Clinton Power Station
8401 Power Road
Clinton, IL 61727

Exelon Generation.

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April 27, 2018

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

Clinton Power Station, Unit 1
Facility Operating License No. NPF-62
NRC Docket No. 50-461

Subject: Clinton Power Station 2017 Annual Radiological Environmental Operating Report

Exelon Generating Company, LLC (Exelon), Clinton Power Station is submitting the 2017 Annual Radiological Environmental Operating Report. This report is submitted in accordance with Technical Specification requirement 5.6.2, "Annual Radiological Environmental Operating Report," and covers the period from January 1, 2017 through December 31, 2017. This report provides the results of the Radiological Environmental Monitoring Program as specified in Section 3/4 and 6.1 of the Offsite Dose Calculation Manual.

There are no regulatory commitments contained within this letter.

Questions on this letter may be directed to Mr. Douglas C. Koons, Chemistry Manager, at 217-937-3200.

Respectfully,

Theodore R. Stoner
Site Vice President
Clinton Power Station

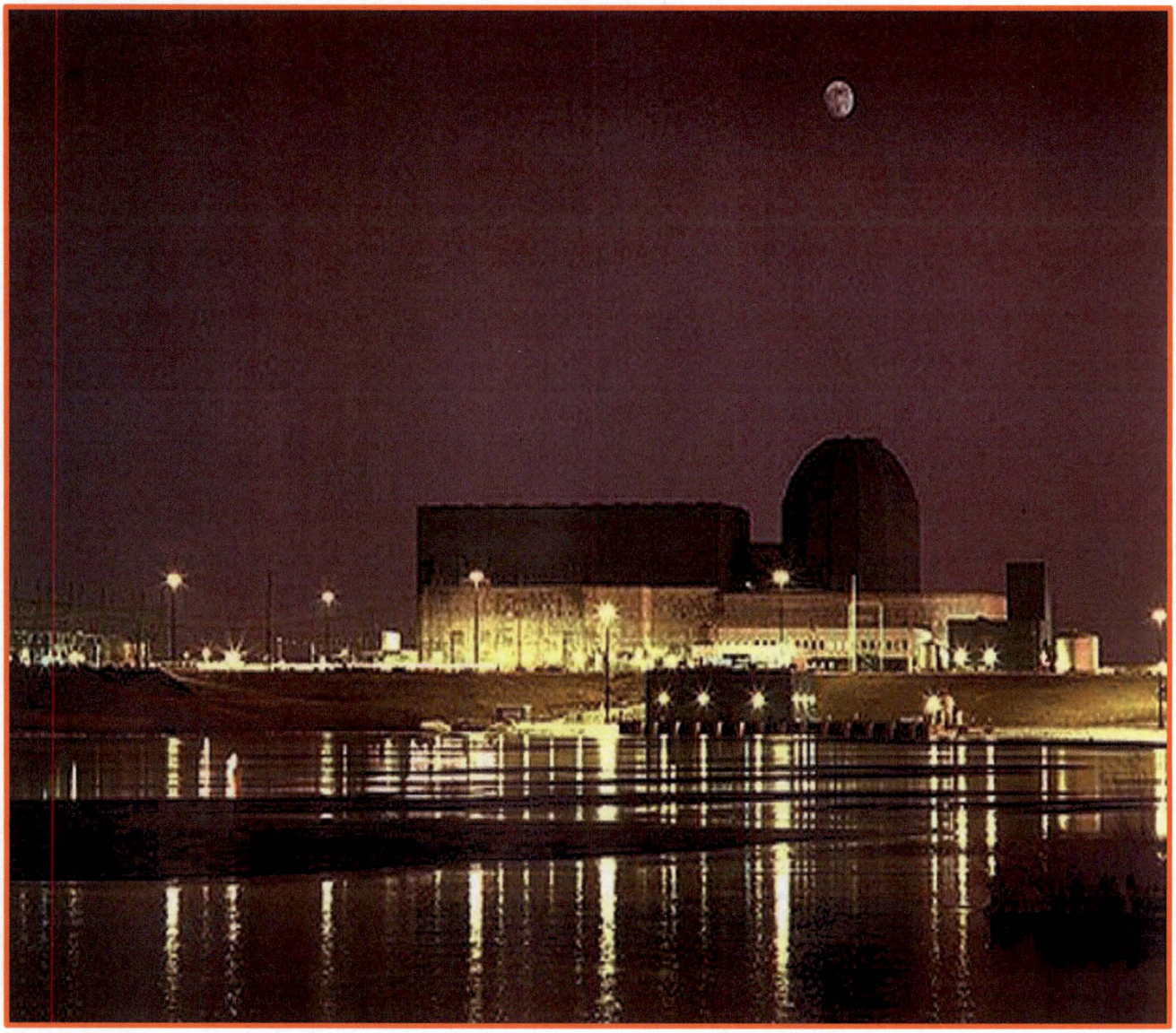
kp/lam

Attachment:

Annual Radiological Environmental Operating Report

cc: Regional Administrator - NRC Region III
NRC Senior Resident Inspector - Clinton Power Station
Office of Nuclear Facility Safety - Illinois Emergency Management Agency

IE25
NRR



Exelon Generation

January 01, 2017 – December 31, 2017

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

CLINTON POWER STATION – DOCKET NUMBER 50-461

Prepared by:

Teledyne Brown Engineering Environmental Services
April 2017

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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, 2017 through December 31, 2017. During that time period, 1,590 analyses were performed on 1,463 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 2017. 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 2017 due to the release of gaseous effluents from CPS was 5.39E-02 or 0.0539 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, while drinking water and surface water were additionally analyzed for 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. Cs-137 was found in one sample that contained an unusually high amount of soil. The resample had no Cs-137 activity above the LLD. No fission or activation products were detected in any other sample.

Grass samples were analyzed for concentrations of gamma-emitting nuclides. Cs-137 was detected in one sample. Low levels of Cs-137 are occasionally detected and are not typically a result of plant effluents. All other gamma nuclides were detected below the LLD.

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 15, 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, 2017 through December 31, 2017.

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) to obtain environmental samples for the CPS REMP in 2017. 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, crappie, carp, bluegill, and channel catfish, 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 October 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-1, CL-2, CL-8 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 two dosimeter sets in a vented PVC conduit located approximately three feet above 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). CL-58MM was installed as part of a volunteer comparison study extending to approximately 5 miles from the site.

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 2017. 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 03969252 ODCM Air Sampler CL-11 Timer Shortage
   02/01/17 - During the weekly airborne iodine and particulate surveillance performed on 2/1/17, the sampling vendor, Environmental, Inc. found ODCM air sampler CL-11 with a timer reading shortage indicating a power outage during the collection week. The timer for CL-11 was approximately two hours short, so it was replaced. CL-11 is the control location situated 16 miles south of the plant. The sample is sufficient for analysis, but the sample collection was not continuous as required by the ODCM.

2. IR 03971842 ODCM CL-2 Timer & CL-90 Power Strip Found OOS
   02/08/2017-During the weekly airborne iodine and particulate surveillance performed on 2/8/2017, the sampling vendor, Environmental Inc. found ODCM air sampler CL-2's timer out of service. Since this location is powered off the same line as CL-3 (which had no issues), no power outage is indicated. The timer was replaced. The time for CL-2 will be estimated for the week with a notation.
   Also, CL-90's power strip was found tripped. The Environmental Inc. Vendor attempted to reset the strip with no success. The power strip was replaced, but due to the power lost, the sample volume is approximate one inch short of the expected 4". It was determined that this slight deviation will not affect the monthly composite analysis, so no supplemental 'grab' sample was added to the collection container.

3. IR 03991383 ODCM Air Samplers CL-7, CL-8, CL-15 & CL-94 Timer Shortages
   03/29/2017-During the weekly airborne iodine and particulate surveillance performed on 3/29/17, the sampling vendor Environmental, Inc. found ODCM air samplers CL-8 and CL-15 and non-ODCM air samplers CL-7 & CL-94 with timer reading shortage indicating a power outage during the collection week. The timers were approximately one hour short, but were all back up and running appropriately. The samples are sufficient for analysis, but the sample collections were not continuous as required by the ODCM.

Throughout 2017, the following IRs were generated to document Program exceptions that were entered into the corrective action program for trending purposes.

Missed Samples

1. IR 04026734 Non-ODCM Air Sampler CL-6 Loss Of Power
   06/28/2017-During the weekly ODCM air sampling surveillance on Wednesday 6/28/2017, the Environmental Inc. sampling vendor identified that non-ODCM sample location CL-6 had no power. The timer and pump were off indicating a power outage at the location. The particulate filter also had little residue indicating the power has been off for a large amount of time between the last filter change out on 6/21/17. Ameren was contacted and restored the power.

2. IR 4031108 Non-ODCM Air Sampler CL-6 Loss Of Power
   07/12/2017-During the weekly ODCM air sampling surveillance on Wednesday 7/12/2017, the Environmental Inc. sampling vendor identified that non-ODCM sample location CL-6 had no power. The timer and pump were off indicating a power outage at the location. The particulate filter also had little residue signifying the power has been off for a large amount of time between the last filter change out on 7/5/17. The filter was exchanged per procedure, but without any power, there is no way to obtain the 7/19/17 sample results at this time. Facilities had Bodine perform a walkdown to find that the fuse that feeds the disconnect by the pole (Transformer #53408) at the entrance of the softball field is still working, so the issue resides between that and the air sampling station. Contacted Ameren to have their service technician evaluate the issue, provide a reason, and fix the issue.

3. IR 4130693 Non-ODCM Monthly Surface Water Grab Sample CL-13
   12/27/2017-During the monthly surface water sampling, location CL-13, located approximately 3.6 miles SW of the plant off of Salt Creek Bridge, could not be sampled due to a frozen lake. The following sample was obtained with no issues.

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 2017.

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-7D 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 (Table C–III.1, 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–III.2, Appendix C). No plant-produced radionuclides were detected and all required LLDs were met.

4. Fish

Fish samples comprised of bluegill, carp, crappie, channel catfish, and largemouth 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 (Table C–IV.1, Appendix C). No plant-produced radionuclides were detected and all required LLDs were met.

5. Shoreline Sediment

Aquatic shoreline sediment samples were collected at CL-7B and CL-105 semiannually. The following analysis was performed:

Gamma Spectrometry

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

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 6 to 32 E–3 pCi/m^3 with a mean of 17 E–3 pCi/m^3. The results from the Intermediate Distance location (Group II) ranged from 6 to 31 E–3 pCi/m^3 with a mean of 17 E–3 pCi/m^3. The results from the Control locations (Group III) ranged from 6 to 30 E–3 pCi/m^3 with a mean of 19 E–3 pCi/m^3. Comparison of the 2017 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 2017 indicate no notable differences among the three groups.

Gamma Spectrometry

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

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 (Table C-VII.1, Appendix C). All results were less than the MDC and the required LLD was met.

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

Gamma Spectrometry

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

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 (Table C–IX.1, Appendix C). Cs-137 was detected in one sample that contained an unusual amount of soil at a concentration of 23 ± 17 pCi/kg. The resample showed no Cs-137 activity above the LLD. No plant-produced radionuclides were detected in any of the other samples and all required LLDs were met.

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 (Table C–IX.2, Appendix C). Cs-137 was detected in one sample at a concentration of 31 ± 21 pCi/kg. Low levels of Cs-137 are occasionally detected and are not typically a result of plant effluents. No other plant-produced radionuclides were detected and all required LLDs were met.

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 2017. The average dose from the inner ring was 25.0 mRem/quarter. The average dose from the outer ring was 25.2 mRem/quarter. The average dose from the special interest group was 24.7 mRem/quarter. The average dose from the supplemental group was 23.7 mRem/quarter. The quarterly measurements ranged from 19.3 to 29.9 mRem/quarter.

The inner ring and outer ring measurements compared well to the Control Station, CL-11, which ranged from 21.2 mRem/quarter to 26.4 mRem/quarter with an average measurement of 23.0 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 Tables C-X.1 to C-X.3, Appendix C.

E. Land Use Survey

A Land Use Survey conducted during the July through October 2017 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 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	4.8	> 8
3 NE	2.1	3.5	> 8
4 ENE	2.9	2.9	4.2
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	6.6	6.6
10 SSW	4.9	> 8	> 8
11 SW	1.2	5.9	> 8
12 WSW	3.6	3.7	4.9
13 W	2	3.2	> 8
14 WNW	2.6	> 8	> 8
15 NW	2.7	> 8	> 8
16 NNW	2.1	2.1	2.1

F. Errata Data

Editorial Issues Identified In Pre-NRC Self-Assessment Report Under AR 2739110:

In the 2015 AREOR, the highest dose received by a member of the public was reported at 2.53E-3 mRem compared to the actual value of 5.95E-2 mRem as documented in the 2015 AREOR (see Appendix E Errata Data for additional details).

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, 168 out of 173 analyses performed met the specified acceptance criteria. Five analyses did not meet the specified acceptance criteria for the following reasons and were addressed through the TBE Corrective Action Program.

1. The ERA April 2017 two nuclides in water were evaluated as *Not Acceptable*. (NCR 17-09)

   a. The Zn-65 result of 39.3 pCi/L, exceeded the lower acceptance limit of 47.2. The known value was unusually low for this study. The sample was run in duplicate on two different detectors. The results of each were 39.3 ± 18.2 pCi/L (46% error and lower efficiency) and 59.3 ± 8.23 pCi/L (13.9% error and higher efficiency). The result from the 2nd detector would have been well within the acceptable range (47.2 – 65.9) and 110.2% of the known value of 53.8 pCi/L.

   b. The Sr-89 result of 40.7 pCi/L exceeded the lower acceptance limit of 53.8. All associated QC and recoveries were reviewed and no apparent cause could be determined for the failure. The prior three cross-check results were from 99 – 115% of the known values and the one that followed this sample (November, 2017) was 114% of the known value.

2. The DOE MAPEP August 2017 air particulate U-238 result of 0.115 ± 0.025 Bq/sample was higher than the known value of 0.087 ± 0.002 with a ratio of 1.32, therefore the upper ratio of 1.30 (acceptable with warning) was exceeded. TBE's result with error easily overlaps with the acceptable range. MAPEP does not evaluate results with any associated error. Also, the spike level for this sample was very low (2.35 pCi) compared to TBE's normal LCS of 6 pCi. TBE considers this result as passing. (NCR 17-15)

3. The Analytics September 2017 soil Cr-51 result was evaluated as *Not Acceptable* (Ratio of TBE to known result at 0.65). The reported value was 0.230 ± 0.144 pCi/g and the known value was 0.355 ± 0.00592 pCi/g. The sample was counted overnight for 14 hours, however the Cr-51 was spiked at a very low level and had a

counting error of 65%. Cr-51 has a 27-day half-life, making low-level quantification even more difficult. The error does not appear to have been taken into consideration for this result. If it had been evaluated with the error, the highest result would have been 105% of the reference value, which is acceptable. Also, the known value is significantly lower than TBE's typical MDC for this nuclide in a soil matrix and would typically not be reported to clients (unless specified). The results of all of the previous cross-checks have been in the acceptable (80 – 120%) range. TBE will evaluate further upon completion of the next ICP sample. (NCR 17-16)

4. The ERA November 2017 water Sr-90 sample was evaluated as *Not Acceptable*. TBE's result of 27.1 pCi/L exceeded the lower acceptance range (30.8 – 48.0 pCi/L). After reviewing the associated QC data for this sample, it was determined that although the spike recovery for Sr-90 was within our laboratory guidelines (70% -130%), both the spike result and our ERA result were biased low. The original cross-check sample was completely consumed and we were unable to reanalyze before submitting the result. We have modified our preparation process to avoid this situation for future cross-check samples. We also have enhanced LIMS programming to force a LCSD when a workgroup includes cross-check samples (as opposed to running a DUP). (NCR 17-19)

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

V. References

1. American National Standards Institute, Inc., "Performance, Testing and Procedural Specifications for Thermoluminescent Dosimetry," ANSI N545-1975.
2. Code of Federal Regulations, Title 10, Part 20 (Nuclear Regulatory Commission).
3. "Environmental Radioactivity," M. Eisenbud, 1987 (E187).
4. "Natural Radon Exposure in the United States," Donald T. Oakley, U.S. Environmental Protection Agency. ORP/SID 72-1, June 1972.
5. Federal Radiation Council Report No. 1, "Background Material for the Development of Radiation Protection Standards," May 13, 1960.
6. International Commission on Radiation Protection, Publication 2, "Report of Committee II on Permissible Dose for Internal Radiation," (1959) with

1962 Supplement issued in ICRP Publication 6; Publication 9, "Recommendations on Radiation Exposure," (1965); ICRP Publication 7 (1965), amplifying specific recommendations of Publication 26 (1977).

7. International Commission on Radiation Protection, Publication No. 39 (1984), "Principles of Limiting Exposure to the Public to Natural Sources of Radiation".

8. "Radioactivity in the Environment: Sources, Distribution and Surveillance," Ronald L. Kathren, 1984.

9. National Council on Radiation Protection and Measurements, Report No. 22, "Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and Water for Occupational Exposure," (Published as National Bureau of Standards Handbook 69, issued June 1959, superseding Handbook 52).

10. National Council on Radiation Protection and Measurements, Report No. 39, "Basic Radiation Protection Criteria," January 1971.

11. National Council on Radiation Protection and Measurements, Report No. 44, "Krypton-85 in the Atmosphere – Accumulation, Biological Significance, and Control Technology," July 1975.

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

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

14. National Research Council, 1990, Committee on Biological Effects of Ionizing Radiation (BEIR V), Board on Radiation Effects Research on Life Sciences, "The Effects of Exposure to Low Levels of Ionizing Radiation".

15. United States Nuclear Regulatory Commission, Regulatory Guide 4.1, "Programs for Monitoring Radioactivity in the Environs of Nuclear Power Plants," Revision 1, April 1975.

16. United States Nuclear Regulatory Commission, Regulatory Guide 4.13, "Performance, Testing and Procedural Specifications for Thermoluminescence Dosimetry: Environmental Applications, "Revision 1, July 1977.

17. United States Nuclear Regulatory Commission, Regulatory Guide 1.109, "Calculation of Annual Dose to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR Part 50, Appendix I, "Revision 1, October 1977.

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

19. United States Nuclear Regulatory Commission, Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs (Norm Operations) – Effluent Streams and the Environment," Revision 1, February 1979.

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

21. Clinton Power Station, Updated Safety Analysis Report.

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

APPENDIX A

RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT SUMMARY

TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR THE CLINTON POWER STATION, 2017

NAME OF FACILITY:	CLINTON POWER STATION			DOCKET NUMBER:	50-461		
LOCATION OF FACILITY:	DEWITT COUNTY IL			REPORTING PERIOD:	2017		

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, 2017

NAME OF FACILITY:	CLINTON POWER STATION			DOCKET NUMBER:	50-461			
LOCATION OF FACILITY:	DEWITT COUNTY IL			REPORTING PERIOD:	2017			
				INDICATOR LOCATIONS	CONTROL LOCATION	LOCATION WI "H 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, 2017

NAME OF FACILITY:	CLINTON POWER STATION			DOCKET NUMBER:	50-461			
LOCATION OF FACILITY:	DEWITT COUNTY IL			REPORTING PERIOD:	2017			
				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
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**	518	**10**	17	19	19	CL-11 CONTROL	0
(E-3 PCI/CU.METER)				(464/466)	(52/52)	(52/52)	ILLINOIS POWER SUBSTATION	
				6 - 32	*6 - 30*	*6 - 30*	16 MILES S OF SITE	
	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**	518						
(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, 2017

NAME OF FACILITY:	**CLINTON POWER STATION**	**DOCKET NUMBER:**	**50-461**
LOCATION OF FACILITY:	**DEWITT COUNTY IL**	**REPORTING PERIOD:**	**2017**

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
MILK *(PCI/LITER)*	**I-131 (LOW LVL)**	19	**1**	*NA*	<LLD	-		0
	GAMMA	19						
	K-40		*NA*	*NA*	1184 (19/19) 924 - 1482	1184 (19/19) 924 - 1482	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 *(PCI/KG WET)*	**GAMMA**	49						
	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**	22.5 (1/37)	<LLD	22.5 (1/13)	CL-118 INDICATOR SITE'S MAIN ACCESS ROAD 0.7 MILES NNE OF SITE	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, 2017

NAME OF FACILITY:	**CLINTON POWER STATION**	**DOCKET NUMBER:**	**50-461**
LOCATION OF FACILITY:	**DEWITT COUNTY IL**	**REPORTING PERIOD:**	**2017**

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
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**	31 (1/39)	<LLD	31 (1/13)	CL-02 INDICATOR CLINTON'S MAIN ACCESS ROAD 0.7 MILES NNE OF SITE	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*	24.7 (212/212) *19.3- 29.9*	23 (4/4) *21.2 - 26.4*	26.9 (4/4) *25 - 29.4*	CL-43 INDICATOR 2.8 MILES SE	0
(MILLI-ROENTGEN/QTR.)								

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

APPENDIX B

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

TABLE B-1: Radiological Environmental Monitoring Program - Sampling Locations, Distance and Direction
Clinton Power Station, 2017

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, 2017

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, 2017

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, 2017

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-2031 Radioactive Iodine in Drinking Water 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., GS-01 Determination of gamma emitters by gamma spectroscopy
Air Particulates	Gross Beta	One-week composite of continuous air sampling through glass fiber filter paper	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, 2017

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

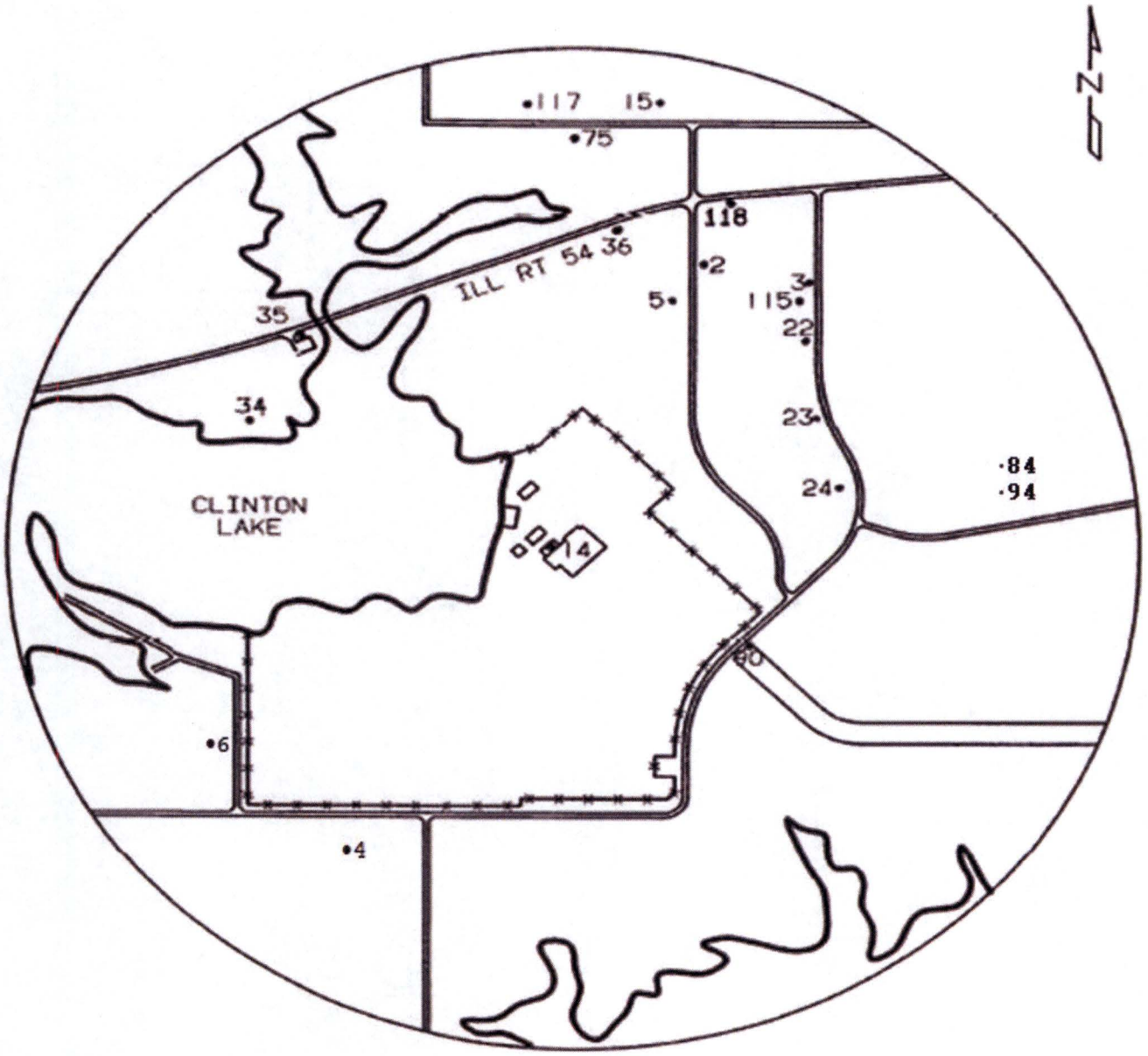


Figure B-1
Environmental Sampling Locations Within One Mile of the Clinton Power Station,
2017

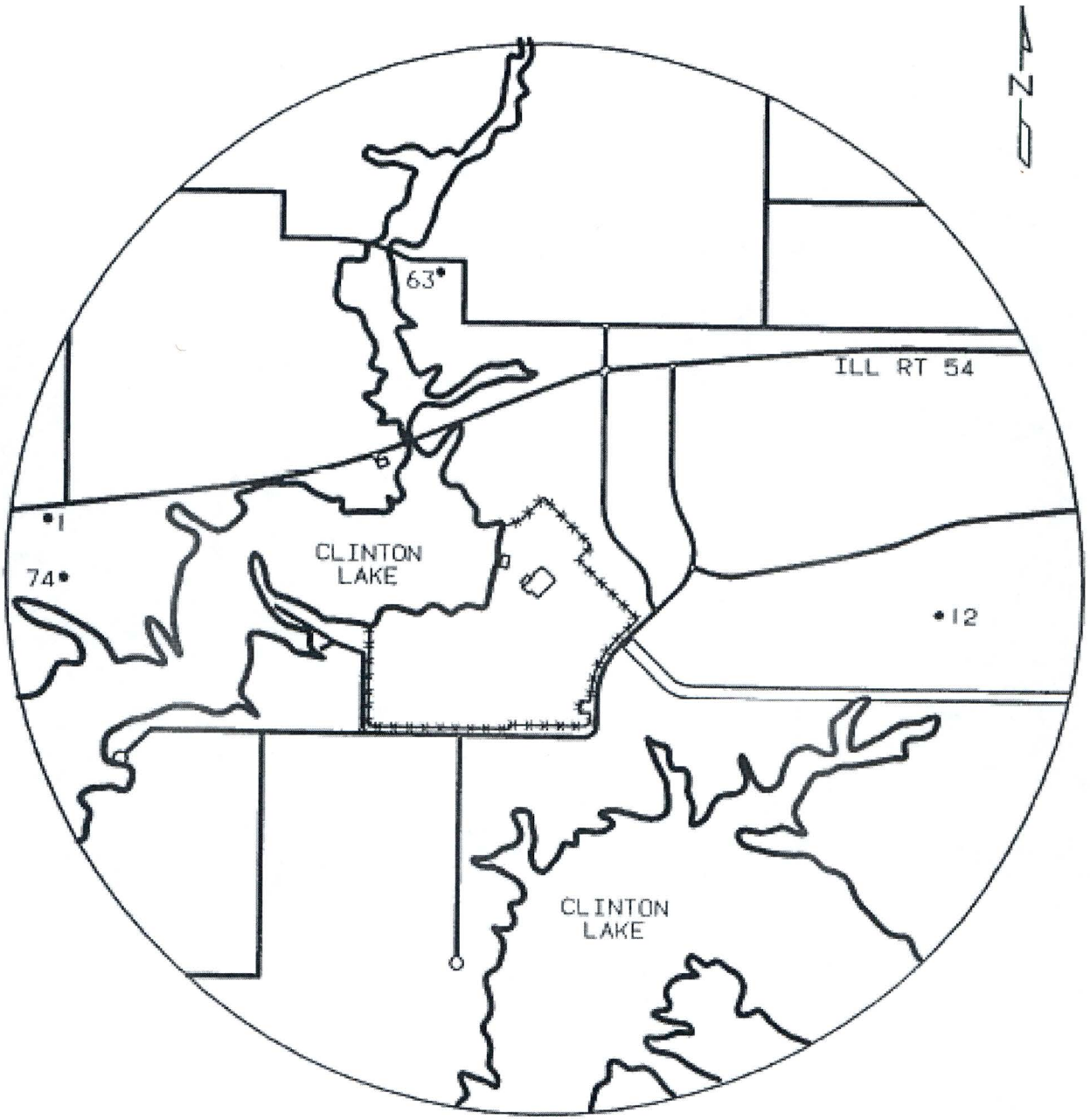


Figure B-2
Environmental Sampling Locations Between One and Two Miles of the Clinton Power Station, 2017

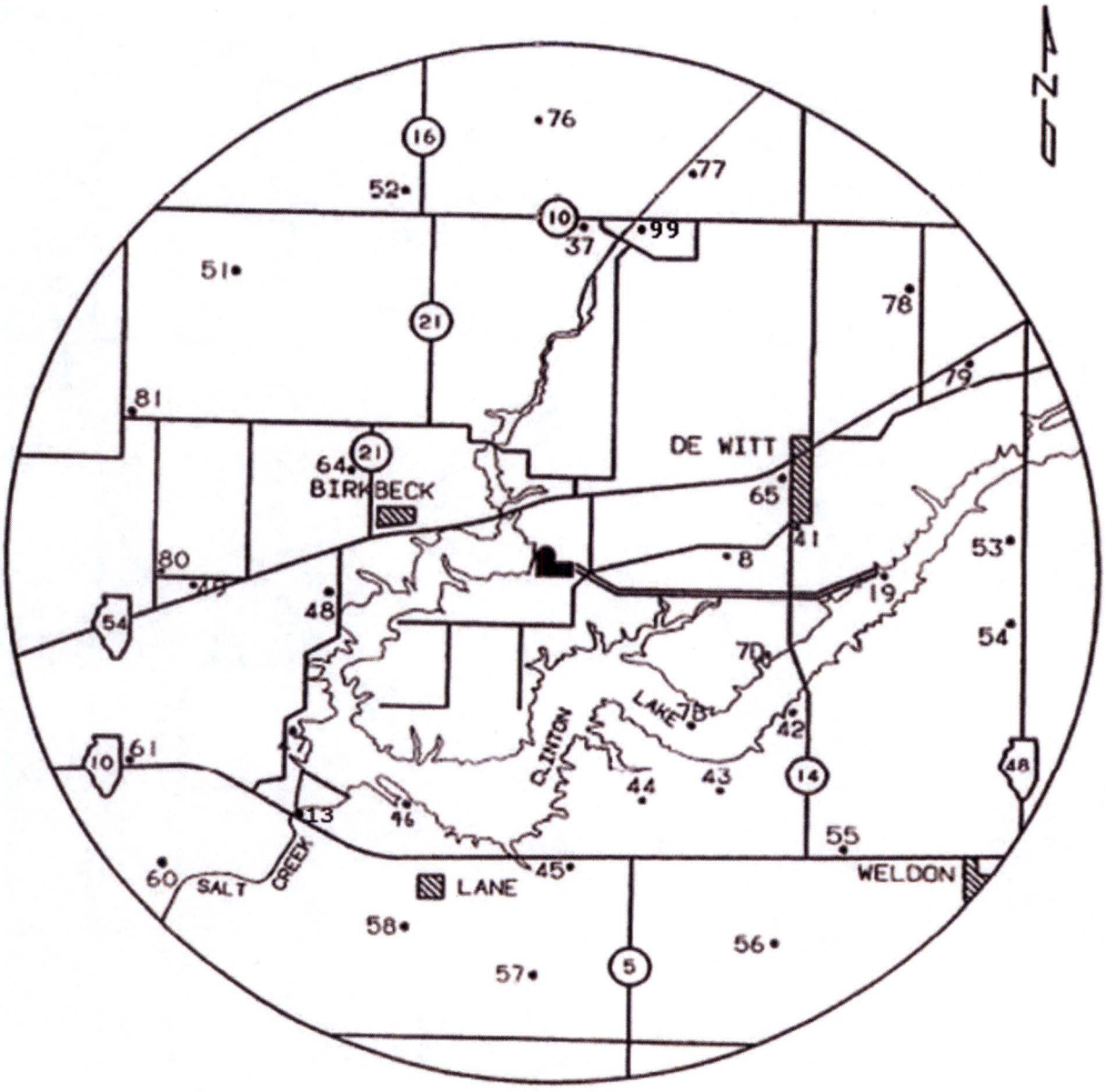


Figure B-3
Environmental Sampling Locations between Two and Five Miles from the Clinton Power Station, 2017

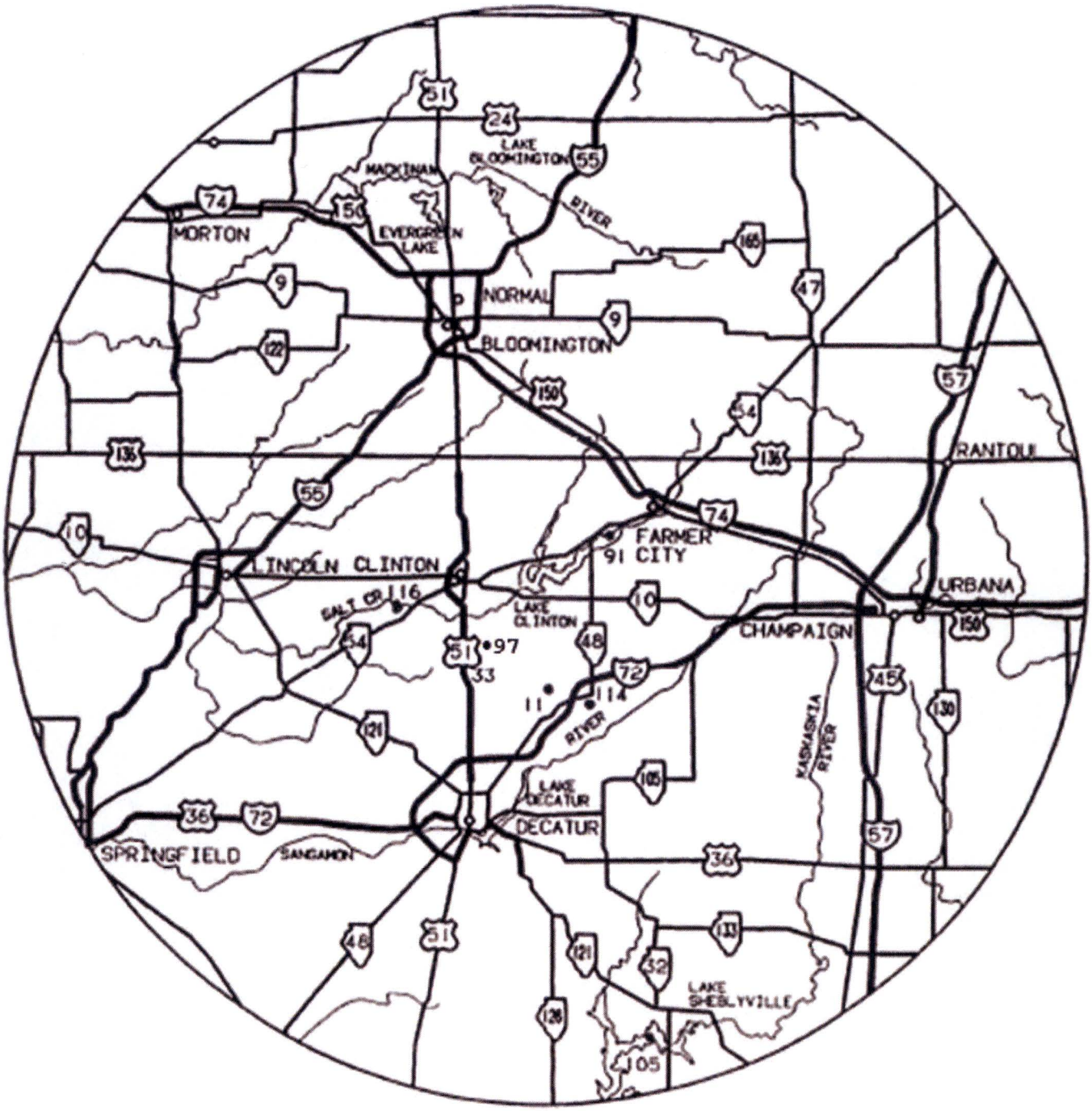


Figure B-3
Environmental Sampling Locations Greater Than Five Miles of the Clinton Power Station, 2017

APPENDIX C

DATA TABLES AND FIGURES

Table C-I.1 **CONCENTRATIONS OF I-131 IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	CL-90
12/28/16 - 01/25/17	< 0.6
01/25/17 - 02/22/17	< 0.7
02/22/17 - 03/29/17	< 0.3
03/29/17 - 04/26/17	< 0.4
04/26/17 - 05/31/17	< 0.7
05/31/17 - 06/28/17	< 0.9
06/28/17 - 07/26/17	< 0.7
07/26/17 - 08/30/17	< 0.9
08/30/17 - 09/27/17	< 0.3
09/27/17 - 10/25/17	< 0.5
10/25/17 - 11/29/17	< 0.6
11/29/17 - 12/27/17	< 0.9
MEAN	-

Table C-I.2 **CONCENTRATIONS OF TRITIUM IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	CL-13	CL-90	CL-91	CL-99
12/02/16 - 03/29/17	< 188	< 187	< 189	< 190
03/29/17 - 06/28/17	< 173	< 175	< 175	< 179
06/28/17 - 09/27/17	< 188	< 188	< 186	< 187
09/27/17 - 12/27/17	< 196	< 195	< 195	< 194
MEAN	-	-	-	-

Table C-I.3

CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017

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	01/25/17 - 01/25/17	< 6	< 5	< 13	< 6	< 12	< 5	< 11	< 5	< 7	< 27	< 9	< 48
	02/22/17 - 02/22/17	< 8	< 7	< 12	< 7	< 19	< 8	< 15	< 7	< 7	< 29	< 13	< 60
	03/29/17 - 03/29/17	< 7	< 8	< 10	< 7	< 14	< 7	< 9	< 6	< 7	< 28	< 7	< 56
	04/26/17 - 04/26/17	< 5	< 6	< 13	< 5	< 13	< 6	< 9	< 7	< 5	< 20	< 7	< 38
	05/31/17 - 05/31/17	< 7	< 5	< 13	< 7	< 17	< 6	< 11	< 8	< 7	< 28	< 14	< 45
	06/28/17 - 06/28/17	< 6	< 7	< 16	< 9	< 15	< 8	< 12	< 8	< 7	< 31	< 15	< 50
	07/26/17 - 07/26/17	< 7	< 8	< 10	< 8	< 20	< 6	< 10	< 8	< 5	< 38	< 11	< 61
	08/30/17 - 08/30/17	< 6	< 5	< 12	< 4	< 12	< 6	< 8	< 7	< 6	< 26	< 7	< 41
	09/27/17 - 09/27/17	< 5	< 6	< 14	< 7	< 14	< 7	< 10	< 7	< 6	< 30	< 8	< 41
	10/25/17 - 10/25/17	< 3	< 3	< 7	< 3	< 6	< 4	< 6	< 3	< 3	< 17	< 5	< 26
	11/29/17 - 11/29/17	< 10	< 9	< 19	< 10	< 20	< 9	< 14	< 8	< 8	< 39	< 13	< 45
	12/27/17 - 12/27/17	(1)											
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
CL-90	12/28/16 - 01/25/17	< 9	< 9	< 19	< 10	< 22	< 8	< 15	< 8	< 10	< 35	< 12	< 41
	01/25/17 - 02/22/17	< 6	< 8	< 17	< 7	< 14	< 8	< 14	< 7	< 8	< 34	< 13	< 57
	02/22/17 - 03/29/17	< 5	< 6	< 10	< 3	< 8	< 6	< 8	< 6	< 4	< 22	< 7	< 37
	03/29/17 - 04/26/17	< 6	< 5	< 11	< 7	< 10	< 7	< 13	< 8	< 6	< 25	< 9	< 42
	04/26/17 - 05/31/17	< 7	< 6	< 16	< 8	< 13	< 6	< 9	< 5	< 7	< 33	< 8	< 51
	05/31/17 - 06/28/17	< 6	< 4	< 14	< 6	< 11	< 7	< 12	< 8	< 6	< 28	< 9	< 50
	06/28/17 - 07/26/17	< 9	< 9	< 20	< 9	< 21	< 9	< 17	< 9	< 10	< 43	< 15	< 80
	07/26/17 - 08/30/17	< 4	< 5	< 9	< 4	< 9	< 5	< 9	< 4	< 5	< 21	< 7	< 31
	08/30/17 - 09/27/17	< 4	< 5	< 13	< 5	< 10	< 7	< 9	< 7	< 5	< 23	< 10	< 39
	09/27/17 - 10/25/17	< 5	< 4	< 9	< 5	< 6	< 5	< 7	< 5	< 5	< 20	< 7	< 32
	10/25/17 - 11/29/17	< 6	< 7	< 15	< 5	< 11	< 8	< 11	< 6	< 7	< 28	< 9	< 53
	11/29/17 - 12/27/17	< 10	< 10	< 22	< 11	< 21	< 9	< 20	< 8	< 11	< 44	< 13	< 48
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-

(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

Table C-I.3

CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017

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-91	12/28/16 - 01/25/17	< 6	< 8	< 11	< 7	< 10	< 6	< 10	< 6	< 6	< 27	< 10	< 55
	01/25/17 - 02/22/17	< 7	< 7	< 13	< 7	< 11	< 8	< 13	< 7	< 7	< 37	< 12	< 61
	02/22/17 - 03/29/17	< 6	< 6	< 15	< 6	< 15	< 6	< 11	< 6	< 7	< 30	< 6	< 48
	03/29/17 - 04/26/17	< 7	< 6	< 14	< 9	< 20	< 8	< 11	< 7	< 7	< 32	< 11	< 55
	04/26/17 - 05/31/17	< 7	< 6	< 12	< 8	< 15	< 8	< 11	< 10	< 7	< 25	< 15	< 51
	05/31/17 - 06/28/17	< 8	< 6	< 11	< 6	< 15	< 8	< 13	< 8	< 9	< 32	< 13	< 53
	06/28/17 - 07/26/17	< 8	< 8	< 10	< 7	< 15	< 8	< 13	< 5	< 7	< 26	< 9	< 47
	07/26/17 - 08/30/17	< 6	< 5	< 11	< 5	< 11	< 5	< 10	< 6	< 6	< 25	< 8	< 36
	08/30/17 - 09/27/17	< 5	< 5	< 10	< 5	< 12	< 6	< 10	< 6	< 5	< 26	< 9	< 38
	09/27/17 - 10/25/17	< 5	< 4	< 10	< 5	< 10	< 5	< 8	< 6	< 5	< 20	< 7	< 37
	10/25/17 - 11/29/17	< 7	< 7	< 14	< 8	< 14	< 8	< 12	< 8	< 8	< 39	< 7	< 55
	11/29/17 - 12/27/17	< 6	< 4	< 12	< 5	< 17	< 5	< 10	< 7	< 7	< 26	< 10	< 47
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
CL-99	12/28/16 - 01/25/17	< 7	< 7	< 12	< 8	< 12	< 6	< 9	< 7	< 7	< 33	< 8	< 54
	01/25/17 - 02/22/17	< 8	< 9	< 17	< 8	< 18	< 8	< 13	< 8	< 9	< 35	< 10	< 72
	02/22/17 - 03/29/17	< 6	< 6	< 14	< 7	< 12	< 6	< 11	< 7	< 6	< 28	< 9	< 42
	03/29/17 - 04/26/17	< 9	< 8	< 16	< 9	< 17	< 8	< 14	< 9	< 9	< 38	< 12	< 67
	04/26/17 - 05/31/17	< 9	< 9	< 23	< 9	< 22	< 10	< 16	< 8	< 8	< 37	< 14	< 47
	05/31/17 - 06/28/17	< 9	< 8	< 18	< 8	< 15	< 8	< 14	< 9	< 9	< 38	< 14	< 52
	06/28/17 - 07/26/17	< 9	< 10	< 17	< 8	< 17	< 9	< 16	< 10	< 9	< 36	< 11	< 57
	07/26/17 - 08/30/17	< 4	< 4	< 7	< 4	< 6	< 5	< 6	< 4	< 4	< 16	< 7	< 29
	08/30/17 - 09/27/17	< 6	< 6	< 14	< 5	< 11	< 7	< 12	< 6	< 6	< 32	< 10	< 40
	09/27/17 - 10/25/17	< 5	< 4	< 10	< 5	< 10	< 5	< 8	< 5	< 5	< 23	< 6	< 39
	10/25/17 - 11/29/17	< 6	< 7	< 14	< 8	< 14	< 8	< 13	< 7	< 7	< 28	< 11	< 54
	11/29/17 - 12/27/17	< 8	< 8	< 12	< 7	< 13	< 6	< 12	< 8	< 8	< 39	< 10	< 55
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-

Table C-II.1 **CONCENTRATIONS OF GROSS BETA IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	CL-14
12/28/16 - 01/25/17	< 1.6
01/25/17 - 02/22/17	< 1.7
02/22/17 - 03/29/17	< 1.8
03/29/17 - 04/26/17	< 1.4
04/26/17 - 05/31/17	< 1.9
05/31/17 - 06/28/17	< 1.8
06/28/17 - 07/26/17	< 2.0
07/26/17 - 08/30/17	< 2.7
08/30/17 - 09/27/17	< 1.8
09/27/17 - 10/25/17	< 1.8
10/25/17 - 11/29/17	< 1.6
11/29/17 - 12/27/17	< 1.4
MEAN	-

Table C-II.2 **CONCENTRATIONS OF TRITIUM IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	CL-14
12/28/16 - 03/29/17	< 189
03/29/17 - 06/28/17	< 175
06/28/17 - 09/27/17	< 189
09/27/17 - 12/27/17	< 196
MEAN	-

Table C-II.3 **CONCENTRATIONS OF I-131 IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	CL-14
12/28/16 - 01/25/17	< 0.9
01/25/17 - 02/22/17	< 0.7
02/22/17 - 03/29/17	< 0.3
03/29/17 - 04/26/17	< 0.5
04/26/17 - 05/31/17	< 0.8
05/31/17 - 06/28/17	< 0.6
06/28/17 - 07/26/17	< 0.5
07/26/17 - 08/30/17	< 0.8
08/30/17 - 09/27/17	< 0.4
09/27/17 - 10/25/17	< 0.5
10/25/17 - 11/29/17	< 0.6
11/29/17 - 12/27/17	< 0.7
MEAN	-

Table C-II.4

CONCENTRATIONS OF GAMMA EMITTERS IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017

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	12/28/16 - 01/25/17	< 6	< 5	< 12	< 6	< 13	< 7	< 12	< 6	< 9	< 32	< 14	< 61
	01/25/17 - 02/22/17	< 7	< 8	< 16	< 8	< 14	< 10	< 15	< 6	< 8	< 45	< 7	< 66
	02/22/17 - 03/29/17	< 8	< 7	< 18	< 8	< 17	< 9	< 15	< 9	< 9	< 45	< 10	< 77
	03/29/17 - 04/26/17	< 5	< 7	< 15	< 7	< 14	< 9	< 11	< 8	< 8	< 32	< 12	< 54
	04/26/17 - 05/31/17	< 6	< 5	< 13	< 7	< 11	< 6	< 10	< 7	< 7	< 24	< 9	< 46
	05/31/17 - 06/28/17	< 8	< 9	< 20	< 10	< 18	< 9	< 16	< 9	< 9	< 41	< 15	< 49
	06/28/17 - 07/26/17	< 5	< 7	< 13	< 4	< 11	< 6	< 10	< 7	< 6	< 27	< 7	< 44
	07/26/17 - 08/30/17	< 7	< 9	< 12	< 7	< 17	< 9	< 11	< 8	< 8	< 30	< 14	< 57
	08/30/17 - 09/27/17	< 5	< 7	< 16	< 6	< 12	< 6	< 12	< 9	< 7	< 35	< 10	< 44
	09/27/17 - 10/25/17	< 4	< 4	< 8	< 4	< 8	< 4	< 8	< 5	< 4	< 19	< 7	< 27
	10/25/17 - 11/29/17	< 5	< 6	< 13	< 8	< 10	< 6	< 10	< 7	< 5	< 27	< 7	< 41
	11/29/17 - 12/27/17	< 5	< 5	< 8	< 4	< 10	< 5	< 8	< 6	< 5	< 22	< 6	< 40
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-

Table C-III.1

CONCENTRATIONS OF TRITIUM IN WELL WATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	CL-07D	CL-12R	CL-12T
03/29/17 - 03/29/17	< 181	< 179	< 181
06/28/17 - 06/28/17	< 187	< 187	< 189
09/27/17 - 09/27/17	< 168	< 174	< 171
12/27/17 - 12/27/17	< 192	< 197	< 197
MEAN	-	-	-

Table C-III.2

CONCENTRATIONS OF GAMMA EMITTERS IN WELL WATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017

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	03/29/17	< 5	< 4	< 9	< 4	< 10	< 5	< 8	< 5	< 4	< 21	< 8	< 34
	06/28/17	< 4	< 5	< 13	< 7	< 15	< 6	< 10	< 7	< 7	< 25	< 13	< 47
	09/27/17	< 5	< 6	< 13	< 7	< 9	< 6	< 10	< 6	< 5	< 37	< 8	< 41
	12/27/17	< 7	< 9	< 14	< 6	< 14	< 8	< 15	< 9	< 8	< 40	< 12	< 44
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
CL-12R	03/29/17	< 6	< 6	< 15	< 6	< 12	< 6	< 9	< 5	< 6	< 27	< 9	< 39
	06/28/17	< 6	< 7	< 12	< 8	< 13	< 7	< 9	< 7	< 5	< 26	< 12	< 45
	09/27/17	< 4	< 4	< 9	< 5	< 9	< 5	< 8	< 5	< 5	< 30	< 9	< 35
	12/27/17	< 5	< 7	< 13	< 6	< 11	< 5	< 11	< 7	< 7	< 27	< 10	< 50
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
CL-12T	03/29/17	< 8	< 8	< 18	< 6	< 18	< 8	< 13	< 7	< 7	< 35	< 15	< 43
	06/28/17	< 5	< 7	< 13	< 7	< 15	< 7	< 13	< 8	< 9	< 36	< 11	< 51
	09/27/17	< 4	< 5	< 12	< 4	< 8	< 5	< 8	< 5	< 5	< 27	< 11	< 33
	12/27/17	< 5	< 6	< 10	< 6	< 11	< 6	< 10	< 6	< 6	< 25	< 7	< 41
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-

Table C-IV.1

CONCENTRATIONS OF GAMMA EMITTERS IN FISH SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017

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													
Bluegill	04/24/17	< 52	< 49	< 83	< 37	< 110	< 52	< 71	< 51	< 55	< 236	< 77	< 304
Carp	04/24/17	< 54	< 74	< 184	< 82	< 168	< 75	< 124	< 83	< 77	< 342	< 124	< 283
Channel Catfish	04/24/17	< 49	< 61	< 95	< 56	< 110	< 49	< 87	< 69	< 39	< 245	< 60	< 226
Largemouth Bass	04/24/17	< 31	< 32	< 92	< 41	< 84	< 44	< 85	< 49	< 43	< 200	< 48	< 193
Bluegill	10/03/17	< 62	< 84	< 161	< 61	< 138	< 67	< 173	< 79	< 97	< 426	< 127	< 310
Carp	10/03/17	< 55	< 45	< 101	< 59	< 95	< 53	< 70	< 58	< 51	< 246	< 82	< 253
Channel Catfish	10/03/17	< 52	< 43	< 107	< 62	< 104	< 53	< 102	< 57	< 57	< 263	< 83	< 318
Largemouth Bass	10/03/17	< 59	< 67	< 101	< 44	< 111	< 39	< 85	< 37	< 47	< 220	< 61	< 284
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
CL-105													
Bluegill	04/24/17	< 43	< 38	< 68	< 52	< 94	< 39	< 72	< 48	< 40	< 207	< 37	< 225
Carp	04/24/17	< 60	< 51	< 143	< 75	< 131	< 52	< 101	< 71	< 61	< 283	< 80	< 245
Crappie	04/24/17	< 33	< 34	< 83	< 42	< 84	< 43	< 64	< 34	< 39	< 149	< 48	< 196
Largemouth Bass	04/24/17	< 33	< 37	< 61	< 58	< 96	< 36	< 70	< 51	< 36	< 182	< 59	< 214
Bluegill	10/03/17	< 63	< 68	< 138	< 66	< 136	< 59	< 118	< 66	< 61	< 355	< 119	< 304
Carp	10/03/17	< 49	< 56	< 103	< 56	< 127	< 57	< 92	< 55	< 58	< 254	< 87	< 335
Crappie	10/03/17	< 91	< 86	< 144	< 78	< 192	< 97	< 146	< 81	< 88	< 414	< 107	< 449
Largemouth Bass	10/03/17	< 55	< 56	< 121	< 61	< 142	< 63	< 107	< 62	< 60	< 290	< 61	< 340
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-

Table C-V.1

CONCENTRATIONS OF GAMMA EMITTERS IN SEDIMENT SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017

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	04/24/17	< 30	< 30	< 57	< 34	< 57	< 32	< 54	< 36	< 28	< 134	< 53	< 153
	10/03/17	< 57	< 56	< 116	< 58	< 132	< 57	< 102	< 66	< 54	< 283	< 66	< 316
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
CL-105	04/24/17	< 41	< 42	< 92	< 38	< 81	< 39	< 49	< 43	< 42	< 181	< 51	< 167
	10/03/17	< 50	< 51	< 121	< 53	< 137	< 56	< 99	< 56	< 56	< 276	< 70	< 348
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-

Table C-VI.1 **CONCENTRATIONS OF GROSS BETA IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017**

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

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

(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

Table C-VI.1 **CONCENTRATIONS OF GROSS BETA IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017**

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

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

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

Table C-VI.2

MONTHLY AND YEARLY MEAN VALUES OF GROSS BETA CONCENTRATIONS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017

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

GROUP I - ON-SITE LOCATIONS

COLLECTION PERIOD	MIN	MAX	MEAN ± 2SD
01/04/17 - 02/01/17	11	25	18 ± 8
02/01/17 - 03/01/17	7	22	17 ± 7
03/01/17 - 03/29/17	11	23	17 ± 6
03/29/17 - 05/03/17	6	19	11 ± 8
05/03/17 - 05/31/17	8	20	14 ± 7
05/31/17 - 06/28/17	9	23	15 ± 7
06/28/17 - 08/02/17	11	27	19 ± 9
08/02/17 - 08/30/17	11	21	17 ± 5
08/30/17 - 09/27/17	13	29	20 ± 10
09/27/17 - 11/01/17	6	21	14 ± 7
11/01/17 - 11/29/17	13	32	22 ± 10
11/29/17 - 01/03/18	14	29	21 ± 8
01/04/17 - 01/03/18	6	32	17 ± 10

GROUP II - INTERMEDIATE DISTANCE LOCATIONS

COLLECTION PERIOD	MIN	MAX	MEAN ± 2SD
01/04/17 - 02/01/17	12	23	18 ± 7
02/01/17 - 03/01/17	12	25	17 ± 7
03/01/17 - 03/29/17	13	22	17 ± 6
03/29/17 - 05/03/17	7	15	11 ± 5
05/03/17 - 05/31/17	11	18	14 ± 4
05/31/17 - 06/28/17	9	22	14 ± 8
06/28/17 - 08/02/17	13	27	19 ± 9
08/02/17 - 08/30/17	14	21	17 ± 5
08/30/17 - 09/27/17	12	29	21 ± 11
09/27/17 - 11/01/17	6	19	14 ± 8
11/01/17 - 11/29/17	14	28	22 ± 9
11/29/17 - 01/03/18	15	31	21 ± 8
01/04/17 - 01/03/18	6	31	17 ± 10

GROUP III - CONTROL LOCATIONS

COLLECTION PERIOD	MIN	MAX	MEAN ± 2SD
01/04/17 - 02/01/17	13	24	20 ± 10
02/01/17 - 03/01/17	17	24	20 ± 6
03/01/17 - 03/29/17	15	22	17 ± 7
03/29/17 - 05/03/17	6	16	11 ± 8
05/03/17 - 05/31/17	16	22	20 ± 6
05/31/17 - 06/28/17	13	28	18 ± 14
06/28/17 - 08/02/17	15	23	19 ± 6
08/02/17 - 08/30/17	15	22	18 ± 6
08/30/17 - 09/27/17	17	30	23 ± 12
09/27/17 - 11/01/17	7	18	14 ± 9
11/01/17 - 11/29/17	18	25	22 ± 6
11/29/17 - 01/03/18	17	24	21 ± 5
01/04/17 - 01/03/18	6	30	19 ± 10

Table C-VI.3 **CONCENTRATIONS OF GAMMA EMITTERS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017**

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	01/04/17 - 03/29/17	< 4	< 4	< 6	< 4	< 36	< 3	< 4	< 6	< 16
	03/29/17 - 06/28/17	< 3	< 3	< 6	< 3	< 24	< 3	< 3	< 5	< 15
	06/28/17 - 09/27/17	< 3	< 4	< 6	< 4	< 15	< 2	< 2	< 5	< 9
	09/27/17 - 01/03/18	< 2	< 4	< 7	< 4	< 30	< 3	< 4	< 4	< 13
	MEAN	-	-	-	-	-	-	-	-	-
CL-2	01/04/17 - 03/29/17	< 3	< 3	< 6	< 4	< 26	< 3	< 3	< 4	< 11
	03/29/17 - 06/28/17	< 2	< 2	< 4	< 2	< 18	< 2	< 2	< 3	< 11
	06/28/17 - 09/27/17	< 4	< 5	< 9	< 6	< 35	< 4	< 4	< 6	< 13
	09/27/17 - 01/03/18	< 3	< 1	< 3	< 2	< 15	< 2	< 2	< 3	< 8
	MEAN	-	-	-	-	-	-	-	-	-
CL-3	01/04/17 - 03/29/17	< 3	< 4	< 6	< 4	< 30	< 4	< 3	< 6	< 18
	03/29/17 - 06/28/17	< 3	< 2	< 5	< 2	< 20	< 2	< 2	< 3	< 9
	06/28/17 - 09/27/17	< 2	< 4	< 6	< 5	< 25	< 3	< 2	< 5	< 13
	09/27/17 - 01/03/18	< 3	< 2	< 4	< 2	< 13	< 2	< 2	< 3	< 9
	MEAN	-	-	-	-	-	-	-	-	-
CL-4	01/04/17 - 03/29/17	< 2	< 2	< 4	< 2	< 19	< 2	< 2	< 3	< 10
	03/29/17 - 06/28/17	< 2	< 3	< 4	< 2	< 23	< 3	< 2	< 3	< 11
	06/28/17 - 09/27/17	< 3	< 3	< 6	< 4	< 21	< 3	< 2	< 5	< 10
	09/27/17 - 01/03/18	< 3	< 4	< 6	< 3	< 24	< 3	< 3	< 4	< 13
	MEAN	-	-	-	-	-	-	-	-	-
CL-6	01/04/17 - 03/29/17	< 2	< 2	< 5	< 3	< 21	< 2	< 3	< 4	< 12
	03/29/17 - 06/21/17	< 4	< 3	< 6	< 5	< 37	< 3	< 3	< 6	< 17
	06/28/17 - 09/27/17	< 3	< 3	< 6	< 4	< 27	< 3	< 3	< 5	< 14
	09/27/17 - 01/03/18	< 2	< 2	< 4	< 2	< 18	< 2	< 2	< 3	< 9
	MEAN	-	-	-	-	-	-	-	-	-

Table C-VI.3 CONCENTRATIONS OF GAMMA EMITTERS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017

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	01/04/17 - 03/29/17	< 3	< 4	< 8	< 4	< 41	< 4	< 4	< 5	< 14
	03/29/17 - 06/28/17	< 3	< 3	< 5	< 3	< 24	< 3	< 3	< 4	< 11
	06/28/17 - 09/27/17	< 5	< 6	< 11	< 8	< 37	< 6	< 5	< 16	< 33
	09/27/17 - 01/03/18	< 2	< 3	< 5	< 2	< 23	< 2	< 2	< 3	< 10
	MEAN	-	-	-	-	-	-	-	-	-
CL-8	01/04/17 - 03/29/17	< 3	< 3	< 6	< 3	< 22	< 2	< 2	< 3	< 10
	03/29/17 - 06/28/17	< 3	< 3	< 5	< 3	< 27	< 3	< 3	< 5	< 16
	06/28/17 - 09/27/17	< 3	< 3	< 5	< 3	< 17	< 2	< 2	< 5	< 9
	09/27/17 - 01/03/18	< 3	< 3	< 5	< 3	< 22	< 3	< 3	< 4	< 14
	MEAN	-	-	-	-	-	-	-	-	-
CL-11	01/04/17 - 03/29/17	< 3	< 4	< 7	< 4	< 30	< 3	< 3	< 5	< 18
	03/29/17 - 06/28/17	< 3	< 2	< 4	< 2	< 20	< 2	< 2	< 3	< 9
	06/28/17 - 09/27/17	< 3	< 4	< 7	< 5	< 28	< 3	< 3	< 7	< 16
	09/27/17 - 01/03/18	< 2	< 3	< 4	< 3	< 20	< 2	< 2	< 3	< 9
	MEAN	-	-	-	-	-	-	-	-	-
CL-15	01/04/17 - 03/29/17	< 3	< 4	< 8	< 3	< 27	< 3	< 3	< 4	< 14
	03/29/17 - 06/28/17	< 3	< 2	< 5	< 3	< 22	< 2	< 2	< 3	< 10
	06/28/17 - 09/27/17	< 2	< 3	< 5	< 3	< 21	< 2	< 2	< 5	< 10
	09/27/17 - 01/03/18	< 3	< 2	< 4	< 3	< 20	< 3	< 2	< 3	< 9
	MEAN	-	-	-	-	-	-	-	-	-
CL-94	01/04/17 - 03/29/17	< 3	< 4	< 7	< 4	< 33	< 3	< 3	< 6	< 18
	03/29/17 - 06/28/17	< 2	< 3	< 6	< 3	< 22	< 3	< 3	< 3	< 8
	06/28/17 - 09/27/17	< 3	< 3	< 5	< 4	< 15	< 2	< 3	< 5	< 13
	09/27/17 - 01/03/18	< 2	< 2	< 3	< 2	< 17	< 2	< 2	< 3	< 8
	MEAN	-	-	-	-	-	-	-	-	-

Table C-VII.1

CONCENTRATIONS OF I-131 IN AIR IODINE SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017

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
01/04/17 - 01/11/17	< 41	< 42	< 41	< 41	< 34	< 34
01/11/17 - 01/18/17	< 57	< 57	< 57	< 56	< 44	< 44
01/18/17 - 01/25/17	< 43	< 43	< 43	< 18	< 36	< 20
01/25/17 - 02/01/17	< 50	< 51	< 51	< 50	< 38	< 15
02/01/17 - 02/08/17	< 48	< 48	< 48	< 48	< 39	< 39
02/08/17 - 02/15/17	< 39	< 40	< 40	< 40	< 38	< 21
02/15/17 - 02/22/17	< 46	< 46	< 46	< 47	< 40	< 22
02/22/17 - 03/01/17	< 43	< 44	< 44	< 44	< 35	< 19
03/01/17 - 03/08/17	< 44	< 45	< 44	< 44	< 28	< 55
03/08/17 - 03/15/17	< 40	< 41	< 41	< 41	< 60	< 60
03/15/17 - 03/22/17	< 58	< 58	< 24	< 58	< 39	< 15
03/22/17 - 03/29/17	< 50	< 21	< 49	< 49	< 49	< 27
03/29/17 - 04/05/17	< 42	< 42	< 42	< 42	< 43	< 44
04/05/17 - 04/12/17	< 39	< 39	< 39	< 39	< 42	< 16
04/12/17 - 04/19/17	< 54	< 55	< 55	< 55	< 43	< 43
04/19/17 - 04/26/17	< 46	< 46	< 46	< 46	< 44	< 44
04/26/17 - 05/03/17	< 42	< 17	< 47	< 47	< 37	< 37
05/03/17 - 05/10/17	< 38	< 39	< 38	< 39	< 39	< 39
05/10/17 - 05/17/17	< 41	< 41	< 41	< 41	< 41	< 40
05/17/17 - 05/24/17	< 65	< 66	< 66	< 65	< 57	< 22
05/24/17 - 05/31/17	< 41	< 42	< 17	< 42	< 51	< 51
05/31/17 - 06/07/17	< 46	< 45	< 45	< 46	< 26	< 10
06/07/17 - 06/14/17	< 48	< 49	< 49	< 49	< 8	< 22
06/14/17 - 06/21/17	< 42	< 42	< 43	< 42	< 42	< 16
06/21/17 - 06/28/17	< 63	< 60	< 62	*(1)*	< 60	< 60
06/28/17 - 07/05/17	< 38	< 38	< 39	< 38	< 42	< 41
07/05/17 - 07/12/17	< 55	< 55	< 56	*(1)*	< 46	< 25
07/12/17 - 07/19/17	< 35	< 36	< 36	< 41	< 38	< 37
07/19/17 - 07/26/17	< 44	< 45	< 19	< 45	< 39	< 15
07/26/17 - 08/02/17	< 46	< 46	< 46	< 46	< 51	< 51
08/02/17 - 08/09/17	< 48	< 48	< 48	< 49	< 44	< 44
08/09/17 - 08/16/17	< 52	< 52	< 52	< 52	< 49	< 22
08/16/17 - 08/23/17	< 54	< 52	< 54	< 54	< 36	< 36
08/23/17 - 08/30/17	< 53	< 54	< 53	< 54	< 45	< 45
08/30/17 - 09/06/17	< 42	< 41	< 42	< 43	< 36	< 36
09/06/17 - 09/13/17	< 48	< 48	< 48	< 49	< 20	< 46
09/13/17 - 09/20/17	< 40	< 40	< 17	< 41	< 32	< 32
09/20/17 - 09/27/17	< 34	< 34	< 34	< 34	< 25	< 30
09/27/17 - 10/04/17	< 46	< 45	< 45	< 45	< 53	< 52
10/04/17 - 10/11/17	< 47	< 48	< 46	< 48	< 35	< 34
10/11/17 - 10/18/17	< 46	< 46	< 45	< 46	< 45	< 45
10/18/17 - 10/25/17	< 37	< 38	< 37	< 15	< 38	< 38
10/25/17 - 11/01/17	< 43	< 23	< 44	< 44	< 19	< 55
11/01/17 - 11/08/17	< 49	< 50	< 50	< 49	< 31	< 37
11/08/17 - 11/15/17	< 42	< 41	< 42	< 42	< 33	< 33
11/15/17 - 11/22/17	< 54	< 55	< 55	< 55	< 38	< 32
11/22/17 - 11/29/17	< 48	< 48	< 48	< 48	< 34	< 33
11/29/17 - 12/06/17	< 62	< 61	< 61	< 61	< 33	< 33
12/06/17 - 12/13/17	< 32	< 32	< 31	< 33	< 48	< 48
12/13/17 - 12/20/17	< 32	< 31	< 13	< 32	< 26	< 26
12/20/17 - 12/27/17	< 40	< 40	< 40	< 40	< 44	< 44
12/27/17 - 01/03/18	< 46	< 47	< 25	< 46	< 52	< 52
MEAN	-	-	-	-	-	-

(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

Table C-VII.1

CONCENTRATIONS OF I-131 IN AIR IODINE SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017

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

COLLECTION	GROUP II			GROUP III
PERIOD	CL-1	CL-7	CL-8	CL-11
01/04/17 - 01/11/17	< 17	< 34	< 34	< 18
01/11/17 - 01/18/17	< 24	< 44	< 44	< 24
01/18/17 - 01/25/17	< 42	< 35	< 35	< 35
01/25/17 - 02/01/17	< 22	< 38	< 39	< 38
02/01/17 - 02/08/17	< 17	< 39	< 39	< 17
02/08/17 - 02/15/17	< 17	< 38	< 38	< 38
02/15/17 - 02/22/17	< 19	< 41	< 41	< 40
02/22/17 - 03/01/17	< 19	< 35	< 34	< 33
03/01/17 - 03/08/17	< 20	< 55	< 55	< 57
03/08/17 - 03/15/17	< 23	< 60	< 60	< 20
03/15/17 - 03/22/17	< 58	< 38	< 38	< 39
03/22/17 - 03/29/17	< 49	< 48	< 48	< 48
03/29/17 - 04/05/17	< 18	< 17	< 44	< 42
04/05/17 - 04/12/17	< 16	< 43	< 42	< 43
04/12/17 - 04/19/17	< 23	< 43	< 17	< 42
04/19/17 - 04/26/17	< 20	< 17	< 43	< 43
04/26/17 - 05/03/17	< 42	< 37	< 38	< 14
05/03/17 - 05/10/17	< 14	< 39	< 39	< 18
05/10/17 - 05/17/17	< 16	< 17	< 40	< 40
05/17/17 - 05/24/17	< 28	< 57	< 57	< 57
05/24/17 - 05/31/17	< 41	< 20	< 51	< 50
05/31/17 - 06/07/17	< 19	< 27	< 27	< 27
06/07/17 - 06/14/17	< 20	< 22	< 22	< 22
06/14/17 - 06/21/17	< 17	< 42	< 42	< 42
06/21/17 - 06/28/17	< 21	< 58	< 58	< 26
06/28/17 - 07/05/17	< 16	< 16	< 42	< 42
07/05/17 - 07/12/17	< 30	< 46	< 46	< 46
07/12/17 - 07/19/17	< 15	< 14	< 37	< 37
07/19/17 - 07/26/17	< 44	< 39	< 40	< 39
07/26/17 - 08/02/17	< 27	< 51	< 51	< 18
08/02/17 - 08/09/17	< 17	< 20	< 44	< 44
08/09/17 - 08/16/17	< 18	< 49	< 49	< 49
08/16/17 - 08/23/17	< 23	< 36	< 36	< 29
08/23/17 - 08/30/17	< 22	< 38	< 44	< 45
08/30/17 - 09/06/17	< 35	< 15	< 36	< 36
09/06/17 - 09/13/17	< 17	< 46	< 46	< 45
09/13/17 - 09/20/17	< 41	< 27	< 33	< 32
09/20/17 - 09/27/17	< 14	< 30	< 30	< 30
09/27/17 - 10/04/17	< 20	< 28	< 52	< 52
10/04/17 - 10/11/17	< 20	< 29	< 34	< 35
10/11/17 - 10/18/17	< 19	< 39	< 45	< 45
10/18/17 - 10/25/17	< 37	< 32	< 38	< 37
10/25/17 - 11/01/17	< 44	< 56	< 55	< 56
11/01/17 - 11/08/17	< 21	< 37	< 38	< 37
11/08/17 - 11/15/17	< 17	< 28	< 33	< 33
11/15/17 - 11/22/17	< 23	< 38	< 38	< 39
11/22/17 - 11/29/17	< 20	< 27	< 33	< 33
11/29/17 - 12/06/17	< 26	< 28	< 33	< 33
12/06/17 - 12/13/17	< 14	< 25	< 49	< 48
12/13/17 - 12/20/17	< 31	< 14	< 26	< 26
12/20/17 - 12/27/17	< 23	< 37	< 44	< 44
12/27/17 - 01/03/18	< 46	< 19	< 51	< 51
MEAN	-	-	-	-

Table C-VIII.1 CONCENTRATIONS OF I-131 IN MILK SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	CONTROL FARM CL-116
01/25/17	< 0.5
02/22/17	< 0.7
03/29/17	< 0.3
04/26/17	< 0.5
05/10/17	< 0.5
05/24/17	< 0.8
06/07/17	< 0.4
06/21/17	< 0.7
07/05/17	< 0.8
07/19/17	< 0.8
08/02/17	< 0.9
08/16/17	< 0.4
08/30/17	< 0.6
09/13/17	< 0.4
09/27/17	< 0.4
10/11/17	< 0.4
10/25/17	< 1.0
11/29/17	< 0.8
12/27/17	< 1.0
MEAN	-

Table C-VIII.2

CONCENTRATIONS OF GAMMA EMITTERS IN MILK SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017

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	01/25/17	944 ± 146	< 8	< 8	< 17	< 7	< 17	< 8	< 14	< 8	< 7	< 35	< 10	< 67
	02/22/17	1238 ± 173	< 8	< 8	< 19	< 8	< 18	< 8	< 15	< 7	< 9	< 34	< 11	< 66
	03/29/17	1042 ± 121	< 8	< 9	< 16	< 8	< 19	< 8	< 13	< 8	< 9	< 37	< 9	< 73
	04/26/17	1171 ± 153	< 7	< 6	< 13	< 5	< 14	< 6	< 10	< 7	< 8	< 26	< 7	< 42
	05/10/17	1058 ± 145	< 8	< 8	< 18	< 9	< 17	< 9	< 17	< 10	< 8	< 37	< 11	< 80
	05/24/17	1212 ± 157	< 7	< 5	< 16	< 6	< 17	< 7	< 14	< 7	< 7	< 32	< 10	< 52
	06/07/17	1482 ± 191	< 9	< 9	< 21	< 9	< 21	< 9	< 16	< 12	< 9	< 39	< 12	< 56
	06/21/17	1290 ± 180	< 7	< 9	< 16	< 10	< 21	< 9	< 14	< 7	< 8	< 34	< 11	< 59
	07/05/17	1450 ± 188	< 7	< 9	< 12	< 10	< 17	< 8	< 12	< 8	< 7	< 29	< 13	< 51
	07/19/17	1149 ± 136	< 5	< 5	< 12	< 7	< 11	< 7	< 11	< 7	< 6	< 26	< 7	< 42
	08/02/17	1253 ± 164	< 11	< 11	< 25	< 10	< 27	< 11	< 18	< 11	< 11	< 50	< 12	< 89
	08/16/17	1216 ± 158	< 5	< 6	< 14	< 7	< 15	< 7	< 11	< 6	< 6	< 26	< 6	< 48
	08/30/17	1255 ± 166	< 11	< 12	< 23	< 11	< 26	< 12	< 15	< 12	< 11	< 57	< 14	< 97
	09/13/17	1365 ± 120	< 5	< 5	< 13	< 5	< 12	< 6	< 10	< 6	< 5	< 35	< 10	< 33
	09/27/17	1297 ± 191	< 9	< 7	< 21	< 11	< 23	< 8	< 16	< 9	< 8	< 35	< 7	< 50
	10/11/17	1050 ± 143	< 7	< 7	< 14	< 7	< 14	< 7	< 10	< 6	< 6	< 29	< 7	< 48
	10/25/17	1140 ± 98	< 6	< 6	< 14	< 6	< 14	< 7	< 11	< 7	< 6	< 28	< 8	< 53
	11/29/17	924 ± 136	< 6	< 7	< 16	< 7	< 16	< 8	< 10	< 10	< 7	< 33	< 6	< 51
	12/27/17	964 ± 118	< 5	< 5	< 13	< 5	< 13	< 5	< 8	< 6	< 6	< 23	< 5	< 37
	MEAN ± 2 STD DEV	1184 ± 320	-	-	-	-	-	-	-	-	-	-	-	-

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, 2017

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														
Corn Leaves	06/28/17	< 31	< 34	< 67	< 37	< 80	< 43	< 55	< 54	< 34	< 33	< 183	< 52	< 250
Corn Leaves/Kale	06/28/17	< 24	< 34	< 69	< 45	< 60	< 38	< 62	< 59	< 36	< 34	< 178	< 58	< 209
Rhubarb leaves	06/28/17	< 33	< 27	< 66	< 25	< 60	< 34	< 53	< 56	< 33	< 32	< 155	< 34	< 213
Kale	07/26/17	< 39	< 36	< 84	< 36	< 81	< 41	< 70	< 58	< 44	< 45	< 171	< 49	< 268
Lettuce	07/26/17	< 39	< 43	< 77	< 42	< 104	< 42	< 74	< 58	< 41	< 36	< 166	< 66	< 188
Swiss Chard	07/26/17	< 29	< 38	< 62	< 38	< 72	< 30	< 63	< 50	< 44	< 38	< 164	< 39	< 204
Kale	08/30/17	< 13	< 13	< 30	< 13	< 29	< 14	< 25	< 34	< 15	< 13	< 83	< 25	< 79
Lettuce	08/30/17	< 14	< 15	< 33	< 13	< 32	< 16	< 28	< 42	< 15	< 16	< 96	< 24	< 94
Swiss Chard	08/30/17	< 11	< 13	< 33	< 14	< 28	< 13	< 24	< 32	< 14	< 12	< 75	< 21	< 66
Corn	09/27/17	< 16	< 18	< 41	< 15	< 49	< 21	< 38	< 33	< 18	< 19	< 82	< 24	< 104
Kale	09/27/17	< 26	< 25	< 52	< 28	< 56	< 28	< 44	< 39	< 28	< 30	< 105	< 40	< 149
Swiss Chard	09/27/17	< 17	< 13	< 34	< 12	< 44	< 16	< 28	< 24	< 16	< 15	< 78	< 23	< 112
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-	-
CL-115														
Cabbage	06/28/17	< 34	< 33	< 69	< 44	< 73	< 35	< 51	< 58	< 38	< 37	< 157	< 59	< 202
Lettuce	06/28/17	< 25	< 32	< 66	< 28	< 79	< 32	< 56	< 51	< 46	< 34	< 183	< 45	< 155
Swiss Chard	06/28/17	< 28	< 27	< 64	< 36	< 72	< 28	< 56	< 48	< 24	< 27	< 139	< 23	< 148
Cabbage	07/26/17	< 29	< 32	< 61	< 30	< 64	< 33	< 53	< 58	< 38	< 35	< 176	< 37	< 234
Lettuce	07/26/17	< 34	< 31	< 77	< 33	< 69	< 29	< 65	< 57	< 34	< 34	< 152	< 36	< 204
Swiss Chard	07/26/17	< 33	< 35	< 63	< 39	< 81	< 34	< 61	< 59	< 37	< 35	< 150	< 32	< 187
Cabbage	08/30/17	< 7	< 8	< 17	< 7	< 16	< 9	< 14	< 23	< 9	< 8	< 51	< 14	< 47
Lettuce	08/30/17	< 14	< 15	< 32	< 15	< 30	< 16	< 26	< 42	< 16	< 16	< 94	< 28	< 91
Swiss Chard	08/30/17	< 13	< 14	< 30	< 13	< 30	< 14	< 26	< 37	< 15	< 15	< 90	< 21	< 65
Cabbage	09/27/17	< 22	< 23	< 61	< 23	< 50	< 26	< 47	< 43	< 31	< 27	< 126	< 33	< 135
Kale	09/27/17	< 22	< 20	< 42	< 21	< 54	< 20	< 34	< 34	< 21	< 20	< 101	< 26	< 124
Swiss Chard	09/27/17	< 20	< 18	< 44	< 18	< 44	< 22	< 37	< 33	< 22	< 18	< 82	< 22	< 142
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-	-
CL-117														
Cabbage	06/28/17	< 27	< 28	< 62	< 34	< 67	< 33	< 49	< 58	< 36	< 31	< 152	< 43	< 175
Lettuce	06/28/17	< 27	< 30	< 58	< 27	< 65	< 26	< 46	< 46	< 32	< 30	< 127	< 36	< 160
Swiss Chard	06/28/17	< 33	< 30	< 79	< 33	< 74	< 40	< 61	< 57	< 40	< 31	< 151	< 53	< 211
Cabbage	07/26/17	< 35	< 35	< 75	< 37	< 63	< 32	< 52	< 44	< 38	< 35	< 156	< 33	< 149
Kale	07/26/17	< 32	< 30	< 84	< 40	< 75	< 33	< 60	< 51	< 40	< 34	< 155	< 46	< 172
Lettuce	07/26/17	< 23	< 26	< 58	< 24	< 66	< 30	< 45	< 42	< 31	< 28	< 116	< 31	< 162
Cabbage	08/30/17	< 11	< 11	< 24	< 10	< 26	< 12	< 21	< 34	< 12	< 11	< 75	< 18	< 85
Kale	08/30/17	< 13	< 13	< 30	< 13	< 29	< 13	< 24	< 38	< 14	< 13	< 82	< 26	< 77
Lettuce	08/30/17	< 10	< 11	< 23	< 12	< 24	< 12	< 20	< 29	< 11	< 11	< 66	< 18	< 64
Cabbage	09/27/17	< 26	< 25	< 62	< 28	< 57	< 32	< 43	< 42	< 26	< 30	< 129	< 29	< 151
Kale	09/27/17	< 31	< 35	< 64	< 28	< 72	< 37	< 58	< 56	< 40	< 32	< 143	< 47	< 192
Lettuce/Cabbage	09/27/17	< 32	< 31	< 72	< 30	< 73	< 35	< 61	< 59	< 32	< 37	< 176	< 40	< 200
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-	-
CL-118														
Cabbage	06/28/17	< 26	< 29	< 47	< 37	< 69	< 36	< 48	< 55	< 41	< 32	< 171	< 34	< 176
Lettuce	06/28/17	< 26	< 30	< 69	< 28	< 70	< 32	< 57	< 57	< 27	< 32	< 141	< 36	< 217
Swiss Chard	06/28/17	< 31	< 33	< 67	< 39	< 76	< 32	< 59	< 52	< 29	< 35	< 130	< 29	< 136
Cabbage	07/26/17	< 29	< 26	< 58	< 21	< 60	< 30	< 51	< 57	< 31	< 32	< 142	< 38	< 217
Lettuce	07/26/17	< 31	< 41	< 69	< 33	< 76	< 35	< 59	< 56	< 37	< 35	< 181	< 50	< 194
Swiss Chard	07/26/17	< 25	< 25	< 68	< 34	< 68	< 32	< 63	< 52	< 36	< 32	< 124	< 36	< 157
Cabbage	08/30/17	< 18	< 19	< 47	< 14	< 35	< 18	< 32	< 49	< 15	< 17	< 116	< 43	< 110
Lettuce	08/30/17	< 13	< 14	< 34	< 13	< 30	< 13	< 27	< 38	< 15	< 14	< 91	< 22	< 79
Swiss Chard	08/30/17	< 10	< 11	< 26	< 11	< 24	< 11	< 19	< 29	< 12	< 11	< 65	< 18	< 66
Cabbage	09/27/17	< 27	< 26	< 52	< 30	< 60	< 27	< 46	< 44	< 28	< 29	< 132	< 41	< 155
Kale	09/27/17	< 18	< 20	< 43	< 18	< 43	< 20	< 30	< 46	< 21	23 ± 17	< 116	< 29	< 112
Swiss Chard	09/27/17	< 23	< 20	< 52	< 26	< 42	< 23	< 34	< 40	< 25	< 20	< 107	< 24	< 130
*Kale (*Resample)*	10/11/17	< 32	< 27	< 61	< 30	< 57	< 25	< 49	< 39	< 33	< 29	< 122	< 34	< 179
	MEAN	-	-	-	-	-	-	-	-	-	23 ± 0	-	-	-

**Resample taken due to unusually high amount of soil in original sample taken 09/27/17*

Table C-IX.2

CONCENTRATIONS OF GAMMA EMITTERS IN GRASS SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017

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	05/10/17	< 20	< 20	< 38	< 19	< 45	< 19	< 34	< 22	< 21	< 21	< 67	< 18	< 140
	05/24/17	< 30	< 33	< 63	< 37	< 56	< 43	< 65	< 57	< 35	< 36	< 165	< 36	< 236
	06/07/17	< 35	< 26	< 70	< 40	< 95	< 38	< 70	< 51	< 43	< 42	< 155	< 35	< 244
	06/21/17	< 29	< 36	< 81	< 39	< 74	< 42	< 58	< 55	< 40	< 35	< 153	< 35	< 232
	07/05/17	< 32	< 34	< 70	< 35	< 78	< 35	< 57	< 50	< 33	< 31	< 154	< 45	< 153
	07/19/17	< 40	< 46	< 96	< 39	< 93	< 32	< 71	< 57	< 39	< 42	< 184	< 42	< 253
	08/02/17	< 21	< 20	< 41	< 21	< 47	< 21	< 35	< 37	< 22	< 22	< 105	< 25	< 156
	08/16/17	< 36	< 39	< 78	< 36	< 96	< 35	< 68	< 56	< 43	< 40	< 154	< 57	< 171
	08/30/17	< 15	< 17	< 38	< 17	< 33	< 18	< 30	< 57	< 17	< 15	< 122	< 28	< 102
	09/13/17	< 21	< 23	< 52	< 24	< 53	< 27	< 41	< 49	< 25	< 24	< 126	< 36	< 144
	09/27/17	< 21	< 22	< 54	< 25	< 45	< 21	< 35	< 46	< 24	< 22	< 107	< 31	< 131
	10/11/17	< 34	< 32	< 64	< 34	< 76	< 35	< 60	< 58	< 40	< 34	< 163	< 33	< 262
	10/25/17	< 24	< 21	< 50	< 24	< 55	< 21	< 31	< 33	< 25	< 21	< 98	< 28	< 144
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-	-
CL-02	05/10/17	< 15	< 16	< 33	< 16	< 38	< 16	< 26	< 17	< 18	< 16	< 56	< 14	< 103
	05/24/17	< 30	< 30	< 65	< 35	< 67	< 31	< 53	< 53	< 34	< 27	< 145	< 32	< 167
	06/07/17	< 36	< 34	< 76	< 29	< 76	< 39	< 70	< 49	< 48	< 37	< 171	< 40	< 246
	06/21/17	< 45	< 47	< 91	< 40	< 95	< 37	< 73	< 51	< 52	< 45	< 173	< 53	< 217
	07/05/17	< 33	< 34	< 97	< 36	< 89	< 49	< 68	< 54	< 39	< 40	< 182	< 43	< 272
	07/19/17	< 21	< 23	< 47	< 24	< 51	< 22	< 40	< 35	< 24	< 25	< 96	< 24	< 152
	08/02/17	< 18	< 17	< 36	< 17	< 38	< 18	< 33	< 28	< 21	< 19	< 80	< 22	< 127
	08/16/17	< 31	< 28	< 66	< 27	< 68	< 30	< 53	< 50	< 32	< 32	< 142	< 32	< 208
	08/30/17	< 17	< 18	< 38	< 16	< 40	< 20	< 31	< 58	< 18	< 18	< 120	< 32	< 110
	09/13/17	< 28	< 25	< 59	< 29	< 60	< 28	< 47	< 56	< 30	< 28	< 140	< 43	< 159
	09/27/17	< 26	< 25	< 57	< 24	< 60	< 29	< 46	< 51	< 29	31 ± 21	< 138	< 42	< 159
	10/11/17	< 28	< 31	< 59	< 24	< 56	< 31	< 47	< 44	< 28	< 29	< 150	< 32	< 197
	10/25/17	< 22	< 20	< 49	< 22	< 41	< 25	< 38	< 37	< 24	< 23	< 101	< 29	< 141
	MEAN	-	-	-	-	-	-	-	-	-	31 ± 0	-	-	-

Table C-IX.2

CONCENTRATIONS OF GAMMA EMITTERS IN GRASS SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017

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	05/10/17	< 16	< 13	< 31	< 15	< 34	< 15	< 24	< 17	< 19	< 16	< 57	< 12	< 106
	05/24/17	< 28	< 30	< 56	< 29	< 68	< 31	< 64	< 54	< 33	< 28	< 160	< 30	< 220
	06/07/17	< 35	< 36	< 69	< 38	< 82	< 38	< 71	< 49	< 38	< 36	< 152	< 40	< 230
	06/21/17	< 38	< 32	< 88	< 49	< 99	< 49	< 69	< 50	< 46	< 42	< 155	< 42	< 221
	07/05/17	< 35	< 28	< 68	< 32	< 74	< 35	< 43	< 52	< 34	< 36	< 152	< 43	< 184
	07/19/17	< 31	< 37	< 87	< 36	< 79	< 34	< 54	< 48	< 39	< 34	< 142	< 26	< 222
	08/02/17	< 16	< 15	< 36	< 15	< 38	< 17	< 28	< 24	< 17	< 15	< 74	< 19	< 96
	08/16/17	< 34	< 36	< 69	< 31	< 80	< 33	< 62	< 47	< 36	< 39	< 160	< 30	< 240
	08/30/17	< 18	< 19	< 39	< 18	< 42	< 19	< 33	< 56	< 17	< 18	< 116	< 32	< 105
	09/13/17	< 24	< 25	< 58	< 26	< 54	< 28	< 47	< 52	< 27	< 26	< 141	< 41	< 150
	09/27/17	< 19	< 20	< 44	< 19	< 42	< 18	< 33	< 34	< 21	< 19	< 96	< 27	< 94
	10/11/17	< 34	< 33	< 66	< 30	< 73	< 29	< 53	< 50	< 29	< 34	< 142	< 33	< 214
	10/25/17	< 24	< 25	< 48	< 25	< 54	< 26	< 46	< 39	< 27	< 26	< 119	< 28	< 185
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-	-
CL-116	05/10/17	< 25	< 22	< 43	< 22	< 50	< 24	< 41	< 29	< 25	< 24	< 87	< 20	< 194
	05/24/17	< 25	< 25	< 58	< 25	< 55	< 28	< 49	< 47	< 30	< 28	< 122	< 37	< 189
	06/07/17	< 51	< 43	< 94	< 43	< 95	< 46	< 67	< 58	< 51	< 41	< 171	< 57	< 265
	06/21/17	< 43	< 38	< 90	< 38	< 66	< 37	< 68	< 54	< 42	< 40	< 165	< 39	< 258
	07/05/17	< 29	< 34	< 75	< 38	< 78	< 33	< 62	< 47	< 37	< 36	< 167	< 45	< 217
	07/19/17	< 38	< 37	< 80	< 29	< 101	< 32	< 69	< 55	< 32	< 40	< 171	< 43	< 240
	08/02/17	< 20	< 20	< 45	< 23	< 42	< 20	< 34	< 35	< 23	< 20	< 92	< 24	< 132
	08/16/17	< 33	< 34	< 73	< 39	< 80	< 35	< 54	< 50	< 34	< 37	< 153	< 36	< 256
	08/30/17	< 19	< 19	< 40	< 18	< 38	< 20	< 35	< 59	< 19	< 19	< 133	< 33	< 107
	09/13/17	< 22	< 23	< 53	< 23	< 53	< 25	< 40	< 49	< 26	< 26	< 134	< 31	< 147
	09/27/17	< 19	< 23	< 52	< 22	< 48	< 22	< 39	< 46	< 23	< 22	< 122	< 32	< 133
	10/11/17	< 42	< 34	< 75	< 34	< 69	< 27	< 60	< 51	< 40	< 38	< 126	< 49	< 216
	10/25/17	< 26	< 25	< 54	< 24	< 60	< 27	< 45	< 40	< 28	< 26	< 118	< 31	< 148
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C-X.1 **QUARTERLY DLR RESULTS FOR CLINTON POWER STATION, 2017**

RESULTS IN UNITS OF MILLIREM/QUARTER ± 2 STANDARD DEVIATIONS

STATION CODE	MEAN ± 2 S.D.	JAN - MAR	APR - JUN	JUL - SEP	OCT - DEC
CL-01	24.6 ± 6.0	22.7	28.4	25.4	21.7
CL-02	25.1 ± 4.3	24.0	27.9	25.6	23.0
CL-03	24.5 ± 5.1	22.6	27.7	25.4	22.3
CL-04	24.5 ± 4.7	22.8	26.9	26.2	22.2
CL-05	25.0 ± 5.0	23.0	28.1	25.8	22.9
CL-06	22.3 ± 4.3	21.2	25.3	22.1	20.4
CL-07	22.9 ± 5.0	20.9	25.8	24.0	20.7
CL-08	24.1 ± 5.0	22.6	27.1	25.1	21.6
CL-11	23.0 ± 4.7	21.8	26.4	22.7	21.2
CL-15	22.6 ± 4.2	21.3	25.6	22.3	21.0
CL-22	25.2 ± 4.8	23.7	28.4	25.6	23.1
CL-23	26.2 ± 4.9	25.2	29.4	26.4	23.6
CL-24	26.3 ± 4.4	24.6	29.0	27.0	24.4
CL-33	25.9 ± 4.4	24.5	29.1	25.7	24.4
CL-34	23.9 ± 4.9	22.7	27.0	24.6	21.4
CL-35	24.1 ± 5.0	23.6	27.6	23.5	21.7
CL-36	24.5 ± 4.4	22.8	26.9	25.8	22.4
CL-37	23.6 ± 3.9	21.8	26.1	24.1	22.4
CL-41	25.3 ± 4.6	23.8	28.3	25.7	23.2
CL-42	24.5 ± 4.9	22.7	27.0	26.2	22.1
CL-43	26.9 ± 4.3	25.2	29.4	27.8	25.0
CL-44	24.5 ± 5.8	22.7	27.9	25.8	21.6
CL-45	26.5 ± 4.1	25.2	29.4	26.3	24.9
CL-46	24.8 ± 5.6	23.5	28.0	26.1	21.7
CL-47	25.9 ± 3.4	23.7	27.3	27.2	25.5
CL-48	24.7 ± 4.9	23.1	27.5	25.8	22.2
CL-49	25.9 ± 4.3	26.0	28.7	25.3	23.5
CL-51	25.6 ± 5.5	24.7	28.1	27.4	22.1
CL-52	25.4 ± 4.1	24.2	28.1	25.7	23.4
CL-53	24.5 ± 4.9	22.3	27.4	25.6	22.6
CL-54	24.9 ± 5.4	23.6	28.0	26.2	21.9
CL-55	25.8 ± 4.1	25.1	28.4	26.0	23.5
CL-56	26.3 ± 5.5	24.4	29.9	27.1	23.9
CL-57	26.4 ± 4.7	25.4	29.5	26.7	24.0
CL-58	25.7 ± 4.7	24.2	28.1	27.2	23.2
CL-60	25.8 ± 4.6	24.4	29.0	25.9	23.8
CL-61	25.0 ± 4.8	24.7	28.0	25.3	22.1
CL-63	22.3 ± 4.8	21.1	25.9	21.5	20.7
CL-64	24.5 ± 4.6	23.0	27.6	24.9	22.5
CL-65	25.7 ± 4.5	23.3	28.2	26.9	24.4
CL-74	22.6 ± 5.6	22.3	26.6	21.4	20.2
CL-75	25.0 ± 4.1	24.3	27.4	25.7	22.6
CL-76	25.5 ± 6.2	24.3	29.1	26.6	21.8
CL-77	23.5 ± 3.6	22.2	25.4	24.5	21.7
CL-78	24.2 ± 6.4	21.9	28.1	25.6	21.3
CL-79	25.5 ± 5.4	24.9	28.7	26.1	22.2
CL-80	25.0 ± 6.6	24.8	29.1	24.9	21.0
CL-81	24.8 ± 5.7	22.2	28.0	26.4	22.6
CL-84	24.9 ± 4.1	23.3	27.7	25.1	23.5
CL-90	21.1 ± 4.3	20.7	24.2	20.2	19.3
CL-91	23.7 ± 5.2	22.9	27.1	23.8	20.9
CL-97	25.2 ± 5.9	23.2	29.2	25.5	22.8
CL-99	21.4 ± 4.5	20.7	24.7	20.4	19.8
CL-114	24.0 ± 5.2	22.2	27.6	24.2	21.9

TABLE C-X.2 MEAN QUARTLY DLR RESULTS FOR THE INNER RING, OUTER RING, SPECIAL INTEREST SUPPLEMENTAL AND CONTROL LOCATIONS FOR CLINTON POWER STATION, 2017

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

COLLECTION PERIOD	INNER RING ± 2 S.D.	OUTER RING	SPECIAL INTEREST	SUPPLEMENTAL	CONTROL
JAN-MAR	23.5 ± 2.3	24.0 ± 2.3	23.5 ± 2.8	22.4 ± 2.5	21.8 ± 0
APR-JUN	28.0 ± 2.0	28.3 ± 2.0	27.6 ± 1.9	26.9 ± 3.1	26.4 ± 0
JUL-SEP	25.7 ± 3.0	26.1 ± 1.6	24.9 ± 3.5	24.0 ± 4.0	22.7 ± 0
OCT-DEC	22.8 ± 2.9	22.6 ± 1.9	22.7 ± 2.6	21.7 ± 2.9	21.2 ± 0

TABLE C-X.3 SUMMARY OF THE AMBIENT DOSIMETRY PROGRAM FOR CLINTON POWER STATION, 2017

RESULTS IN UNITS OF MILLIREM/QUARTER ± 2 STANDARD DEVIATION

LOCATION	SAMPLES ANALYZED	PERIOD MINIMUM	PERIOD MAXIMUM	PERIOD MEAN ± 2 S.D.	PRE-OP MEAN ± 2 S.D, ALL LOCATIONS
INNER RING	64	20.7	29.4	25.0 ± 4.8	
OUTER RING	64	21.0	29.9	25.2 ± 4.8	18.0 ± 2.4
SPECIAL INTEREST	28	20.2	28.7	24.7 ± 4.6	
SUPPLEMENTAL	56	19.3	29.2	23.7 ± 5.0	
CONTROL	4	21.2	26.4	23.0 ± 4.7	

INNER RING STATIONS - CL-01, CL-05, 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, CL-63

OUTER RING STATIONS - 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, CL-81

SPECIAL INTEREST STATIONS - CL-37, CL-41, CL-49, CL-64, CL-65, CL-74, CL-75

SUPPLEMENTAL STATIONS - CL-02, CL-03, CL-04, CL-06, CL-07, CL-08, CL-114, CL-15, CL-33, CL-84, CL-90, CL-91, CL-97, CL-99

CONTROL STATIONS - CL-11

FIGURE C-1
MEAN MONTHLY GROSS BETA CONCENTRATION IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF CPS, 2017

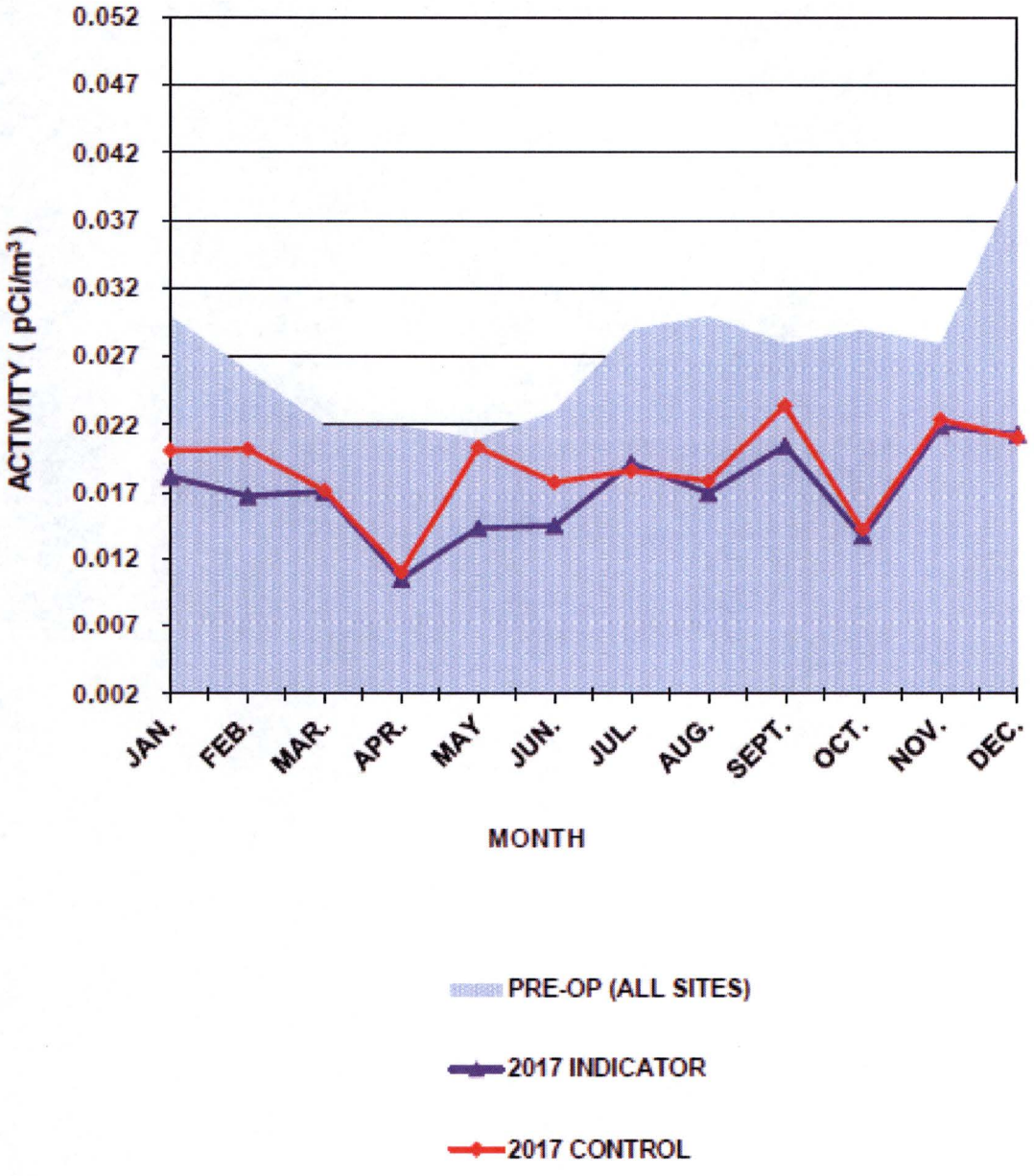
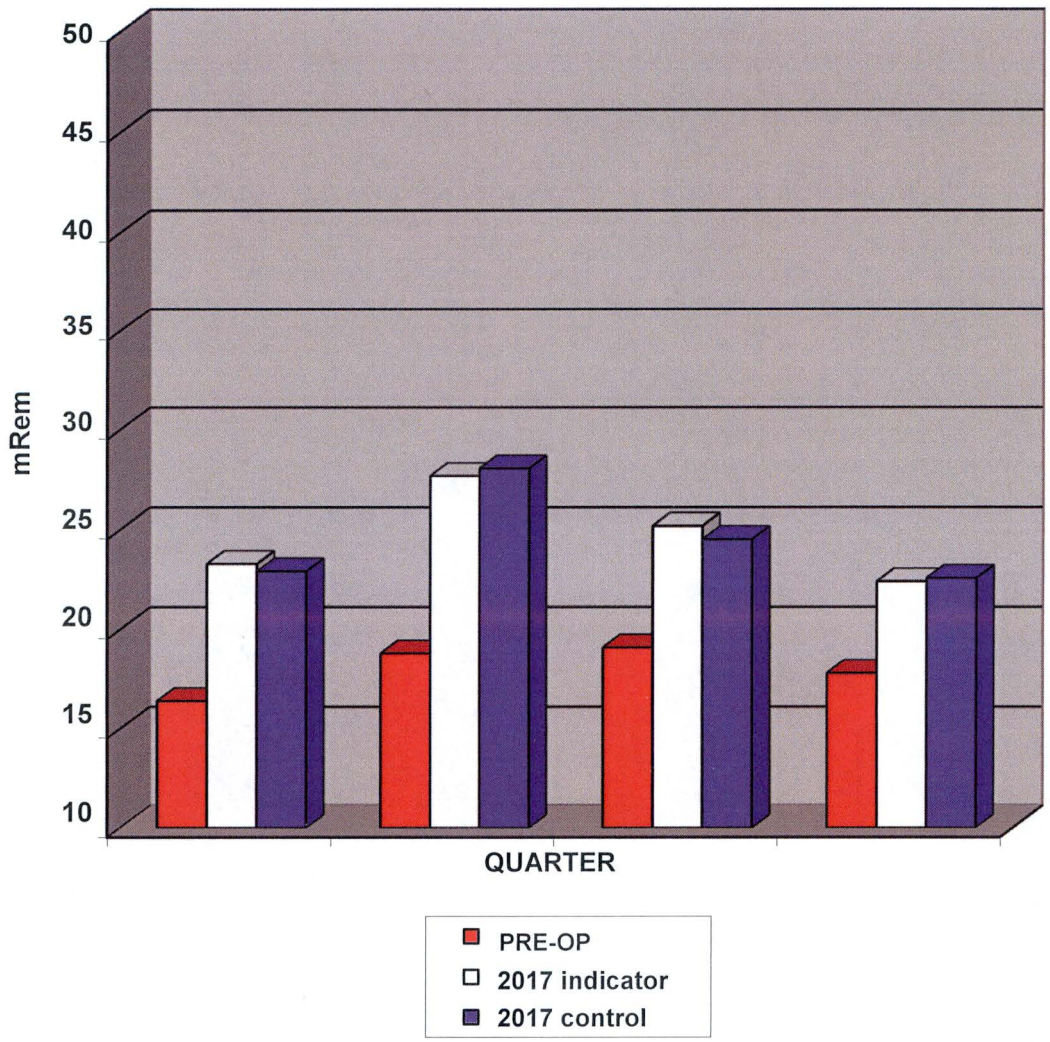


FIGURE C-2
MEAN QUARTERLY AMBIENT GAMMA RADIATION LEVELS (DLR) IN THE VICINITY OF CPS, 2017



APPENDIX D

INTER-LABORATORY COMPARISON PROGRAM

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 2017	E11811	Milk	Sr-89	pCi/L	87	97.7	0.89	A
			Sr-90	pCi/L	12.4	16.2	0.77	W
	E11812	Milk	Ce-141	pCi/L	135	145	0.93	A
			Co-58	pCi/L	153	150	1.02	A
			Co-60	pCi/L	182	183	1.00	A
			Cr-51	pCi/L	258	290	0.89	A
			Cs-134	pCi/L	104	120	0.87	A
			Cs-137	pCi/L	142	140	1.02	A
			Fe-59	pCi/L	135	129	1.05	A
			I-131	pCi/L	92.6	97.9	0.95	A
			Mn-54	pCi/L	173	164	1.05	A
			Zn-65	pCi/L	208	199	1.04	A
	E11813	Charcoal	I-131	pCi	92	93.9	0.98	A
	E11814	AP	Ce-141	pCi	99.9	101	0.99	A
			Co-58	pCi	95.4	104	0.92	A
			Co-60	pCi	140	127	1.10	A
			Cr-51	pCi	211	201	1.05	A
			Cs-134	pCi	82.1	83.2	0.99	A
			Cs-137	pCi	92.8	97.0	0.96	A
			Fe-59	pCi	107	89.3	1.20	A
			Mn-54	pCi	106	114	0.93	A
			Zn-65	pCi	137	138	0.99	A
	E11816	Soil	Ce-141	pCi/g	0.258	0.250	1.03	A
			Co-58	pCi/g	0.241	0.258	0.93	A
			Co-60	pCi/g	0.312	0.315	0.99	A
			Cr-51	pCi/g	0.439	0.500	0.88	A
			Cs-134	pCi/g	0.176	0.207	0.85	A
			Cs-137	pCi/g	0.304	0.317	0.96	A
			Fe-59	pCi/g	0.210	0.222	0.95	A
			Mn-54	pCi/g	0.292	0.283	1.03	A
			Zn-65	pCi/g	0.353	0.344	1.03	A
	E11815	Water	Fe-55	pCi/L	1600	1890	0.85	A

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

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

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

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

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

TABLE 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]
June 2017	E11844	Milk	Sr-89	pCi/L	81.3	92.6	0.88	A
			Sr-90	pCi/L	12.1	13.5	0.90	A
	E11846	Milk	Ce-141	pCi/L	142	151	0.94	A
			Co-58	pCi/L	147	155	0.95	A
			Co-60	pCi/L	185	191	0.97	A
			Cr-51	pCi/L	321	315	1.02	A
			Cs-134	pCi/L	168	188	0.89	A
			Cs-137	pCi/L	148	150	0.99	A
			Fe-59	pCi/L	116	115	1.01	A
			I-131	pCi/L	102	93.6	1.09	A
			Mn-54	pCi/L	168	172	0.98	A
			Zn-65	pCi/L	195	204	0.96	A
	E11847	Charcoal	I-131	pCi	87.9	84.8	1.04	A
	E11845	AP	Sr-89	pCi	70.8	79.1	0.90	A
			Sr-90	pCi	9.10	11.5	0.79	W
	E11848	AP	Ce-141	pCi	112	116	0.96	A
			Co-58	pCi	119	119	1.00	A
			Co-60	pCi	171	146	1.17	A
			Cr-51	pCi	270	241	1.12	A
			Cs-134	pCi	152	144	1.05	A
			Cs-137	pCi	114	115	0.99	A
			Fe-59	pCi	94.1	88.3	1.07	A
			Mn-54	pCi	139	132	1.06	A
			Zn-65	pCi	141	156	0.90	A
	E11849	Water	Fe-55	pCi/L	1840	1890	0.97	A
July 2017	E11901	AP	GR-A	pCi	50.1	44.2	1.13	A
			GR-B	pCi	218	233	0.93	A

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

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

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

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

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

TABLE 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 2017	E11914	Milk	Sr-89	pCi/L	84.3	82.7	1.02	A
			Sr-90	pCi/L	12.6	12.1	1.04	A
	E11915	Milk	Ce-141	pCi/L	93.9	87.0	1.08	A
			Co-58	pCi/L	115	117	0.98	A
			Co-60	pCi/L	265	262	1.01	A
			Cr-51	pCi/L	273	217	1.26	W
			Cs-134	pCi/L	186	201	0.93	A
			Cs-137	pCi/L	175	172	1.02	A
			Fe-59	pCi/L	137	125	1.09	A
			I-131	pCi/L	78.0	71.0	1.10	A
			Mn-54	pCi/L	128	123	1.04	A
			Zn-65	pCi/L	206	184	1.12	A
	E11916	Charcoal	I-131	pCi	71.9	64.4	1.12	A
	E11917	AP	Ce-141	pCi	80.1	86.3	0.93	A
			Co-58	pCi	110	116	0.95	A
			Co-60	pCi	277	260	1.07	A
			Cr-51	pCi	275	215	1.28	W
			Cs-134	pCi	192	199	0.96	A
			Cs-137	pCi	165	170	0.97	A
			Fe-59	pCi	122	124	0.98	A
			Mn-54	pCi	120	122	0.99	A
			Zn-65	pCi	175	183	0.96	A
	E11918	Water	Fe-55	pCi/L	1630	1630	1.00	A
	E11919	Soil	Ce-141	pCi/g	0.136	0.142	0.96	A
			Co-58	pCi/g	0.179	0.191	0.94	A
			Co-60	pCi/g	0.405	0.429	0.94	A
			Cr-51	pCi/g	0.230	0.355	0.65	N [1]
			Cs-134	pCi/g	0.272	0.328	0.83	A
			Cs-137	pCi/g	0.336	0.356	0.94	A
			Fe-59	pCi/g	0.210	0.205	1.02	A
			Mn-54	pCi/g	0.210	0.201	1.05	A
			Zn-65	pCi/g	0.301	0.301	1.00	A

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

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

(1) See NCR 17-16

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]
December 2017	E12054	Milk	Sr-89	pCi/L	92.1	92.3	1.00	A
			Sr-90	pCi/L	18.3	16.9	1.09	A
	E12055	Milk	Ce-141	pCi/L	97.8	98.3	0.99	A
			Co-58	pCi/L	92.3	89.9	1.03	A
			Co-60	pCi/L	176	173	1.02	A
			Cr-51	pCi/L	226	242	0.93	A
			Cs-134	pCi/L	118	125	0.95	A
			Cs-137	pCi/L	148	141	1.05	A
			Fe-59	pCi/L	123	113	1.08	A
			I-131	pCi/L	66.0	57.8	1.14	A
			Mn-54	pCi/L	173	161	1.08	A
			Zn-65	pCi/L	233	211	1.10	A
	E12056	Charcoal	I-131	pCi	48.1	47.5	1.01	A
	E12057A	AP	Ce-141	pCi	108	111	0.97	A
			Co-58	pCi	89.5	102	0.88	A
			Co-60	pCi	223	196	1.14	A
			Cr-51	pCi	311	274	1.13	A
			Cs-134	pCi	141	142	1.00	A
			Cs-137	pCi	162	160	1.01	A
			Fe-59	pCi	121	129	0.94	A
			Mn-54	pCi	177	182	0.97	A
			Zn-65	pCi	203	239	0.85	A
	E12058	Water	Fe-55	pCi/L	1970	1740	1.13	A
	E12059	AP	Sr-89	pCi	71.2	87.4	0.81	A
			Sr-90	pCi	12.9	16.0	0.81	A

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

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

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

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

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

TABLE 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 2017	17-MaS36	Soil	Ni-63	Bq/kg	-5.512		*(1)*	A
			Sr-90	Bq/kg	571	624	437 - 811	A
	17-MaW36	Water	Am-241	Bq/L	0.693	0.846	0.592 - 1.100	A
			Ni-63	Bq/L	13.4	12.2	8.5 - 15.9	A
			Pu-238	Bq/L	0.7217	0.703	0.492 - 0.914	A
			Pu-239/240	Bq/L	0.9277	0.934	0.654 - 1.214	A
	17-RdF36	AP	U-234/233	Bq/sample	0.0911	0.104	0.073 - 0.135	A
			U-238	Bq/sample	0.0967	0.107	0.075 - 0.139	A
	17-RdV36	Vegetation	Cs-134	Bq/sample	6.44	6.95	4.87 - 9.04	A
			Cs-137	Bq/sample	4.61	4.60	3.22 - 5.98	A
			Co-57	Bq/sample	-0.0229		*(1)*	A
			Co-60	Bq/sample	8.52	8.75	6.13 - 11.38	A
			Mn-54	Bq/sample	3.30	3.28	2.30 - 4.26	A
			Sr-90	Bq/sample	1.30	1.75	1.23 - 2.28	W
			Zn-65	Bq/sample	5.45	5.39	3.77 - 7.01	A
August 2017	17-MaS37	Soil	Ni-63	Bq/kg	1130	1220	854 - 1586	A
			Sr-90	Bq/kg	296	289	202 - 376	A
	17-MaW37	Water	Am-241	Bq/L	0.838	0.892	0.624 - 1.160	A
			Ni-63	Bq/L	-0.096		*(1)*	A
			Pu-238	Bq/L	0.572	0.603	0.422 - 0.784	A
			Pu-239/240	Bq/L	0.863	0.781	0.547 - 1.015	A
	17-RdF37	AP	U-234/233	Bq/sample	0.103	0.084	0.059 - 0.109	W
			U-238	Bq/sample	0.115	0.087	0.061 - 0.113	N [2]
	17-RdV37	Vegetation	Cs-134	Bq/sample	2.34	2.32	1.62 - 3.02	A
			Cs-137	Bq/sample	0.05		*(1)*	A
			Co-57	Bq/sample	3.32	2.8	2.0 - 3.6	A
			Co-60	Bq/sample	2.09	2.07	1.45 - 2.69	A
			Mn-54	Bq/sample	2.90	2.62	1.83 - 3.41	A
			Sr-90	Bq/sample	1.17	1.23	0.86 - 1.60	A
			Zn-65	Bq/sample	6.07	5.37	3.76 - 6.98	A

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

(b) DOE/MAPEP evaluation:

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

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

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

(1) False positive test

(2) See NCR 17-15

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]
March 2017	MRAD-26	AP	GR-A	pCi/sample	76.3	85.5	28.6 - 133	A
April 2017	RAD-109	Water	Ba-133	pCi/L	49.2	49.7	40.8 - 55.1	A
			Cs-134	pCi/L	83.2	90.1	74.0 - 99.1	A
			Cs-137	pCi/L	202	206	185 - 228	A
			Co-60	pCi/L	51.2	54.7	49.2 - 62.7	A
			Zn-65	pCi/L	39.3	53.8	47.2 - 65.9	N (1)
			GR-A	pCi/L	53.6	75.0	39.5 - 92.3	A
			GR-B	pCi/L	42.7	38.5	25.5 - 46.0	A
			U-Nat	pCi/L	50.1	55.6	45.2 - 61.7	A
			H-3	pCi/L	7080	6850	5920 - 7540	A
			Sr-89	pCi/L	40.7	66.2	53.8 - 74.3	N (1)
			Sr-90	pCi/L	26.9	26.7	19.3 - 31.1	A
			I-131	pCi/L	26.7	29.9	24.9 - 34.9	A
September 2017	MRAD-27	AP	GR-A	pCi/sample	40.9	50.1	16.8 - 77.8	A
		AP	GR-B	pCi/sample	58.0	61.8	39.1 - 90.1	A
October 2017	RAD-111	Water	Ba-133	pCi/L	71.3	73.7	61.7 - 81.1	A
			Cs-134	pCi/L	43.0	53.0	42.8 - 58.3	A
			Cs-137	pCi/L	48.2	52.9	47.6 - 61.1	A
			Co-60	pCi/L	69.0	69.5	62.6 - 78.9	A
			Zn-65	pCi/L	335	348	313 - 406	A
			GR-A	pCi/L	32.5	35.6	18.3 - 45.8	A
			GR-B	pCi/L	24.3	25.6	16.0 - 33.6	A
			U-Nat	pCi/L	36.6	37.0	30.0 - 40.9	A
			H-3	pCi/L	6270	6250	5390 - 6880	A
			I-131	pCi/L	26.4	24.2	20.1 - 28.7	A
November 2017	111317O	Water	Sr-89	pCi/L	57.1	50.0	39.4 - 57.5	A
			Sr-90	pCi/L	27.1	41.8	30.8 - 48.0	N (2)

(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 17-09
(2) See NCR 17-19

APPENDIX E

ERRATA DATA

2017 Errata Data

Editorial Issues Identified in Pre-NRC Self-Assessment Report under AR 2739110:

1. The 2016 Recapture Study location RG-NNW is incorrectly located on the AMO precipitation report and Figure A-4 in the ARGPPR section of the 2016 AREOR. RG-NNW was collected and should be indicated on the fence line in the NNW sector.

2. In the 2015 AREOR, the sample anomalies sample points are transposed, WM-CL-17S and MS-CL-19S. The correct locations are documented in IR 03964938, MW-CL-17S and MW-CL-19S.

3. In the 2015 AREOR, the highest dose received by a member of the public was reported at 2.53E-3 mRem compared to the actual value of 5.95E-2 mRem as documented in the 2015 ARERR.

APPENDIX F

ANNUAL RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM REPORT (ARGPPR)

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 2017. During that time period, 335 analyses were performed on 102 samples from 33 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 2017.

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 four of seventeen groundwater monitoring locations. The tritium concentrations ranged from 188 ± 115 pCi/L to 284 ± 118 pCi/L. Tritium was detected in one of the ten precipitation samples at a concentration of 359 ± 133 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 2017. Gross Alpha (dissolved and suspended) was not detected at any of the groundwater locations. Gross Beta (dissolved) was detected in sixteen of seventeen groundwater locations. The concentrations ranged from 2.0 to 12.9 pCi/L. Gross Beta (suspended) was detected at one of the groundwater locations with a concentration of 1.6 ± 1.0 pCi/L.

Hard-To-Detect analyses were performed on two 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 0.51 ± 0.19 pCi/L and 0.37 ± 0.17 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 15, 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 2017.

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 implemented new 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 2017. 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

IR 04096672 4Q2017 RGPP Surface Well Elevations Not Measured
01/24/2018-During the fourth quarter of 2017, the sampling vendor, Environmental Inc./Normandeau Associates did not measure the elevations of Surface Water Wells SW-CL-4, SW-CL-5, SW-CL-6, and SW-CL-7. The samples were obtained at these locations, but the elevations were not recorded. Per EN-AA-408-4000, surface water elevations are to be obtained with each round of RGPP sampling where instrumentation exists. There is no impact to the RGPP program other than missed trending data for this issue.

2. Missed Samples

IR 03997163 RGPP 1Q2017 SW-CL-2
04/12/2017-The quarterly Radioactive Groundwater Protection Program (RGPP) monitoring and surface well sampling was performed

by the sampling vendor, Environmental Inc., on February 6 and 7, 2017. It was identified on April 6, 2017 when the vendor results were sent to station personnel that there was not a sample obtained for SW-CL-2 due to a frozen pond. SW-CL-2 is the surface well located at the lower sediment pond and is not associated with any ODCM required monitoring. These samples are obtained in accordance with EN-AA-408-4000 and EN-CL-408-4160. When station personnel were aware of this missed sample, there was no chance to bring the vendor back to obtain a first quarter sample of this surface well since the quarter had past. All other quarterly RGPP samples were obtained and analyzed as expected.

B. Program Changes

There were no program changes in 2017.

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 (Table B–I.1 Appendix B). Tritium values ranged from below the Exelon-imposed LLD of 200 pCi/l to 284 pCi/l.

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 2017. Gross Alpha (dissolved and suspended) was not detected at any of the groundwater locations. Gross Beta (dissolved) was

detected in sixteen of seventeen groundwater locations. The concentrations ranged from 2.0 to 12.9 pCi/L. Gross Beta (suspended) was detected at one of the groundwater location with a concentration of 1.6 ± 1.0 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 seven locations were analyzed for tritium activity (Table B–II.1 Appendix B). Tritium was not detected at concentrations greater than the LLD.

Gamma Emitters

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

E. Precipitation Water Results (Recapture)

Precipitation water samples were collected at ten locations (see Figure A-4, Appendix A) during 2017 and analyzed for tritium activity (Table B–III.1

Appendix B). Tritium was detected in one location at a concentration of 359 ± 133 pCi/L. All other locations had concentrations less than the LLD. No consistent indication of recapture was identified.

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 were two editorial issues relating to the RGPP identified in the Pre-NRC Self-Assessment Report under AR 2739110. (See Appendix E Errata Data)

H. Leaks, Spills, and Releases

IR 4084782 Valve Has Body to Bonnet and Seat Leakby
On 12/16/17, valve 1E51F387 had an 8 drop per minute (dpm) leak at the body to bonnet area and a 7 dpm leak passing by the valve seat that was dripping out of the open end of the pipe. This valve is located outside of the RCA on the RCIC Tank and is located inside of the designated berm for the tank. A catch basin was installed under the leaks and the soil from the berm was sampled. Tritium levels were calculated to be below the reportability threshold of <0.002 Curies on-site. The affected soil was excavated and appropriately handled per Radiation Protection procedures.

I. Trends

No trends have been identified in 2017.

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 2017.

2. Installation of Monitoring Wells

   No new wells were installed during the 2017.

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)

TABLE A-1: Radiological Groundwater Protection Program - Sampling Locations, Clinton Power Station, 2017

Site	Site Type
B-3	Monitoring Well
MW-1	Monitoring Well
MW-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

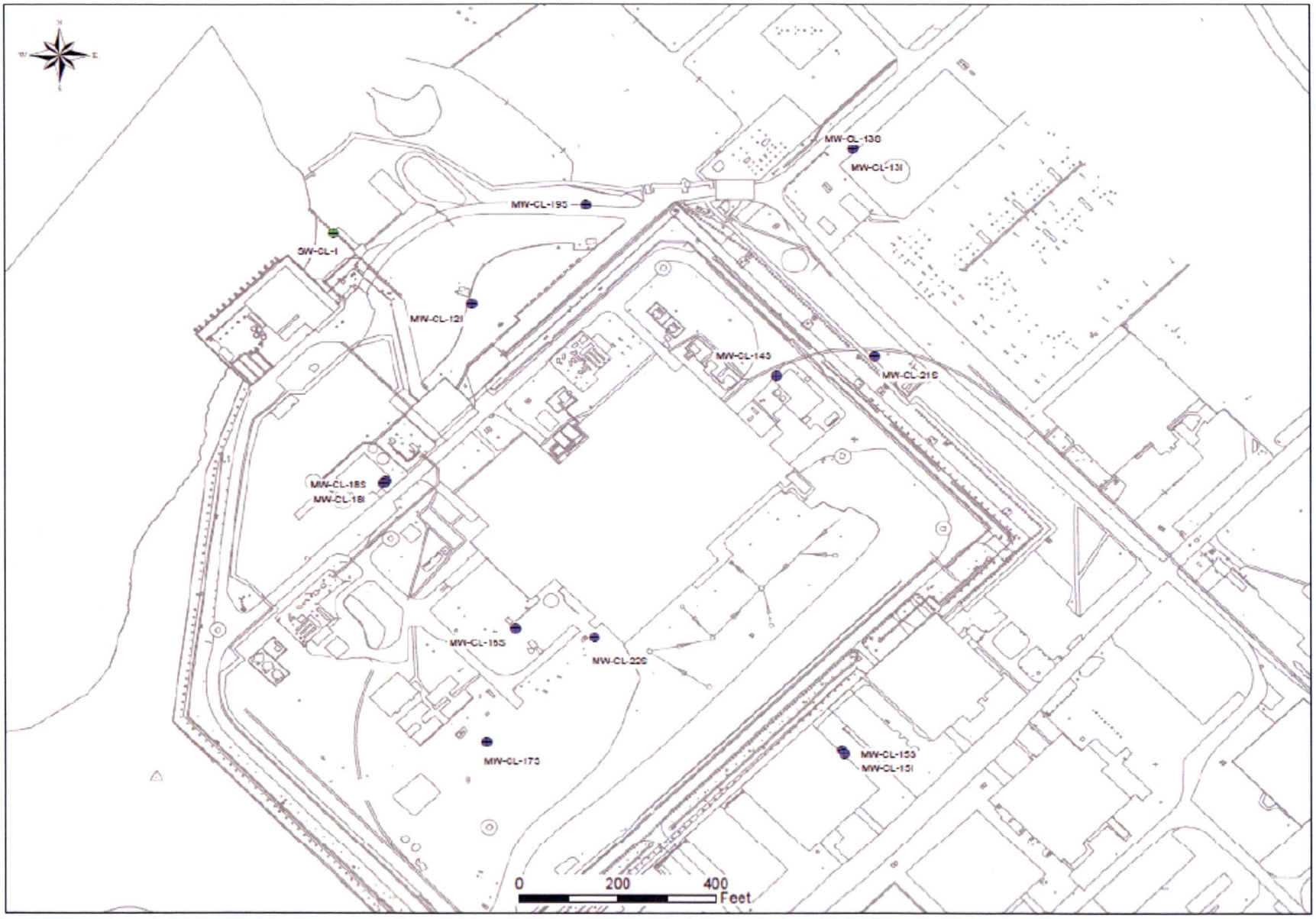


Figure A – 1
Onsite Sampling Locations at Clinton Power Station

Figure A – 2
Sampling Locations South of Clinton Power Station

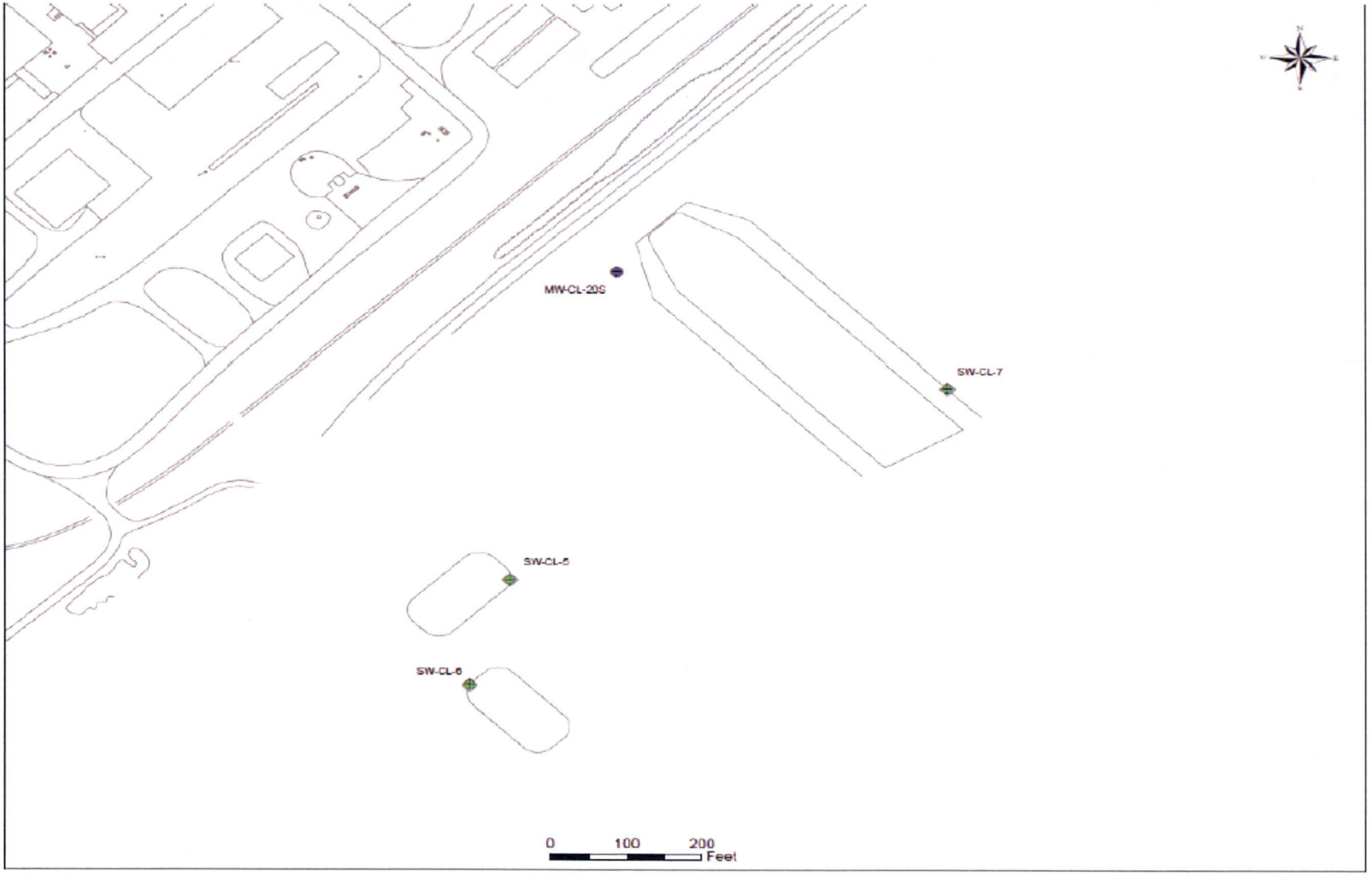


Figure A – 3
Sampling Locations East of Clinton Power Station

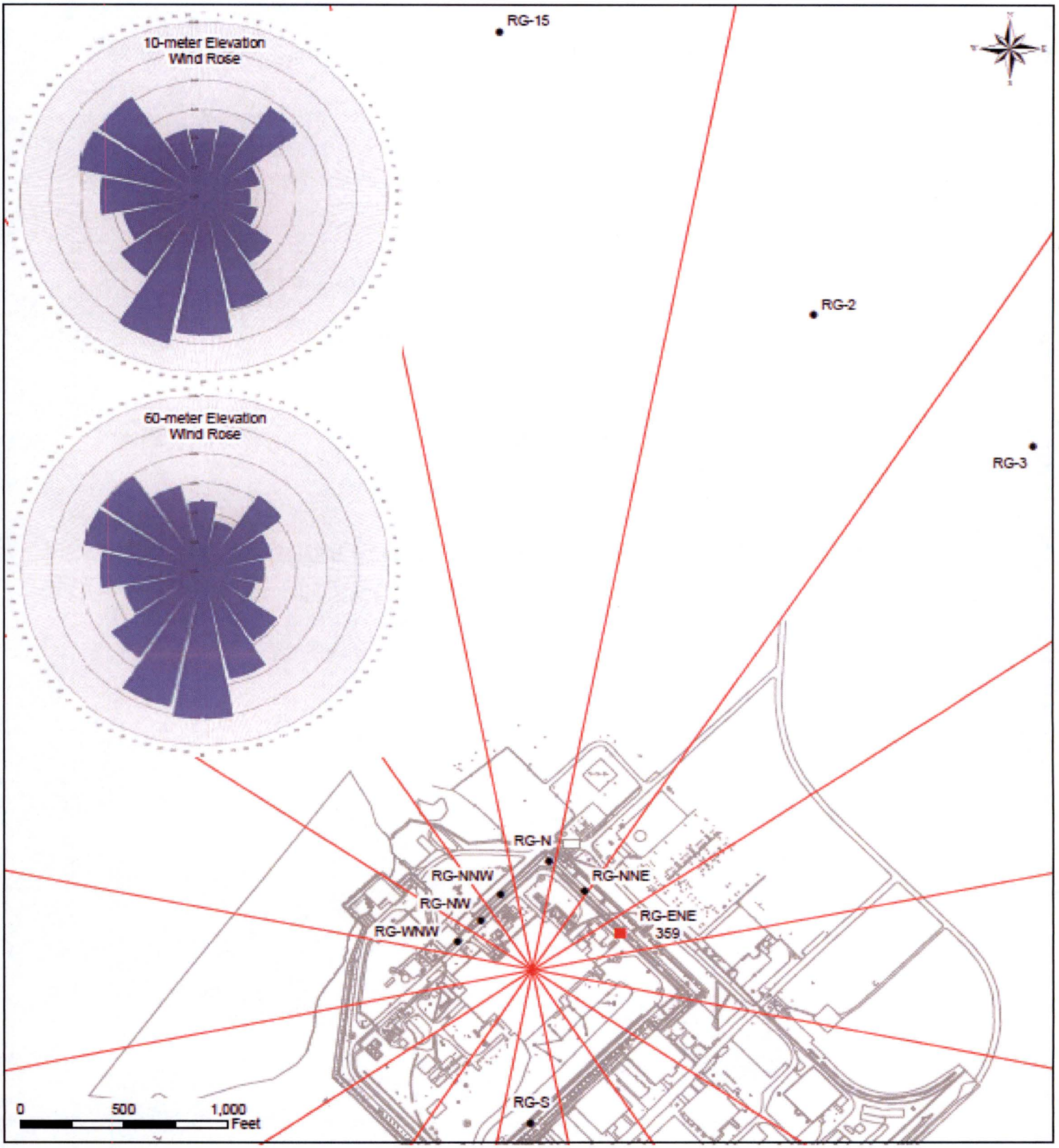


Figure A – 4
Recapture Sampling Locations of Clinton Power Station

APPENDIX B

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

TABLE B-I.1 **CONCENTRATIONS OF TRITIUM, STRONTIUM, GROSS ALPHA AND GROSS BETA IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017**

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	02/06/17	< 197						
B-3	06/05/17	< 192						
B-3	09/25/17	< 168	< 9.1	< 0.9	< 2.0	< 0.6	2.1 ± 1.1	< 1.5
B-3	11/13/17	< 166						
MW-CL-1	02/06/17	< 194						
MW-CL-1	06/05/17	< 197						
MW-CL-1	08/28/17	< 186	< 4.0	< 0.4	< 1.4	< 0.9	2.1 ± 0.9	< 1.4
MW-CL-1	11/13/17	< 166						
MW-CL-2	02/06/17	< 197						
MW-CL-2	06/05/17	< 190						
MW-CL-2	08/28/17	< 193	< 7.4	< 0.8	< 1.8	< 0.9	2.3 ± 1.1	< 1.4
MW-CL-2	11/13/17	< 168						
MW-CL-12I	02/06/17	< 191						
MW-CL-12I	06/05/17	< 191						
MW-CL-12I	08/28/17	< 187	< 4.0	< 0.5	< 1.4	< 0.9	2.0 ± 0.9	< 1.4
MW-CL-12I	11/13/17	< 165						
MW-CL-13I	02/06/17	< 195						
MW-CL-13I	06/05/17	< 193						
MW-CL-13I	08/28/17	< 192	< 5.2	< 0.6	< 1.5	< 0.9	2.0 ± 1.0	< 1.4
MW-CL-13I	11/13/17	< 169						
MW-CL-13S	02/06/17	< 194						
MW-CL-13S	06/05/17	< 190						
MW-CL-13S	08/28/17	< 187	< 5.4	< 0.7	< 1.3	< 0.9	2.6 ± 1.0	< 1.4
MW-CL-13S	11/13/17	201 ± 112						
MW-CL-14S	02/07/17	< 195						
MW-CL-14S	06/06/17	< 190						
MW-CL-14S	08/28/17	< 187	< 5.9	< 0.6	< **3.3**	< 0.9	12.9 ± 1.8	< 1.4
MW-CL-14S	11/14/17	284 ± 118						
MW-CL-15I	02/06/17	< 199						
MW-CL-15I	06/05/17	< 191						
MW-CL-15I	08/28/17	< 191	< 8.3	< 0.8	< 1.2	< 0.9	2.7 ± 0.9	1.6 ± 1.0
MW-CL-15I	11/13/17	< 165						
MW-CL-15S	02/06/17	< 196						
MW-CL-15S	06/05/17	< 191						
MW-CL-15S	08/28/17	< 190	< 4.4	< 0.5	< 0.7	< 0.9	< 1.0	< 1.4
MW-CL-15S	11/13/17	< 163						
MW-CL-16S	02/07/17	< 199						
MW-CL-16S	06/06/17	< 190						
MW-CL-16S	08/28/17	< 187	< 8.5	< 0.9	< 1.9	< 0.9	7.3 ± 1.2	< 1.6
MW-CL-16S	11/14/17	< 165						
MW-CL-17S	02/07/17	< 194						
MW-CL-17S	06/06/17	< 193						
MW-CL-17S	08/28/17	< 190	< 5.4	< 0.6	< **4.6**	< 0.9	3.8 ± 1.4	< 1.6
MW-CL-17S	11/14/17	< 165						
MW-CL-18I	02/07/17	< 200						
MW-CL-18I	06/06/17	< 192						
MW-CL-18I	08/28/17	< 187	< 9.5	< 0.9	< 1.8	< 0.9	3.5 ± 1.0	< 1.6
MW-CL-18I	11/14/17	< 166						

TABLE B-I.1 **CONCENTRATIONS OF TRITIUM, STRONTIUM, GROSS ALPHA AND GROSS BETA IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017**

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	02/07/17	< 195						
MW-CL-18S	06/06/17	< 177						
MW-CL-18S	08/28/17	< 185	< 9.1	< 0.9	< **3.5**	< 0.9	5.8 ± 1.4	< 1.6
MW-CL-18S	11/14/17	< 167						
MW-CL-19S	02/06/17	< 198						
MW-CL-19S	06/05/17	< 172						
MW-CL-19S	08/28/17	< 182	< 4.6	< 0.5	< **5.0**	< 0.9	6.8 ± 1.6	< 1.6
MW-CL-19S	11/13/17	< 163						
MW-CL-20S	02/06/17	< 198						
MW-CL-20S	06/05/17	< 189						
MW-CL-20S	08/28/17	< 183	< 7.2	< 0.9	< 2.1	< 0.9	3.4 ± 1.2	< 1.6
MW-CL-20S	11/13/17	< 163						
MW-CL-21S	02/06/17	< 199						
MW-CL-21S	06/05/17	188 ± 115						
MW-CL-21S	08/28/17	< 185	< 6.4	< 0.7	< 1.5	< 0.9	2.5 ± 0.9	< 1.6
MW-CL-21S	11/13/17	190 ± 113						
MW-CL-22S	02/07/17	< 199						
MW-CL-22S	06/06/17	< 174						
MW-CL-22S	08/28/17	< 182	< 3.4	< 0.6	< 2.2	< 0.9	9.9 ± 1.5	< 1.6
MW-CL-22S	11/14/17	< 163						

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

Table B-I.2

CONCENTRATIONS OF GAMMA EMITTERS IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017

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	09/25/17	< 44	< 45	< 4	< 5	< 10	< 3	< 7	< 5	< 7	< 5	< 4	< 33	< 10
MW-CL-1	08/28/17	< 40	< 34	< 4	< 5	< 10	< 5	< 8	< 5	< 8	< 5	< 4	< 30	< 8
MW-CL-2	08/28/17	< 51	< 96	< 5	< 4	< 13	< 7	< 13	< 6	< 11	< 6	< 6	< 33	< 13
MW-CL-12I	08/28/17	< 52	< 106	< 4	< 5	< 10	< 5	< 12	< 5	< 9	< 6	< 6	< 24	< 12
MW-CL-13I	08/28/17	< 43	< 84	< 3	< 5	< 10	< 5	< 9	< 5	< 10	< 4	< 6	< 25	< 9
MW-CL-13S	08/28/17	< 58	< 143	< 5	< 5	< 12	< 7	< 14	< 6	< 13	< 7	< 6	< 42	< 14
MW-CL-14S	02/07/17	< 57	< 117	< 6	< 6	< 13	< 5	< 14	< 7	< 10	< 6	< 7	< 29	< 11
MW-CL-14S	06/06/17	< 62	< 84	< 8	< 8	< 13	< 7	< 12	< 7	< 12	< 8	< 7	< 29	< 10
MW-CL-14S	08/28/17	< 50	< 46	< 6	< 6	< 13	< 5	< 10	< 6	< 9	< 6	< 6	< 33	< 9
MW-CL-15I	08/28/17	< 56	< 127	< 5	< 5	< 11	< 5	< 12	< 5	< 8	< 6	< 7	< 27	< 13
MW-CL-15S	08/28/17	< 55	< 112	< 6	< 7	< 12	< 6	< 9	< 6	< 12	< 8	< 7	< 35	< 12
MW-CL-16S	08/28/17	< 53	< 42	< 5	< 6	< 13	< 6	< 13	< 7	< 11	< 7	< 6	< 35	< 12
MW-CL-17S	08/28/17	< 45	< 91	< 6	< 6	< 10	< 6	< 14	< 6	< 9	< 6	< 5	< 28	< 9
MW-CL-18I	08/28/17	< 52	< 99	< 6	< 7	< 12	< 6	< 11	< 6	< 11	< 5	< 8	< 33	< 14
MW-CL-18S	08/28/17	< 54	< 128	< 6	< 7	< 13	< 4	< 14	< 8	< 8	< 8	< 5	< 36	< 12
MW-CL-19S	08/28/17	< 50	< 86	< 5	< 5	< 11	< 5	< 12	< 6	< 10	< 6	< 5	< 32	< 9
MW-CL-20S	08/28/17	< 55	< 85	< 5	< 6	< 13	< 6	< 14	< 6	< 10	< 6	< 7	< 37	< 10
MW-CL-21S	02/06/17	< 57	< 142	< 6	< 5	< 10	< 7	< 12	< 6	< 11	< 6	< 7	< 36	< 10
MW-CL-21S	06/05/17	< 70	< 54	< 6	< 7	< 12	< 7	< 15	< 7	< 11	< 8	< 7	< 33	< 8
MW-CL-21S	08/28/17	< 51	< 106	< 6	< 5	< 12	< 6	< 11	< 6	< 9	< 5	< 6	< 35	< 11
MW-CL-22S	08/28/17	< 50	< 98	< 4	< 4	< 14	< 8	< 13	< 6	< 10	< 6	< 7	< 36	< 9

TABLE B-I.3

CONCENTRATIONS OF HARD TO DETECTS IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017

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-14S	08/28/17	< 0.07	< 0.02	< 0.02	< 0.18	< 0.06	0.51 ± 0.19	< 0.05	0.37 ± 0.17	< 196	< 4.1
MW-CL-21S	08/28/17	< 0.06	< 0.03	< 0.03	< 0.10	< 0.08	< 0.13	< 0.09	< 0.14	< 187	< 4.2

TABLE B-II.1 CONCENTRATIONS OF TRITIUM IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	H-3
SW-CL-1	02/06/17	< 198
SW-CL-1	06/05/17	< 175
SW-CL-1	08/28/17	< 184
SW-CL-1	11/13/17	< 167
SW-CL-2	02/06/17	*(1)*
SW-CL-2	06/05/17	< 177
SW-CL-2	08/28/17	< 185
SW-CL-2	11/13/17	<
SW-CL-4	02/06/17	< 191
SW-CL-4	06/05/17	< 173
SW-CL-4	08/28/17	< 182
SW-CL-4	11/13/17	< 168
SW-CL-5	02/06/17	< 194
SW-CL-5	06/05/17	< 175
SW-CL-5	08/28/17	< 181
SW-CL-5	11/12/17	< 172
SW-CL-6	02/06/17	< 191
SW-CL-6	06/05/17	< 176
SW-CL-6	08/28/17	< 183
SW-CL-6	11/13/17	< 168
SW-CL-7	02/06/17	< 189
SW-CL-7	06/05/17	< 179
SW-CL-7	08/28/17	< 183
SW-CL-7	11/13/17	< 163

(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

Table B-II.2

CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017

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	08/28/17	< 49	< 44	< 4	< 5	< 11	< 5	< 9	< 5	< 10	< 6	< 6	< 38	< 13
SW-CL-2	08/28/17	< 59	< 62	< 7	< 8	< 15	< 7	< 12	< 7	< 14	< 7	< 7	< 39	< 13
SW-CL-4	08/28/17	< 49	< 85	< 7	< 5	< 14	< 6	< 13	< 6	< 10	< 6	< 5	< 37	< 15
SW-CL-5	08/28/17	< 47	< 110	< 5	< 5	< 11	< 6	< 10	< 5	< 9	< 5	< 6	< 39	< 11
SW-CL-6	08/28/17	< 54	< 146	< 6	< 6	< 14	< 6	< 12	< 6	< 10	< 6	< 7	< 33	< 11
SW-CL-7	08/28/17	< 49	< 56	< 5	< 6	< 11	< 6	< 10	< 6	< 12	< 6	< 5	< 32	< 14

TABLE B-III.1

CONCENTRATIONS OF TRITIUM IN PRECIPITATION WATER SAMPLES COLLECTED IN THE VICINITY OF CLINTON POWER STATION, 2017

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	H-3
RG-2	12/24/17 - 12/28/17	< 190
RG-3	12/24/17 - 12/28/17	< 187
RG-15	12/24/17 - 12/28/17	< 189
RG-ENE	12/24/17 - 12/28/17	359 ± 133
RG-N	12/24/17 - 12/28/17	< 187
RG-NNE	12/24/17 - 12/28/17	< 186
RG-NNW	12/24/17 - 12/28/17	< 190
RG-NW	12/24/17 - 12/28/17	< 186
RG-S	12/24/17 - 12/28/17	< 196
RG-WNW	12/24/17 - 12/28/17	< 185