miles WSW of the station. All samples were collected in new unused plastic bags and sent to the laboratory for analysis.

Ambient Gamma Radiation

Direct radiation measurements were made using DLRs. Each location consisted of 2 dosimeter sets in a vented PVC conduit located a few feet off the ground. The DLRs were exchanged quarterly and sent to Landauer for analysis. The DLR locations were placed around the CPS site as follows:

An inner ring consisting of 16 locations (CL-1, CL-5, CL-22, CL-23, CL-24, CL-34, CL-35, CL-36, CL-42 CL-43, CL-44, CL-45, CL-46, CL-47, CL-48 and CL-63).

An outer ring consisting of 16 locations (CL-51, CL-52, CL-53, CL-54, CL-55, CL-56, CL-57, CL-58, CL-60, CL-61, CL-76, CL-77, CL-78, CL-79, CL-80 and CL-81).

A special interest set consisting of seven locations (CL-37, CL-41, CL-49, CL-64, CL-65, CL-74 and CL-75) representing special interest areas.

A supplemental set consisting of 14 locations (CL-2, CL-3, CL-4, CL-6, CL-7, CL-8, CL-15, CL-33, CL-84, CL-90, CL-91, CL-97, CL-99 and CL-114).

CL-11 represents the control location for all environmental DLRs.

The specific DLR 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 meteorological sectors around the

site, where estimated annual dose from CPS, if detected, would be most significant;

3. On hills free from local obstructions and within sight of the HVAC and VG stacks (where practical);

4. And near the closest dwelling to the HVAC and VG stacks in the prevailing downwind direction.

B. Sample Analysis

This section describes the general analytical methodologies used by TBE and Environmental Inc. (Midwest Labs) to analyze the environmental samples for radioactivity for the CPS REMP in 2019. The analytical procedures used by the laboratories are listed in Table B-2.

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

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

2. Concentrations of gamma emitters in surface, drinking and well water, air particulates, milk, fish, grass, sediment and vegetables

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

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

5. Ambient gamma radiation levels at various off-site environs

C. Data Interpretation

The radiological and direct radiation data collected prior to CPS becoming operational was used as a baseline with which these operational data were compared. For the purpose of this report, CPS was considered operational at initial criticality. In addition, data were compared to previous years' operational data for consistency and trending. 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" value. 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 CPS detection capabilities for environmental sample analysis.

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 resulting in a negative number. A minimum detectable concentration (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 water, drinking water, well water, fish, and sediment: 12 nuclides, Mn-54, Co-58, Fe-59, Co-60, Zn-65, Nb-95, Zr-95, Cs-134, Cs-137, Ba-140, La-140 and Ce-144 were reported

For milk: 13 nuclides, K-40, Mn-54, Co-58, Fe-59, Co-60, Zn-65, Nb-95, Zr-95, Cs-134, Cs-137, Ba-140, La-140 and Ce-144 were reported

For grass and vegetation: 13 nuclides, Mn-54, Co-58, Fe-59, Co-60, Zn-65, Nb-95, Zr-95, I-131, Cs-134, Cs-137, Ba-140, La-140 and Ce-144 were reported

For air particulate: 9 nuclides, Co-60, Nb-95, Zr-95, Ru-103, Ru-106, Cs-134, Cs-137, Ce-141 and Ce-144 were reported

The mean and standard deviation of the results were calculated. The standard deviation represents the variability of measured results for different samples rather than single analysis uncertainty.

D. Program Exceptions

The exceptions (Issue Reports, IRs) described below are those that are considered 'deviations' from the Radiological Environmental Monitoring Program as required by the Station's ODCM. By definition, 'deviations' are permitted as delineated within NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants", October 1978, and within Radiological Assessment Branch Technical Position, Revision 1, November 1979, which states.... "Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailability,

malfunction of automatic sampling equipment and other legitimate reasons".... The below section addresses the reporting requirements found within Section 6.0 of the Station's ODCM.

Exceptions/Anomalies

1. IR 4216350 Scheduled Sampling Delayed Due to Weather
   01/31/2019 - WOs 4870408 (Surface Water Monitoring), 4880369 (Airborne Iodine/Particulate), and 4870407 (Milk Monitoring) were all scheduled to be worked by the Environmental Inc. sampling vendor on Wednesday, 01/30/19. With the extreme low temperatures reaching a wind chill of -40° F, the work was rescheduled to 01/31/19 due to the hazardous conditions. Stay times at these low temperatures were not conducive with the outside environmental sampling, so rescheduling the work caused extended sampler timers (approximately 192 hours were noted rather than the typical 168 hours).

2. IR 4243360 ODCM Drinking Water Compositor, CL-14, Outage
   04/24/2019 - During the 12kV outage, the ODCM drinking water compositor CL-14 located in the Service Building was secured on 4/18/19 at 07:58. Securing the compositor does not allow the 20 mL per hour sample to be obtained. On 04/24/19, the Environmental Inc. sampling vendor collected the monthly composite sample but had to take an additional grab sample to make up for the missed 20 mL per hour samples since the outage began. The sample volume is adequate for proper analysis, but this additional grab sample does not constitute as a 'composite' sample since it was not obtained over a period of time.

3. IR 4245299 Non-ODCM CL-99 Water Compositor Found Flooded
   05/01/2019 - During the weekly inspection of the water compositors, the sampling vendor from Environmental Inc. identified the non-ODCM water compositor and access point flooded. CL-99 is located approximately 3.5 miles upstream from the station and serves as an additional control (background) water sampler to make comparisons against the ODCM Composite Sampler CL-90. This affected the May composite sample, and a subsequent grab sample was obtained once the waters resided.

4. IR4252847 Duplicate TLD Not Received From Vendor & Compositor Repair Impact on April CL-91 Composite Sample
   05/30/2019 - When performing the quarterly TLD exchange, it was noted that there was only one TLD allocated for location CL-01 from the vendor, Landauer. CL-01 is an ODCM required location approximately 1.8 miles W of the station. Typically, there are two TLDs allocated and placed at each monitoring location. Since there was only one for CL-01, the sampling vendor was instructed to replace the

second missing TLD with the TLD labeled Spare-01. Both TLDs (one labeled CL-01 and one labeled Spare-01) were placed out in the field at the same time, so there should be no impacts to the dose collected. Four spare TLDs are sent each quarter from the vendor for situations as this where replacement of TLDs is required.

Also, when performing the weekly water compositor check, water compositor CL-91 was sent off for repair during the weekly compositor inspection. CL-91 is an ODCM required upstream surface water sampler located 6.1 miles ENE of the station that collects 20 mL aliquots every hour throughout the month. The repairs took two weeks, so grab samples were obtained on 4/03/2019 and 4/10/2019. The April composite sample will not meet the definition of a composite sample due to the grabs taken on these dates.

5. IR4268503 ODCM Air Samplers CL-2 and CL-3 Loss of Power
   7/31/2019 - During the weekly ODCM air sampling surveillance on Wednesday, 7/31/19, the Environmental Inc. sampling vendor identified that two ODCM sample compositors CL-2 (location off of the main access road) and CL-3 (location on wren road) had no power. The timer and pump were off indicating power outage at the location. Collection was adequate for sample analysis.

6. IR 4268685 ODCM: Insufficient Vegetation for the July, 2019 REMP Sampling
   7/31/2019 - During the vegetation sampling on 07/31/19, the vendor collector could not obtain enough cabbage sample for the July monthly sample at CL-114. The vendor was able to obtain the little amount of cabbage that was left and gathered extra lettuce as a substitute to complete the amount of vegetation required for analysis.

7. IR 4270243 ODCM Water Compositor CL-91 Found with Jammed Pump
   08/07/2019 - While performing weekly checks of the supplemental ODCM water compositors, CL-91, the vendor found that the pump had jammed and needed to be replaced. The vendor replaced the pump but had to obtain a supplemental grab sample from the process stream to add to the monthly collection container.

8. IR 4282220 ODCM: Insufficient Vegetation for September, 2019 REMP Sampling
   09/25/2019 - During the September vegetation sampling, the vendor collector was required to obtain substitute samples. Since September is the end of harvest season, three differing types of broadleaves could not be collected at the sampling locations, CL-114, CL-115, CL-117 and CL-118. Enough sample was obtained at each location for analysis, but not all gardens had three differing types of broadleaf

vegetation as required.

9. IR 4293189 ODCM Water Compositor CL-90 Found Without Power
   10/30/2019 - The Environmental Inc. vendor notified chemistry management on that CL-90 water compositor did not have power. The vendor was able to obtain the required amount of weekly sample for the week of 10/30/19, but the power needed to be restored.

10. IR 4295194 ODCM Water Compositor CL-90 Sample Volume Less Than Adequate
    11/06/2019 - During the weekly checks of the ODCM water compositor CL-90, located 0.4 miles SE downstream from the station, the vendor observed the compositor to have less than the weekly composite sample collection volume for the monthly analysis. A supplemental grab sample was obtained from the process stream and added to the monthly collection container. The cause for the less than normal weekly compositor collection was due to two power outages at the flume detox building between 10/30/19 to 11/01/19 (reference work order 4975036 and IR 4292855) that also caused a power outage at the CL-90 ODCM water compositor that are fed from the same power source. Power was restored prior to the following sampling collection.

11. IR 4298823 ODCM and Non-ODCM Air Sampler Issues
    11/20/2019 - During the weekly ODCM air sampling surveillance on Wednesday, 11/20/19, the Environmental Inc. sampling vendor identified that all the samples were satisfactory except for CL-1 and CL-94. CL-1 is located approximately 1.8 miles west of the plant near the gate to Camp Quest south of Birkbeck. CL-1 had a timer shortage due to a power outage on Sunday, 11/17/19. The sample was still enough for analysis. CL-94 also had a timer shortage, but sufficient sample was obtained for analysis.

Throughout 2019, the following IRs were generated to document Program exceptions that were entered into the corrective action program for trending purposes.

Missed Samples

1. IR 4216350 No Sample Obtained at CL-13 Surface Water
   01/31/19 - While performing Surface Water Sampling WO 4870408, the sample at the non-ODCM location CL-13, was not obtained due to a frozen lake. CL-13 is a monthly surface water grab sample located approximately 3.6 miles SW of t the plant off of Salt Creek Bridge.

2. IR 4298823 ODCM and Non-ODCM Air Sampler Issues
   11/20/2019 - During the weekly ODCM air sampling surveillance on Wednesday, 11/20/19, the Environmental Inc. sampling vendor

identified that CL-11 was found with the power cord ajar. The vendor plugged in the power cord and it is now working, but the weekly sample could not be obtained. CL-11 is located approximately 16 miles south of the plant.

Program exceptions were reviewed to understand the causes of the exception and to return to ODCM sample compliance before the next sampling frequency period.

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

E. Program Changes

There were no program changes in 2019.

IV. Results and Discussion

A. Aquatic Environment

1. Surface Water

Composite samples were taken hourly at three locations (CL-90, CL-91 and CL-99) on a monthly schedule and grab samples were taken monthly from one location (CL-13). The following analyses were performed:

Iodine-131

Monthly samples from location CL-90 were analyzed for I-131 activity (Table C-I.1, Appendix C). No I-131 was detected in any samples and the required LLD was met.

Tritium

Monthly samples from all locations were composited quarterly and analyzed for tritium activity (Table C–I.2, Appendix C). No tritium was detected in any samples and the required LLD was met.

Gamma Spectrometry

Samples from all locations were analyzed for gamma-emitting nuclides (Table C–I.3, Appendix C). No plant-produced radionuclides were detected and all required LLDs were met.

2. Drinking Water

Monthly composite samples were taken hourly at one location (CL-14). The following analyses were performed:

Gross Beta

Monthly samples were analyzed for concentrations of gross beta (Tables C–II.1, Appendix C). No gross beta was detected in any of the samples.

Tritium

Monthly samples were composited quarterly and analyzed for tritium activity (Table C–II.2, Appendix C). No tritium was detected in any samples and the required LLD was met.

Iodine-131

Monthly samples from location CL-14 were analyzed for I-131 activity (Table C-II.3, Appendix C). No I-131 was detected in any samples and the required LLD was met.

Gamma Spectrometry

Monthly samples were analyzed for gamma-emitting nuclides (Table C–II.4, Appendix C). No plant-produced radionuclides were detected and all required LLDs were met.

3. Well Water

Quarterly grab samples were collected at two locations (CL-07D and CL-12, consisting of CL-12R [a raw water sample from this well] and CL-12T [same well water, but after treatment and available for consumption]). The following analyses were performed:

Tritium

Samples from all locations were analyzed for tritium activity. No tritium was detected in any samples and the required LLD was met. (Table C–III.1, Appendix C)

Gamma Spectrometry

Samples from all locations were analyzed for gamma-emitting

nuclides. No plant-produced radionuclides were detected and all required LLDs were met. (Table C–III.2, Appendix C)

4. Fish

Fish samples comprised of largemouth bass, channel catfish, bluegill, carp, white crappies and white bass were collected at two locations (CL-19 and CL-105) semiannually. The following analysis was performed:

Gamma Spectrometry

The edible portion of fish samples from both locations was analyzed for gamma-emitting nuclides. No plant-produced radionuclides were detected and all required LLDs were met. (Table C–IV.1, Appendix C)

5. Shoreline Sediment

Aquatic shoreline sediment samples were collected at CL-07B and CL-105 semiannually. The following analysis was performed:

Gamma Spectrometry

Shoreline sediment samples were analyzed for gamma-emitting nuclides. No plant-produced radionuclides were detected and all required LLDs were met. (Table C–V.1, Appendix C)

B. Atmospheric Environment

1. Airborne

a. Air Particulates

Continuous air particulate samples were collected from 10 locations on a weekly basis. The 10 locations were separated into three groups: Group I represents locations within one mile of the CPS site boundary (CL-2, CL-3, CL-4, CL-6, CL-15 and CL-94); Group II represents the locations at an intermediate distance within one to five miles of CPS (CL-1, CL-7 and CL-8); and Group III represents the control location greater than five miles from CPS (CL-11). The following analyses were performed:

Gross Beta

Weekly samples were analyzed for concentrations of beta emitters (Table C–VI.1 and C–VI.2 and Figure C–1,

Appendix C). Detectable gross beta activity was observed at all locations. Comparison of results among the three groups aid in determining the effects, if any, resulting from the operation of CPS. The results from the On-Site locations (Group I) ranged from 5 to 31 E–3 pCi/m^3 with a mean of 16 E–3 pCi/m^3. The results from the Intermediate Distance location (Group II) ranged from 7 to 29 E–3 pCi/m^3 with a mean of 15 E–3 pCi/m^3. The results from the Control locations (Group III) ranged from 6 to 32 E–3 pCi/m^3 with a mean of 16 E–3 pCi/m^3. Comparison of the 2019 air particulate data with previous years' data indicate no measurable impact from the operation of CPS. In addition, a comparison of the weekly mean values for 2019 indicate no notable differences among the three groups.

Gamma Spectrometry

Weekly samples were composited quarterly and analyzed for gamma-emitting nuclides. No plant-produced radionuclides were detected and all required LLDs were met.
(Table C–VI.3, Appendix C)

b. Airborne Iodine

Continuous air samples were collected from 10 locations (CL-1, CL-2, CL-3, CL-4, CL-6, CL-7, CL-8, CL-11, CL-15 and CL-94) and analyzed weekly for I-131. All results were less than the MDC and the required LLD was met.
(Table C-VII.1, Appendix C)

2. Terrestrial

a. Milk

Samples were collected from CL-116 biweekly May through October to coincide with the grazing season, and monthly November through April. The following analyses were performed:

Iodine-131

Milk samples were analyzed for concentrations of I-131 Iodine-131 was not detected in any of the samples. The required LLD was met. (Table C–VIII.1, Appendix C).

Gamma Spectrometry

Each milk sample was analyzed for concentrations of gamma-

emitting nuclides. Naturally-occurring K-40 activity was found in all samples. No plant-produced radionuclides were detected and all required LLDs were met. (Table C–VIII.2, Appendix C)

b. Food Products

Broadleaf vegetation samples were collected from four locations (CL-114, CL-115, CL-117 and CL-118) monthly June through September to coincide with the harvest season. The following analysis was performed:

Gamma Spectrometry

Each food product sample was analyzed for concentrations of gamma-emitting nuclides. No plant-produced radionuclides were detected and all required LLDs were met. (Table C–IX.1, Appendix C)

c. Grass

Samples were collected from four locations (CL-1, CL-2, CL-8, and CL-116) biweekly May through October. The following analysis was performed:

Gamma Spectrometry

Each grass sample was analyzed for concentrations of gamma-emitting nuclides. No plant-produced radionuclides were detected and all required LLDs were met. (Table C–IX.2, Appendix C)

C. Ambient Gamma Radiation

Ambient gamma radiation levels were measured utilizing DLRs. Fifty-four DLR locations were established around the site. Results of DLR measurements are listed in Tables C–X.1 to C–X.3, Appendix C.

A total of 216 OSLD measurements were made in 2019. The average dose from the inner ring was 18.9 mRem/quarter. The average dose from the outer ring was 19.3 mRem/quarter. The average dose from the special interest group was 18.9 mRem/quarter. The average dose from the supplemental group was 17.8 mRem/quarter. The quarterly measurements ranged from 13.5 to 23.6 mRem/quarter.

The inner ring and outer ring measurements compared well to the Control Station, CL-11, which ranged from 15.9 to 18.6 mRem/quarter with an average measurement of 17.4 mRem/quarter. A comparison of the Inner

Ring and Outer Ring data to the Control Location data indicate that the ambient gamma radiation levels from all the locations were comparable. The historical ambient gamma radiation data from the control location were plotted along with similar data from the Inner and Outer Ring Locations (Figure C–2, Appendix C).

D. Independent Spent Fuel Storage Installation (ISFSI)

Ambient gamma radiation levels were measured utilizing DLRs. Fifty-four DLR locations were established around the site, which encompasses the ISFSI pad. ISFSI dose contribution is in the form of direct radiation as no liquid or gas releases are expected to occur. Results of DLR measurements are listed in Table C-X.1, Appendix C.

E. Land Use Survey

The Annual Land Use Survey conducted during the growing season around the Clinton Power Station (CPS) was performed by Environmental Inc. (Midwest Labs) for Exelon to comply with Clinton's Offsite Dose Calculation Manual, section 8.0. The report to CPS was dated December, 18, 2019. The purpose of the survey was to document the nearest resident, milk-producing animal and garden of greater than 50 m^2 in each of the sixteen 22 ½ degree sectors around the site. The distance and direction of all locations from the CPS Station HVAC vent stack were positioned using Global Positioning System (GPS) technology. There were no changes required to the CPS REMP as a result of the Land Use Survey. The results of this survey are summarized below:

	Distance in Kilometers from the CPS Station HVAC Vent Stack		
Sector	Residence (km)	Garden (km)	Milk Animal (km)
1 N	1.5	1.5	1.5
2 NNE	1.5	> 8	> 8
3 NE	2.1	3.5	> 8
4 ENE	2.9	4.3	> 8
5 E	1.7	1.7	> 8
6 ESE	5.1	7.7	> 8
7 SE	4.4	> 8	> 8
8 SSE	2.9	> 8	> 8
9 S	4.8	> 8	6.6
10 SSW	4.7	> 8	> 8
11 SW	1.2	> 8	> 8
12 WSW	3.6	4.3	4.3
13 W	2.0	> 8	> 8
14 WNW	2.6	> 8	> 8
15 NW	2.7	4.7	> 8
16 NNW	2.1	2.1	2.1

F. Errata Data

There was no errata data for 2019.

G. Summary of Results – Inter-Laboratory Comparison Program

The TBE Laboratory analyzed Performance Evaluation (PE) samples of air particulate, air iodine, milk, soil, vegetation, and water matrices for various analytes. The PE samples supplied by Analytics Inc., Environmental Resource Associates (ERA) and Department of Energy (DOE) Mixed Analyte Performance Evaluation Program (MAPEP), were evaluated against the following pre-set acceptance criteria:

A. 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 evaluates the reported ratios based on internal QC requirements based on the DOE MAPEP criteria.

B. 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, National Environmental Laboratory Accreditation Conference (NELAC), state-specific Performance Testing (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.

C. DOE Evaluation Criteria

MAPEP's evaluation report provides an acceptance range with associated flag values. MAPEP defines three levels of performance:

- Acceptable (flag = "A") - result within ± 20% of the reference value
- Acceptable with Warning (flag = "W") - result falls in the ± 20% to ± 30% of the reference value
- Not Acceptable (flag = "N") – bias is greater than 30% of the reference value

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

environmental samples obtained at commercial nuclear power facilities.

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

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

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

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

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

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

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

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

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

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

10. The Analytics September 2019 soil Cr-51 sample was evaluated as *Not Acceptable*. TBE's reported result of 0.765 ± 0.135 pCi/g exceeded the upper acceptance range (140% of the known result of 0.547 pCi/g). The TBE result was within the acceptable range (0.63 - 0.90 pCi/g) with the associated error. The Cr-51 result is very close to TBE's normal detection limit. In order to get a reportable result, the sample must be counted for 15 hours (10x longer than client

samples). There is no client or regulatory requirement for this nuclide and TBE will remove Cr-51 from the reported gamma nuclides going forward. (NCR 19-27)

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

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13. National Council on Radiation Protection and Measurements, Report No. 91, "Recommendations on Limits for Exposure to Ionizing Radiation," June 1987.

14. National Council on Radiation Protection and Measurements, Report No. 93, "Ionizing Radiation Exposure of the Population of the United States," September 1987.

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19. United States Nuclear Regulatory Commission Branch Technical Position, "An Acceptable Radiological Environmental Monitoring Program," Revision 1, November 1979.

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21. Technical Specifications, Clinton Power Station, Unit No. 1, Docket No. 50-461, Office of Nuclear Reactor Regulation, 1986. Facility Operating License Number NPF-62.

22. Clinton Power Station, Updated Safety Analysis Report.

23. Clinton Power Station, Unit 1, Off-Site Dose Calculation Manual.

APPENDIX A

RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT SUMMARY

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TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR THE CLINTON POWER STATION, 2019

NAME OF FACILITY:	CLINTON POWER STATION			DOCKET NUMBER:	50-461		
LOCATION OF FACILITY:	DEWITT COUNTY IL			REPORTING PERIOD:	2019		

MEDIUM OR PATHWAY SAMPLED *(UNIT OF MEASUREMENT)*	TYPES OF ANALYSIS PERFORMED	NUMBER OF ANALYSIS PERFORMED	REQUIRED LOWER LIMIT OF DETECTION (LLD)	INDICATOR LOCATIONS MEAN (M) (F) *RANGE*	CONTROL LOCATION MEAN (M) (F) *RANGE*	LOCATION WITH HIGHEST ANNUAL MEAN (M) MEAN (M) (F) *RANGE*	**STATION # NAME** DISTANCE AND DIRECTION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
SURFACE WATER *(PCI/LITER)*	**I-131 (LOW LVL)**	12	**1**	<LLD	NA			0
	H-3	16	**2000**	<LLD	<LLD	-		0
	GAMMA	47						
	MN-54		**15**	<LLD	<LLD	-		0
	CO-58		**15**	<LLD	<LLD	-		0
	FE-59		**30**	<LLD	<LLD	-		0
	CO-60		**15**	<LLD	<LLD	-		0
	ZN-65		**30**	<LLD	<LLD	-		0
	NB-95		**15**	<LLD	<LLD	-		0
	ZR-95		**30**	<LLD	<LLD	-		0
	CS-134		**15**	<LLD	<LLD	-		0
	CS-137		**18**	<LLD	<LLD	-		0
	BA-140		**60**	<LLD	<LLD	-		0
	LA-140		**15**	<LLD	<LLD	-		0
	CE-144		**NA**	<LLD	<LLD	-		0
DRINKING WATER *(PCI/LITER)*	**GR-B**	12	**4**	<LLD	*NA*	-		0
	H-3	4	**2000**	<LLD	*NA*	-		0
	I-131 (LOW LVL)	12	**1**	<LLD	*NA*	-		0
	GAMMA	12						
	MN-54		**15**	<LLD	*NA*	-		0
	CO-58		**15**	<LLD	*NA*	-		0
	FE-59		**30**	<LLD	*NA*	-		0
	CO-60		**15**	<LLD	*NA*	-		0
	ZN-65		**30**	<LLD	*NA*	-		0
	NB-95		**15**	<LLD	*NA*	-		0
	ZR-95		**30**	<LLD	*NA*	-		0
	CS-134		**15**	<LLD	*NA*	-		0
	CS-137		**18**	<LLD	*NA*	-		0
	BA-140		**60**	<LLD	*NA*	-		0
	LA-140		**15**	<LLD	*NA*	-		0
	CE-144		*NA*	<LLD	*NA*	-		0

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

TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR THE CLINTON POWER STATION, 2019

NAME OF FACILITY:	CLINTON POWER STATION			DOCKET NUMBER:		50-461		
LOCATION OF FACILITY:	DEWITT COUNTY IL			REPORTING PERIOD:		2019		
				INDICATOR LOCATIONS	CONTROL LOCATION	LOCATION WITH HIGHEST ANNUAL MEAN (M)		
MEDIUM OR PATHWAY SAMPLED *(UNIT OF MEASUREMENT)*	TYPES OF ANALYSIS PERFORMED	NUMBER OF ANALYSIS PERFORMED	REQUIRED LOWER LIMIT OF DETECTION (LLD)	MEAN (M) (F) *RANGE*	MEAN (M) (F) *RANGE*	MEAN (M) (F) *RANGE*	**STATION # NAME** DISTANCE AND DIRECTION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
WELL WATER *(PCI/LITER)*	**H-3**	12	**2000**	<LLD	*NA*	-		0
	GAMMA	12						
	MN-54		**15**	<LLD	*NA*	-		0
	CO-58		**15**	<LLD	*NA*	-		0
	FE-59		**30**	<LLD	*NA*	-		0
	CO-60		**15**	<LLD	*NA*	-		0
	ZN-65		**30**	<LLD	*NA*	-		0
	NB-95		**15**	<LLD	*NA*	-		0
	ZR-95		**30**	<LLD	*NA*	-		0
	CS-134		**15**	<LLD	*NA*	-		0
	CS-137		**18**	<LLD	*NA*	-		0
	BA-140		**60**	<LLD	*NA*	-		0
	LA-140		**15**	<LLD	*NA*	-		0
	CE-144		*NA*	<LLD	*NA*	-		0
FISH *(PCI/KG WET)*	**GAMMA**	16						
	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
	NB-95		*NA*	<LLD	<LLD	-		0
	ZR-95		*NA*	<LLD	<LLD	-		0
	CS-134		**130**	<LLD	<LLD	-		0
	CS-137		**150**	<LLD	<LLD	-		0
	BA-140		*NA*	<LLD	<LLD	-		0
	LA-140		*NA*	<LLD	<LLD	-		0
	CE-144		*NA*	<LLD	<LLD	-		0

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

TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR THE CLINTON POWER STATION, 2019

NAME OF FACILITY:	**CLINTON POWER STATION**			**DOCKET NUMBER:**		**50-461**		
LOCATION OF FACILITY:	**DEWITT COUNTY IL**			**REPORTING PERIOD:**		**2019**		
MEDIUM OR PATHWAY SAMPLED *(UNIT OF MEASUREMENT)*	TYPES OF ANALYSIS PERFORMED	NUMBER OF ANALYSIS PERFORMED	REQUIRED LOWER LIMIT OF DETECTION (LLD)	**INDICATOR LOCATIONS** MEAN (M) (F) *RANGE*	**CONTROL LOCATION** MEAN (M) (F) *RANGE*	**LOCATION WITH HIGHEST ANNUAL MEAN (M)** MEAN (M) (F) *RANGE*	**STATION #** **NAME** DISTANCE AND DIRECTION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
SEDIMENT	**GAMMA**	4						
(PCI/KG DRY)	*MN-54*		*NA*	<LLD	<LLD	-		0
	CO-58		*NA*	<LLD	<LLD	-		0
	FE-59		*NA*	<LLD	<LLD	-		0
	CO-60		*NA*	<LLD	<LLD	-		0
	ZN-65		*NA*	<LLD	<LLD	-		0
	NB-95		*NA*	<LLD	<LLD	-		0
	ZR-95		*NA*	<LLD	<LLD	-		0
	CS-134		**150**	<LLD	<LLD	-		0
	CS-137		**180**	<LLD	<LLD	-		0
	BA-140		*NA*	<LLD	<LLD	-		0
	LA-140		*NA*	<LLD	<LLD	-		0
	CE-144		*NA*	<LLD	<LLD	-		0
AIR PARTICULATE	**GR-B**	519	**10**	16 (467/468) *5 - 31*	16 (51/51) *6 - 32*	16 (51/51) *6 - 32*	CL-11 CONTROL ILLINOIS POWER SUBSTATION 16 MILES S OF SITE	0
(E-3 PCI/CU.METER)								
	GAMMA	40						
	CO-60		*NA*	<LLD	<LLD	-		0
	NB-95		*NA*	<LLD	<LLD	-		0
	ZR-95		*NA*	<LLD	<LLD	-		0
	RU-103		*NA*	<LLD	<LLD	-		0
	RU-106		*NA*	<LLD	<LLD	-		0
	CS-134		**50**	<LLD	<LLD	-		0
	CS-137		**60**	<LLD	<LLD	-		0
	CE-141		*NA*	<LLD	<LLD	-		0
	CE-144		*NA*	<LLD	<LLD	-		0
AIR IODINE	**GAMMA**	519						
(E-3 PCI/CU.METER)	*I-131*		**70**	<LLD	<LLD	-		0

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

TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR THE CLINTON POWER STATION, 2019

NAME OF FACILITY:	CLINTON POWER STATION			DOCKET NUMBER:	50-461		
LOCATION OF FACILITY:	DEWITT COUNTY IL			REPORTING PERIOD:	2019		

MEDIUM OR PATHWAY SAMPLED *(UNIT OF MEASUREMENT)*	TYPES OF ANALYSIS PERFORMED	NUMBER OF ANALYSIS PERFORMED	REQUIRED LOWER LIMIT OF DETECTION (LLD)	INDICATOR LOCATIONS MEAN (M) (F) *RANGE*	CONTROL LOCATION MEAN (M) (F) *RANGE*	LOCATION WITH HIGHEST ANNUAL MEAN (M) MEAN (M) (F) *RANGE*	LOCATION WITH HIGHEST ANNUAL MEAN (M) STATION # NAME DISTANCE AND DIRECTION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
MILK	**I-131 (LOW LVL)**	19	1	*NA*	<LLD	-		0
(PCI/LITER)								
	GAMMA	19						
	K-40		*NA*	*NA*	1031 (19/19) 614 - 1302	1031 (19/19) 614 - 1302	CL-116 CONTROL DEMENT DAIRY 14 MILES WSW OF SITE	0
	MN-54		*NA*	*NA*	<LLD	-		0
	CO-58		*NA*	*NA*	<LLD	-		0
	FE-59		*NA*	*NA*	<LLD	-		0
	CO-60		*NA*	*NA*	<LLD	-		0
	ZN-65		*NA*	*NA*	<LLD	-		0
	NB-95		*NA*	*NA*	<LLD	-		0
	ZR-95		*NA*	*NA*	<LLD	-		0
	CS-134		**15**	*NA*	<LLD	-		0
	CS-137		**18**	*NA*	<LLD	-		0
	BA-140		**60**	*NA*	<LLD	-		0
	LA-140		**15**	*NA*	<LLD	-		0
	CE-144		*NA*	*NA*	<LLD	-		0
VEGETATION	**GAMMA**	48						
(PCI/KG WET)	*MN-54*		*NA*	<LLD	<LLD	-		0
	CO-58		*NA*	<LLD	<LLD	-		0
	FE-59		*NA*	<LLD	<LLD	-		0
	CO-60		*NA*	<LLD	<LLD	-		0
	ZN-65		*NA*	<LLD	<LLD	-		0
	NB-95		*NA*	<LLD	<LLD	-		0
	ZR-95		*NA*	<LLD	<LLD	-		0
	I-131		**60**	<LLD	<LLD	-		0
	CS-134		**60**	<LLD	<LLD	-		0
	CS-137		**80**	<LLD	<LLD			0
	BA-140		*NA*	<LLD	<LLD	-		0
	LA-140		*NA*	<LLD	<LLD	-		0
	CE-144		*NA*	<LLD	<LLD	-		0

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

TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR THE CLINTON POWER STATION, 2019

NAME OF FACILITY:	CLINTON POWER STATION			DOCKET NUMBER:	50-461			
LOCATION OF FACILITY:	DEWITT COUNTY IL			REPORTING PERIOD:	2019			
				INDICATOR	CONTROL	LOCATION WITH HIGHEST ANNUAL MEAN (M)		
MEDIUM OR PATHWAY SAMPLED *(UNIT OF MEASUREMENT)*	TYPES OF ANALYSIS PERFORMED	NUMBER OF ANALYSIS PERFORMED	REQUIRED LOWER LIMIT OF DETECTION (LLD)	LOCATIONS MEAN (M) (F) *RANGE*	LOCATION MEAN (M) (F) *RANGE*	MEAN (M) (F) *RANGE*	**STATION # NAME** DISTANCE AND DIRECTION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GRASS	**GAMMA**	52						
(PCI/KG WET)	*MN-54*		*NA*	<LLD	<LLD	-		0
	CO-58		*NA*	<LLD	<LLD	-		0
	FE-59		*NA*	<LLD	<LLD	-		0
	CO-60		*NA*	<LLD	<LLD	-		0
	ZN-65		*NA*	<LLD	<LLD	-		0
	NB-95		*NA*	<LLD	<LLD	-		0
	ZR-95		*NA*	<LLD	<LLD	-		0
	I-131		**60**	<LLD	<LLD	-		0
	CS-134		**60**	<LLD	<LLD	-		0
	CS-137		**80**	<LLD	<LLD	-		0
	BA-140		*NA*	<LLD	<LLD	-		0
	LA-140		*NA*	<LLD	<LLD	-		0
	CE-144		*NA*	<LLD	<LLD	-		0
DIRECT RADIATION	**OSLD-QUARTERLY**	216	*NA*	18.7	17.4	21.2	CL-65 INDICATOR	0
(MILLI-ROENTGEN/QTR.)				(212/212)	(4/4)	(4/4)		
				13.5 - 23.6	*159 - 18.6*	*19.9 - 22.2*	2.6 MILES ENE	

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

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APPENDIX B

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

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TABLE B-1: Radiological Environmental Monitoring Program - Sampling Locations, Distance and Direction
Clinton Power Station, 2019

Location	Location Description	Distance & Direction From Site
A. Surface Water		
CL-13	Salt Creek Bridge on Rt. 10 (indicator)	3.6 miles SW
CL-90	Discharge Flume (indicator)	0.4 miles SE
CL-91	Parnell Boat Access (control)	6.1 miles ENE
CL-99	North Fork Access (control)	3.5 miles NNE
B. Drinking (Potable) Water		
CL-14	Station Plant Service Bldg (indicator)	Onsite
C. Well Water		
CL-7D	Mascoutin Recreation Area (indicator)	2.3 miles ESE
CL-12T	DeWitt Pump House (indicator)	1.6 miles E
CL-12R	DeWitt Pump House (indicator)	1.6 miles E
D. Milk - bi-weekly / monthly		
CL-116	Dement Dairy (control)	14 miles WSW
E. Air Particulates / Air Iodine		
CL-1	Camp Quest	1.8 miles W
CL-2	Clinton's Main Access Road	0.7 miles NNE
CL-3	Clinton's Secondary Access Road	0.7 miles NE
CL-4	Residence Near Recreation Area	0.8 miles SW
CL-6	Clinton's Recreation Area	0.7 miles WSW
CL-7	Mascoutin Recreation Area	2.3 miles SE
CL-8	DeWitt Cemetery	2.2 miles E
CL-11	Illinois Power Substation (control)	16 miles S
CL-15	Rt. 900N Residence	0.9 miles N
CL-94	Old Clinton Road	0.6 miles E
F. Fish		
CL-19	End of Discharge Flume (indicator)	3.4 miles E
CL-105	Lake Shelbyville (control)	50 miles S
G. Shoreline Sediment		
CL-7B	Clinton Lake (indicator)	2.1 miles SE
CL-105	Lake Shelbyville (control)	50 miles S
H. Food Products		
CL-114	Residence SSE of Site (Control)	12.5 miles SSE
CL-115	Site's Secondary Access Road	0.7 miles NE
CL-117	Residence North of Site	0.9 miles N
CL-118	Site's Main Access Road	0.7 miles NNE
I. Grass		
CL-1	Camp Quest	1.8 miles W
CL-2	Clinton's Main Access Road	0.7 miles NNE
CL-8	DeWitt Cemetery	2.2 miles E
CL-116	Pasture in Rural Kenney (control)	14 miles WSW

TABLE B-1: Radiological Environmental Monitoring Program - Sampling Locations, Distance and Direction
Clinton Power Station, 2019

Location	Location Description	Distance & Direction From Site
J. Environmental Dosimetry - DLR		
Inner Ring		
CL-1		1.8 miles W
CL-5		0.7 miles NNE
CL-22		0.6 miles NE
CL-23		0.5 miles ENE
CL-24		0.5 miles E
CL-34		0.8 miles WNW
CL-35		0.7 miles NW
CL-36		0.6 miles N
CL-42		2.8 miles ESE
CL-43		2.8 miles SE
CL-44		2.3 miles SSE
CL-45		2.8 miles S
CL-46		2.8 miles SSW
CL-47		3.3 miles SW
CL-48		2.3 miles WSW
CL-63		1.3 miles NNW
Outer Ring		
CL-51		4.4 miles NW
CL-52		4.3 miles NNW
CL-53		4.3 miles E
CL-54		4.6 miles ESE
CL-55		4.1 miles SE
CL-56		4.1 miles SSE
CL-57		4.6 miles S
CL-58		4.3 miles SSW
CL-60		4.5 miles SW
CL-61		4.5 miles WSW
CL-76		4.6 miles N
CL-77		4.5 miles NNE
CL-78		4.8 miles NE
CL-79		4.5 miles ENE
CL-80		4.1 miles W
CL-81		4.5 miles WNW
Special Interest		
CL-37		3.4 miles N
CL-41		2.4 miles E
CL-49		3.5 miles W
CL-64		2.1 miles WNW
CL-65		2.6 miles ENE
CL-74		1.9 miles W
CL-75		0.9 miles N

TABLE B-1: Radiological Environmental Monitoring Program - Sampling Locations, Distance and Direction
Clinton Power Station, 2019

Location	Location Description	Distance & Direction From Site
J. Environmental Dosimetry – DLR (cont.)		
Supplemental		
CL-2		0.7 miles NNE
CL-3		0.7 miles NE
CL-4		0.8 miles SW
CL-6		0.8 miles WSW
CL-7		2.3 miles SE
CL-8		2.2 miles E
CL-15		0.9 miles N
CL-33		11.7 miles SW
CL-84		0.6 miles E
CL-90		0.4 miles SE
CL-91		6.1 miles ENE
CL-97		10.3 miles SW
CL-99		3.5 miles NNE
CL-114		12.5 miles SE
Control		
CL-11		16 miles S

TABLE B-2: Radiological Environmental Monitoring Program – Summary of Sample Collection and Analytical Methods, Clinton Power Station, 2019

Sample Medium	Analysis	Sampling Method	Analytical Procedure Number
Surface Water	Gamma Spectroscopy	Monthly composite from a continuous water compositor	TBE, TBE-2007 Gamma-Emitting Radioisotope Analysis Env. Inc., SPM-1 Sampling Procedure Manual
Surface Water	Tritium	Quarterly composite from a continuous water compositor	TBE, TBE-2011 Tritium Analysis in Drinking Water by Liquid Scintillation Env. Inc., SPM-1 Sampling Procedure Manual
Surface Water	I-131	Monthly composite from a continuous water compositor	TBE, TBE-2012 Radioiodine in Various Matrices Env. Inc., SPM-1 Sampling Procedure Manual
Drinking Water	Gross Beta	Monthly composite from a continuous water compositor	TBE, TBE-2008 Gross Alpha and/or Gross Beta Activity in Various Matrices Env. Inc., SPM-1 Sampling Procedure Manual
Drinking Water	Gamma Spectroscopy	Monthly composite from a continuous water compositor	TBE, TBE-2007 Gamma-Emitting Radioisotope Analysis Env. Inc., SPM-1 Sampling Procedure Manual
Drinking Water	Tritium	Quarterly composite from a continuous water compositor	TBE, TBE-2011 Tritium Analysis in Drinking Water by Liquid Scintillation Env. Inc., SPM-1 Sampling Procedure Manual
Drinking Water	I-131	Monthly composite from a continuous water compositor	TBE, TBE-2012 Radioiodine in Various Matrices Env. Inc., SPM-1 Sampling Procedure Manual
Well Water	Gamma Spectroscopy	Quarterly composite from a continuous water compositor	TBE, TBE-2007 Gamma-Emitting Radioisotope Analysis Env. Inc., SPM-1 Sampling Procedure Manual
Well Water	Tritium	Quarterly composite from a continuous water compositor	TBE, TBE-2011 Tritium Analysis in Drinking Water by Liquid Scintillation Env. Inc., SPM-1 Sampling Procedure Manual
Fish	Gamma Spectroscopy	Semi-annual samples collected via electroshocking or other techniques	TBE-2007 Gamma-Emitting Radioisotope Analysis Env. Inc., SPM-1 Sampling Procedure Manual
Sediment	Gamma Spectroscopy	Semi-annual grab samples	TBE, TBE-2007 Gamma-Emitting Radioisotope Analysis Env. Inc., SPM-1 Sampling Procedure Manual
Air Particulates	Gross Beta	One-week composite of continuous air sampling through glass fiber filter paper	TBE, TBE-2008 Gross Alpha and/or Gross Beta Activity in Various Matrices Env. Inc., SPM-1 Sampling Procedure Manual
Air Particulates	Gamma Spectroscopy	Quarterly composite of each station	TBE, TBE-2007 Gamma-Emitting Radioisotope Analysis Env. Inc., SPM-1 Sampling Procedure Manual
Air Iodine	Gamma Spectroscopy	One-week composite of continuous air sampling through charcoal filter	TBE, TBE-2007 Gamma-Emitting Radioisotope Analysis Env. Inc., SPM-1 Sampling Procedure Manual
Milk	I-131	Bi-weekly grab sample when cows are on pasture. Monthly all other times	TBE, TBE-2012 Radioiodine in Various Matrices Env. Inc., SPM-1 Sampling Procedure Manual

TABLE B-2: Radiological Environmental Monitoring Program – Summary of Sample Collection and Analytical Methods, Clinton Power Station, 2019

Sample Medium	Analysis	Sampling Method	Analytical Procedure Number
Milk	Gamma Spectroscopy	Bi-weekly grab sample when cows are on pasture. Monthly all other times	TBE-2007 Gamma-Emitting Radioisotope Analysis Env. Inc., SPM-1 Sampling Procedure Manual
Food Products	Gross Beta	Monthly grab June through September	TBE, TBE-2008 Gross Alpha and/or Gross Beta Activity in Various Matrices Env. Inc., SPM-1 Sampling Procedure Manual
Food Products	Gamma Spectroscopy	Monthly grab June through September	TBE, TBE-2007 Gamma-Emitting Radioisotopes Analysis Env. Inc., SPM-1 Sampling Procedure Manual
Grass	Gamma Spectroscopy	Biweekly May through October	TBE, TBE-2007 Gamma-Emitting Radioisotopes Analysis Env. Inc., SPM-1 Sampling Procedure Manual
DLR	Thermo-Luminescence Dosimetry	Quarterly DLRs comprised of two Al_2O_3:C Landauer Incorporated elements	Landauer Incorporated

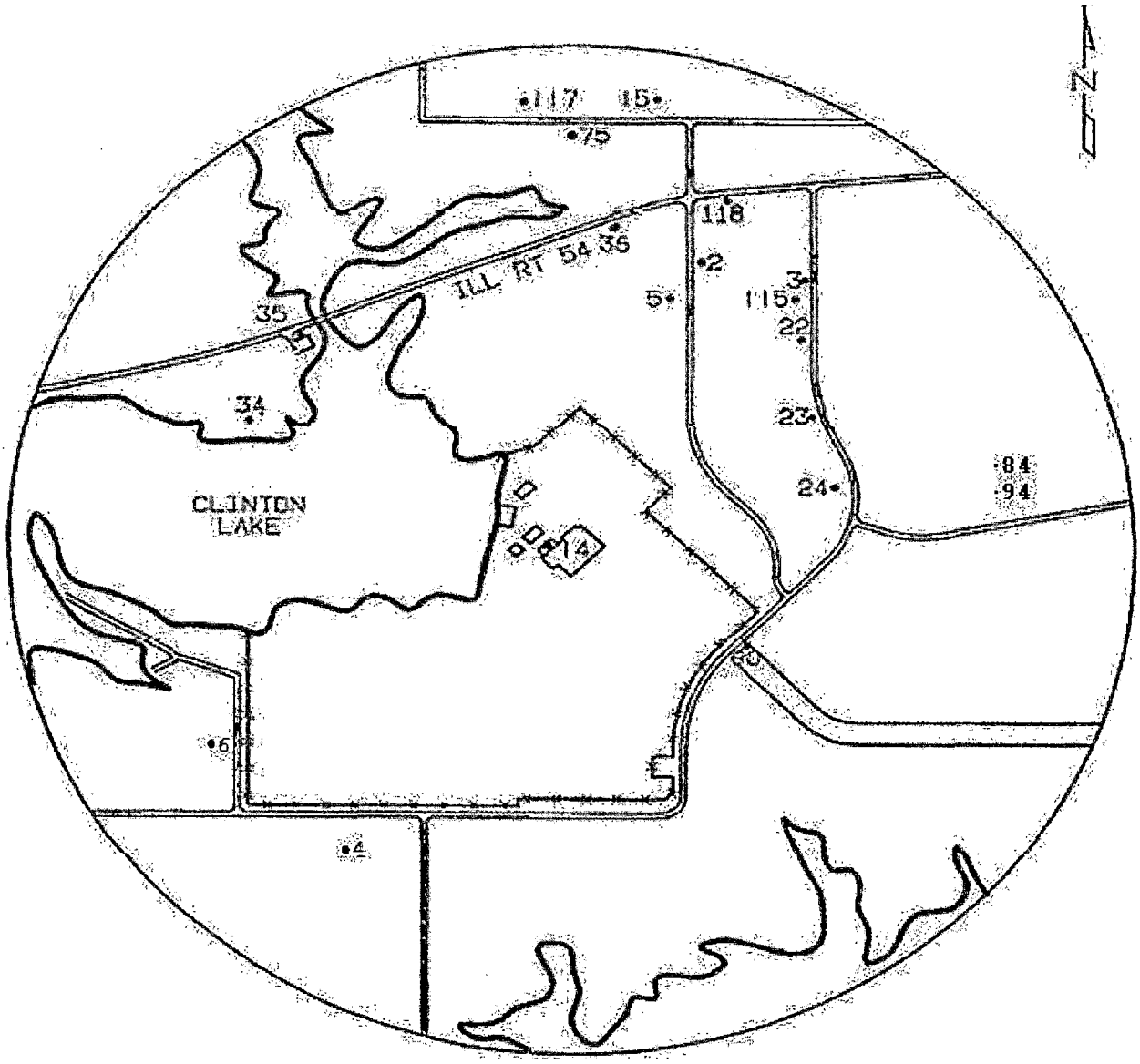

Figure B-1
Environmental Sampling Locations Within One
Mile of the Clinton Power Station, 2019

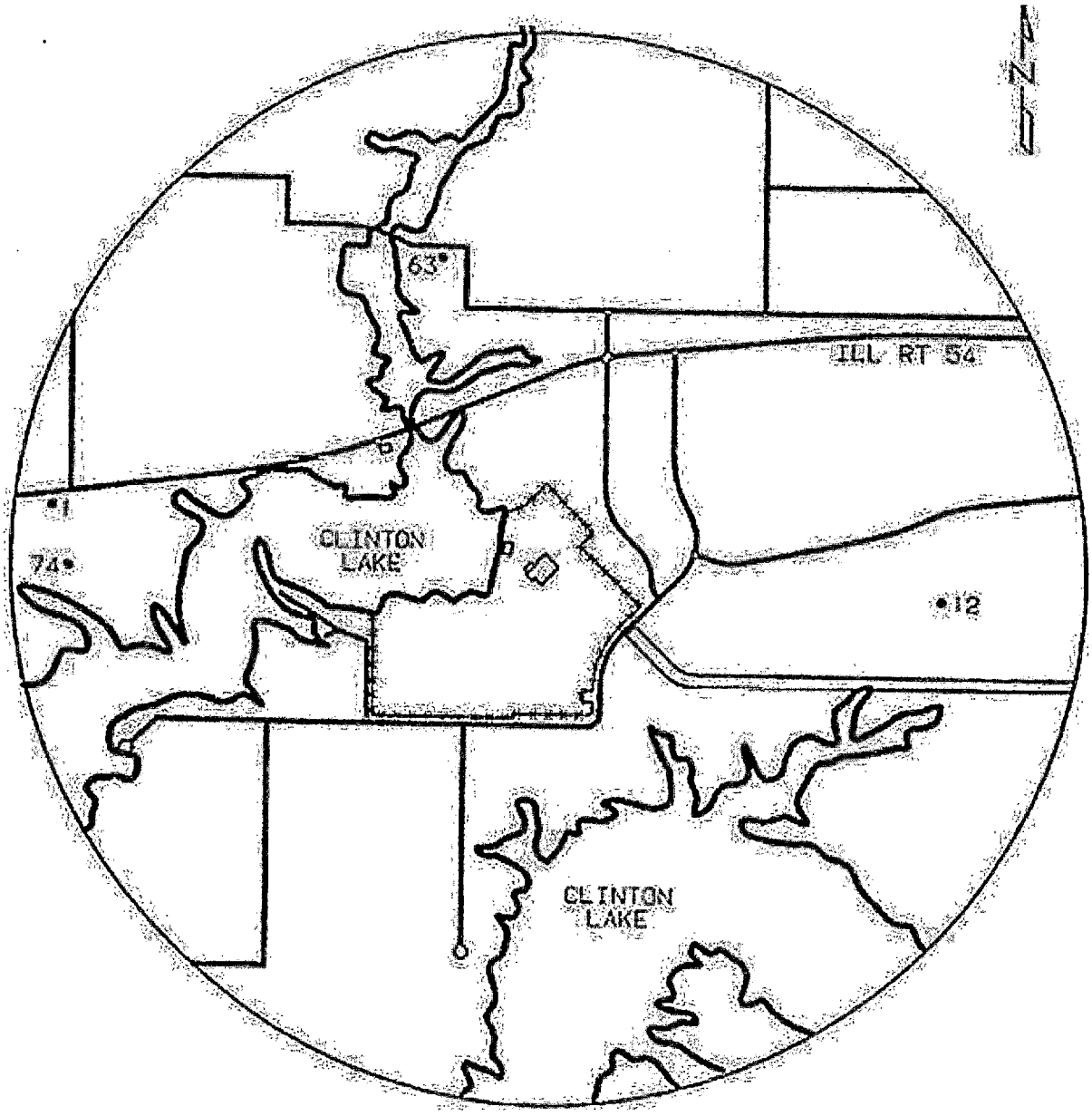

Figure B-2
Environmental Sampling Locations Between One and Two
Miles of the Clinton Power Station, 2019

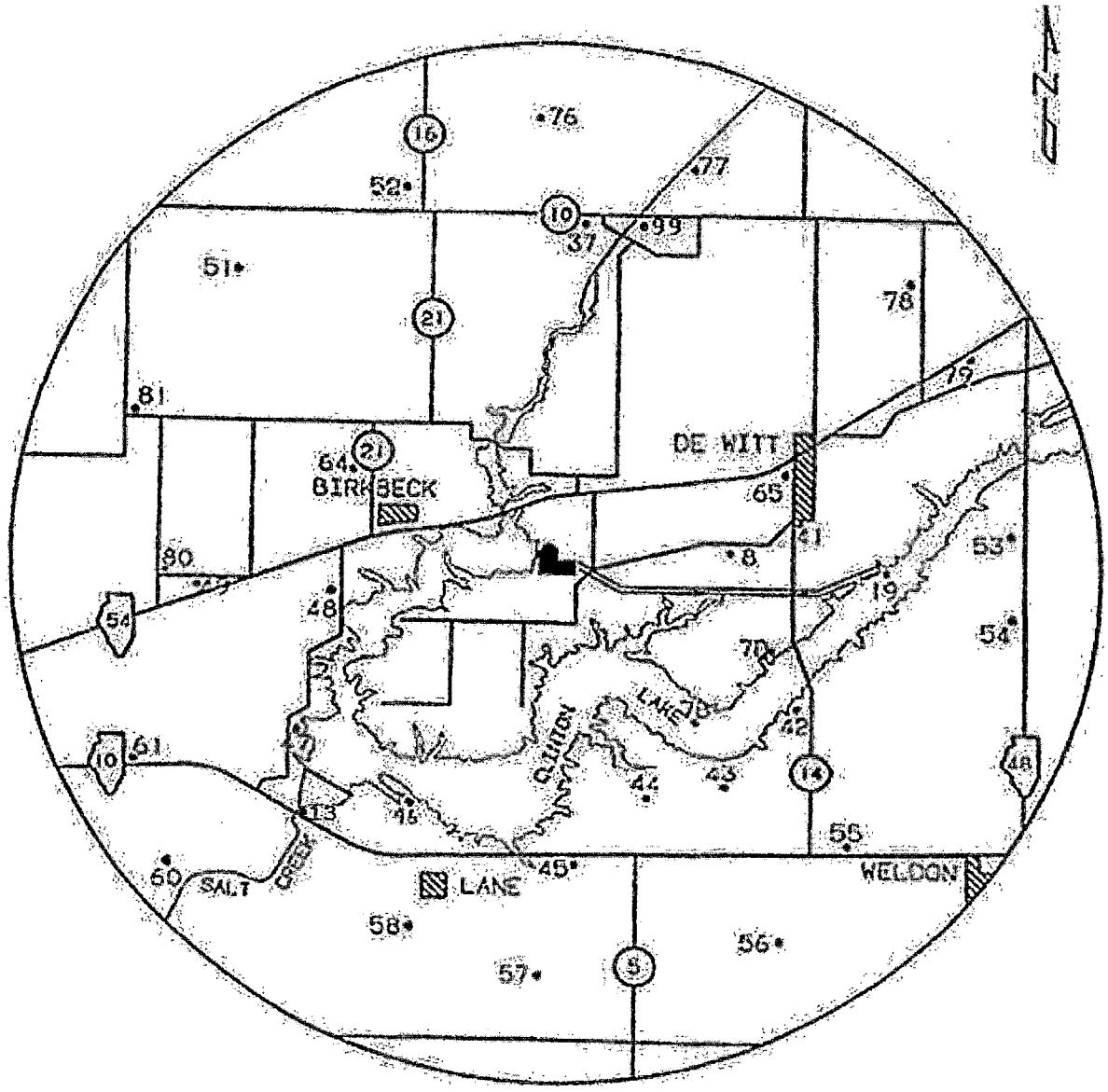

Figure B-3
Environmental Sampling Locations between Two and Five
Miles from the Clinton Power Station, 2019

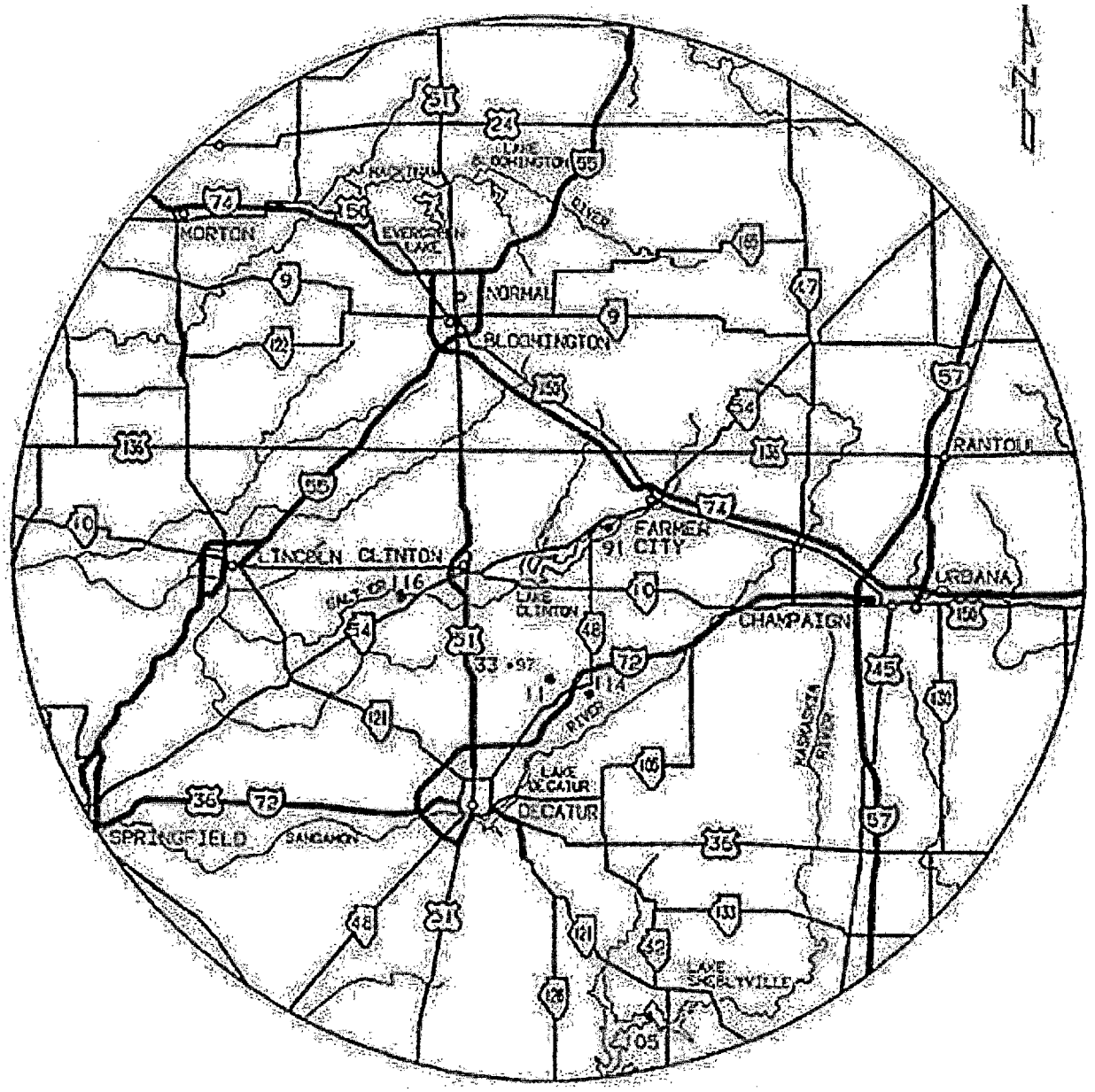

Figure B-4
Environmental Sampling Locations Greater Than Five
Miles of the Clinton Power Station, 2019

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APPENDIX C

DATA TABLES AND FIGURES

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Table C-I.1 **CONCENTRATIONS OF I-131 IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	CL-90
12/26/18 - 01/31/19	< 0.6
01/31/19 - 02/27/19	< 0.7
02/27/19 - 03/27/19	< 0.8
03/27/19 - 04/24/19	< 0.7
04/24/19 - 05/29/19	< 0.5
05/29/19 - 06/26/19	< 0.8
06/26/19 - 07/31/19	< 0.8
07/31/19 - 08/28/19	< 0.5
08/28/19 - 09/25/19	< 0.9
09/25/19 - 10/30/19	< 0.7
10/30/19 - 11/27/19	< 0.8
11/27/19 - 12/26/19	< 0.8
MEAN	-

Table C-I.2 **CONCENTRATIONS OF TRITIUM IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	CL-13	CL-90	CL-91	CL-99
12/26/18 - 03/27/19	< 181	< 185	< 183	< 183
03/27/19 - 06/26/19	< 195	< 193	< 197	< 194
06/26/19 - 09/25/19	< 178	< 183	< 180	< 185
09/25/19 - 12/26/19	< 197	< 194	< 195	< 186
MEAN	-	-	-	-

Table C-I.3

CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD		Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140	Ce-144
CL-13	01/31/19 - 01/31/19	*(1)*	< 6	< 6	< 10	< 8	< 10	< 5	< 8	< 5	< 6	< 29	< 8	< 34
	02/27/19 - 02/27/19		< 6	< 6	< 11	< 5	< 11	< 6	< 10	< 7	< 5	< 27	< 7	< 49
	03/27/19 - 03/27/19		< 8	< 8	< 15	< 9	< 14	< 7	< 13	< 7	< 7	< 30	< 6	< 62
	04/24/19 - 04/24/19		< 6	< 6	< 15	< 4	< 15	< 7	< 13	< 6	< 6	< 28	< 10	< 45
	05/29/19 - 05/29/19		< 6	< 5	< 13	< 4	< 9	< 7	< 10	< 7	< 7	< 27	< 8	< 47
	06/26/19 - 06/26/19		< 7	< 6	< 11	< 9	< 10	< 6	< 12	< 7	< 6	< 24	< 9	< 41
	07/31/19 - 07/31/19		< 6	< 7	< 15	< 8	< 12	< 7	< 11	< 7	< 6	< 29	< 9	< 46
	08/28/19 - 08/28/19		< 5	< 5	< 14	< 6	< 12	< 5	< 9	< 6	< 6	< 21	< 10	< 38
	09/25/19 - 09/25/19		< 6	< 6	< 11	< 6	< 11	< 8	< 10	< 5	< 5	< 27	< 9	< 45
	10/30/19 - 10/30/19		< 6	< 6	< 11	< 9	< 8	< 6	< 12	< 6	< 6	< 27	< 10	< 37
	11/27/19 - 11/27/19		< 5	< 6	< 14	< 6	< 15	< 6	< 9	< 7	< 5	< 31	< 8	< 44
	12/26/19 - 12/26/19		< 6	< 6	< 12	< 7	< 13	< 5	< 11	< 6	< 6	< 27	< 11	< 35
	MEAN		-	-	-	-	-	-	-	-	-	-	-	-
CL-90	12/26/18 - 01/31/19		< 6	< 5	< 9	< 7	< 10	< 7	< 10	< 7	< 6	< 22	< 13	< 35
	01/31/19 - 02/27/19		< 6	< 8	< 15	< 8	< 14	< 7	< 13	< 7	< 8	< 34	< 8	< 61
	02/27/19 - 03/27/19		< 8	< 9	< 14	< 7	< 15	< 8	< 12	< 9	< 9	< 44	< 13	< 66
	03/27/19 - 04/24/19		< 6	< 7	< 11	< 6	< 16	< 7	< 13	< 5	< 6	< 30	< 5	< 38
	04/24/19 - 05/29/19		< 5	< 5	< 10	< 4	< 12	< 4	< 10	< 6	< 6	< 26	< 8	< 43
	05/29/19 - 06/26/19		< 7	< 6	< 12	< 7	< 14	< 8	< 13	< 7	< 7	< 30	< 8	< 44
	06/26/19 - 07/31/19		< 8	< 7	< 13	< 7	< 12	< 7	< 9	< 6	< 7	< 30	< 12	< 39
	07/31/19 - 08/28/19		< 5	< 5	< 11	< 4	< 9	< 5	< 8	< 5	< 6	< 23	< 5	< 35
	08/28/19 - 09/25/19		< 5	< 6	< 12	< 6	< 13	< 6	< 10	< 7	< 6	< 26	< 8	< 45
	09/25/19 - 10/30/19		< 6	< 5	< 14	< 6	< 10	< 6	< 11	< 5	< 7	< 25	< 7	< 43
	10/30/19 - 11/27/19		< 6	< 6	< 13	< 8	< 14	< 7	< 12	< 6	< 7	< 33	< 10	< 48
	11/27/19 - 12/26/19		< 5	< 6	< 10	< 5	< 11	< 5	< 9	< 6	< 5	< 20	< 7	< 33
	MEAN		-	-	-	-	-	-	-	-	-	-	-	-

(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

CL-91	12/26/18 - 01/31/19		< 7	< 7	< 12	< 7	< 15	< 7	< 11	< 6	< 5	< 29	< 10	< 39

Table C-I.3

CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140	Ce-144
	01/31/19 - 02/27/19	< 6	< 8	< 11	< 5	< 14	< 7	< 11	< 7	< 7	< 28	< 8	< 48
	02/27/19 - 03/27/19	< 3	< 7	< 15	< 7	< 12	< 8	< 10	< 7	< 8	< 29	< 11	< 39
	03/27/19 - 04/24/19	< 7	< 7	< 17	< 7	< 14	< 9	< 12	< 8	< 8	< 37	< 13	< 52
	04/24/19 - 05/29/19	< 5	< 7	< 15	< 4	< 10	< 7	< 13	< 5	< 6	< 28	< 9	< 45
	05/29/19 - 06/26/19	< 6	< 7	< 13	< 5	< 13	< 7	< 11	< 7	< 6	< 26	< 12	< 48
	06/26/19 - 07/31/19	< 5	< 6	< 13	< 8	< 13	< 6	< 10	< 6	< 6	< 33	< 10	< 42
	07/31/19 - 08/28/19	< 4	< 4	< 13	< 7	< 10	< 6	< 11	< 7	< 5	< 24	< 8	< 35
	08/28/19 - 09/25/19	< 5	< 4	< 11	< 8	< 13	< 6	< 11	< 5	< 5	< 17	< 9	< 35
	09/25/19 - 10/30/19	< 7	< 4	< 13	< 7	< 13	< 6	< 7	< 6	< 6	< 22	< 14	< 43
	10/30/19 - 11/27/19	< 7	< 9	< 12	< 8	< 12	< 7	< 9	< 9	< 7	< 33	< 13	< 38
	11/27/19 - 12/26/19	< 6	< 6	< 11	< 6	< 13	< 7	< 10	< 6	< 6	< 20	< 9	< 35
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
CL-99	12/26/18 - 01/31/19	< 5	< 6	< 12	< 5	< 13	< 6	< 6	< 6	< 5	< 27	< 7	< 43
	01/31/19 - 02/27/19	< 5	< 7	< 10	< 7	< 14	< 7	< 13	< 6	< 7	< 25	< 9	< 40
	02/27/19 - 03/27/19	< 5	< 5	< 15	< 6	< 15	< 8	< 11	< 8	< 5	< 34	< 8	< 42
	03/27/19 - 04/24/19	< 5	< 5	< 12	< 5	< 11	< 6	< 9	< 5	< 5	< 26	< 7	< 35
	04/24/19 - 05/29/19	< 5	< 5	< 11	< 6	< 9	< 6	< 8	< 6	< 5	< 23	< 11	< 42
	05/29/19 - 06/26/19	< 6	< 7	< 19	< 4	< 14	< 8	< 11	< 6	< 6	< 27	< 6	< 34
	06/26/19 - 07/31/19	< 7	< 6	< 15	< 6	< 10	< 6	< 9	< 7	< 7	< 29	< 10	< 51
	07/31/19 - 08/28/19	< 5	< 5	< 10	< 6	< 11	< 5	< 9	< 5	< 5	< 22	< 7	< 39
	08/28/19 - 09/25/19	< 7	< 7	< 12	< 7	< 13	< 8	< 11	< 7	< 7	< 29	< 11	< 52
	09/25/19 - 10/30/19	< 5	< 6	< 10	< 6	< 10	< 5	< 9	< 5	< 6	< 23	< 9	< 41
	10/30/19 - 11/27/19	< 6	< 6	< 12	< 7	< 9	< 6	< 11	< 8	< 5	< 26	< 10	< 46
	11/27/19 - 12/26/19	< 5	< 4	< 11	< 4	< 11	< 6	< 8	< 5	< 5	< 24	< 7	< 37
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-

Table C-II.1 **CONCENTRATIONS OF GROSS BETA IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	CL-14
12/26/18 - 01/31/19	< 1.7
01/31/19 - 02/27/19	< 1.6
02/27/19 - 03/27/19	< 1.6
03/27/19 - 04/24/19	< 1.5
04/24/19 - 05/29/19	< 2.0
05/29/19 - 06/26/19	< 1.6
06/26/19 - 07/31/19	< 1.8
07/31/19 - 08/28/19	< 1.6
08/28/19 - 09/25/19	< 1.6
09/25/19 - 10/30/19	< 1.7
10/30/19 - 11/27/19	< 1.6
11/27/19 - 12/26/19	< 1.6
MEAN	-

Table C-II.2 **CONCENTRATIONS OF TRITIUM IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	CL-14
12/26/18 - 03/27/19	< 187
03/27/19 - 06/26/19	< 198
06/26/19 - 09/25/19	< 198
09/25/19 - 12/26/19	< 188
MEAN	-

Table C-II.3 **CONCENTRATIONS OF I-131 IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	CL-14
12/26/18 - 01/31/19	< 0.4
01/31/19 - 02/27/19	< 0.8
02/27/19 - 03/27/19	< 0.9
03/27/19 - 04/24/19	< 0.8
04/24/19 - 05/29/19	< 0.4
05/29/19 - 06/26/19	< 0.7
06/26/19 - 07/31/19	< 0.8
07/31/19 - 08/28/19	< 0.4
08/28/19 - 09/25/19	< 0.7
09/25/19 - 10/30/19	< 0.7
10/30/19 - 11/27/19	< 0.6
11/27/19 - 12/26/19	< 0.8
MEAN	-

Table C-II.4

CONCENTRATIONS OF GAMMA EMITTERS IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140	Ce-144
CL-14	12/26/18 - 01/31/19	< 5	< 5	< 13	< 8	< 9	< 5	< 9	< 6	< 6	< 27	< 11	< 35
	01/31/19 - 02/27/19	< 5	< 7	< 10	< 8	< 7	< 6	< 10	< 8	< 6	< 35	< 11	< 41
	02/27/19 - 03/27/19	< 6	< 7	< 14	< 7	< 13	< 4	< 10	< 6	< 7	< 24	< 12	< 46
	03/27/19 - 04/24/19	< 4	< 7	< 8	< 6	< 15	< 8	< 13	< 6	< 7	< 27	< 9	< 43
	04/24/19 - 05/29/19	< 5	< 4	< 12	< 4	< 10	< 5	< 9	< 6	< 6	< 25	< 8	< 35
	05/29/19 - 06/26/19	< 5	< 5	< 11	< 5	< 12	< 6	< 10	< 5	< 5	< 28	< 8	< 43
	06/26/19 - 07/31/19	< 5	< 7	< 13	< 10	< 16	< 7	< 12	< 8	< 6	< 39	< 12	< 52
	07/31/19 - 08/28/19	< 7	< 7	< 14	< 8	< 15	< 7	< 12	< 7	< 7	< 30	< 10	< 51
	08/28/19 - 09/25/19	< 5	< 4	< 10	< 5	< 10	< 4	< 8	< 5	< 5	< 20	< 7	< 35
	09/25/19 - 10/30/19	< 5	< 5	< 14	< 7	< 13	< 5	< 9	< 6	< 7	< 24	< 8	< 39
	10/30/19 - 11/27/19	< 8	< 7	< 16	< 8	< 13	< 6	< 11	< 9	< 9	< 29	< 10	< 46
	11/27/19 - 12/26/19	< 5	< 6	< 11	< 5	< 13	< 5	< 8	< 7	< 5	< 25	< 5	< 35
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-

Table C-III.1 **CONCENTRATIONS OF TRITIUM IN WELL WATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	CL-07D	CL-12R	CL-12T
03/27/19 - 03/27/19	< 199	< 199	< 197
06/26/19 - 06/26/19	< 194	< 193	< 198
09/25/19 - 09/25/19	< 188	< 190	< 188
12/26/19 - 12/26/19	< 180	< 180	< 183
MEAN	-	-	-

Table C-III.2

CONCENTRATIONS OF GAMMA EMITTERS IN WELL WATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019

RESULTS IN UNITS OF PCI/LITER + 2 SIGMA

SITE	COLLECTION PERIOD	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140	Ce-144
CL-07D	03/27/19	< 6	< 7	< 15	< 7	< 7	< 7	< 11	< 7	< 8	< 21	< 11	< 45
	06/26/19	< 4	< 5	< 7	< 5	< 9	< 5	< 7	< 6	< 5	< 25	< 9	< 41
	09/25/19	< 6	< 6	< 12	< 7	< 12	< 8	< 9	< 7	< 6	< 29	< 10	< 46
	12/26/19	< 5	< 5	< 11	< 5	< 10	< 5	< 8	< 5	< 6	< 22	< 7	< 33
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
CL-12R	03/27/19	< 5	< 6	< 15	< 6	< 5	< 6	< 10	< 8	< 7	< 24	< 15	< 45
	06/26/19	< 4	< 4	< 12	< 6	< 9	< 6	< 7	< 5	< 6	< 28	< 6	< 37
	09/25/19	< 6	< 6	< 11	< 5	< 15	< 7	< 9	< 6	< 6	< 25	< 7	< 41
	12/26/19	< 5	< 5	< 6	< 7	< 9	< 6	< 10	< 6	< 5	< 25	< 8	< 35
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
CL-12T	03/27/19	< 8	< 6	< 11	< 7	< 15	< 6	< 14	< 6	< 6	< 30	< 13	< 40
	06/26/19	< 5	< 6	< 13	< 6	< 11	< 6	< 11	< 7	< 6	< 22	< 7	< 37
	09/25/19	< 5	< 5	< 11	< 8	< 9	< 4	< 7	< 6	< 5	< 22	< 7	< 34
	12/26/19	< 5	< 4	< 11	< 6	< 14	< 4	< 12	< 6	< 5	< 24	< 9	< 37
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-

Table C-IV.1

CONCENTRATIONS OF GAMMA EMITTERS IN FISH SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

SITE	COLLECTION PERIOD	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140	Ce-144
CL-19													
Largemouth Bass	04/23/19	< 78	< 78	< 120	< 70	< 114	< 67	< 108	< 70	< 75	< 329	< 114	< 402
Channel Catfish	04/23/19	< 62	< 49	< 103	< 59	< 127	< 56	< 100	< 47	< 42	< 275	< 82	< 343
Bluegill	04/23/19	< 79	< 69	< 154	< 105	< 147	< 69	< 120	< 83	< 71	< 265	< 127	< 355
Carp	04/23/19	< 61	< 58	< 130	< 96	< 117	< 49	< 102	< 52	< 69	< 226	< 72	< 351
Largemouth Bass	09/30/19	< 72	< 60	< 204	< 60	< 110	< 62	< 115	< 62	< 71	< 318	< 52	< 256
Channel Catfish	09/30/19	< 78	< 77	< 150	< 56	< 136	< 69	< 125	< 63	< 79	< 389	< 80	< 359
Bluegill	09/30/19	< 66	< 94	< 141	< 83	< 187	< 84	< 140	< 98	< 78	< 384	< 83	< 391
Carp	09/30/19	< 50	< 68	< 115	< 74	< 135	< 66	< 106	< 61	< 61	< 274	< 85	< 307
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
CL-105													
Largemouth Bass	04/23/19	< 53	< 55	< 108	< 52	< 130	< 52	< 84	< 49	< 62	< 209	< 77	< 270
Crappie	04/23/19	< 74	< 63	< 121	< 80	< 144	< 62	< 119	< 64	< 64	< 333	< 95	< 391
Bluegill	04/23/19	< 57	< 41	< 107	< 51	< 91	< 64	< 86	< 51	< 43	< 300	< 91	< 292
Carp	04/23/19	< 82	< 82	< 166	< 76	< 145	< 70	< 98	< 71	< 78	< 390	< 130	< 398
Largemouth Bass	09/30/19	< 65	< 62	< 103	< 61	< 137	< 33	< 121	< 75	< 57	< 273	< 116	< 258
White Crappie/White Bass	09/30/19	< 52	< 56	< 130	< 71	< 134	< 57	< 99	< 70	< 53	< 269	< 67	< 301
Bluegill	09/30/19	< 75	< 68	< 160	< 74	< 203	< 88	< 107	< 63	< 78	< 387	< 110	< 313
Carp	09/30/19	< 72	< 61	< 148	< 73	< 121	< 68	< 100	< 72	< 51	< 307	< 77	< 280
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-

Table C-V.1

CONCENTRATIONS OF GAMMA EMITTERS IN SEDIMENT SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019

RESULTS IN UNITS OF PCI/KG DRY + 2 SIGMA

SITE	COLLECTION PERIOD	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140	Ce-144
CL-07B	04/23/19	< 59	< 40	< 108	< 56	< 98	< 49	< 75	< 51	< 43	< 205	< 63	< 276
	09/30/19	< 41	< 39	< 98	< 46	< 98	< 41	< 63	< 43	< 37	< 201	< 70	< 185
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
CL-105	04/23/19	< 52	< 32	< 96	< 50	< 82	< 46	< 70	< 52	< 44	< 167	< 47	< 202
	09/30/19	< 31	< 32	< 83	< 46	< 86	< 37	< 56	< 40	< 38	< 185	< 83	< 175
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-

Table C-VI.1 CONCENTRATIONS OF GROSS BETA IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019

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

COLLECTION PERIOD	GROUP I					
	CL-2	CL-3	CL-4	CL-6	CL-15	CL-94
01/02/19 - 01/09/19	23 ± 4	24 ± 5	24 ± 4	23 ± 5	22 ± 4	25 ± 5
01/09/19 - 01/16/19	16 ± 4	16 ± 4	13 ± 3	18 ± 4	17 ± 4	12 ± 3
01/16/19 - 01/23/19	12 ± 4	13 ± 4	13 ± 4	12 ± 4	11 ± 4	9 ± 4
01/23/19 - 01/31/19	20 ± 4	21 ± 4	25 ± 4	21 ± 4	23 ± 4	20 ± 4
01/31/19 - 02/06/19	17 ± 4	19 ± 5	18 ± 5	17 ± 4	14 ± 4	20 ± 5
02/06/19 - 02/13/19	12 ± 4	13 ± 4	11 ± 4	10 ± 4	10 ± 4	12 ± 4
02/13/19 - 02/20/19	20 ± 4	20 ± 4	22 ± 4	25 ± 5	23 ± 4	22 ± 5
02/20/19 - 02/27/19	27 ± 5	29 ± 5	29 ± 5	28 ± 5	29 ± 5	25 ± 5
02/27/19 - 03/06/19	24 ± 5	26 ± 5	20 ± 4	21 ± 4	23 ± 4	25 ± 5
03/06/19 - 03/13/19	19 ± 4	18 ± 4	18 ± 4	17 ± 4	15 ± 4	16 ± 4
03/13/19 - 03/20/19	15 ± 4	14 ± 4	13 ± 4	13 ± 4	14 ± 4	13 ± 4
03/20/19 - 03/27/19	12 ± 4	8 ± 3	9 ± 3	8 ± 3	10 ± 3	8 ± 3
03/27/19 - 04/03/19	16 ± 4	14 ± 4	18 ± 4	21 ± 5	16 ± 4	18 ± 4
04/03/19 - 04/10/19	12 ± 3	14 ± 4	14 ± 4	13 ± 3	15 ± 4	14 ± 4
04/10/19 - 04/17/19	8 ± 4	8 ± 4	7 ± 4	7 ± 4	9 ± 4	6 ± 3
04/17/19 - 04/24/19	13 ± 4	11 ± 4	11 ± 4	12 ± 4	13 ± 4	12 ± 4
04/24/19 - 05/01/19	11 ± 3	11 ± 3	13 ± 4	11 ± 3	12 ± 4	12 ± 3
05/01/19 - 05/08/19	11 ± 3	7 ± 3	12 ± 3	10 ± 3	11 ± 4	8 ± 3
05/08/19 - 05/15/19	15 ± 4	12 ± 4	10 ± 4	14 ± 4	11 ± 4	17 ± 4
05/15/19 - 05/22/19	13 ± 4	15 ± 4	16 ± 4	14 ± 4	14 ± 4	14 ± 4
05/22/19 - 05/29/19	11 ± 4	13 ± 4	11 ± 4	9 ± 3	12 ± 4	11 ± 4
05/29/19 - 06/05/19	9 ± 4	13 ± 4	9 ± 4	12 ± 4	10 ± 4	9 ± 4
06/05/19 - 06/12/19	17 ± 4	19 ± 4	15 ± 4	18 ± 4	15 ± 4	14 ± 4
06/12/19 - 06/19/19	9 ± 3	12 ± 4	11 ± 3	10 ± 3	13 ± 4	10 ± 3
06/19/19 - 06/26/19	15 ± 4	11 ± 3	12 ± 4	14 ± 4	14 ± 4	17 ± 4
06/26/19 - 07/03/19	20 ± 4	19 ± 4	18 ± 4	21 ± 4	18 ± 4	17 ± 4
07/03/19 - 07/10/19	11 ± 4	14 ± 4	11 ± 4	10 ± 4	10 ± 4	12 ± 4
07/10/19 - 07/17/19	15 ± 4	15 ± 4	10 ± 4	14 ± 4	13 ± 4	12 ± 4
07/17/19 - 07/24/19	9 ± 4	8 ± 4	10 ± 4	9 ± 4	5 ± 3	6 ± 3
07/24/19 - 07/31/19	18 ± 5	15 ± 5	15 ± 4	18 ± 4	14 ± 4	15 ± 4
07/31/19 - 08/07/19	23 ± 5	23 ± 5	19 ± 4	19 ± 5	17 ± 4	18 ± 4
08/07/19 - 08/14/19	9 ± 3	13 ± 4	10 ± 4	13 ± 4	8 ± 3	12 ± 4
08/14/19 - 08/21/19	17 ± 5	18 ± 5	16 ± 5	13 ± 4	11 ± 4	11 ± 4
08/21/19 - 08/28/19	14 ± 4	14 ± 4	11 ± 4	16 ± 4	14 ± 4	12 ± 4
08/28/19 - 09/04/19	19 ± 4	20 ± 4	20 ± 4	19 ± 4	21 ± 4	20 ± 4
09/04/19 - 09/11/19	12 ± 4	15 ± 4	17 ± 4	14 ± 4	8 ± 3	12 ± 4
09/11/19 - 09/18/19	24 ± 5	24 ± 5	20 ± 4	27 ± 5	23 ± 5	28 ± 5
09/18/19 - 09/25/19	24 ± 5	25 ± 5	23 ± 5	21 ± 5	23 ± 5	23 ± 5
09/25/19 - 10/02/19	15 ± 4	15 ± 4	17 ± 4	18 ± 4	11 ± 4	14 ± 4
10/02/19 - 10/09/19	15 ± 4	11 ± 3	12 ± 3	14 ± 4	13 ± 4	10 ± 3
10/09/19 - 10/16/19	20 ± 4	21 ± 5	19 ± 4	14 ± 4	15 ± 4	19 ± 4
10/16/19 - 10/23/19	16 ± 4	14 ± 4	14 ± 4	12 ± 4	14 ± 4	15 ± 4
10/23/19 - 10/30/19	11 ± 5	10 ± 5	9 ± 4	10 ± 4	< 6	10 ± 5
10/30/19 - 11/06/19	11 ± 4	8 ± 3	12 ± 4	9 ± 4	8 ± 4	9 ± 4
11/06/19 - 11/13/19	15 ± 4	17 ± 4	15 ± 4	14 ± 4	11 ± 4	19 ± 4
11/13/19 - 11/20/19	20 ± 4	27 ± 5	22 ± 4	31 ± 5	20 ± 4	23 ± 5
11/20/19 - 11/27/19	16 ± 4	17 ± 4	20 ± 4	19 ± 4	16 ± 4	19 ± 4
11/27/19 - 12/04/19	7 ± 3	5 ± 3	7 ± 3	11 ± 4	8 ± 3	10 ± 4
12/04/19 - 12/11/19	18 ± 4	24 ± 5	15 ± 4	18 ± 4	19 ± 5	18 ± 5
12/11/19 - 12/18/19	25 ± 4	31 ± 5	23 ± 4	27 ± 5	24 ± 4	25 ± 4
12/18/19 - 12/26/19	21 ± 4	22 ± 4	28 ± 5	26 ± 4	24 ± 4	25 ± 4
12/26/19 - 01/01/20	18 ± 5	25 ± 5	20 ± 5	21 ± 5	19 ± 5	20 ± 5
MEAN ± 2 STD DEV	16 ± 10	16 ± 12	15 ± 11	16 ± 12	15 ± 11	15 ± 11

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

Table C-VI.1 **CONCENTRATIONS OF GROSS BETA IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019**

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

COLLECTION PERIOD	GROUP II			GROUP III
	CL-1	CL-7	CL-8	CL-11
01/02/19 - 01/09/19	25 ± 5	25 ± 5	24 ± 5	26 ± 5
01/09/19 - 01/16/19	17 ± 4	12 ± 3	15 ± 4	15 ± 4
01/16/19 - 01/23/19	12 ± 4	13 ± 4	12 ± 4	11 ± 4
01/23/19 - 01/31/19	24 ± 4	19 ± 4	20 ± 4	22 ± 4
01/31/19 - 02/06/19	21 ± 5	18 ± 4	21 ± 5	15 ± 4
02/06/19 - 02/13/19	11 ± 4	9 ± 4	12 ± 4	11 ± 4
02/13/19 - 02/20/19	20 ± 4	19 ± 4	20 ± 4	23 ± 4
02/20/19 - 02/27/19	22 ± 4	26 ± 5	29 ± 5	28 ± 5
02/27/19 - 03/06/19	21 ± 4	23 ± 5	22 ± 4	19 ± 4
03/06/19 - 03/13/19	22 ± 4	16 ± 4	17 ± 4	19 ± 4
03/13/19 - 03/20/19	11 ± 3	12 ± 3	12 ± 4	15 ± 4
03/20/19 - 03/27/19	8 ± 3	10 ± 3	9 ± 3	11 ± 3
03/27/19 - 04/03/19	13 ± 4	15 ± 4	15 ± 4	12 ± 4
04/03/19 - 04/10/19	13 ± 4	14 ± 4	14 ± 4	16 ± 4
04/10/19 - 04/17/19	8 ± 4	7 ± 4	10 ± 4	9 ± 4
04/17/19 - 04/24/19	14 ± 4	11 ± 4	10 ± 3	13 ± 4
04/24/19 - 05/01/19	15 ± 4	13 ± 4	10 ± 3	13 ± 4
05/01/19 - 05/08/19	8 ± 3	11 ± 3	10 ± 3	10 ± 3
05/08/19 - 05/15/19	11 ± 4	15 ± 4	14 ± 4	12 ± 4
05/15/19 - 05/22/19	16 ± 4	15 ± 4	12 ± 4	17 ± 4
05/22/19 - 05/29/19	12 ± 4	11 ± 4	11 ± 4	10 ± 4
05/29/19 - 06/05/19	10 ± 4	11 ± 4	9 ± 4	12 ± 4
06/05/19 - 06/12/19	16 ± 4	17 ± 4	18 ± 4	17 ± 4
06/12/19 - 06/19/19	12 ± 4	13 ± 4	13 ± 4	12 ± 4
06/19/19 - 06/26/19	13 ± 4	13 ± 4	15 ± 4	17 ± 4
06/26/19 - 07/03/19	19 ± 4	17 ± 4	19 ± 4	16 ± 4
07/03/19 - 07/10/19	11 ± 4	9 ± 3	11 ± 4	13 ± 4
07/10/19 - 07/17/19	17 ± 4	14 ± 4	13 ± 4	13 ± 4
07/17/19 - 07/24/19	8 ± 4	10 ± 4	8 ± 4	11 ± 4
07/24/19 - 07/31/19	14 ± 4	17 ± 4	14 ± 4	14 ± 4
07/31/19 - 08/07/19	20 ± 4	17 ± 4	17 ± 4	22 ± 5
08/07/19 - 08/14/19	13 ± 4	12 ± 4	9 ± 4	10 ± 4
08/14/19 - 08/21/19	13 ± 4	15 ± 5	14 ± 4	18 ± 5
08/21/19 - 08/28/19	14 ± 4	15 ± 4	12 ± 4	16 ± 4
08/28/19 - 09/04/19	24 ± 5	19 ± 4	18 ± 4	21 ± 4
09/04/19 - 09/11/19	19 ± 4	15 ± 4	15 ± 4	19 ± 4
09/11/19 - 09/18/19	26 ± 5	19 ± 4	23 ± 5	25 ± 5
09/18/19 - 09/25/19	21 ± 5	21 ± 5	23 ± 5	26 ± 5
09/25/19 - 10/02/19	15 ± 4	15 ± 4	17 ± 4	24 ± 5
10/02/19 - 10/09/19	9 ± 3	13 ± 4	12 ± 4	15 ± 4
10/09/19 - 10/16/19	15 ± 4	17 ± 4	12 ± 4	21 ± 5
10/16/19 - 10/23/19	16 ± 4	14 ± 4	14 ± 4	18 ± 4
10/23/19 - 10/30/19	13 ± 5	9 ± 4	10 ± 4	11 ± 5
10/30/19 - 11/06/19	9 ± 4	13 ± 4	11 ± 4	11 ± 4
11/06/19 - 11/13/19	14 ± 4	14 ± 4	15 ± 4	18 ± 4
11/13/19 - 11/20/19	24 ± 5	22 ± 4	19 ± 4	*(1)*
11/20/19 - 11/27/19	18 ± 4	14 ± 3	17 ± 4	17 ± 4
11/27/19 - 12/04/19	7 ± 3	7 ± 3	7 ± 3	6 ± 3
12/04/19 - 12/11/19	19 ± 5	16 ± 4	22 ± 5	17 ± 4
12/11/19 - 12/18/19	25 ± 5	25 ± 4	27 ± 5	32 ± 5
12/18/19 - 12/26/19	23 ± 4	20 ± 4	24 ± 4	23 ± 4
12/26/19 - 01/01/20	15 ± 5	20 ± 5	22 ± 5	17 ± 5
MEAN ± 2 STD DEV	16 ± 10	15 ± 9	15 ± 10	16 ± 11

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

(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

Table C-VI.2 **MONTHLY AND YEARLY MEAN VALUES OF GROSS BETA CONCENTRATIONS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019**

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

GROUP I - ON-SITE LOCATIONS				GROUP II - INTERMEDIATE DISTANCE LOCATIONS				GROUP III - CONTROL LOCATIONS			
COLLECTION PERIOD	MIN	MAX	MEAN ± 2SD	COLLECTION PERIOD	MIN	MAX	MEAN ± 2SD	COLLECTION PERIOD	MIN	MAX	MEAN ± 2SD
01/02/19 - 01/31/19	9	25	18 ± 10	01/02/19 - 01/31/19	12	25	18 ± 11	01/02/19 - 01/31/19	11	26	19 ± 14
01/31/19 - 02/27/19	10	29	20 ± 13	01/31/19 - 02/27/19	9	29	19 ± 12	01/31/19 - 02/27/19	11	28	19 ± 15
02/27/19 - 04/03/19	8	26	16 ± 10	02/27/19 - 04/03/19	8	23	15 ± 10	02/27/19 - 04/03/19	11	19	15 ± 7
04/03/19 - 05/01/19	6	15	11 ± 5	04/03/19 - 05/01/19	7	15	11 ± 5	04/03/19 - 05/01/19	9	16	13 ± 6
05/01/19 - 05/29/19	7	17	12 ± 5	05/01/19 - 05/29/19	8	16	12 ± 4	05/01/19 - 05/29/19	10	17	12 ± 7
05/29/19 - 07/03/19	9	21	14 ± 7	05/29/19 - 07/03/19	9	19	14 ± 7	05/29/19 - 07/03/19	12	17	15 ± 5
07/03/19 - 07/31/19	5	18	12 ± 7	07/03/19 - 07/31/19	8	17	12 ± 6	07/03/19 - 07/31/19	11	14	13 ± 3
07/31/19 - 09/04/19	8	23	16 ± 8	07/31/19 - 09/04/19	9	24	15 ± 8	07/31/19 - 09/04/19	10	22	18 ± 10
09/04/19 - 10/02/19	8	28	19 ± 11	09/04/19 - 10/02/19	15	26	19 ± 7	09/04/19 - 10/02/19	19	26	23 ± 7
10/02/19 - 10/30/19	9	21	14 ± 7	10/02/19 - 10/30/19	9	17	13 ± 5	10/02/19 - 10/30/19	11	21	16 ± 8
10/30/19 - 12/04/19	5	31	15 ± 13	10/30/19 - 12/04/19	7	24	14 ± 11	10/30/19 - 12/04/19	6	18	13 ± 11
12/04/19 - 01/01/20	15	31	22 ± 8	12/04/19 - 01/01/20	15	27	22 ± 7	12/04/19 - 01/01/20	17	32	22 ± 14
01/02/19 - 01/01/20	5	31	16 ± 11	01/02/19 - 01/01/20	7	29	15 ± 10	01/02/19 - 01/01/20	6	32	16 ± 11

Table C-VI.3 CONCENTRATIONS OF GAMMA EMITTERS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019

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

SITE	COLLECTION PERIOD	Co-60	Nb-95	Zr-95	Ru-103	Ru-106	Cs-134	Cs-137	Ce-141	Ce-144
CL-1	01/02/19 - 04/03/19	< 3	< 3	< 5	< 3	< 26	< 3	< 3	< 3	< 11
	04/03/19 - 07/03/19	< 2	< 3	< 4	< 2	< 17	< 1	< 2	< 3	< 10
	07/03/19 - 10/02/19	< 2	< 3	< 4	< 2	< 23	< 3	< 3	< 3	< 11
	10/02/19 - 01/01/20	< 4	< 3	< 7	< 3	< 27	< 4	< 3	< 4	< 13
	MEAN	-	-	-	-	-	-	-	-	-
CL-2	01/02/19 - 04/03/19	< 3	< 2	< 4	< 2	< 17	< 2	< 2	< 2	< 8
	04/03/19 - 07/03/19	< 4	< 2	< 4	< 3	< 11	< 2	< 2	< 4	< 11
	07/03/19 - 10/02/19	< 3	< 2	< 3	< 2	< 16	< 2	< 2	< 2	< 6
	10/02/19 - 01/01/20	< 2	< 2	< 3	< 2	< 14	< 2	< 1	< 2	< 7
	MEAN	-	-	-	-	-	-	-	-	-
CL-3	01/02/19 - 04/03/19	< 3	< 2	< 5	< 3	< 24	< 3	< 3	< 3	< 11
	04/03/19 - 07/03/19	< 2	< 3	< 5	< 3	< 16	< 3	< 2	< 4	< 11
	07/03/19 - 10/02/19	< 2	< 2	< 3	< 2	< 15	< 2	< 2	< 2	< 8
	10/02/19 - 01/01/20	< 2	< 2	< 4	< 3	< 21	< 2	< 2	< 3	< 9
	MEAN	-	-	-	-	-	-	-	-	-
CL-4	01/02/19 - 04/03/19	< 1	< 3	< 3	< 2	< 17	< 3	< 2	< 2	< 8
	04/03/19 - 07/03/19	< 2	< 3	< 6	< 3	< 22	< 3	< 2	< 4	< 11
	07/03/19 - 10/02/19	< 2	< 2	< 3	< 2	< 12	< 2	< 2	< 2	< 7
	10/02/19 - 01/01/20	< 2	< 2	< 4	< 3	< 16	< 2	< 3	< 3	< 11
	MEAN	-	-	-	-	-	-	-	-	-
CL-6	01/02/19 - 04/03/19	< 2	< 2	< 4	< 2	< 16	< 2	< 2	< 2	< 7
	04/03/19 - 07/03/19	< 4	< 4	< 6	< 3	< 28	< 3	< 3	< 4	< 12
	07/03/19 - 10/02/19	< 3	< 3	< 5	< 3	< 22	< 2	< 3	< 3	< 9
	10/02/19 - 01/01/20	< 2	< 2	< 4	< 2	< 15	< 2	< 2	< 2	< 7
	MEAN	-	-	-	-	-	-	-	-	-

Table C-VI.3 CONCENTRATIONS OF GAMMA EMITTERS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019

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

SITE	COLLECTION PERIOD	Co-60	Nb-95	Zr-95	Ru-103	Ru-106	Cs-134	Cs-137	Ce-141	Ce-144
CL-7	01/02/19 - 04/03/19	< 2	< 1	< 4	< 2	< 18	< 2	< 2	< 3	< 10
	04/03/19 - 07/03/19	< 2	< 2	< 3	< 3	< 18	< 2	< 2	< 3	< 8
	07/03/19 - 10/02/19	< 2	< 3	< 5	< 2	< 23	< 3	< 2	< 3	< 10
	10/02/19 - 01/01/20	< 2	< 2	< 4	< 2	< 17	< 2	< 2	< 2	< 7
	MEAN	-	-	-	-	-	-	-	-	-
CL-8	01/02/19 - 04/03/19	< 3	< 3	< 5	< 2	< 17	< 3	< 2	< 3	< 10
	04/03/19 - 07/03/19	< 3	< 3	< 3	< 3	< 19	< 3	< 2	< 3	< 10
	07/03/19 - 10/02/19	< 3	< 2	< 3	< 2	< 16	< 2	< 2	< 2	< 7
	10/02/19 - 01/01/20	< 2	< 2	< 4	< 2	< 20	< 2	< 2	< 2	< 7
	MEAN	-	-	-	-	-	-	-	-	-
CL-11	01/02/19 - 04/03/19	< 3	< 3	< 5	< 3	< 23	< 3	< 3	< 3	< 11
	04/03/19 - 07/03/19	< 2	< 3	< 4	< 3	< 22	< 2	< 2	< 3	< 7
	07/03/19 - 10/02/19	< 3	< 2	< 4	< 2	< 12	< 2	< 2	< 2	< 8
	10/02/19 - 01/01/20	< 3	< 3	< 5	< 3	< 21	< 3	< 3	< 3	< 11
	MEAN	-	-	-	-	-	-	-	-	-
CL-15	01/02/19 - 04/03/19	< 2	< 3	< 4	< 2	< 23	< 2	< 3	< 2	< 7
	04/03/19 - 07/03/19	< 3	< 3	< 5	< 3	< 21	< 2	< 2	< 4	< 13
	07/03/19 - 10/02/19	< 2	< 2	< 3	< 2	< 15	< 2	< 2	< 2	< 6
	10/02/19 - 01/01/20	< 2	< 2	< 4	< 2	< 17	< 2	< 2	< 2	< 7
	MEAN	-	-	-	-	-	-	-	-	-
CL-94	01/02/19 - 04/03/19	< 3	< 3	< 5	< 3	< 24	< 3	< 3	< 4	< 16
	04/03/19 - 07/03/19	< 3	< 2	< 4	< 3	< 23	< 2	< 2	< 4	< 10
	07/03/19 - 10/02/19	< 4	< 3	< 5	< 2	< 22	< 2	< 2	< 3	< 10
	10/02/19 - 01/01/20	< 3	< 3	< 4	< 3	< 22	< 3	< 2	< 3	< 10
	MEAN	-	-	-	-	-	-	-	-	-

Table C-VII.1 **CONCENTRATIONS OF I-131 IN AIR IODINE SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019**

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

COLLECTION PERIOD	GROUP I					
	CL-2	CL-3	CL-4	CL-6	CL-15	CL-94
01/02/19 - 01/09/19	< 48	< 48	< 47	< 49	< 27	< 26
01/09/19 - 01/16/19	< 54	< 55	< 56	< 56	< 46	< 46
01/16/19 - 01/23/19	< 36	< 36	< 36	< 37	< 51	< 51
01/23/19 - 01/31/19	< 29	< 30	< 30	< 31	< 37	< 20
01/31/19 - 02/06/19	< 45	< 44	< 45	< 44	< 61	< 61
02/06/19 - 02/13/19	< 39	< 39	< 38	< 38	< 26	< 26
02/13/19 - 02/20/19	< 50	< 49	< 50	< 51	< 40	< 42
02/20/19 - 02/27/19	< 37	< 37	< 38	< 37	< 48	< 48
02/27/19 - 03/06/19	< 56	< 55	< 57	< 54	< 33	< 33
03/06/19 - 03/13/19	< 39	< 40	< 40	< 40	< 62	< 62
03/13/19 - 03/20/19	< 32	< 33	< 34	< 33	< 39	< 16
03/20/19 - 03/27/19	< 46	< 46	< 45	< 47	< 35	< 36
03/27/19 - 04/03/19	< 29	< 30	< 30	< 30	< 43	< 43
04/03/19 - 04/10/19	< 32	< 33	< 33	< 33	< 44	< 44
04/10/19 - 04/17/19	< 42	< 42	< 42	< 43	< 20	< 47
04/17/19 - 04/24/19	< 38	< 38	< 38	< 38	< 65	< 64
04/24/19 - 05/01/19	< 36	< 36	< 36	< 36	< 46	< 45
05/01/19 - 05/08/19	< 40	< 40	< 40	< 17	< 30	< 29
05/08/19 - 05/15/19	< 52	< 52	< 52	< 22	< 36	< 15
05/15/19 - 05/22/19	< 36	< 36	< 36	< 36	< 23	< 23
05/22/19 - 05/29/19	< 45	< 45	< 46	< 46	< 32	< 32
05/29/19 - 06/05/19	< 42	< 42	< 42	< 42	< 22	< 22
06/05/19 - 06/12/19	< 28	< 30	< 29	< 29	< 34	< 33
06/12/19 - 06/19/19	< 32	< 32	< 32	< 32	< 35	< 35
06/19/19 - 06/26/19	< 65	< 66	< 65	< 66	< 48	< 49
06/26/19 - 07/03/19	< 68	< 68	< 69	< 69	< 36	< 36
07/03/19 - 07/10/19	< 39	< 39	< 39	< 39	< 24	< 42
07/10/19 - 07/17/19	< 58	< 58	< 58	< 58	< 43	< 43
07/17/19 - 07/24/19	< 24	< 21	< 24	< 24	< 36	< 37
07/24/19 - 07/31/19	< 22	< 26	< 20	< 20	< 37	< 16
07/31/19 - 08/07/19	< 38	< 38	< 32	< 32	< 47	< 47
08/07/19 - 08/14/19	< 48	< 50	< 49	< 49	< 56	< 56
08/14/19 - 08/21/19	< 44	< 44	< 44	< 19	< 42	< 42
08/21/19 - 08/28/19	< 41	< 41	< 41	< 41	< 41	< 21
08/28/19 - 09/04/19	< 21	< 25	< 25	< 25	< 27	< 33
09/04/19 - 09/11/19	< 36	< 15	< 36	< 36	< 23	< 27
09/11/19 - 09/18/19	< 18	< 44	< 44	< 44	< 30	< 25
09/18/19 - 09/25/19	< 35	< 35	< 35	< 35	< 27	< 27
09/25/19 - 10/02/19	< 28	< 28	< 28	< 23	< 44	< 18
10/02/19 - 10/09/19	< 24	< 25	< 10	< 25	< 14	< 12
10/09/19 - 10/16/19	< 15	< 37	< 37	< 37	< 27	< 27
10/16/19 - 10/23/19	< 50	< 50	< 50	< 50	< 24	< 30
10/23/19 - 10/30/19	< 20	< 48	< 47	< 47	< 24	< 42
10/30/19 - 11/06/19	< 36	< 35	< 18	< 36	< 14	< 29
11/06/19 - 11/13/19	< 32	< 15	< 32	< 32	< 13	< 28
11/13/19 - 11/20/19	< 36	< 38	< 36	< 36	< 37	< 36
11/20/19 - 11/27/19	< 37	< 32	< 38	< 38	< 39	< 40
11/27/19 - 12/04/19	< 31	< 31	< 31	< 26	< 18	< 18
12/04/19 - 12/11/19	< 31	< 27	< 31	< 31	< 38	< 16
12/11/19 - 12/18/19	< 27	< 23	< 27	< 27	< 15	< 36
12/18/19 - 12/26/19	< 49	< 51	< 50	< 21	< 52	< 52
12/26/19 - 01/01/20	< 25	< 25	< 25	< 25	< 33	< 15
MEAN	-	-	-	-	-	-

Table C-VII.1 **CONCENTRATIONS OF I-131 IN AIR IODINE SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019**

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

COLLECTION PERIOD	GROUP II			GROUP III
	CL-1	CL-7	CL-8	CL-11
01/02/19 - 01/09/19	< 20	< 11	< 26	< 26
01/09/19 - 01/16/19	< 19	< 46	< 46	< 19
01/16/19 - 01/23/19	< 20	< 18	< 51	< 51
01/23/19 - 01/31/19	< 25	< 37	< 37	< 37
01/31/19 - 02/06/19	< 38	< 25	< 60	< 60
02/06/19 - 02/13/19	< 16	< 22	< 26	< 26
02/13/19 - 02/20/19	< 18	< 22	< 41	< 40
02/20/19 - 02/27/19	< 29	< 20	< 47	< 47
02/27/19 - 03/06/19	< 23	< 28	< 34	< 34
03/06/19 - 03/13/19	< 33	< 25	< 61	< 61
03/13/19 - 03/20/19	< 28	< 39	< 39	< 38
03/20/19 - 03/27/19	< 20	< 35	< 29	< 35
03/27/19 - 04/03/19	< 16	< 24	< 42	< 42
04/03/19 - 04/10/19	< 27	< 18	< 44	< 43
04/10/19 - 04/17/19	< 18	< 47	< 47	< 47
04/17/19 - 04/24/19	< 21	< 64	< 63	< 34
04/24/19 - 05/01/19	< 15	< 18	< 45	< 45
05/01/19 - 05/08/19	< 41	< 24	< 28	< 28
05/08/19 - 05/15/19	< 51	< 36	< 36	< 36
05/15/19 - 05/22/19	< 15	< 19	< 23	< 23
05/22/19 - 05/29/19	< 19	< 26	< 32	< 32
05/29/19 - 06/05/19	< 18	< 22	< 22	< 9
06/05/19 - 06/12/19	< 25	< 28	< 33	< 33
06/12/19 - 06/19/19	< 18	< 35	< 35	< 12
06/19/19 - 06/26/19	< 28	< 20	< 49	< 48
06/26/19 - 07/03/19	< 29	< 30	< 36	< 35
07/03/19 - 07/10/19	< 16	< 43	< 43	< 42
07/10/19 - 07/17/19	< 25	< 42	< 42	< 35
07/17/19 - 07/24/19	< 25	< 15	< 37	< 37
07/24/19 - 07/31/19	< 21	< 36	< 36	< 36
07/31/19 - 08/07/19	< 26	< 47	< 46	< 20
08/07/19 - 08/14/19	< 21	< 24	< 57	< 56
08/14/19 - 08/21/19	< 44	< 41	< 34	< 41
08/21/19 - 08/28/19	< 23	< 39	< 39	< 40
08/28/19 - 09/04/19	< 25	< 33	< 33	< 32
09/04/19 - 09/11/19	< 36	< 27	< 27	< 28
09/11/19 - 09/18/19	< 44	< 30	< 30	< 30
09/18/19 - 09/25/19	< 15	< 27	< 23	< 27
09/25/19 - 10/02/19	< 28	< 44	< 44	< 43
10/02/19 - 10/09/19	< 25	< 13	< 13	< 14
10/09/19 - 10/16/19	< 37	< 23	< 27	< 27
10/16/19 - 10/23/19	< 21	< 30	< 30	< 29
10/23/19 - 10/30/19	< 48	< 42	< 41	< 41
10/30/19 - 11/06/19	< 36	< 28	< 29	< 29
11/06/19 - 11/13/19	< 32	< 28	< 27	< 28
11/13/19 - 11/20/19	< 18	< 36	< 36	*(1)*
11/20/19 - 11/27/19	< 38	< 19	< 40	< 39
11/27/19 - 12/04/19	< 31	< 18	< 18	< 16
12/04/19 - 12/11/19	< 32	< 38	< 38	< 38
12/11/19 - 12/18/19	< 28	< 36	< 35	< 35
12/18/19 - 12/26/19	< 50	< 50	< 51	< 21
12/26/19 - 01/01/20	< 25	< 33	< 34	< 34
MEAN	-	-	-	-

(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

Table C-VIII.1 CONCENTRATIONS OF I-131 IN MILK SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	CONTROL FARM CL-116
01/31/19	< 0.6
02/27/19	< 0.8
03/27/19	< 0.8
04/24/19	< 0.8
05/08/19	< 0.6
05/22/19	< 0.8
06/05/19	< 0.9
06/19/19	< 0.8
07/03/19	< 0.6
07/17/19	< 0.8
07/31/19	< 0.6
08/14/19	< 0.9
08/28/19	< 0.8
09/11/19	< 0.8
09/25/19	< 0.7
10/09/19	< 0.9
10/23/19	< 0.8
11/27/19	< 0.8
12/26/19	< 0.8
MEAN	-

Table C-VIII.2

CONCENTRATIONS OF GAMMA EMITTERS IN MILK SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140	Ce-144
CL-116	01/31/19	1127 ± 137	< 5	< 6	< 13	< 7	< 12	< 5	< 11	< 7	< 6	< 25	< 7	< 40
	02/27/19	855 ± 149	< 7	< 6	< 16	< 9	< 16	< 6	< 11	< 6	< 7	< 20	< 5	< 39
	03/27/19	1114 ± 186	< 8	< 7	< 18	< 8	< 17	< 8	< 14	< 10	< 8	< 35	< 9	< 60
	04/24/19	926 ± 163	< 8	< 8	< 16	< 11	< 20	< 8	< 14	< 12	< 10	< 28	< 12	< 61
	05/08/19	905 ± 123	< 6	< 6	< 15	< 7	< 14	< 7	< 11	< 6	< 6	< 28	< 8	< 42
	05/22/19	1169 ± 164	< 7	< 6	< 16	< 7	< 16	< 9	< 11	< 9	< 8	< 41	< 9	< 54
	06/05/19	938 ± 174	< 7	< 9	< 15	< 9	< 17	< 8	< 16	< 10	< 9	< 33	< 13	< 60
	06/19/19	1177 ± 163	< 8	< 6	< 14	< 9	< 14	< 6	< 15	< 7	< 8	< 36	< 11	< 59
	07/03/19	979 ± 165	< 8	< 8	< 16	< 7	< 16	< 8	< 15	< 11	< 8	< 35	< 12	< 62
	07/17/19	1048 ± 149	< 7	< 6	< 14	< 8	< 18	< 7	< 12	< 7	< 7	< 36	< 9	< 56
	07/31/19	1041 ± 166	< 7	< 8	< 15	< 8	< 18	< 7	< 13	< 9	< 7	< 26	< 10	< 47
	08/14/19	932 ± 170	< 6	< 11	< 17	< 10	< 17	< 7	< 15	< 9	< 8	< 36	< 11	< 62
	08/28/19	1017 ± 148	< 7	< 7	< 16	< 9	< 15	< 8	< 12	< 8	< 7	< 30	< 10	< 49
	09/11/19	614 ± 140	< 8	< 8	< 18	< 10	< 18	< 8	< 13	< 9	< 9	< 31	< 12	< 62
	09/25/19	1265 ± 201	< 8	< 7	< 22	< 7	< 20	< 10	< 15	< 9	< 10	< 42	< 9	< 62
	10/09/19	1302 ± 171	< 7	< 8	< 15	< 8	< 18	< 9	< 12	< 8	< 8	< 34	< 8	< 54
	10/23/19	1169 ± 187	< 10	< 9	< 17	< 10	< 21	< 8	< 12	< 8	< 9	< 39	< 10	< 63
	11/27/19	855 ± 169	< 8	< 8	< 17	< 12	< 15	< 9	< 14	< 10	< 8	< 44	< 12	< 62
	12/26/19	1156 ± 158	< 7	< 6	< 16	< 7	< 14	< 6	< 11	< 8	< 8	< 25	< 7	< 45
	MEAN	1031 ± 335	-	-	-	-	-	-	-	-	-	-	-	-

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

Table C-IX.1

CONCENTRATIONS OF GAMMA EMITTERS IN VEGETATION SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

SITE	COLLECTION PERIOD	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140	Ce-144
CL-114														
Cabbage	06/26/19	< 29	< 27	< 53	< 29	< 60	< 38	< 60	< 52	< 33	< 35	< 137	< 36	< 187
Lettuce	06/26/19	< 35	< 31	< 85	< 40	< 77	< 39	< 73	< 52	< 40	< 29	< 152	< 52	< 193
Swiss Chard	06/26/19	< 25	< 24	< 50	< 20	< 60	< 25	< 43	< 39	< 26	< 29	< 112	< 35	< 145
Cabbage/Lettuce	07/31/19	< 25	< 31	< 68	< 35	< 62	< 31	< 47	< 45	< 40	< 28	< 150	< 36	< 203
Lettuce	07/31/19	< 29	< 30	< 50	< 23	< 72	< 31	< 61	< 41	< 33	< 28	< 109	< 50	< 169
Swiss Chard	07/31/19	< 34	< 32	< 84	< 35	< 76	< 35	< 59	< 49	< 33	< 34	< 137	< 32	< 235
Corn	08/28/19	< 27	< 23	< 48	< 27	< 39	< 21	< 42	< 35	< 24	< 23	< 101	< 28	< 147
Lettuce	08/28/19	< 26	< 27	< 61	< 30	< 65	< 28	< 43	< 38	< 37	< 33	< 103	< 35	< 144
Swiss Chard	08/28/19	< 24	< 21	< 62	< 19	< 48	< 26	< 46	< 40	< 30	< 25	< 111	< 28	< 134
Corn	09/25/19	< 28	< 31	< 72	< 33	< 55	< 39	< 64	< 39	< 33	< 37	< 123	< 54	< 151
Swiss Chard	09/25/19	< 28	< 30	< 60	< 26	< 76	< 29	< 47	< 29	< 35	< 28	< 92	< 24	< 173
Swiss Chard	09/25/19	< 35	< 42	< 86	< 50	< 89	< 52	< 66	< 51	< 43	< 38	< 159	< 48	< 241
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-	-
CL-115														
Cabbage	06/26/19	< 25	< 32	< 73	< 41	< 51	< 22	< 56	< 44	< 25	< 30	< 117	< 39	< 172
Lettuce	06/26/19	< 18	< 18	< 42	< 21	< 46	< 20	< 31	< 27	< 21	< 19	< 76	< 24	< 89
Swiss Chard	06/26/19	< 31	< 32	< 57	< 29	< 63	< 28	< 44	< 42	< 26	< 30	< 117	< 42	< 180
Cabbage	07/31/19	< 23	< 26	< 45	< 33	< 55	< 23	< 47	< 42	< 31	< 33	< 115	< 32	< 140
Lettuce	07/31/19	< 31	< 31	< 69	< 32	< 70	< 35	< 45	< 47	< 34	< 34	< 125	< 26	< 181
Swiss Chard	07/31/19	< 29	< 30	< 78	< 29	< 77	< 35	< 45	< 47	< 33	< 28	< 114	< 27	< 193
Cabbage	08/28/19	< 28	< 29	< 52	< 34	< 79	< 27	< 54	< 42	< 32	< 32	< 133	< 36	< 185
Lettuce	08/28/19	< 24	< 22	< 52	< 22	< 50	< 28	< 40	< 38	< 27	< 23	< 119	< 26	< 135
Swiss Chard	08/28/19	< 24	< 27	< 57	< 32	< 66	< 26	< 54	< 37	< 28	< 28	< 95	< 38	< 151
Cabbage	09/25/19	< 23	< 21	< 47	< 32	< 51	< 22	< 41	< 22	< 31	< 25	< 81	< 30	< 141
Cabbage	09/25/19	< 28	< 28	< 72	< 37	< 51	< 30	< 42	< 36	< 31	< 31	< 98	< 41	< 145
Swiss Chard	09/25/19	< 27	< 25	< 65	< 25	< 81	< 28	< 41	< 28	< 37	< 30	< 106	< 34	< 162
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C-IX.1

CONCENTRATIONS OF GAMMA EMITTERS IN VEGETATION SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

SITE	COLLECTION PERIOD	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140	Ce-144
CL-117														
Cabbage	06/26/19	< 22	< 22	< 41	< 24	< 43	< 15	< 34	< 32	< 21	< 25	< 84	< 12	< 108
Lettuce	06/26/19	< 21	< 28	< 57	< 26	< 46	< 22	< 42	< 40	< 30	< 23	< 124	< 38	< 159
Swiss Chard	06/26/19	< 18	< 21	< 52	< 22	< 45	< 23	< 38	< 31	< 29	< 23	< 91	< 22	< 105
Cabbage	07/31/19	< 27	< 26	< 58	< 30	< 57	< 31	< 58	< 42	< 35	< 26	< 148	< 32	< 175
Lettuce	07/31/19	< 28	< 29	< 73	< 36	< 69	< 29	< 51	< 49	< 36	< 32	< 150	< 36	< 207
Swiss Chard	07/31/19	< 30	< 29	< 75	< 37	< 81	< 30	< 54	< 50	< 35	< 33	< 122	< 30	< 203
Cabbage	08/28/19	< 28	< 26	< 54	< 32	< 57	< 26	< 44	< 44	< 28	< 32	< 148	< 39	< 160
Lettuce	08/28/19	< 30	< 23	< 77	< 32	< 70	< 36	< 52	< 55	< 31	< 30	< 136	< 31	< 165
Swiss Chard	08/28/19	< 27	< 27	< 57	< 30	< 64	< 31	< 55	< 40	< 33	< 28	< 136	< 34	< 163
Cabbage	09/25/19	< 30	< 31	< 61	< 29	< 69	< 34	< 47	< 33	< 33	< 30	< 121	< 40	< 203
Cabbage	09/25/19	< 22	< 26	< 33	< 25	< 49	< 18	< 32	< 25	< 23	< 22	< 91	< 21	< 122
Swiss Chard	09/25/19	< 24	< 22	< 48	< 28	< 59	< 25	< 40	< 28	< 28	< 28	< 85	< 18	< 139
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-	-
CL-118														
Cabbage	06/26/19	< 25	< 22	< 56	< 30	< 56	< 24	< 33	< 41	< 27	< 26	< 112	< 34	< 155
Lettuce	06/26/19	< 19	< 21	< 43	< 29	< 51	< 22	< 39	< 32	< 22	< 20	< 83	< 26	< 150
Swiss Chard	06/26/19	< 23	< 20	< 49	< 30	< 53	< 23	< 39	< 37	< 25	< 23	< 89	< 30	< 131
Cabbage	07/31/19	< 29	< 37	< 76	< 24	< 80	< 24	< 58	< 49	< 33	< 28	< 139	< 46	< 220
Lettuce	07/31/19	< 25	< 24	< 65	< 25	< 59	< 25	< 43	< 34	< 22	< 26	< 95	< 30	< 146
Swiss Chard	07/31/19	< 23	< 24	< 73	< 36	< 69	< 26	< 53	< 40	< 37	< 26	< 115	< 37	< 164
Cabbage	08/28/19	< 31	< 27	< 62	< 29	< 52	< 28	< 51	< 37	< 34	< 28	< 117	< 26	< 144
Lettuce	08/28/19	< 28	< 28	< 52	< 25	< 79	< 26	< 54	< 44	< 34	< 31	< 128	< 20	< 168
Swiss Chard	08/28/19	< 19	< 16	< 44	< 24	< 42	< 21	< 44	< 34	< 23	< 21	< 83	< 23	< 112
Cabbage	09/25/19	< 28	< 26	< 53	< 38	< 57	< 26	< 50	< 28	< 30	< 29	< 99	< 28	< 161
Cabbage	09/25/19	< 33	< 30	< 67	< 27	< 60	< 32	< 49	< 38	< 37	< 32	< 113	< 32	< 197
Swiss Chard	09/25/19	< 25	< 28	< 59	< 28	< 64	< 24	< 44	< 39	< 31	< 28	< 105	< 36	< 127
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C-IX.2

CONCENTRATIONS OF GAMMA EMITTERS IN GRASS SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

SITE	COLLECTION PERIOD	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140	Ce-144
CL-01	05/08/19	< 27	< 26	< 50	< 29	< 58	< 25	< 37	< 35	< 24	< 22	< 81	< 27	< 134
	05/22/19	< 23	< 29	< 54	< 23	< 50	< 19	< 44	< 31	< 24	< 24	< 94	< 23	< 151
	06/05/19	< 37	< 36	< 80	< 43	< 77	< 36	< 54	< 48	< 32	< 35	< 108	< 44	< 207
	06/19/19	< 35	< 32	< 97	< 34	< 82	< 34	< 56	< 51	< 39	< 41	< 145	< 42	< 198
	07/03/19	< 35	< 29	< 77	< 39	< 62	< 30	< 50	< 59	< 35	< 35	< 143	< 46	< 208
	07/17/19	< 13	< 13	< 29	< 13	< 29	< 13	< 20	< 21	< 13	< 13	< 58	< 14	< 64
	07/31/19	< 23	< 33	< 68	< 40	< 53	< 29	< 50	< 49	< 32	< 27	< 114	< 43	< 169
	08/14/19	< 28	< 28	< 56	< 24	< 58	< 35	< 51	< 40	< 29	< 33	< 113	< 32	< 173
	08/28/19	< 30	< 31	< 72	< 33	< 69	< 30	< 51	< 47	< 36	< 32	< 139	< 26	< 191
	09/11/19	< 27	< 28	< 75	< 39	< 98	< 31	< 61	< 56	< 39	< 37	< 126	< 39	< 196
	09/25/19	< 25	< 28	< 65	< 30	< 75	< 31	< 49	< 43	< 29	< 31	< 125	< 38	< 191
	10/09/19	< 32	< 37	< 86	< 38	< 92	< 34	< 60	< 56	< 37	< 42	< 141	< 47	< 227
	10/23/19	< 34	< 32	< 75	< 42	< 69	< 37	< 62	< 52	< 36	< 44	< 139	< 32	< 264
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-	-
CL-02	05/08/19	< 29	< 29	< 64	< 25	< 68	< 30	< 36	< 39	< 25	< 28	< 121	< 35	< 174
	05/22/19	< 38	< 31	< 68	< 41	< 89	< 39	< 59	< 47	< 43	< 45	< 142	< 51	< 250
	06/05/19	< 26	< 29	< 70	< 36	< 76	< 31	< 44	< 51	< 35	< 30	< 112	< 46	< 167
	06/19/19	< 39	< 37	< 86	< 36	< 64	< 36	< 68	< 53	< 31	< 34	< 137	< 35	< 205
	07/03/19	< 32	< 32	< 70	< 28	< 70	< 28	< 57	< 55	< 32	< 36	< 155	< 35	< 242
	07/17/19	< 12	< 13	< 28	< 14	< 30	< 13	< 22	< 21	< 14	< 14	< 56	< 17	< 82
	07/31/19	< 30	< 36	< 83	< 27	< 85	< 35	< 63	< 55	< 45	< 37	< 137	< 40	< 229
	08/14/19	< 34	< 41	< 71	< 47	< 101	< 36	< 71	< 57	< 45	< 40	< 171	< 33	< 249
	08/28/19	< 33	< 29	< 50	< 31	< 54	< 31	< 54	< 55	< 33	< 28	< 119	< 35	< 179
	09/11/19	< 30	< 32	< 56	< 37	< 69	< 38	< 55	< 47	< 40	< 37	< 137	< 39	< 198
	09/25/19	< 32	< 34	< 78	< 38	< 86	< 39	< 61	< 59	< 43	< 35	< 160	< 32	< 242
	10/09/19	< 37	< 32	< 74	< 40	< 91	< 28	< 56	< 53	< 33	< 34	< 133	< 31	< 236
	10/23/19	< 40	< 32	< 78	< 45	< 68	< 37	< 66	< 56	< 35	< 37	< 166	< 43	< 232
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C-IX.2

CONCENTRATIONS OF GAMMA EMITTERS IN GRASS SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

SITE	COLLECTION PERIOD	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140	Ce-144
CL-08	05/08/19	< 25	< 24	< 67	< 24	< 66	< 28	< 44	< 46	< 31	< 28	< 107	< 26	< 198
	05/22/19	< 26	< 25	< 59	< 27	< 68	< 27	< 49	< 37	< 34	< 30	< 111	< 32	< 175
	06/05/19	< 29	< 27	< 54	< 32	< 62	< 24	< 48	< 41	< 28	< 28	< 108	< 34	< 172
	06/19/19	< 35	< 33	< 73	< 43	< 79	< 34	< 52	< 50	< 35	< 41	< 145	< 48	< 228
	07/03/19	< 31	< 23	< 67	< 29	< 67	< 36	< 47	< 49	< 24	< 27	< 136	< 33	< 194
	07/17/19	< 12	< 11	< 25	< 10	< 27	< 12	< 21	< 18	< 12	< 11	< 51	< 15	< 69
	07/31/19	< 23	< 30	< 55	< 23	< 86	< 34	< 48	< 42	< 35	< 33	< 128	< 37	< 186
	08/14/19	< 21	< 20	< 64	< 37	< 61	< 28	< 44	< 30	< 27	< 28	< 95	< 26	< 129
	08/28/19	< 27	< 26	< 58	< 24	< 69	< 31	< 42	< 35	< 26	< 24	< 103	< 27	< 133
	09/11/19	< 14	< 13	< 33	< 16	< 33	< 15	< 24	< 22	< 15	< 14	< 64	< 19	< 71
	09/25/19	< 37	< 33	< 82	< 35	< 86	< 36	< 72	< 58	< 40	< 34	< 170	< 36	< 245
	10/09/19	< 30	< 39	< 75	< 37	< 78	< 40	< 52	< 55	< 38	< 40	< 173	< 35	< 221
	10/23/19	< 30	< 22	< 85	< 43	< 71	< 27	< 47	< 42	< 20	< 30	< 134	< 18	< 169
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-	-
CL-116	05/08/19	< 23	< 20	< 54	< 26	< 53	< 17	< 38	< 35	< 33	< 26	< 101	< 27	< 150
	05/22/19	< 25	< 21	< 38	< 18	< 52	< 25	< 37	< 30	< 28	< 27	< 90	< 25	< 147
	06/05/19	< 32	< 37	< 90	< 44	< 95	< 36	< 53	< 58	< 43	< 39	< 161	< 25	< 204
	06/19/19	< 33	< 25	< 80	< 26	< 58	< 33	< 71	< 44	< 35	< 34	< 174	< 32	< 203
	07/03/19	< 29	< 26	< 63	< 38	< 67	< 32	< 41	< 50	< 35	< 27	< 157	< 54	< 141
	07/17/19	< 26	< 23	< 55	< 27	< 71	< 27	< 44	< 30	< 23	< 26	< 122	< 24	< 152
	07/31/19	< 28	< 31	< 69	< 28	< 67	< 31	< 47	< 46	< 29	< 31	< 140	< 32	< 188
	08/14/19	< 26	< 27	< 53	< 23	< 55	< 25	< 45	< 37	< 31	< 25	< 129	< 35	< 156
	08/28/19	< 22	< 20	< 63	< 26	< 49	< 25	< 39	< 39	< 30	< 25	< 96	< 23	< 138
	09/11/19	< 26	< 31	< 65	< 29	< 68	< 33	< 54	< 52	< 36	< 34	< 140	< 47	< 215
	09/25/19	< 30	< 36	< 62	< 32	< 84	< 41	< 54	< 53	< 38	< 32	< 138	< 31	< 252
	10/09/19	< 37	< 38	< 59	< 35	< 84	< 36	< 50	< 52	< 33	< 40	< 136	< 51	< 194
	10/23/19	< 37	< 34	< 77	< 35	< 87	< 42	< 73	< 55	< 34	< 45	< 130	< 26	< 245
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C-X.1 QUARTERLY DLR RESULTS FOR CLINTON POWER STATION, 2019

Location	Qtr 1 (mrem)	Qtr 2 (mrem)	Qtr 3 (mrem)	Qtr 4 (mrem)	Normalized Annual Dose, M_A (mrem/yr)	B_A[1]	B_A + MDD_A[2]	Annual Facility Dose, F_A (mrem)
CL-01	17.3	13.5	19.3	19.3	69.4	74.0	83.6	ND
CL-02	17.8	18.6	21.2	19.1	76.7	76.7	86.2	ND
CL-03	17.2	19.0	19.7	20.4	76.3	74.7	84.2	ND
CL-04	17.2	19.4	20.2	19.1	75.9	72.8	82.3	ND
CL-05	17.3	19.1	21.3	19.8	77.5	76.5	86.0	ND
CL-06	15.1	16.0	17.7	17.5	66.3	65.8	75.3	ND
CL-07	15.9	16.9	19.8	17.9	70.5	69.5	79.0	ND
CL-08	17.0	18.7	18.1	17.2	71.0	74.0	83.5	ND
CL-11	15.9	17.0	18.6	18.1	69.6	69.3	78.8	ND
CL-15	14.8	16.9	16.6	15.9	64.2	66.3	75.8	ND
CL-22	16.1	18.9	20.9	20.6	76.5	77.6	87.1	ND
CL-23	18.1	20.5	21.3	19.3	79.2	81.5	91.0	ND
CL-24	17.0	20.1	21.2	20.7	79.0	80.5	90.0	ND
CL-33	17.6	18.5	22.3	19.1	77.5	79.2	88.7	ND
CL-34	16.8	18.2	17.2	17.9	70.1	77.5	87.0	ND
CL-35	16.2	18.1	19.7	17.6	71.6	71.6	81.1	ND
CL-36	16.7	18.1	21.1	18.6	74.5	74.2	83.7	ND
CL-37	16.3	18.1	21.8	18.2	74.4	71.1	80.6	ND
CL-41	17.9	20.5	20.2	20.6	79.2	79.4	88.9	ND
CL-42	16.7	17.5	19.6	18.7	72.5	74.2	83.7	ND
CL-43	17.4	20.3	22.8	20.9	81.4	79.7	89.2	ND
CL-44	16.4	17.9	19.4	19.0	72.7	75.4	84.9	ND
CL-45	18.0	21.8	23.6	19.9	83.3	80.6	90.1	ND
CL-46	18.1	18.3	20.5	18.7	75.6	73.0	82.5	ND
CL-47	17.7	19.3	22.5	19.7	79.2	79.4	88.9	ND
CL-48	16.5	19.7	19.4	19.0	74.6	74.2	83.7	ND
CL-49	17.6	18.6	19.4	20.0	75.6	79.8	89.3	ND
CL-51	17.2	20.4	22.2	21.9	81.7	76.6	86.1	ND
CL-52	16.7	19.9	19.6	20.5	76.7	75.6	85.1	ND
CL-53	15.4	17.1	19.1	18.2	69.8	71.9	81.4	ND
CL-54	17.9	19.3	21.0	20.7	78.9	78.0	87.5	ND
CL-55	17.2	19.4	21.1	20.9	78.6	78.7	88.2	ND
CL-56	18.6	20.0	22.9	20.6	82.1	81.0	90.5	ND
CL-57	16.5	21.2	22.8	20.7	81.2	81.5	91.0	ND
CL-58	17.1	19.3	20.5	20.4	77.3	79.1	88.6	ND
CL-60	17.4	19.7	20.8	19.5	77.4	79.0	88.5	ND
CL-61	16.4	18.3	21.2	19.0	74.9	78.1	87.6	ND
CL-63	14.9	19.8	18.6	16.8	70.1	66.6	76.1	ND
CL-64	17.3	18.2	19.7	18.9	74.1	75.9	85.4	ND
CL-65	19.9	22.2	21.9	20.6	84.6	80.5	90.01	ND
CL-74	15.0	17.1	16.9	17.8	66.8	68	77.51	ND
CL-75	17.7	18.5	18.9	20.4	75.5	75.7	85.21	ND
CL-76	17.2	20.1	21.0	20.4	78.7	78.7	88.21	ND
CL-77	16.2	18.0	18.8	18.6	71.6	72.2	81.71	ND
CL-78	18.2	20.6	19.0	20.0	77.8	72	81.51	ND
CL-79	16.1	19.5	19.9	19.8	75.3	77.1	86.61	ND
CL-80	17.0	19.2	20.6	19.5	76.3	75.5	85.01	ND
CL-81	17.4	19.1	21.1	20.0	77.6	76.8	86.31	ND
CL-84	16.7	19.5	20.6	18.9	75.7	76.3	85.81	ND
CL-90	14.1	15.8	15.1	15.0	60	62.2	71.71	ND
CL-91	15.6	18.8	18.6	18.4	71.4	69.5	79.01	ND
CL-97	16.9	20.3	20.4	19.9	77.5	77.6	87.11	ND
CL-99	13.5	15.1	16.1	16.1	60.8	60.6	70.11	ND
CL-114	15.3	19.3	19.3	19.1	73.0	72.3	81.8	ND

[1] **Baseline background dose (BB_A):** The estimated mean background radiation dose at each field monitoring location annually based on historical measurements, excluding any dose contribution from the monitored facility

[2] **Minimum differential dose (MDD_A):** The smallest amount of facility related dose at each monitored location annually above the baseline background dose that can be reliably detected by an environmental dosimetry system

FIGURE C-1
MEAN MONTHLY GROSS BETA CONCENTRATION IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF CPS, 2019

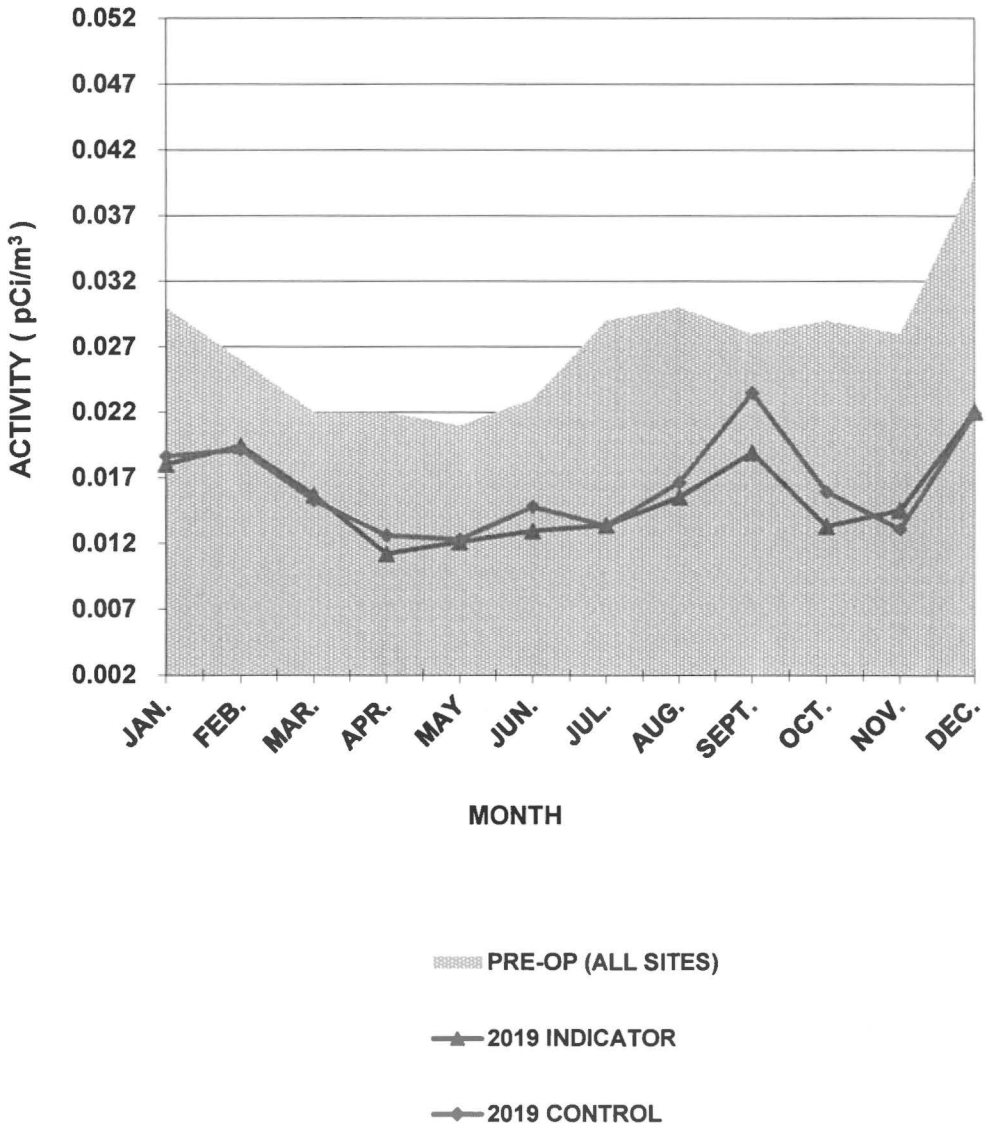
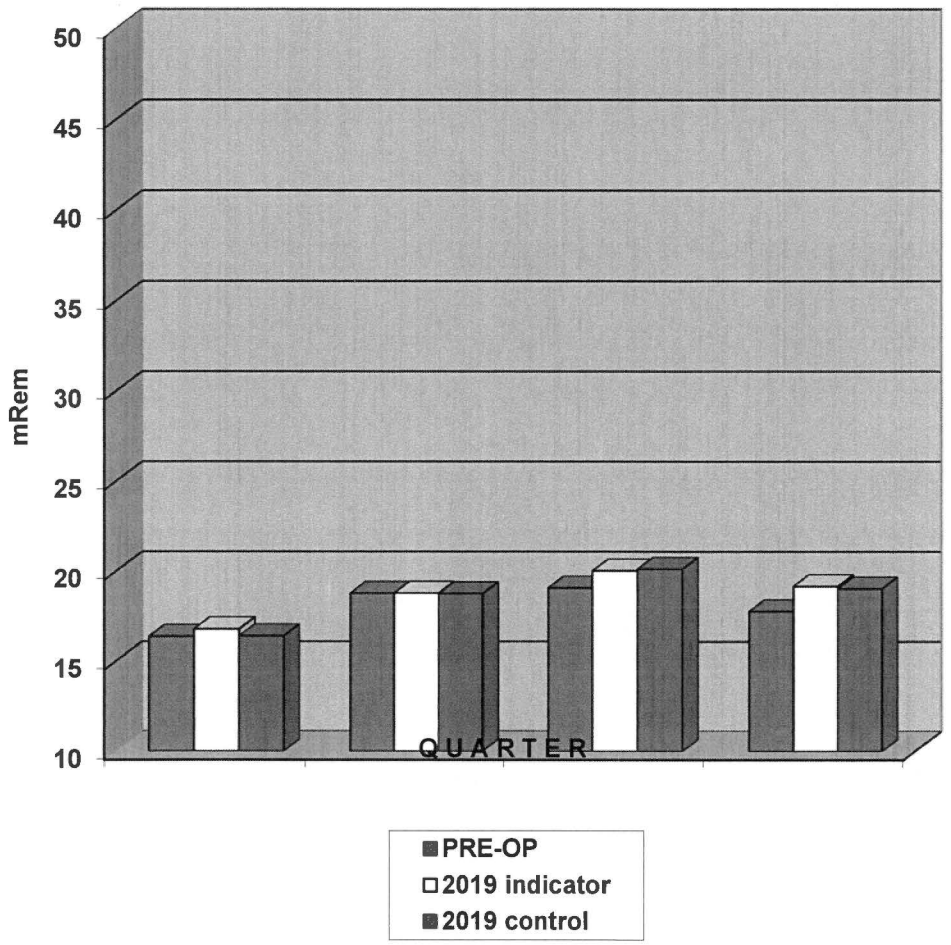


FIGURE C-2
MEAN QUARTERLY AMBIENT GAMMA RADIATION LEVELS (DLR) IN THE VICINITY OF CPS, 2019



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APPENDIX D

INTER-LABORATORY COMPARISON PROGRAM

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Table D.1 **Analytics Environmental Radioactivity Cross Check Program**
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Ratio of TBE to Analytics Result	Evaluation [b]
March 2019	E12468A	Milk	Sr-89	pCi/L	87.1	96	0.91	A
			Sr-90	pCi/L	12.6	12.6	1.00	A
	E12469A	Milk	Ce-141	pCi/L	113	117	0.97	A
			Co-58	pCi/L	153	143	1.07	A
			Co-60	pCi/L	289	299	0.97	A
			Cr-51	pCi/L	233	293	0.80	A
			Cs-134	pCi/L	147	160	0.92	A
			Cs-137	pCi/L	193	196	0.98	A
			Fe-59	pCi/L	153	159	0.96	A
			I-131	pCi/L	91.5	89.5	1.02	A
			Mn-54	pCi/L	149	143	1.04	A
			Zn-65	pCi/L	209	220	0.95	A
	E12470	Charcoal	I-131	pCi	77.5	75.2	1.03	A
	E12471	AP	Ce-141	pCi	60.7	70.2	0.87	A
			Co-58	pCi	87.9	85.8	1.02	A
			Co-60	pCi	175	179	0.98	A
			Cr-51	pCi	165	176	0.94	A
			Cs-134	pCi	91.2	95.9	0.95	A
			Cs-137	pCi	120	118	1.02	A
			Fe-59	pCi	108	95.3	1.13	A
			Mn-54	pCi	94.2	85.7	1.10	A
			Zn-65	pCi	102	132	0.77	W
	E12472	Water	Fe-55	pCi/L	2230	1920	1.16	A
	E12473	Soil	Ce-141	pCi/g	0.189	0.183	1.03	A
			Co-58	pCi/g	0.209	0.224	0.93	A
			Co-60	pCi/g	0.481	0.466	1.03	A
			Cr-51	pCi/g	0.522	0.457	1.14	A
			Cs-134	pCi/g	0.218	0.250	0.87	A
			Cs-137	pCi/g	0.370	0.381	0.97	A
			Fe-59	pCi/g	0.263	0.248	1.06	A
			Mn-54	pCi/g	0.248	0.223	1.11	A
			Zn-65	pCi/g	0.371	0.344	1.08	A
	E12474	AP	Sr-89	pCi	88.3	95.2	0.93	A
			Sr-90	pCi	11.7	12.5	0.94	A
August 2019	E12562	Soil	Sr-90	pCi/g	4.710	6.710	0.70	W

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

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

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

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

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

Table D.1 **Analytics Environmental Radioactivity Cross Check Program**
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Ratio of TBE to Analytics Result	Evaluation [b]
September 2019	E12475	Milk	Sr-89	pCi/L	70.0	93.9	0.75	W
			Sr-90	pCi/L	12.0	12.9	0.93	A
	E12476	Milk	Ce-141	pCi/L	150	167	0.90	A
			Co-58	pCi/L	170	175	0.97	A
			Co-60	pCi/L	211	211	1.00	A
			Cr-51	pCi/L	323	331	0.98	A
			Cs-134	pCi/L	180	207	0.87	A
			Cs-137	pCi/L	147	151	0.97	A
			Fe-59	pCi/L	156	148	1.05	A
			I-131	pCi/L	81.1	92.1	0.88	A
			Mn-54	pCi/L	160	154	1.04	A
			Zn-65	pCi/L	303	293	1.03	A
	E12477	Charcoal	I-131	pCi	95.9	95.1	1.01	A
	E12478	AP	Ce-141	pCi	129	138	0.93	A
			Co-58	pCi	128	145	0.88	A
			Co-60	pCi	181	174	1.04	A
			Cr-51	pCi	292	274	1.07	A
			Cs-134	pCi	166	171	0.97	A
			Cs-137	pCi	115	125	0.92	A
			Fe-59	pCi	119	123	0.97	A
			Mn-54	pCi	129	128	1.01	A
			Zn-65	pCi	230	242	0.95	A
	E12479	Water	Fe-55	pCi/L	1810	1850	0.98	A
	E12480	Soil	Ce-141	pCi/g	0.305	0.276	1.10	A
			Co-58	pCi/g	0.270	0.289	0.93	A
			Co-60	pCi/g	0.358	0.348	1.03	A
			Cr-51	pCi/g	0.765	0.547	1.40	N[1]
			Cs-134	pCi/g	0.327	0.343	0.95	A
			Cs-137	pCi/g	0.308	0.321	0.96	A
			Fe-59	pCi/g	0.257	0.245	1.05	A
			Mn-54	pCi/g	0.274	0.255	1.07	A
			Zn-65	pCi/g	0.536	0.485	1.11	A
	E12481	AP	Sr-89	pCi	95.9	91.9	1.04	A
			Sr-90	pCi	12.3	12.6	0.97	A
	E12563	Soil	Sr-90	pCi/g	0.392	0.360	1.09	A

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

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

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

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

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

*(1) See **NCR 19-27***

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

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

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

(b) DOE/MAPEP evaluation:
A = Acceptable - reported result falls within ratio limits of 0.80-1.20
W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30
N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30
NR = Not Reported

(1) False positive test
(2) Sensitivity evaluation
*(3) See **NCR 19-12***
*(4) See **NCR 19-13***
*(5) See **NCR 19-14***
*(6) See **NCR 19-25***
*(7) See **NCR 19-26***

Table D.3 **ERA Environmental Radioactivity Cross Check Program**
Teledyne Brown Engineering Environmental Services

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

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

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

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

APPENDIX E

ERRATA DATA

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There was no errata data for 2019.

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APPENDIX F

ANNUAL RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM REPORT (ARGPPR)

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ARGPPR Table Of Contents

ARGPPR 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 Clinton Power Station (CPS). This evaluation involved numerous station personnel and contractor support personnel. This report covers groundwater and surface water samples, collected outside of the Licensee required Off-Site Dose Calculation Manual (ODCM) requirements, both on and off station property in 2019. During that time period, 236 analyses were performed on 92 samples from 30 locations. The monitoring was conducted in four phases.

In assessing all the data gathered for this report, it was concluded that the operation of CPS had no adverse radiological impact on the environment, and there are no known active releases into the groundwater or surface water at CPS. No program changes occurred during the sampling year of 2019.

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 NUREG-1302 in any of the groundwater or surface water samples. In the case of tritium, Exelon specified that the independent laboratory achieve a lower limit of detection ten times lower than that required by the United States Environmental Protection Agency (USEPA) regulation.

Strontium-89 (Sr-89) was not detected in any samples. Strontium-90 (Sr-90) was not detected in any samples.

Tritium was not detected in any of the 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. Background levels of tritium were detected at concentrations greater than the self-imposed LLD of 200 pCi/L in two of seventeen groundwater monitoring locations. The tritium concentrations ranged from 247 ± 127 pCi/L to 507 ± 137 pCi/L. Tritium was not detected in any surface water samples.

Gross Alpha and Gross Beta analyses in the dissolved and suspended fractions were performed on groundwater samples during the third quarter of sampling in 2019. Gross Alpha (dissolved) was not detected at any of the groundwater locations. Gross Alpha (suspended) was detected in one of the seventeen groundwater locations at a concentration of 10 ± 1.9 pCi/L. Gross Beta (dissolved) was detected in eleven of seventeen groundwater locations. The concentrations ranged from 1.6 to 6.8 pCi/L. Gross Beta (suspended) was

detected in three of seventeen groundwater locations. The concentrations ranged from 2.0 to 9.7 pCi/L.

Hard-to-Detect analyses were performed on three groundwater locations. The analyses included Iron-55 (Fe-55), Nickel-63 (Ni-63), Americium-241 (Am-241), Cerium-242 (Cm-242), Cerium-243/244 (Cm-243/244), Plutonium-238 (Pu-238), Plutonium-239/240 (Pu-239/240), Uranium-234 (U-234), Uranium-235 (U-235) and Uranium-238 (U-238). U-234 and U-238 were detected at one location with concentrations of 0.29 ± 0.14 pCi/L and 0.25 ± 0.13 pCi/L respectively. All other hard-to-detect nuclides analyzed were not found at concentrations greater than their respective MDCs.

II. Introduction

The Clinton Power Station (CPS), consisting of one approximately 1,140 MW gross electrical power output boiling water reactor is located in Harp Township, DeWitt County, Illinois. CPS is owned and operated by Exelon and became operational in 1987. Unit No. 1 went critical on February 27, 1987. The site encloses approximately 13,730 acres. This includes the 4,895 acre, man-made cooling lake and about 452 acres of property not owned by Exelon. The plant is situated on approximately 150 acres. The cooling water discharge flume, which discharges to the eastern arm of the lake, occupies an additional 130 acres. Although the nuclear reactor, supporting equipment and associated electrical generation and distribution equipment lie in Harp Township, portions of the aforementioned 13,730 acre plot reside within Wilson, Rutledge, DeWitt, Creek, Nixon and Santa Anna Townships.

This report covers those analyses performed by Teledyne Brown Engineering (TBE) on samples collected in 2019.

A. Objectives of the Radiological Groundwater Protection Program (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 knowledge of flow patterns on the surface and shallow subsurface.

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

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

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 Clinton Power Station as discussed below:

1. Exelon and its consultant identified locations as described in the Phase 1 study. Phase 1 studies were conducted by Connestoga Rovers and Associates (CRA) and the results and conclusions were made available to state and federal regulators as well as the public in station specific reports.

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

3. Clinton Power Station will continue to perform routine sampling and radiological analysis of water from selected locations.

4. Clinton Power Station has procedures to identify and report new leaks, spills, or other detections with potential radiological significance in a timely manner.

5. Clinton Power 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, A–2, A–3, and A–4 Appendix A.

Groundwater, Surface Water and Precipitation Water

Samples of water are collected, managed, transported and analyzed in accordance with approved procedures following regulatory methods. Groundwater, surface water, and precipitation 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. Analytical laboratories are subject to internal quality assurance programs and inter-laboratory cross-check programs, as well as nuclear industry audits. Station personnel review and evaluate all analytical data deliverables after initial review by the contractor.

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." The chemical properties of tritium are essentially those of ordinary hydrogen.

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

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

Tritium has a half-life of approximately 12.3 years. It decays spontaneously to Helium-3 (3He). 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 beta 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 to analyze the environmental samples for radioactivity for the Clinton Power Station RGPP in 2019. In order to achieve the stated objectives, the current program includes the following analyses:

1. Concentrations of gamma emitters in groundwater and surface water
2. Concentrations of strontium in groundwater
3. Concentrations of tritium in groundwater, surface water and precipitation samples
4. Concentrations of gross alpha and gross beta in groundwater
5. Concentrations of Am-241 in groundwater
6. Concentrations of Cm-242 and Cm-243/244 in groundwater
7. Concentrations of Pu-238 and Pu-239/240 in groundwater
8. Concentrations of U-234, U-235 and U-238 in groundwater
9. Concentrations of Fe-55 in groundwater
10. Concentrations of Ni-63 in groundwater

B. Data Interpretation

The radiological data collected prior to Clinton Power Station becoming operational were used as a baseline with which these operational data were compared. For the purpose of this report, Clinton Power Station 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) is defined as the smallest concentration of radioactive material in a sample that would yield a net count (above background) that would be detected with only a 5% probability of falsely concluding that a blank observation

represents a "real" signal. The LLD is intended as an *a priori* (a before the fact) estimate of a system (including instrumentation, procedure and sample type) and not as an *a posteriori* (after the fact) criteria for the presence of activity. All analyses were designed to achieve the required CPS detection capabilities for environmental sample analysis.
The minimum detectable concentration (MDC) is defined above with the exception that the measurement is an *a posteriori* (after the fact) estimate of the presence of activity.

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) as well as all sources of error (Total Propagated Uncertainty or TPU). Each result has two values calculated. Exelon reports the TPU by following the result with plus or minus ± the estimated sample standard deviation, as TPU, that is obtained by propagating all sources of analytical uncertainty in measurements.

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

C. Background Analysis

Pre-operational Radiological Environmental Monitoring Program (pre-operational REMP) was conducted to establish background radioactivity levels prior to operation of the Station. The environmental media sampled and analyzed during the pre-operational REMP were atmospheric radiation, fall-out, domestic water, surface water, marine life, milk, and vegetation. The results of the monitoring were detailed in the report entitled, Environmental Radiological Monitoring for Clinton Power Nuclear Power Station, Illinois Power Company, Annual Report 1987, May 1988.

The pre-operational REMP contained analytical results from samples collected from the surface water and groundwater.

1. Background Concentrations of Tritium

The purpose of the following discussion is to summarize background measurements of tritium in various media performed by others:

a. Tritium Production

Tritium is created in the environment from naturally-occurring processes both cosmic and subterranean, as well as from anthropogenic (i.e., man-made) sources. In the upper atmosphere, "Cosmogenic" tritium is produced from the bombardment of stable nuclides and combines with oxygen to form tritiated water, which will then enter the hydrologic cycle. Below ground, "lithogenic" tritium is produced by the bombardment of natural 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 Sr-90 comes from the former atmospheric testing of thermonuclear weapons. Levels of tritium in precipitation increased significantly during the 1950s and early 1960s, and later with additional testing, resulting in the release of significant amounts of tritium to the atmosphere. The Canadian heavy water nuclear power reactors, other commercial power reactors, nuclear research and weapons production continue to influence tritium concentrations in the environment.

b. Precipitation Data

Precipitation samples are routinely collected at stations around the world for the analysis of tritium and other radionuclides. Two publicly available databases that provide tritium concentrations in precipitation are Global Network of Isotopes in Precipitation (GNIP) and USEPA's RadNet database. GNIP provides tritium precipitation concentration data for samples collected world wide from 1960 to 2006. RadNet provides tritium precipitation concentration data for samples collected at stations through out the U.S. from 1960 up to and including 2006. Based on GNIP data for sample stations located in the U.S. Midwest, tritium concentrations peaked around 1963. This peak, which approached 10,000 pCi/L for some stations, coincided with the

atmospheric testing of thermonuclear weapons. Tritium concentrations in surface water showed a sharp decline up until 1975, followed by a gradual decline since that time. Tritium concentrations in Midwest precipitation have typically been below 100 pCi/L since around 1980. Tritium concentrations in wells may still be above the 200 pCi/L detection limit from the external causes described above.

c. Surface Water Data

Tritium concentrations are routinely measured in Clinton Lake.

According to the USEPA, surface water data typically has an uncertainty ± 70 to 100 pCi/L 95% confidence bound on each given measurement. Therefore, the typical background data provided may be subject to measurement uncertainty of approximately ± 70 to 100 pCi/L.

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

IV. Results and Discussion

A. Program Exceptions

1. Sample Anomalies

There were no sample anomalies in 2019.

2. Missed Samples

There were no missed samples in 2019.

B. Program Changes

During 2019, monitoring well MW-CL-13I was conservatively changed from a detection well to an elevated well per Station procedures.

C. Groundwater Results

Groundwater

Baseline samples were collected from off-site wells during four (4) phases at the station. Analytical results are discussed below:

Tritium

Samples from seventeen locations were analyzed for tritium activity. Tritium values ranged from below the Exelon-imposed LLD of 200 pCi/l to 507 pCi/l. (Table B–I.1 Appendix B)

Strontium

Sr-89 was not detected in any of the seventeen samples analyzed and the required LLD of 10 pCi/L was met. Sr-90 was also not detected in any of the seventeen samples analyzed and the required LLD of 1 pCi/L was met. (Table B-I.1 Appendix B)

Gross Alpha and Gross Beta (dissolved and suspended)

Gross Alpha and Gross Beta analyses in the dissolved and suspended fractions were performed on groundwater samples during the third quarter of sampling in 2019. Gross Alpha (dissolved) was not detected at any of the groundwater locations. Gross Alpha (suspended) was detected in one of seventeen groundwater locations at a concentration of 10 ± 1.9 pCi/L pCi/L. Gross Beta (dissolved) was detected in eleven of seventeen groundwater locations. The concentrations ranged from 1.6 to 6.8 pCi/L. Gross Beta (suspended) was detected in three of the groundwater locations. The concentrations ranged from 2.0 to 9.7 pCi/L.
(Table B–I.1 Appendix B)

Gamma Emitters

No plant-produced radionuclides were detected.
(Table B–I.2, Appendix B)

Hard-to-Detect

Hard-to-Detect analyses were performed on two groundwater locations to establish background levels. The analyses included Fe-55, Ni-63, Am- 241, Cm-242, Cm-243/244, Pu-238, Pu-239/240, U-234, U-235, and U-238. One sample detected U-234 and U-238. Occasionally, the isotopes of U-234 and U-238 are detected at low levels and

indistinguishable from background. All other hard-to-detect nuclides were not detected at concentrations greater than their respective MDCs. (Table B–I.3 Appendix B)

D. Surface Water Results

Surface Water

Baseline samples were collected from on-site surface waters during four (4) phases at the station. Analytical results are discussed below. No anomalies were noted during the year.

Tritium

Samples from six locations were analyzed for tritium activity. Tritium was not detected at concentrations greater than the LLD. (Table B–II.1 Appendix B)

Gamma Emitters

No plant-produced radionuclides were detected. (Table B–II.2, Appendix B)

E. Precipitation Water Results (Recapture)

Precipitation water samples from 7 locations were analyzed for tritium activity. Tritium was detected in two samples with concentrations ranging from 187 to 574 pCi/L. (Table B-III.1, Appendix B)

F. Summary of Results – Inter-Laboratory Comparison Program

Inter-Laboratory Comparison Program results for TBE are presented in Section IV, Part G in the Annual Radiological Environmental Operating Report.

G. Errata Data

There was no Errata Data for 2019.

H. Leaks, Spills, and Releases

There were no leaks, spills or releases in 2019.

I. Trends

No trends have been identified in 2019.

J. Investigations

Currently no investigations are on-going.

K. Actions Taken

1. Compensatory Actions

   There have been no station events requiring compensatory actions at the Clinton Power Station in 2019.

2. Installation of Monitoring Wells

   No new wells were installed during the 2019.

3. Actions to Recover/Reverse Plumes

   No actions were required to recover or reverse groundwater plumes.

APPENDIX A

LOCATION DESIGNATION OF THE ANNUAL RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM REPORT (ARGPPR)

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TABLE A-1: Radiological Groundwater Protection Program - Sampling Locations, Clinton Power Station, 2019

Site	Site Type
B-3	Monitoring Well
MW-CL-1	Monitoring Well
MW-CL-2	Monitoring Well
MW-CL-12I	Monitoring Well
MW-CL-13I	Monitoring Well
MW-CL-13S	Monitoring Well
MW-CL-14S	Monitoring Well
MW-CL-15I	Monitoring Well
MW-CL-15S	Monitoring Well
MW-CL-16S	Monitoring Well
MW-CL-17S	Monitoring Well
MW-CL-18I	Monitoring Well
MW-CL-18S	Monitoring Well
MW-CL-19S	Monitoring Well
MW-CL-20S	Monitoring Well
MW-CL-21S	Monitoring Well
MW-CL-22S	Monitoring Well
SW-CL-1	Surface Water
SW-CL-2	Surface Water
SW-CL-4	Surface Water
SW-CL-5	Surface Water
SW-CL-6	Surface Water
SW-CL-7	Surface Water
RG-2	Precipitation Water
RG-3	Precipitation Water
RG-15	Precipitation Water
RG-ENE	Precipitation Water
RG-N	Precipitation Water
RG-NNE	Precipitation Water
RG-NNW	Precipitation Water
RG-NW	Precipitation Water
RG-S	Precipitation Water
RG-WNW	Precipitation Water

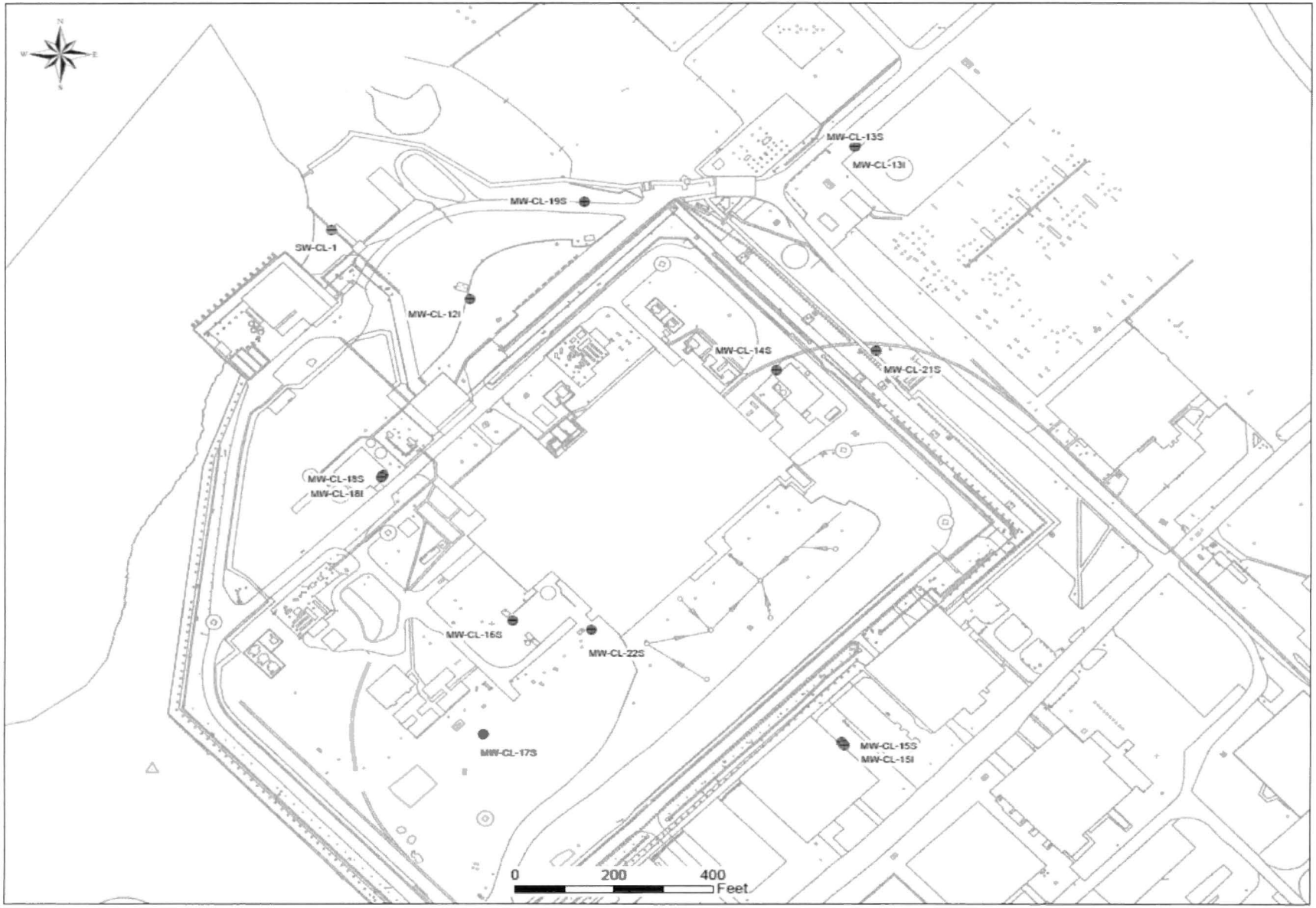

Figure A – 1
Onsite Sampling Locations at Clinton Power Station

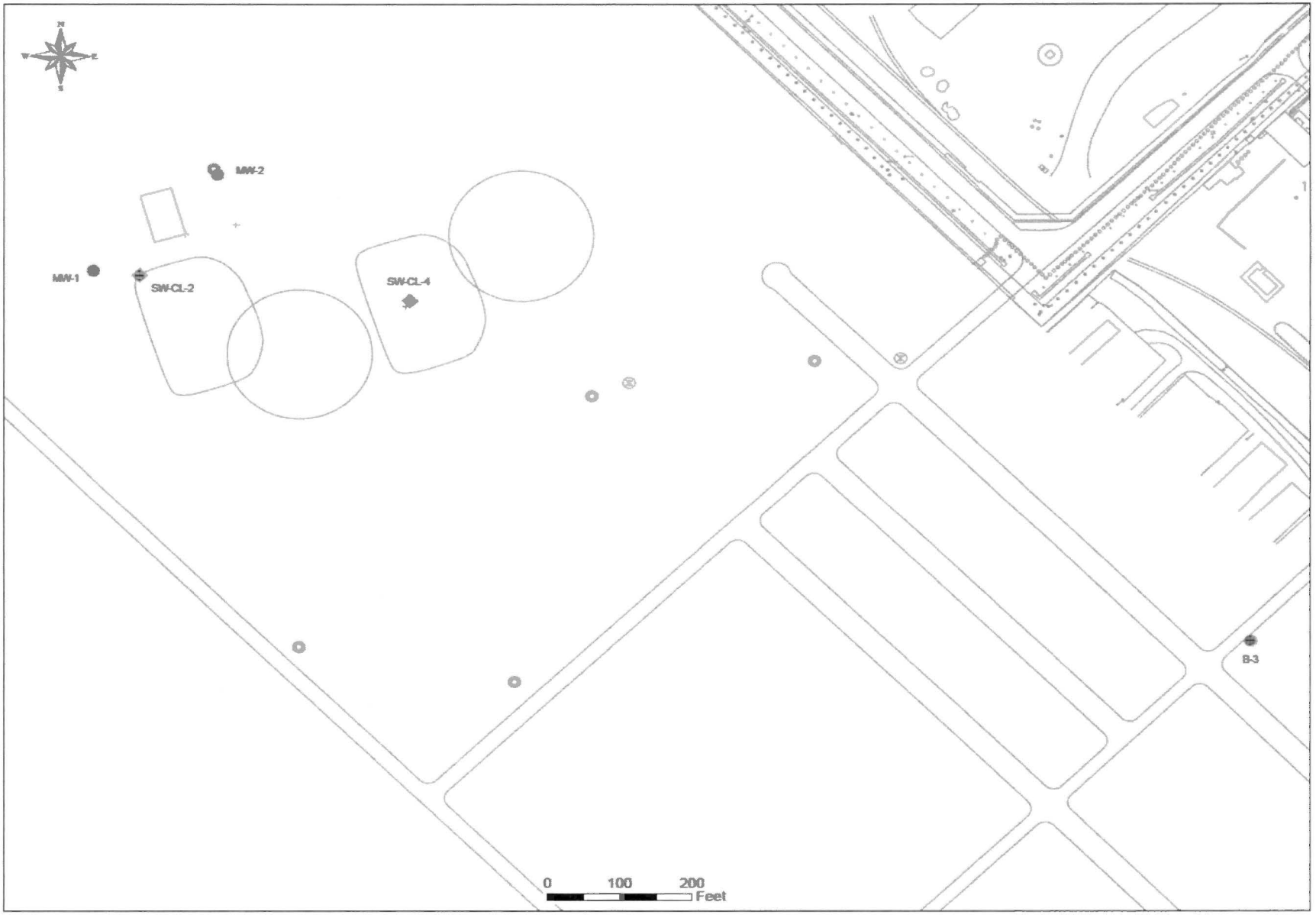

Figure A – 2
Sampling Locations South of Clinton Power Station

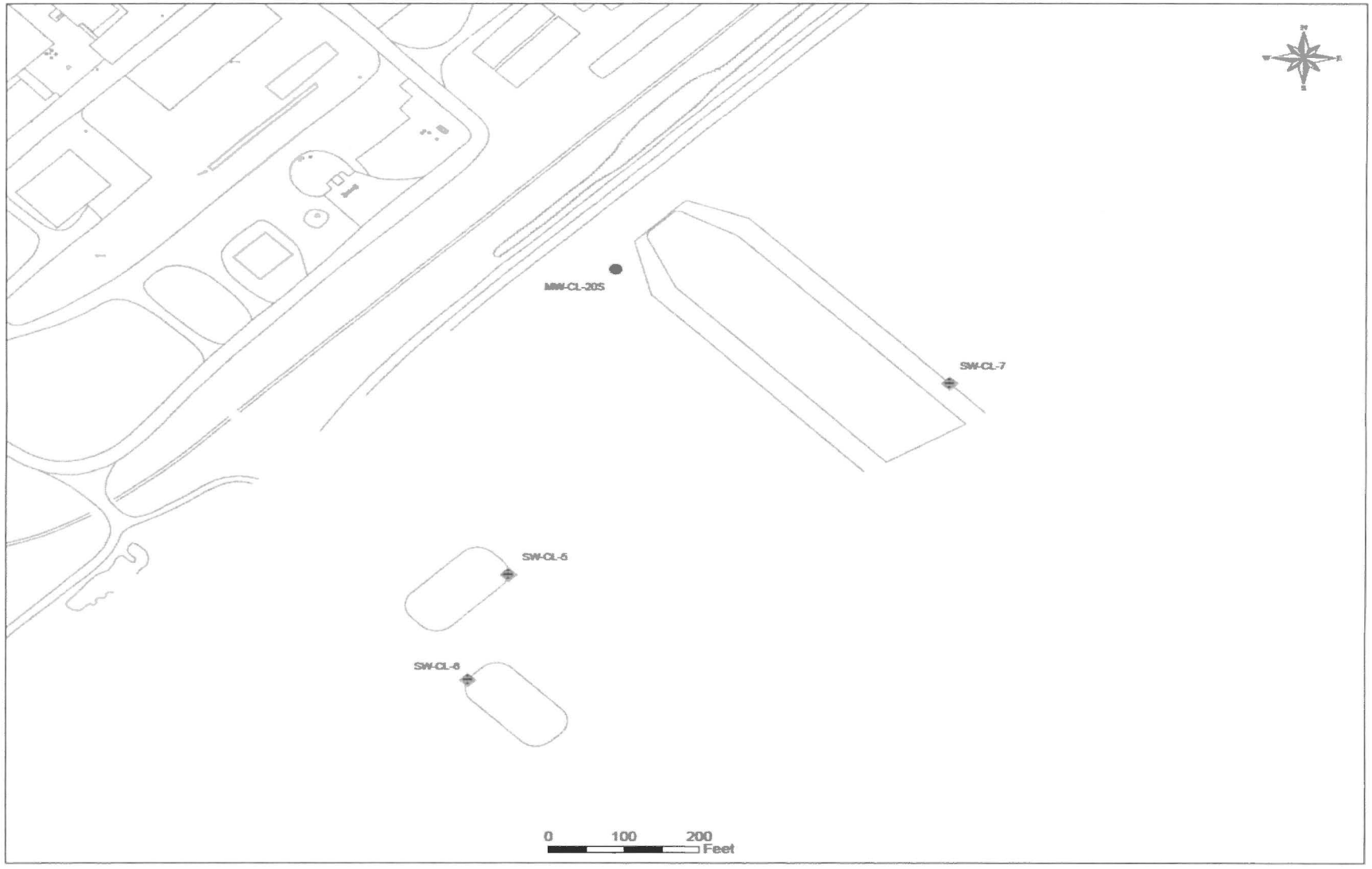

Figure A – 3
Sampling Locations East of Clinton Power Station

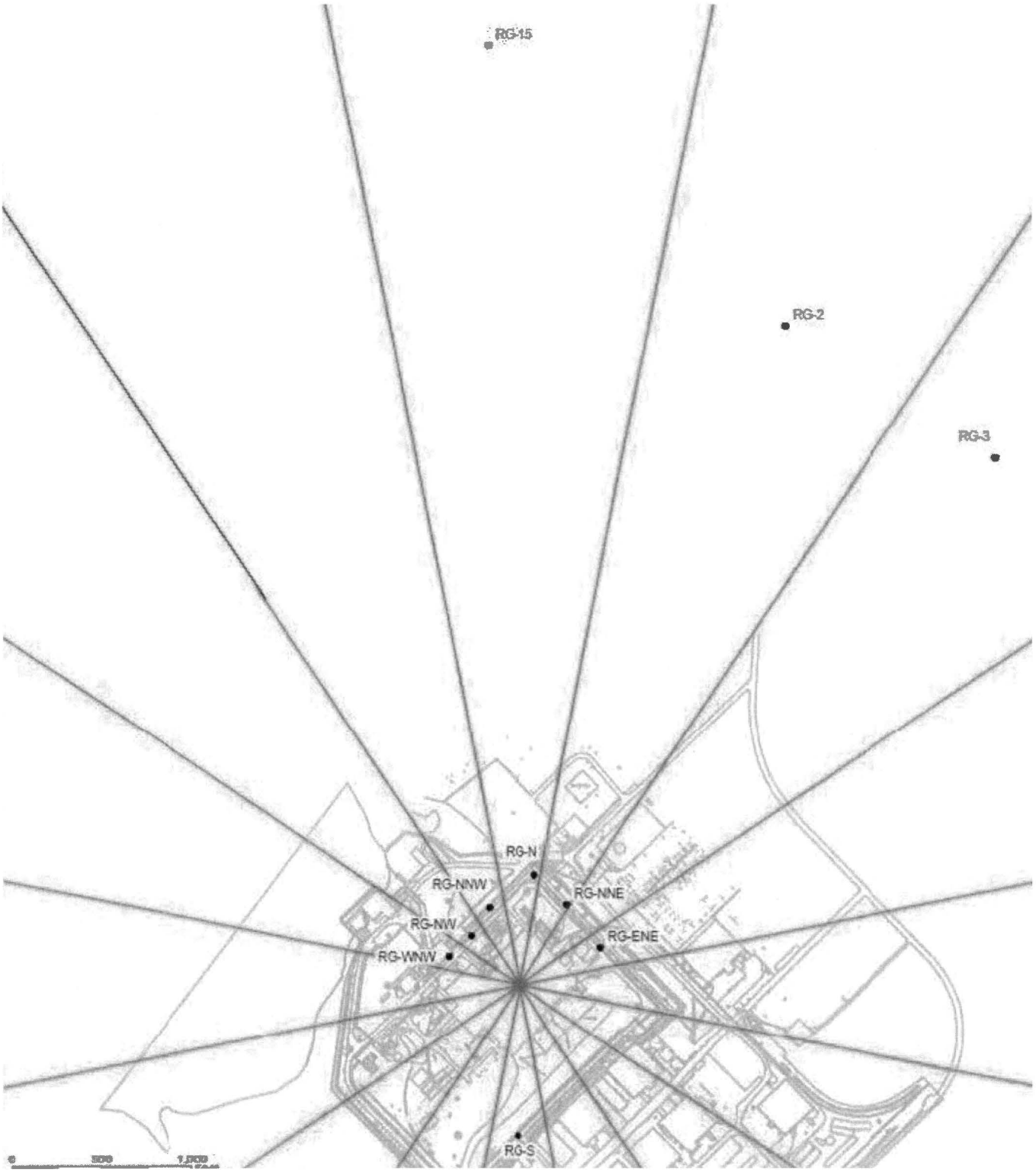

Figure A – 4
Recapture Sampling Locations of Clinton Power Station

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APPENDIX B

DATA TABLES OF THE ANNUAL RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM REPORT (ARGPPR)

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TABLE B-I.1 CONCENTRATIONS OF TRITIUM, STRONTIUM, GROSS ALPHA AND GROSS BETA IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	H-3	Sr-89	Sr-90	Gr-A (Dis)	Gr-A (Sus)	Gr-B (Dis)	Gr-B (Sus)
B-3	02/27/19	< 190						
B-3	05/22/19	< 198						
B-3	08/21/19	< 193	< 7.0	< 0.7	< 0.5	< 1.0	< 2.0	< 1.7
B-3	12/04/19	< 183						
MW-CL-1	02/27/19	< 190						
MW-CL-1	05/22/19	< 192						
MW-CL-1	08/21/19	< 191	< 7.9	< 0.8	< 0.8	< 1.0	1.6 ± 0.9	< 1.7
MW-CL-1	12/04/19	< 183						
MW-CL-2	02/27/19	< 189						
MW-CL-2	05/22/19	< 192						
MW-CL-2	08/21/19	< 190	< 7.1	< 1.0	< 0.5	< 1.0	< 2.0	< 1.7
MW-CL-2	12/04/19	< 182						
MW-CL-12I	02/27/19	< 196						
MW-CL-12I	05/22/19	< 197						
MW-CL-12I	08/21/19	< 193	< 6.8	< 0.8	< 1.3	< 1.1	2.5 ± 1.3	< 1.7
MW-CL-12I	12/04/19	< 184						
MW-CL-13I	02/27/19	< 194						
MW-CL-13I	05/23/19	< 195						
MW-CL-13I	08/22/19	< 193	< 5.3	< 0.8	< 1.0	< 1.0	2.8 ± 1.0	< 1.7
MW-CL-13I	12/05/19	< 185						
MW-CL-13S	02/27/19	< 189						
MW-CL-13S	05/23/19	< 192						
MW-CL-13S	08/22/19	< 191	< 5.0	< 0.9	< 0.9	< 1.1	< 1.3	< 1.7
MW-CL-13S	12/05/19	< 182						
MW-CL-14S	02/28/19	404 ± 139						
MW-CL-14S	05/23/19	< 192						
MW-CL-14S	08/22/19	< 190	< 5.0	< 0.5	< 1.2	10 ± 1.9	4.6 ± 1.1	9.7 ± 1.7
MW-CL-14S	12/05/19	507 ± 137						
MW-CL-15I	02/27/19	< 188						
MW-CL-15I	05/22/19	< 190						
MW-CL-15I	08/21/19	< 190	< 7.0	< 0.9	< 0.9	< 1.2	< 1.4	< 1.8
MW-CL-15I	12/04/19	< 186						
MW-CL-15S	02/27/19	< 191						
MW-CL-15S	05/22/19	< 189						
MW-CL-15S	08/21/19	< 191	< 6.6	< 0.7	< 0.5	< 1.0	< 0.9	2.0 ± 1.1
MW-CL-15S	12/04/19	< 186						
MW-CL-16S	02/28/19	< 191						
MW-CL-16S	05/23/19	< 190						
MW-CL-16S	08/22/19	< 187	< 6.1	< 0.7	< 0.9	< 1.1	2.7 ± 1.1	2.0 ± 1.1
MW-CL-16S	12/05/19	< 188						
MW-CL-17S	02/28/19	< 191						
MW-CL-17S	05/23/19	< 184						
MW-CL-17S	08/22/19	< 189	< 6.1	< 0.7	< 1.7	< 1.0	2.5 ± 1.2	< 1.4
MW-CL-17S	12/05/19	< 186						
MW-CL-18I	02/28/19	< 195						
MW-CL-18I	05/23/19	< 190						
MW-CL-18I	08/22/19	< 191	< 6.8	< 0.9	< 0.9	< 1.0	2.4 ± 0.9	< 1.4
MW-CL-18I	12/05/19	< 187						
MW-CL-18S	02/28/19	< 197						

TABLE B-I.1 CONCENTRATIONS OF TRITIUM, STRONTIUM, GROSS ALPHA AND GROSS BETA IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	H-3	Sr-89	Sr-90	Gr-A (Dis)	Gr-A (Sus)	Gr-B (Dis)	Gr-B (Sus)
MW-CL-18S	05/23/19	< 190						
MW-CL-18S	08/22/19	< 190	< 7.3	< 0.9	< 1.1	< 1.0	3.8 ± 1.1	< 1.4
MW-CL-18S	12/05/19	< 185						
MW-CL-19S	02/27/19	< 191						
MW-CL-19S	05/22/19	< 187						
MW-CL-19S	08/21/19	< 194	< 5.3	< 0.6	< 2.1	< 1.1	3.9 ± 1.3	< 1.5
MW-CL-19S	12/04/19	< 189						
MW-CL-20S	02/27/19	< 194						
MW-CL-20S	05/22/19	< 187						
MW-CL-20S	08/21/19	< 192	< 4.9	< 1.0	< 1.1	< 1.0	2.8 ± 1.1	< 1.4
MW-CL-20S	12/04/19	< 183						
MW-CL-21S	02/27/19	< 194						
MW-CL-21S	05/22/19	247 ± 127						
MW-CL-21S	08/21/19	< 192	< 4.9	< 0.9	< 0.9	< 1.0	< 1.4	< 1.4
MW-CL-21S	12/04/19	< 184						
MW-CL-22S	02/28/19	< 198						
MW-CL-22S	05/23/19	< 191						
MW-CL-22S	08/22/19	< 191	< 5.6	< 0.6	< 1.1	< 1.0	6.8 ± 1.2	< 1.4
MW-CL-22S	12/05/19	< 184						

Table B-I.2

CONCENTRATIONS OF GAMMA EMITTERS IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019

RESULTS IN UNITS OF PCI/LITER + SIGMA

SITE	COLLECTION DATE	Be-7	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140
B-3	08/21/19	< 58	< 114	< 6	< 5	< 18	< 8	< 13	< 7	< 15	< 6	< 7	< 31	< 9
MW-CL-1	08/21/19	< 66	< 172	< 8	< 6	< 15	< 5	< 16	< 8	< 11	< 8	< 7	< 31	< 10
MW-CL-2	08/21/19	< 42	< 92	< 4	< 5	< 9	< 5	< 10	< 5	< 8	< 5	< 5	< 25	< 9
MW-CL-12I	08/21/19	< 50	< 109	< 5	< 4	< 9	< 5	< 11	< 6	< 9	< 5	< 7	< 35	< 13
MW-CL-13I	08/22/19	< 65	< 75	< 7	< 8	< 17	< 8	< 18	< 7	< 15	< 7	< 8	< 46	< 14
MW-CL-13S	05/23/19	< 68	< 106	< 6	< 7	< 15	< 8	< 16	< 6	< 10	< 8	< 8	< 40	< 8
MW-CL-13S	08/22/19	< 45	< 55	< 5	< 6	< 14	< 7	< 12	< 6	< 8	< 7	< 6	< 26	< 12
MW-CL-14S	02/28/19	< 57	< 96	< 6	< 6	< 13	< 7	< 11	< 9	< 12	< 9	< 7	< 36	< 8
MW-CL-14S	08/22/19	< 63	< 131	< 7	< 7	< 15	< 8	< 12	< 6	< 11	< 8	< 7	< 30	< 11
MW-CL-15I	08/21/19	< 68	< 120	< 9	< 7	< 14	< 6	< 13	< 6	< 13	< 7	< 7	< 26	< 9
MW-CL-15S	08/21/19	< 45	< 115	< 5	< 6	< 11	< 5	< 7	< 5	< 9	< 6	< 5	< 25	< 9
MW-CL-16S	08/22/19	< 50	< 87	< 6	< 6	< 10	< 5	< 10	< 6	< 9	< 6	< 5	< 29	< 13
MW-CL-17S	08/22/19	< 57	< 118	< 6	< 6	< 12	< 7	< 16	< 9	< 9	< 5	< 7	< 34	< 9
MW-CL-18I	08/22/19	< 47	< 125	< 6	< 7	< 13	< 8	< 12	< 6	< 10	< 6	< 8	< 33	< 9
MW-CL-18S	08/22/19	< 54	< 97	< 6	< 6	< 10	< 6	< 12	< 6	< 8	< 8	< 7	< 26	< 9
MW-CL-19S	08/21/19	< 39	< 48	< 5	< 5	< 10	< 4	< 9	< 4	< 7	< 4	< 3	< 25	< 7
MW-CL-20S	08/21/19	< 47	< 128	< 6	< 7	< 13	< 6	< 12	< 7	< 10	< 7	< 7	< 30	< 11
MW-CL-21S	02/27/19	< 50	< 63	< 7	< 5	< 12	< 7	< 14	< 5	< 14	< 8	< 7	< 26	< 13
MW-CL-21S	08/21/19	< 69	< 131	< 7	< 8	< 15	< 8	< 16	< 7	< 12	< 7	< 8	< 39	< 12
MW-CL-22S	08/22/19	< 58	< 130	< 8	< 7	< 13	< 9	< 15	< 9	< 12	< 9	< 8	< 30	< 11

TABLE B-I.3

CONCENTRATIONS OF HARD TO DETECTS IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	Am-241	Cm-242	Cm-243/244	Pu-238	Pu-239/240	U-234	U-235	U-238	Fe-55	Ni-63
MW-CL-13S	08/22/19	< 0.08	< 0.03	< 0.06	< 0.08	< 0.17	< 0.11	< 0.03	< 0.11	< 55	< 4.7
MW-CL-14S	08/22/19	< 0.04	< 0.02	< 0.02	< 0.16	< 0.16	0.29 ± 0.14	< 0.05	0.25 ± 0.13	< 90	< 4.7
MW-CL-21S	08/21/19	< 0.03	< 0.02	< 0.02	< 0.07	< 0.14	< 0.12	< 0.07	< 0.09	< 61	< 4.0

TABLE B-II.1 CONCENTRATIONS OF TRITIUM IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	H-3
SW-CL-1	02/27/19	< 197
SW-CL-1	05/22/19	< 190
SW-CL-1	08/21/19	< 190
SW-CL-1	12/04/19	< 187
SW-CL-2	02/27/19	< 198
SW-CL-2	05/22/19	< 190
SW-CL-2	08/21/19	< 191
SW-CL-2	12/04/19	< *188*
SW-CL-4	02/27/19	< 190
SW-CL-4	05/22/19	< 184
SW-CL-4	08/21/19	< 190
SW-CL-4	12/04/19	< 184
SW-CL-5	02/27/19	< 195
SW-CL-5	05/22/19	< 185
SW-CL-5	08/21/19	< 195
SW-CL-5	12/04/19	< 188
SW-CL-6	02/27/19	< 191
SW-CL-6	05/22/19	< 185
SW-CL-6	08/21/19	< 195
SW-CL-6	12/04/19	< 183
SW-CL-7	02/27/19	< 192
SW-CL-7	05/22/19	< 185
SW-CL-7	08/21/19	< 199
SW-CL-7	12/04/19	< 184

Table B-II.2

CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019

RESULTS IN UNITS OF PCI/LITER + SIGMA

SITE	COLLECTION DATE	Be-7	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140
SW-CL-1	08/21/19	< 44	< 97	< 4	< 5	< 10	< 5	< 10	< 4	< 7	< 6	< 6	< 25	< 8
SW-CL-2	08/21/19	< 61	< 89	< 6	< 7	< 12	< 6	< 12	< 7	< 11	< 7	< 6	< 39	< 15
SW-CL-4	08/21/19	< 80	< 121	< 8	< 9	< 18	< 8	< 21	< 8	< 15	< 10	< 9	< 41	< 13
SW-CL-5	08/21/19	< 59	< 135	< 6	< 4	< 18	< 9	< 14	< 8	< 9	< 10	< 7	< 39	< 12
SW-CL-6	08/21/19	< 56	< 60	< 7	< 7	< 12	< 8	< 10	< 8	< 10	< 6	< 7	< 33	< 12
SW-CL-7	08/21/19	< 55	< 111	< 6	< 4	< 14	< 5	< 8	< 5	< 10	< 7	< 6	< 28	< 8

TABLE B-III.1 CONCENTRATIONS OF TRITIUM IN PRECIPITATION WATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	H-3
RG-ENE	12/18/19	574 ± 140
RG-ESE	12/18/19	187 ± 121
RG-N	12/18/19	< 184
RG-NNW	12/18/19	< 184
RG-S	12/18/19	< 185
RG-SE	12/18/19	< 182
RG-WNW	12/18/19	< 184

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