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Quad Cities Nuclear Power Station, Units 1 and 2
Renewed Facility Operating License Nos. DPR-29 and DPR-30
NRC Docket Nos. 50-254 and 50-265

Subject: Annual Radiological Environmental Operating Report

Pursuant to Technical Specifications Section 5.6.2, enclosed is the 2021 Radiological Environmental Operating Report for Quad Cities Nuclear Power Station. This Report contains the results of the Radiological Environmental Monitoring Program (REMP). In addition, the 2021 Radiological Groundwater Protection Program (RGPP) Report is included as Appendix F of the enclosure.

Should you have any questions concerning this letter, please contact Anna Wilson at (309) 227-3200.

Respectfully,

Brian Wake
Site Vice President
Quad Cities Nuclear Power Station

Enclosure: Annual Radiological Environmental Operating Report

cc: Regional Administrator – NRC Region III
NRC Senior Resident Inspector – Quad Cities Nuclear Power Station

Enclosure

Annual Radiological Environmental Operating Report

Docket No: 50-254
50-265

QUAD CITIES NUCLEAR POWER STATION
UNITS 1 and 2

Annual Radiological
Environmental Operating Report

1 January through 31 December 2021

Prepared By
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Environmental Services

Quad Cities Nuclear Power Station
Cordova, IL 61242

May 2022

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Table Of Contents

Appendices

Figures

I. Summary and Conclusions

In 2021, the Quad Cities Generating Station released to the environment through the radioactive effluent gaseous pathways, approximately 41.9 curies of noble gas, 1.98E-03 curies of fission and activation products, 29.2 curies of Carbon-14 and approximately 77.2 curies of tritium. The dose from both gaseous effluents was conservatively calculated for the Maximum Exposed Member of the Public. In 2021, Quad Cities Generating Station released to the environment, through the radioactive liquid effluent pathway, approximately 3.65E+00 curies of tritium and 3.07E-03 curies of fission and activation products. Included in the liquid totals are curies released as part of remediation of a 2021 leak. The results of those calculations and their comparison to the allowable limits were as follows:

NOTE: Percent of applicable limits are for Unit 1 and Unit 2 combined (Site)

Gaseous and Liquid Radiation Doses to Members of the Public at Locations								
Effluents	Applicable Organ	Estimated Dose	Age Group	Location		% of Applicable Limit	Site Limit	Unit
				Distance (meters)	Direction (toward)			
Noble Gas	Gamma - Air Dose	9.15E-04	All	1029	NNE	4.58E-03	20	mRad
Noble Gas	Beta – Air Dose	9.70E-05	All	1029	NNE	2.43E-04	40	mRad
Iodine, Particulate C-14 & Tritium	Total Body	4.37E-02	Child	1029	NNE	1.75E-01	25	mrem
Iodine, Particulate C-14 & Tritium	Bone	2.05E-01	Child	1029	NNE	6.83E-01	30	mrem
Liquid	Total Body	1.16E-04	Adult	Mississippi River		1.93E-03	6	mrem
Liquid	Liver	1.84E-04	Teen	Mississippi River		9.20E-04	20	mrem
Skyshine	Total Body	7.81E+00	All	800	N	3.12E+01	25	mrem
40CFR190	Total Body (Gas + Liq+ Skyshine)	7.85E+00	All	800	N	3.14E+01	25	mrem

The doses as a result of the radiological effluents released from the Quad Cities Generating Station were a very small percentage of the allowable limits, with the exception of 40CFR190 whole body radiation which was calculated to be 31.4% of the 25 mrem/yr limit. The largest component of 40CFR190 dose is attributable to BWR skyshine from N-16. This value is conservatively calculated for the hypothetical maximum exposed member of the public.

Nitrogen-16 (N-16) is a byproduct of Hydrogen addition into the Reactor Coolant System (RCS). Hydrogen addition is performed to maintain RCS chemistry parameters that reduce corrosion potential. Due to its short half-life (7.13 seconds), N-16 is not detectable as a plant effluent as it decays prior to reaching gaseous discharge pathways. Additionally, this dose is conservatively calculated instead of measured because an annual dose of 7.79E+00 mrem is too low to be reliably detected on the environmental dosimetry utilized by the station.

This report on the Radiological Environmental Monitoring Program (REMP) conducted for the Quad Cities Nuclear Power Station (QCNPS) by Exelon covers the period 01 January 2021 through 31 December 2021. During that time period, 1,580 analyses were performed on 1,519 samples. In assessing all the data gathered for this report and comparing these results with preoperational data, it was concluded that the operation of QCNPS had no adverse radiological impact on the environment.

Surface water samples were analyzed for concentrations of gross beta, tritium, iron, nickel and gamma emitting nuclides. Ground water samples were analyzed for concentrations of tritium and gamma emitting nuclides. No fission or activation products were detected. Gross beta activities detected were consistent with those detected in previous years and consistent with the control stations.

Fish (commercially and recreationally important species) and sediment samples were analyzed for concentrations of gamma emitting nuclides. No fission or activation products were detected above the required LLD in any fish or sediment samples.

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

High sensitivity iodine-131 (I-131) analyses were performed on air samples. No I-131 was detected.

Cow milk samples were analyzed for concentrations of I-131 and gamma emitting nuclides. No I-131 was detected. Concentrations of naturally occurring isotopes (K-40 averaging 1,096 pCi/L) were consistent with those detected in previous years. No fission or activation products were detected.

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

Environmental gamma radiation measurements were performed quarterly using Optically Stimulated Luminescence Dosimeters (OSLD). Beginning in 2012, Exelon changed the type of dosimetry used for the Radiological Environmental Monitoring Program (REMP). Optically Stimulated Luminescent Dosimeters were deployed and Thermoluminescent Dosimeters (TLD) were discontinued. The relative comparison to control locations remains valid. OSLD technology is different than that used in a TLD but has the same purpose (to measure direct radiation).

II. Introduction

The Quad Cities Nuclear Power Station (QCNPS), consisting of two 2,957 MWth boiling water reactors owned and operated by Exelon Corporation, is located in Cordova, Illinois along the Mississippi River. Unit No.1 went critical on 16 March 1972. Unit No. 2 went critical on 02 December 1973. The site is located in northwestern Illinois, approximately 182 miles west of Chicago, Illinois.

This report covers those analyses performed by Teledyne Brown Engineering (TBE) and Landauer on samples collected during the period 1 January 2021 through 31 December 2021.

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

C. Radiation and Radioactivity

All matter is made of atoms. An atom is the smallest part into which matter can be broken down and still maintain all its chemical properties. Nuclear radiation is energy, in the form of waves or particles that is given off by unstable, radioactive atoms. Radioactive material exists naturally and has always been a part of our environment. The earth's crust, for example, contains radioactive uranium, radium, thorium and potassium. Some radioactivity is a result of nuclear weapons testing. Examples of radioactive fallout that is normally present in environmental samples are cesium-137 and strontium-90. Some examples of radioactive materials released from a nuclear power plant are cesium-137, iodine-131, strontium-90 and cobalt-60.

Radiation is measured in units of millirem; much like temperature is measured in degrees. A millirem is a measure of the biological effect of the energy deposited in tissue. The natural and man-made radiation dose received in one year by the average American is 300 to 400 mrem (References 2, 3, 4 in Table II.D-1 below). Radioactivity is measured in curies. A curie is that

amount of radioactive material needed to produce 37,000,000,000 nuclear disintegrations per second. This is an extremely large amount of radioactivity in comparison to environmental radioactivity. That is why radioactivity in the environment is measured in picocuries. One picocurie is equal to one trillionth of a curie.

D. Sources of Radiation

As mentioned previously, naturally occurring radioactivity has always been a part of our environment. Table II D-1 shows the sources and doses of radiation from natural and man-made sources.

Table II.D-1

Radiation Sources and Corresponding Dose (1)

NATURAL		MAN-MADE	
Source	Radiation Dose (millirem/year)	Source	Radiation Dose (millirem/year)
Internal, inhalation (2)	228	Medical (3)	300
External, space	33	Consumer (4)	13
Internal, ingestion	29	Industrial(5)	0.3
External, terrestrial	21	Occupational	0.5
		Weapons Fallout	<1
		Nuclear Power Plants	<1
Approximate Total	311	Approximate Total	314

(1) Information from NCRP Reports 160 and 94

(2) Primarily from airborne radon and its radioactive progeny

(3) Includes CT (147 mrem), nuclear medicine (77 mrem), interventional fluoroscopy (43 mrem) and conventional radiography and fluoroscopy (33 mrem)

(4) Primarily from cigarette smoking (4.6 mrem), commercial air travel (3.4 mrem), building materials (3.5 mrem), and mining and agriculture (0.8 mrem)

(5) Industrial, security, medical, educational, and research

Cosmic radiation from the sun and outer space penetrates the earth's atmosphere and continuously bombards us with rays and charged particles. Some of this cosmic radiation interacts with gases and particles in the atmosphere, making them radioactive in turn. These radioactive byproducts from cosmic ray bombardment are referred to as cosmogenic radionuclides. Isotopes such as beryllium-7 and carbon-14 are formed in this way.

Exposure to cosmic and cosmogenic sources of radioactivity results in about 33 mrem of radiation dose per year.

Additionally, natural radioactivity is in our body and in the food we eat (about 29 millirem/yr), the ground we walk on (about 21 millirem/yr) and the air we breathe (about 228 millirem/yr). The majority of a person's annual dose results from exposure to radon and thoron in the air we breathe. These

gases and their radioactive decay products arise from the decay of naturally occurring uranium, thorium and radium in the soil and building products such as brick, stone and concrete. Radon and thoron levels vary greatly with location, primarily due to changes in the concentration of uranium and thorium in the soil. Residents at some locations in Colorado, New York, Pennsylvania, and New Jersey have a higher annual dose as a result of higher levels of radon/thoron gases in these areas. In total, these various sources of naturally occurring radiation and radioactivity contribute to a total dose of about 311 mrem per year.

In addition to natural radiation, we are normally exposed to radiation from a number of man-made sources. The single largest doses from man-made sources result from therapeutic and diagnostic applications of x-rays and radiopharmaceuticals. The annual dose to an individual in the U.S. from medical and dental exposure is about 300 mrem. Consumer products, such as televisions and smoke detectors, contribute about 13 mrem/yr. Much smaller doses result from weapons fallout (less than 1 mrem/yr) and nuclear power plants. Typically, the average person in the United States receives about 314 mrem per year from man-made sources.

III. Program Description

A. Sample Collection

Samples for the QCNPS REMP were collected for Exelon Nuclear by ATI Environmental Inc. (Midwest Labs). This section describes the general sampling methods used by Environmental Inc. to obtain environmental samples for the QCNPS REMP in 2021. Sample locations and descriptions can be found in Table B–1 and Figures B–1 and B–2, Appendix B.

Aquatic Environment

The aquatic environment was evaluated by performing radiological analyses on samples of surface water, ground water, fish and sediment. Surface water samples were collected weekly from two locations, Q-33 and Q-34 (Control). Ground water samples were collected quarterly from two locations, Q-35 and Q-36. All water samples were collected in new containers, which were rinsed with source water prior to collection.

Fish samples comprising the edible portions of commercially and recreationally important species were collected semiannually at two locations, Q-24 and Q-29 (Control). Sediment samples composed of recently-deposited substrate were collected at two locations semiannually, Q-39 and Q-40 (Control).

Atmospheric Environment

The atmospheric environment was evaluated by performing radiological analyses on samples of air particulate, and airborne iodine. Airborne iodine and particulate samples were collected and analyzed at ten locations (Q-01, Q-02, Q-03, Q-04, Q-13, Q-16, Q-37, Q-38, Q-41 and Q-42 (control)). 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 air particulate filters and air iodine samples were replaced weekly and sent to the laboratory for analysis.

Terrestrial Environment

The terrestrial environment was evaluated by performing radiological analyses on samples of milk and food product. Milk samples were collected biweekly at one location (Q-26) from May through October, and monthly from November through April. All samples were collected in new plastic containers from the bulk tank, preserved with sodium bisulfite, and shipped promptly to the laboratory.

Food products were collected annually in July at five locations (Q-Control, Q-Quad 1, Q-Quad 2, Q-Quad 3, and Q-Quad 4). Various types of broadleaf and root vegetables were collected and placed in new plastic bags and sent to the laboratory for analysis.

Ambient Gamma Radiation

Beginning in 2012, Exelon changed the type of dosimetry used for the Radiological Environmental Monitoring Program (REMP). Optically Stimulated Luminescent Dosimeters (OSLD) were deployed and Thermoluminescent Dosimeters (TLD) were discontinued. The relative comparison to control locations remains valid. OSLD technology is different than that used in a TLD but has the same purpose (to measure direct radiation).

Each location consisted of 2 OSLD sets. The OSLD locations were placed on and around the QCNPS site as follows:

An inner ring consisting of 15 locations (Q-101, Q-102, Q-103, Q-104, Q-105, Q-106, Q-107, Q-108, Q-109, Q-111, Q-112, Q-113, Q-114, Q-115 and Q-116). These OSLDs are located in 15 of the 16 meteorological sectors in the general area of the site boundary (approximately 0.1 - 3 miles from the site). There are no OSLDs located in the SSW sector because this sector is located over water.

An outer ring consisting of 16 locations (Q-201, Q-202, Q-203, Q-204, Q-205, Q-206, Q-207, Q-208, Q-209, Q-210, Q-211, Q-212, Q-213, Q-214, Q-215 and Q-216). These OSLDs are located in each of the 16 meteorological sectors (approximately 6.0 – 8.0 km from the site).

An other set consisting of 9 locations (Q-01, Q-02, Q-03, Q-04, Q-13, Q-16, Q-37, Q-38 and Q-41). The locations are at each of the air sample stations around the site.

The balance of one location (Q-42) is the control site.

The specific OSLD 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 22.5 degree sectors around the site, where estimated annual dose from QCNPS, if any, would be most significant;
3. On hills free from local obstructions and within sight of the stack (where practical);
4. Near the closest dwelling to the stack in the prevailing downwind direction.

The OSLDs were exchanged quarterly and sent to Landauer for analysis.

B. Sample Analysis

This section describes the general analytical methodologies used by TBE to analyze the environmental samples for radioactivity for the QCNPS REMP in 2021 and the type of analyses. The analytical procedures used by the TBE laboratory 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 surface water and air particulates
2. Concentrations of gamma emitters in ground and surface water, air particulates, milk, fish, sediment and vegetation
3. Concentrations of tritium (H-3) in ground and surface water
4. Concentrations of I-131 in air and milk
5. Ambient gamma radiation levels at various site environs
6. Concentrations of Iron-55 (Fe-55) and Nickel-63 (Ni-63) in surface water

C. Data Interpretation

The radiological and direct radiation data collected prior to Quad Cities Nuclear Power Station becoming operational were used as a baseline with which these operational data were compared. For the purpose of this report, Quad Cities Nuclear Power Station 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) 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 QCNPS 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. Net Activity Calculation and Reporting of Results

   Net activity for a sample is calculated by subtracting background activity from the sample activity. Since the REMP measures extremely small changes in radioactivity in the environment, background variations may result in sample activity being lower than the background activity effecting a negative number. An MDC is 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, groundwater and vegetation 12 nuclides,

manganese-54 (Mn-54), cobalt-58 (Co-58), iron-59 (Fe-59), colbalt-60 (Co-60), zinc-65 (Zn-65), zirconium-95 (Zr-95), niobium-95 (Nb-95), I-131, cesium-134 (Cs-134), Cs-137, barium-140 (Ba-140), and lanthanum-140 (La-140) were reported.

For fish, sediment, air particulate and milk 11 nuclides, Mn-54, Co-58, Fe-59, Co-60, Zn-65, Nb-95, Zr-95, Cs-134, Cs-137 and Ba-140 and La-140 were reported.

For air iodine, one nuclide, I-131 was reported.

Means and standard deviations of the results were calculated. The standard deviations represent the variability of measured results for different samples rather than single analysis uncertainty.

D. Program Exceptions

For 2021 the QCNPS REMP had a sample recovery rate in excess of 97.6%. Sample anomalies and missed samples are listed in the tables below:

Table D-1 LISTING OF SAMPLE ANOMALIES

Sample Type	Location Code	Collection Date(s)	Reason
AP/AI	Q-01	02/05/21	Collector was unable to access the location due to a broken lock. Run time and pump parameters estimated; station informed; repair scheduled.
AP/AI	Q-01	02/12/21	Collector was unable to access the location due to a broken lock. Run time and pump parameters estimated; station informed; repair rescheduled due to harsh winter conditions.
Air Pump	Q-01 Q-04	02/12/21	Unable to check pump running parameters due to the pump's inaccessibility caused by a broken lock.
AP/AI	Q-01	02/19/21	Collector was unable to access the location due to a broken lock. Run time and pump parameters estimated.
AP/AI	Q-01	02/26/21	The timer indicates 673.3 hrs. The very high reading is caused by the collector's inability to reset the pump's timer during the weekly collections. The lack of access was caused by a broken lock. Sample run time estimated based on the insertion and collection dates and times.
AP/AI	Q-04	03/05/21	Sample removed after 5 weeks run, after ice and snow melt. Timer indicates 831.2 hrs., approximately 10 hrs. less than expected, with a power outage as possible reason.
AP/AI	Q-01, Q-02 Q-03, Q-04	06/09/1	Sample removed after 5 days run per station request. Collector observed by NRC inspector.
Air Pump	Q-04	06/25/21	Pump shows dropping Vmax. Pump replaced.
Pump Logbook	Q-42	10/23/21	Logbook missing from the cage, possibly blown away by strong winds. Logbook replaced.
AP/AI	Q-02	12/03/21	The timer indicates lower value of 143.1 hrs. during the 7 days collection period, possibly due to a power outage. NOTE: during the 12/01/21 collection, the timer indicated 194.4 hrs., normal reading for the 8 days collection period.

Table D-2 LISTING OF MISSED SAMPLES

Sample Type	Location Code	Collection Date(s)	Reason
SW	Q-33, Q-34	01/01/21 - 03/05/21	No sample; water frozen
AP	Q-04	02/05/21 02/12/21 02/19/21 02/26/21	No sample; unable to reach the station due to ice and snow.
OSLD	Q-111-2/2A Q-201-1/1A	1st Qtr. 2021	OSLD's lost during processing.
OSLD	Q-41-2 Q-204-2A Q205-4/4A Q-215-1/1A	2nd Qtr. 2021	OSLD's missing, probably dislodged by strong winds.
OSLD	Q-38	08/27/21	OSLD found missing during the weekly visual check. Replaced with OSLD EX00062495M on 08/28 at 10:20.
OSLD	Q202-2/2A	3rd Qtr. 2021	OSLD missing, possibly dislodged by strong winds; premises searched unsuccessfully.
OSLD	Q-113-2	4th Qtr. 2021	OSLD missing, possibly dislodged by strong winds; premises searched unsuccessfully.

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 2021.

IV. Results and Discussion

A. Aquatic Environment

1. Surface Water

Samples were taken weekly and composited monthly at two locations (Q-33 and Q-34). Of these locations only Q-33, located downstream, could be affected by Quad Cities' effluent releases. The following analyses were performed:

Gross Beta

Samples from all locations were analyzed for concentrations of gross beta (Table C–I.1, Appendix C**).** Gross beta activity was detected in 12 of 20 samples. The values ranged from 2.9 to 401 pCi/L. Concentrations detected were consistent with those detected in previous years (Figure C–1, Appendix C). The required LLD was met.

Tritium

Quarterly composites of weekly collections were analyzed for tritium activity (Table C–I.2, Appendix C). No tritium activity was detected (Figure C–2, Appendix C). The 2000 pCi/L OCDM and contractually-required 200 pCi/L LLDs were met.

Iron-55 and Nickel-63

Quarterly composites of monthly collections were analyzed for Fe-55 and Ni-63 (Table C–I.2, Appendix C). No Fe-55 or Ni-63 were detected. The required LLDs were met.

Gamma Spectrometry

Samples from both locations were analyzed monthly for gamma emitting nuclides (Table C–I.3, Appendix C). No nuclides associated with QCNPS were detected and all required LLDs were met.

2. Ground Water

Quarterly grab samples were collected at two locations (Q-35 and Q-36). Both locations could be affected by Quad Cities' effluent releases. The following analyses were performed:

Tritium

Quarterly grab samples from the locations were analyzed for tritium activity (Table C–II.1, Appendix C). No tritium activity was detected (Figure C–3, Appendix C). The 2000 pCi/L OCDM and contractually-required 200 pCi/L LLDs were met.

Gamma Spectrometry

Samples from all locations were analyzed for gamma emitting nuclides (Table C–II.2, Appendix C). No nuclides associated with QCNPS were

detected and all required LLDs were met.

3. Fish

Fish samples comprised of various commercially and recreationally important species were collected at two locations (Q-24 and Q-29) semiannually. Location Q-24 could be affected by Quad Cities' effluent releases. The following analysis was performed:

Gamma Spectrometry

The edible portion of fish samples from both locations were analyzed for gamma emitting nuclides (Table C–III.1, Appendix C). No nuclides associated with QCNPS were detected and all required LLDs were met.

4. Sediment

Aquatic sediment samples were collected at two locations (Q-39 and Q-40) semiannually. The location Q-39, located downstream, could be affected by Quad Cities' effluent releases. The following analysis was performed:

Gamma Spectrometry

Sediment samples from Q-39 and Q-40 were analyzed for gamma emitting nuclides (Table C–IV.1, Appendix C**).** No nuclides potentially associated with QCNPS were detected and all required LLDs were met.

B. Atmospheric Environment

1. Airborne

a. Air Particulates

Continuous air particulate samples were collected from ten locations on a weekly basis. The ten locations were separated into three groups: Near-field samplers within 4 km (2.5 miles) of the site (Q-01, Q-02, Q-03 and Q-04), far-field samplers between 4 and 10 km (2.5 – 6.2 miles) from the site (Q-13, Q-16, Q-37, Q-38 and Q-41) and the Control sampler between 10 and 30 km (6.2 - 18.6 miles) from the site (Q-42). The following analyses were performed:

Gross Beta

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

Comparison of results among the four groups aid in determining the effects, if any, resulting from the operation of QCNPS. The results from the near-field locations (Group I) ranged from 6 to 43E–03 pCi/m^3 with a mean of 20E–03 pCi/m^3. The results from the far-field locations (Group II) ranged from 4 to 42E–03 pCi/m^3 with a mean of 19E–03 pCi/m^3. The results from the Control location (Group III) ranged from 8 to 40E–03 pCi/m^3 with a mean of 20E–03 pCi/m^3.

Comparison of the 2021 air particulate data with previous year's data indicate no effects from the operation of QCNPS. In addition comparisons of the weekly mean values for 2021 indicate no notable differences among the three groups.
(Figures C–4 through C–9, Appendix C).

Gamma Spectrometry

Weekly samples were composited quarterly and analyzed for gamma emitting nuclides (Table C–V.3, Appendix C). No nuclides associated with QCNPS were detected and all required LLDs were met.

b. Airborne Iodine

Continuous air samples were collected from ten locations (Q-01, Q-02, Q-03, Q-04, Q-13, Q-16, Q-37, Q-38, Q-41 and Q-42) and analyzed weekly for I-131 (Table C–VI.1, Appendix C). All results were less than the LLD for I-131.

2. Terrestrial

a. Milk

Samples were collected from one location (Q-26) biweekly May through October and monthly November through April. The following analyses were performed:

Iodine-131

Milk samples from the location were analyzed for concentrations of I-131 (Table C–VII.1, Appendix C). No I-131 was detected and the LLD was met.

Gamma Spectrometry

Each milk sample was analyzed for concentrations of gamma emitting nuclides (Table C–VII.2, Appendix C). No nuclides associated with QCNPS were detected and all required LLDs were met.

b. Food Products

Food product samples were collected at four locations plus a control location (Q-Control, Q-Quad 1, Q-Quad 2, Q-Quad 3 and Q-Quad 4) annually during growing season. Four locations, (Q-Quad 1, Q-Quad 2, Q-Quad 3 and Q-Quad 4) could be affected by Quad Cities' effluent releases. The following analysis was performed:

Gamma Spectrometry

Samples from all locations were analyzed for gamma emitting nuclides (Table C–VIII.1, Appendix C). No nuclides associated with QCNPS were detected and all required LLDs were met.

C. Ambient Gamma Radiation

Ambient gamma radiation levels were measured utilizing optically stimulated luminescence dosimeters. Forty-one OSLD locations were established around the site. Results of OSLD measurements are listed in Tables C-IX.1 and C–IX.2, Appendix C.

All of the OSLD measurements were < 20 mRem/quarter, with a range of 7.9 to 18.7 mRem/quarter. A comparison of the Inner Ring, Outer Ring and Other data to the Control Location data, indicate that the ambient gamma radiation levels from all the locations were comparable.

D. Independent Spent Fuel Storage Installation

QCNPS commenced use of an Independent Spent Fuel Storage Installation (ISFSI) in Dec 2005. There are no measurable changes in ambient gamma radiation levels as a result of ISFSI operations.

E. Land Use Survey

A Land Use Survey conducted during August 2021 around QCNPS was performed by ATI Environmental Inc. (Midwest Labs) for Exelon Nuclear to comply with the Quad Cities' Offsite Dose Calculation Manual. The purpose of the survey was to document the nearest resident and milk producing animals in each of the sixteen 22.5 degree sectors around the site. The results from the land use census have not identified any locations, which yield a calculated dose or dose commitment, via the same pathway, that is at least 20% greater than at a location from which samples are currently being obtained. The results of this survey are summarized below:

	Distance in Miles from QCNPS		
Sector	Residence Miles	Livestock Miles	Milk Farm Miles
N	0.60	2.7	-
NNE	1.20	3.1	-
NE	1.30	3.2	-
ENE	2.90	2.9	-
E	2.00	5.5	-
ESE	2.80	3.1	3.1
SE	1.70	5.3	-
SSE	1.10	4.5	6.6
S	0.75	4.8	-
SSW	3.20	3.5	-
SW	2.90	3.3	-
WSW	2.20	2.7	-
W	2.60	4.3	-
WNW	2.70	3.8	-
NW	2.60	4.7	-
NNW	2.10	2.2	-

Of the above listed Milk Farms, only the farm located at 3.1 miles ESE of QCNPS, listed in the sample results section as Bill Stanley Dairy, has elected to

participate in the QCNPS REMP program. Participation by local farmers is voluntary.

F. Errata Data

There is no errata data for 2021.

G. Summary of Results – Inter-Laboratory Comparison Program

The TBE Laboratory analyzed Performance Evaluation (PE) samples of air particulate (AP), 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 US EPA, 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, 146 out of 154 analyses performed met the specified acceptance criteria. Seven analyses did not meet the specified acceptance criteria and were addressed through the TBE Corrective Action Program. *NOTE: One analysis (soil for Tc-99) that did not meet acceptance criteria was performed for TBE information and is not on the list of required ICP analyses.* A summary is found below:

1. The ERA MRAD March 2021 Water Fe-55 result was evaluated as *Not Acceptable*. The reported value for Fe-55 was 579 pCi/L and the known result was 275 pCi/L (acceptance range 162 - 400). When reviewing the original sample data, it was found that the carrier yield was 52.6% (lower than typical water samples). Looking at the etched plate that was counted, it appeared that some loss of sample could have occurred. The sample was logged for reanalysis and used as the workgroup duplicate. The results were acceptable at 197 and 221 respectively. Yields were 97.4% and 105.7% and the plated samples were centered with no apparent loss of sample. The loss of sample during plating resulted in a low yield which produced an artificially high sample result. (NCR 21-01)

2. The MAPEP February 2021 AP Gross Alpha result was evaluated as *Not Acceptable*. The reported value was 0.371 Bq/sample and the known result was 1.77 Bq/sample (acceptance range 0.53 - 3.01). A similar failure had occurred several years prior due to the filter being placed with the wrong side up on the detector. At that time, a small dot was placed on the top of the filter prior to removal from the package to indicate the correct side for counting. The current sample was still in the detector when the result was received (dot side facing the detector). The sample was recounted with a similar result and was flipped and recounted. The flipped result was 0.661 Bq/sample, within the acceptable range. Because TBE cannot rely on receiving correct packaging from the provider, MAPEP AP cross-checks will be counted on both sides going forward. *NOTE: The August sample had the same packaging issue (upside down).* (NCR 21-02)

3. The MAPEP February 2021 soil Ni-63 was evaluated as *Not Acceptable*. The reported value was 310 Bq/kg and the known result was 689 (acceptance range 482 - 896). All workgroup QC was reviewed with no anomalies. The analytical procedure had been revised prior to this analysis to eliminate added interferences. The sample yield was >100%, indicative of incomplete separation from interferences, leading to a lower result. The procedure was again revised after acceptable results were obtained. (NCR 21-03)

4. The ERA October 2021 water Gross Beta result was evaluated as *Not Acceptable*. The reported value was 63.0 pCi/L and the known was 55.7 (acceptance range 38.1 - 62.6) or 113% of the known. The 2-sigma error was 6.8, placing the reported result well within the acceptable range. All QA was reviewed with no anomalies. A follow-up Quick Response cross-check was analyzed with a 120% ratio (see item 7). (NCR 21-10)

5. The ERA October 2021 water Tritium result was evaluated as *Not Acceptable*. The reported value was 13,800 pCi/L and the known was 17,200 (acceptance

range 15,000 - 18,900). The 2-sigma error was 1,430, placing the result within the acceptable range. TBE's internal QC acceptance is 70% - 130%, while ERA's for this sample was 87% - 110%. All QA was reviewed with no anomalies. A Quick Response follow-up cross-check was analyzed with a result of 17,500 pCi/L (known 17,800 pCi/L). (NCR 21-11)

6. The MAPEP August 2021 soil Ni-63 result was evaluated as *Not Acceptable*. The reported value was 546 Bq/kg and the known result was 1,280 Bq/kg (acceptance range 896 - 1,664). All QC was reviewed and no anomalies found. The procedure revision to remove added MAPAP interferences was ineffective for this sample. No client soil matrix samples were analyzed for Ni-63 in 2020 or 2021. The root cause investigation is still ongoing at this time. (NCR 21-13)

7. The ERA December 2021 Quick Response water Gross Beta result was evaluated as *Not Acceptable*. The reported value was 47.6 pCi/L and the known was 39.8 pCi/L or 120% of the known (acceptance range of 26.4 - 47.3). The 2-sigma error was 6.1, placing the reported result well within the acceptable range. All QA was reviewed with no anomalies. The original sample was recounted on a different detector with a result of 40.3 ± 6.27 pCi/L. The "failure" of this sample and the RAD-127 was due to the narrow upper acceptance ranges assigned (119% and 112%) (NCR 21-14)

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

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APPENDIX A

RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT SUMMARY

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TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR QUAD CITIES NUCLEAR POWER STATION, 2021

NAME OF FACILITY: QUAD CITIES **DOCKET NUMBER:** 50-254 &50-265

LOCATION OF FACILITY: CORDOVA, IL **REPORTING PERIOD:** 2021

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)*	**GR-B**	20	4	3.5 (7/10) *2.9 - 4.0*	3.6 (5/10) *3.3 - 4.1*	3.6 (5/10) *3.3 - 4.1*	Q-34 CONTROL CAMANCHE - UPSTREAM 4.4 MILES NNE OF SITE	0
	H-3	8	2000	<LLD	<LLD	-		0
	FE-55	8	200	<LLD	<LLD	-		0
	NI-63	8	5	<LLD	<LLD	-		0
	GAMMA	20						
	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
	I-131		15	<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
GROUND WATER (PCI/LITER)	**H-3**	8	2000	<LLD	*NA*	-		0
	GAMMA	8						
	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
	I-131		15	<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

(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 QUAD CITIES NUCLEAR POWER STATION, 2021

NAME OF FACILITY:	**QUAD CITIES**	**DOCKET NUMBER:**	**50-254 &50-265**
LOCATION OF FACILITY:	**CORDOVA, IL**	**REPORTING PERIOD:**	**2021**

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
FISH	**GAMMA**	8						
(PCI/KG WET)	*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
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
AIR PARTICULATE	**GR-B**	516	10	19.7	19.6	20.7	Q-03 INDICATOR	0
(E-3 PCI/CU.METER)				(463/464)	(52/52)	(52/52)	ONSITE 3	
				4.4 - 42.8	*8 - 39.6*	*6.9 - 42.8*	0.6 MILES S OF SITE	

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

TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR QUAD CITIES NUCLEAR POWER STATION, 2021

NAME OF FACILITY:	**QUAD CITIES**	**DOCKET NUMBER:**	**50-254 &50-265**
LOCATION OF FACILITY:	**CORDOVA, IL**	**REPORTING PERIOD:**	**2021**

MEDIUM OR PATHWAY SAMPLED *(UNIT OF MEASUREMENT)*	TYPES OF ANALYSIS PERFORMED	NUMBER OF ANALYSIS PERFORMED	REQUIRED LOWER LIMIT OF DETECTION (LLD)	**INDICATOR LOCATIONS** MEAN (M) (F) *RANGE*	**CONTROL LOCATION** MEAN (M) (F) *RANGE*	**LOCATION WITH HIGHEST ANNUAL MEAN (M)** MEAN (M) (F) *RANGE*	STATION # NAME DISTANCE AND DIRECTION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
AIR PARTICULATE	**GAMMA**	40						
(E-3 PCI/CU.METER)	*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		50	<LLD	<LLD	-		0
	CS-137		60	<LLD	<LLD	-		0
	BA-140		*NA*	<LLD	<LLD	-		0
	LA-140		*NA*	<LLD	<LLD	-		0
AIR IODINE	**GAMMA**	516						
(E-3 PCI/CU.METER)	*I-131*		70	<LLD	<LLD	-		0
MILK	**I-131 (LOW LVL)**	18	1	<LLD	*NA*	-		0
(PCI/LITER)								
	GAMMA	19						
	MN-54		*NA*	<LLD	*NA*	-		0
	CO-58		*NA*	<LLD	*NA*	-		0
	FE-59		*NA*	<LLD	*NA*	-		0
	CO-60		*NA*	<LLD	*NA*	-		0
	ZN-65		*NA*	<LLD	*NA*	-		0
	NB-95		*NA*	<LLD	*NA*	-		0
	ZR-95		*NA*	<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

(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 QUAD CITIES NUCLEAR POWER STATION, 2021

NAME OF FACILITY:	**QUAD CITIES**	**DOCKET NUMBER:**	**50-254 &50-265**
LOCATION OF FACILITY:	**CORDOVA, IL**	**REPORTING PERIOD:**	**2021**

MEDIUM OR PATHWAY SAMPLED *(UNIT OF MEASUREMENT)*	TYPES OF ANALYSIS PERFORMED	NUMBER OF ANALYSIS PERFORMED	REQUIRED LOWER LIMIT OF DETECTION (LLD)	**INDICATOR LOCATIONS** MEAN (M) (F) *RANGE*	**CONTROL LOCATION** MEAN (M) (F) *RANGE*	**LOCATION WITH HIGHEST ANNUAL MEAN (M)** MEAN (M) (F) *RANGE*	STATION # NAME DISTANCE AND DIRECTION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
VEGETATION	**GAMMA**	13						
(PCI/KG WET)	*MN-54*		*NA*	<LLD	<LLD	-		0
	CO-58		*NA*	<LLD	<LLD	-		0
	FE-59		*NA*	<LLD	<LLD	-		0
	CO-60		*NA*	<LLD	<LLD	-		0
	ZN-65		*NA*	<LLD	<LLD	-		0
	NB-95		*NA*	<LLD	<LLD	-		0
	ZR-95		*NA*	<LLD	<LLD	-		0
	I-131		60	<LLD	<LLD	-		0
	CS-134		60	<LLD	<LLD	-		0
	CS-137		80	<LLD	<LLD	-		0
	BA-140		*NA*	<LLD	<LLD	-		0
	LA-140		*NA*	<LLD	<LLD	-		0
DIRECT RADIATION	**OSLD-QUARTERLY**	287	*NA*	12.5	13.1	15.9	Q-211-2 INDICATOR	0
(MILLI-ROENTGEN/QTR.)				(283/283)	(4/4)	(4/4)		
				7.9 - 18.7	*10.9 - 14.6*	*12.5 - 18.7*	4.5 MILES SW	

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

APPENDIX B

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

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TABLE B-1: Radiological Environmental Monitoring Program - Sampling Locations, Distance and Direction, Quad Cities Nuclear Power Station, 2021

Location	Location Description	Distance & Direction From Site
A. Surface Water		
Q-33	Cordova (indicator)	3.1 miles SSW
Q-34	Camanche, Upstream (control)	4.4 miles NNE
B. Ground/Well Water		
Q-35	McMillan Well (indicator)	1.5 miles S
Q-36	Cordova Well (indicator)	3.3 miles SSW
C. Milk - bi-weekly / monthly		
Q-26	Bill Stanley Dairy (indicator)	3.1 miles ESE
D. Air Particulates / Air Iodine		
Q-01	Onsite 1 (indicator)	0.5 miles N
Q-02	Onsite 2 (indicator)	0.4 miles ENE
Q-03	Onsite 3 (indicator)	0.6 miles S
Q-04	Nitrin (indicator)	1.7 miles NE
Q-13	Princeton (indicator)	4.7 miles SW
Q-16	Low Moor (indicator)	5.7 miles NNW
Q-37	Meredosia Road (indicator)	4.4 miles ENE
Q-38	Fuller Road (indicator)	4.7 miles E
Q-41	Camanche, Upstream (control)	4.3 miles NNE
Q-42	LeClaire (control)	8.7 miles SSW
E. Fish		
Q-24	Pool #14 of Mississippi River, Downstream (indicator)	0.5 miles SW
Q-29	Mississippi River, Upstream (control)	1.0 miles N
F. Sediment		
Q-39	Cordova, Downstream on Mississippi River (indicator)	0.8 miles SSW
Q-40	North of Albany, Upstream on Mississippi River (control)	8.9 miles NE
G. Food Products		
Quadrant 1	Ken DeBaille	2.3 miles ENE
Quadrant 2	Dale Nimmic	3.0 miles ESE
Quadrant 3	Amy Johnston	1.8 miles S
Quadrant 4	Mike Fawcett	4.5 miles NW
Control	Charles Leavens	9.5 miles NE
H. Environmental Dosimetry - OSLD		
Inner Ring		
Q-101-1 / Q-101-1A		0.6 miles N
Q-101-2 / Q-101-2A		0.9 miles N
Q-102-1 / Q-102-1A		1.3 miles NNE
Q-102-3 / Q-102-3A		1.4 miles NNE
Q-103-1 / Q-103-1A		1.2 miles NE
Q-103-2 / Q-103-2A		1.2 miles NE
Q-104-1 / Q-104-1A		1.1 miles ENE
Q-104-2 / Q-104-2A		0.9 miles ENE
Q-105-1 / Q-105-1A		0.8 miles E
Q-105-2 / Q-105-2A		0.8 miles E
Q-106-2 / Q-106-2A		0.7 miles ESE
Q-106-3 / Q-106-3A		0.7 miles ESE
Q-107-2 / Q-107-2A		0.7 miles SE
Q-107-3 / Q-107-3A		0.8 miles SE
Q-108-1 / Q-108-1A		1.0 miles SSE
Q-108-2 / Q-108-2A		0.9 miles SSE
Q-109-1 / Q-109-1A		0.9 miles S
Q-109-2 / Q-109-2A		1.2 miles S
Q-111-1 / Q-111-1A		2.6 miles SW
Q-111-2 / Q-111-2A		2.5 miles SW

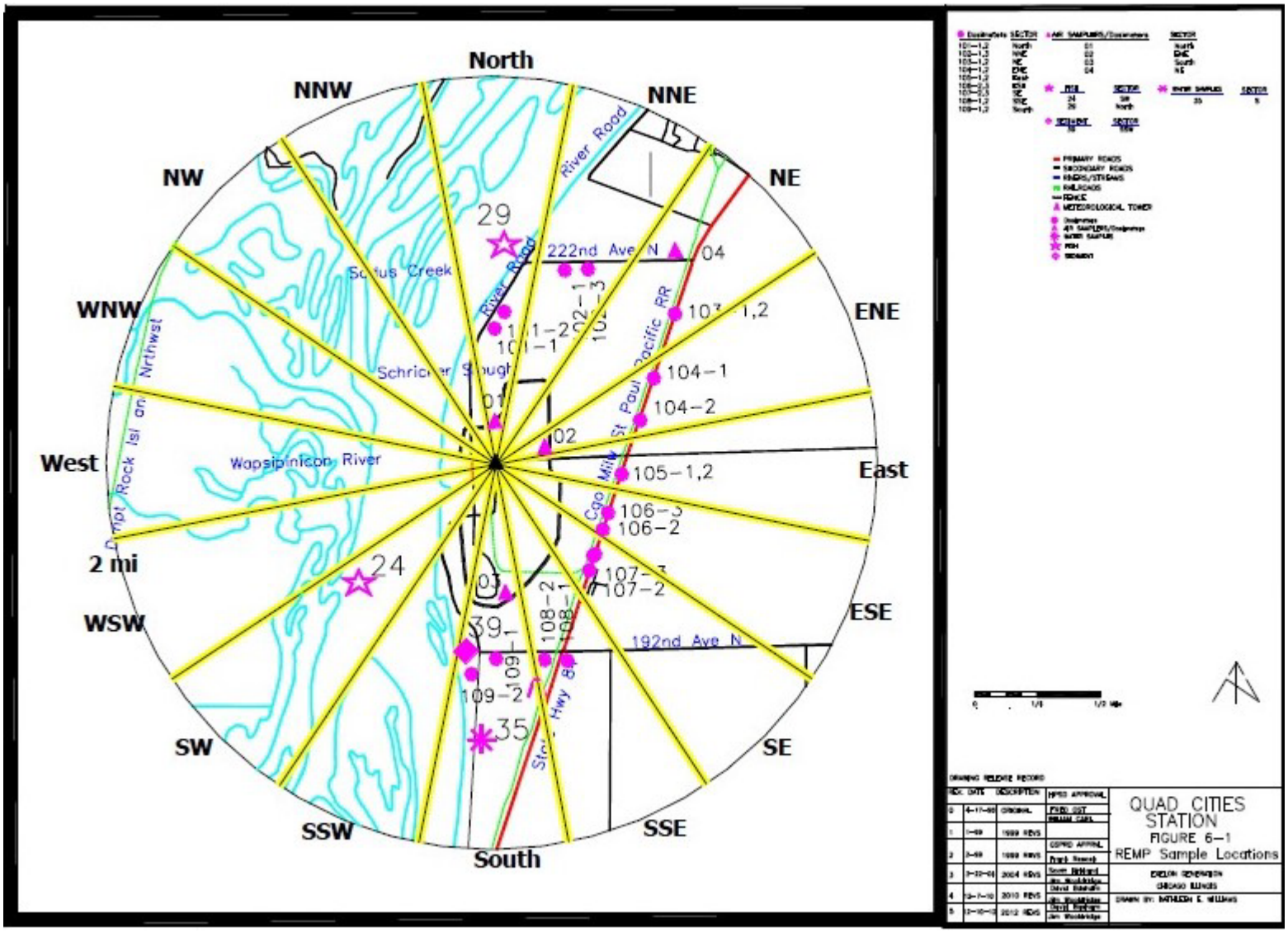
TABLE B-1: Radiological Environmental Monitoring Program - Sampling Locations, Distance and Direction, Quad Cities Nuclear Power Station, 2021

Location	Location Description	Distance & Direction From Site
H. Environmental Dosimetry - OSLD (continued)		
Inner Ring (continued)		
Q-112-1 / Q-112-1A		2.5 miles WSW
Q-112-2 / Q-112-2A		2.2 miles WSW
Q-113-1 / Q-113-1A		2.5 miles W
Q-113-2 / Q-113-2A		2.5 miles W
Q-114-1 / Q-114-1A		2.1 miles WNW
Q-114-2 / Q-114-2A		2.5 miles WNW
Q-115-1 / Q-115-1A		2.6 miles NW
Q-115-2 / Q-115-2A		2.3 miles NW
Q-116-1 / Q-116-1A		2.3 miles NNW
Q-116-3 / Q-116-3A		2.4 miles NNW
Outer Ring		
Q-201-1 / Q-201-1A		4.2 miles N
Q-201-2 / Q-201-2A		4.4 miles NNE
Q-202-1 / Q-202-1A		4.8 miles NNE
Q-203-1 / Q-203-1A		4.7 miles NE
Q-203-2 / Q-203-2A		5.0 miles NE
Q-204-1 / Q-204-1A		4.7 miles ENE
Q-204-2 / Q-204-2A		4.5 miles ENE
Q-205-1 / Q-205-1A		4.7 miles E
Q-205-4 / Q-205-4A		4.8 miles E
Q-206-1 / Q-206-1A		4.8 miles ESE
Q-206-2 / Q-206-2A		4.8 miles ESE
Q-207-1 / Q-207-1A		4.7 miles SE
Q-207-4 / Q-207-4A		4.7 miles SE
Q-208-1 / Q-208-1A		4.3 miles SSE
Q-208-2 / Q-208-2A		4.9 miles SSE
Q-209-1 / Q-209-1A		4.7 miles S
Q-209-4 / Q-209-4A		4.7 miles S
Q-210-1 / Q-210-1A		4.1 miles SWW
Q-210-4* / Q-210-4A*		4.1 miles SSW
Q-210-5 / Q-210-5A		3.3 miles SSW
Q-211-1 / Q-211-1A		4.5 miles SW
Q-211-2 / Q-211-2A		4.5 miles SW
Q-212-1 / Q-212-1A		5.4 miles WSW
Q-212-2 / Q-212-2A		4.4 miles WSW
Q-213-1 / Q-213-1A		4.3 miles W
Q-213-2 / Q-213-2A		4.8 miles W
Q-214-1 / Q-214-1A		4.7 miles WNW
Q-214-2 / Q-214-2A		4.4 miles WNW
Q-215-1 / Q-215-1A		5.0 miles NW
Q-215-2 / Q-215-2A		4.2 miles NW
Q-216-1 / Q-216-1A		4.6 miles NNW
Q-216-2 / Q-216-2A		4.3 miles NNW
Other		
Q-01-1 / Q-01-2	Onsite 1 (indicator)	0.5 miles N
Q-02-1 / Q-02-2	Onsite 2 (indicator)	0.4 miles ENE
Q-03-1 / Q-03-2	Onsite 3 (indicator)	0.6 miles S
Q-04-1 / Q-04-2	Nitrin (indicator)	1.7 miles NE
Q-13-1 / Q-13-2	Princeton (indicator)	4.7 miles SW
Q-16-1 / Q-16-2	Low Moor (indicator)	5.7 miles NNW
Q-37-1 / Q-37-2	Meredosia (indicator)	4.4 miles ENE
Q-38-1 / Q-38-2	Fuller Road (indicator)	4.7 miles E
Q-41-1 / Q-41-2	Camanche (indicator)	4.3 miles NNE
Control		
Q-42-1 / Q-42-2	LeClaire	8.7 miles SSW

**Removed from ODCM in December 2006 and replaced by Q-210-5. Q-210-4 is for trending only*

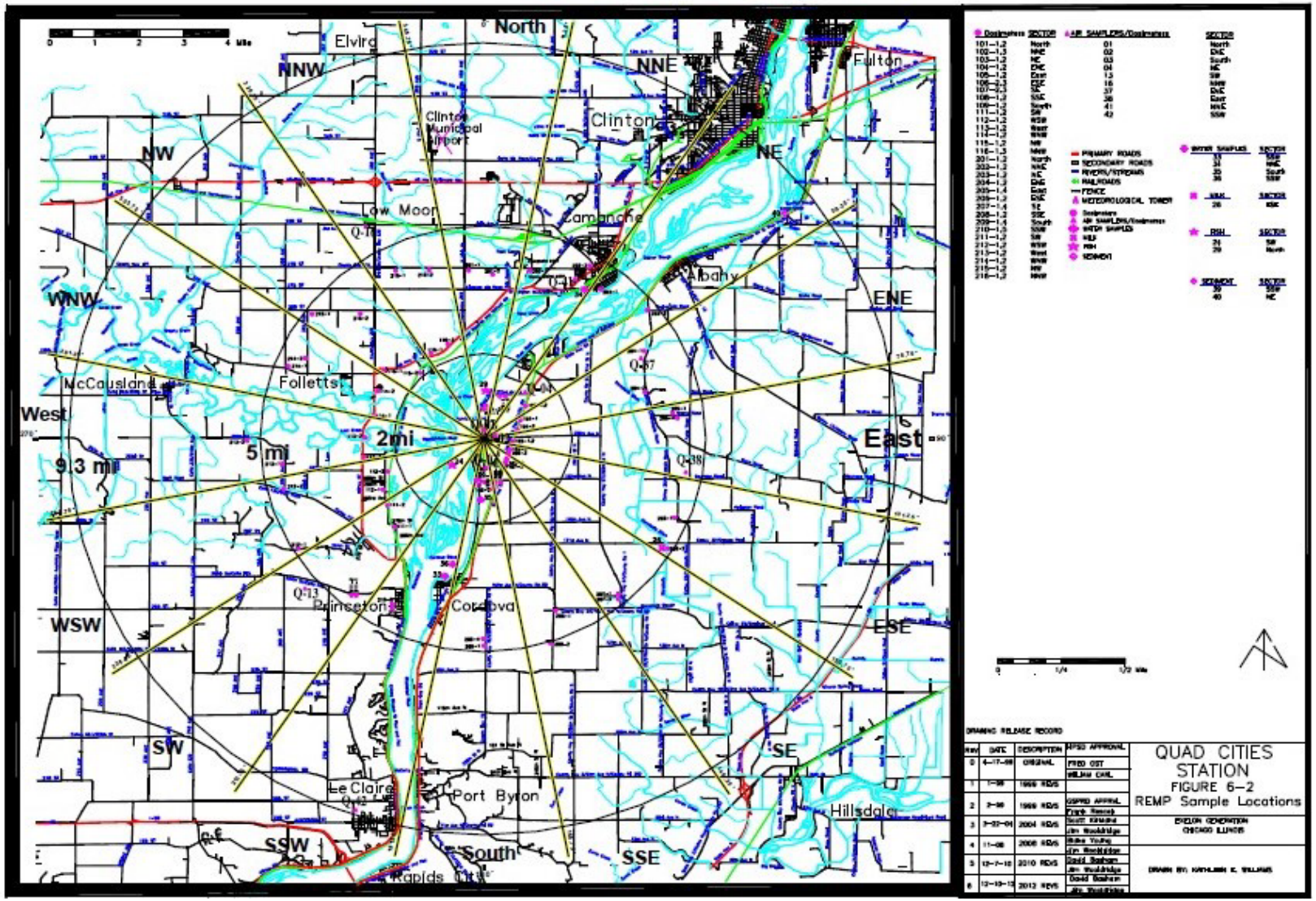
TABLE B-2: Radiological Environmental Monitoring Program - Summary of Sample Collection and Analytical Methods, Quad Cities Nuclear Power Station, 2021

Sample Medium	Analysis	Sampling Method	Analytical Procedure Number
Surface Water	Gamma Spectroscopy	Monthly composite from weekly grab samples	TBE, TBE-2007 Gamma emitting radioisotope analysis
Surface Water	Gross Beta	Monthly composite from weekly grab samples	TBE, TBE-2008 Gross Alpha and/or gross beta activity in various matrices
Surface Water	Tritium	Quarterly composite from weekly grab samples	TBE, TBE-2011 Tritium analysis in drinking water by liquid scintillation
Surface Water	Iron and Nickel	Quarterly composite from weekly grab samples	TBE, TBE-2006 Iron-55 in various matrices TBE, TBE-2013 Radionickel in various matrices
Ground Water	Gamma Spectroscopy	Quarterly grab samples	TBE, TBE-2007 Gamma emitting radioisotope analysis
Ground Water	Tritium	Quarterly grab samples	TBE, TBE-2011 Tritium analysis in drinking water by liquid scintillation
Fish	Gamma Spectroscopy	Semi-annual samples collected via electroshocking or other techniques	TBE-2007 Gamma emitting radioisotope analysis
Sediment	Gamma Spectroscopy	Semi-annual grab samples	TBE, TBE-2007 Gamma emitting radioisotope analysis
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
Air Particulates	Gamma Spectroscopy	Quarterly composite of each station	TBE, TBE-2007 Gamma emitting radioisotope analysis
Air Iodine	Gamma Spectroscopy	Weekly composite of continuous air sampling through charcoal filter	TBE, TBE-2007 Gamma emitting radioisotope analysis
Milk	I-131	Bi-weekly grab sample when cows are on pasture. Monthly all other times	TBE, TBE-2012 Radioiodine in various matrices
Milk	Gamma Spectroscopy	Bi-weekly grab sample when cows are on pasture. Monthly all other times	TBE, TBE-2007 Gamma emitting radioisotope analysis
Food Products	Gamma Spectroscopy	Annual grab samples	TBE, TBE-2007 Gamma emitting radioisotope analysis
OSLD	Optically Stimulated Luminescence Dosimetry	Quarterly OSLDs comprised of two Al_2O_3:C Landauer Incorporated elements	Landauer Incorporated



NOTE: All dosimeter locations contain two dosimeters, ex. numbering convention 102-1 / 102-1A

Figure B-1 Map
Quad Cities REMP Sampling Locations – 2 Mile Radius, 2021



NOTE: All dosimeter locations contain two dosimeters, ex. numbering convention 102-1 / 102-1A

Figure B-2 Map
Quad Cities REMP Sampling Locations – 9.3 Mile Radius, 2021

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APPENDIX C

DATA TABLES AND FIGURES

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Table C-I.1 CONCENTRATIONS OF GROSS BETA IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF QUAD CITIES NUCLEAR POWER STATION, 2021

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	Q-33	Q-34
01/01/21 - 01/31/21	*(1)*	*(1)*
02/01/21 - 02/28/21	*(1)*	*(1)*
03/12/21 - 03/26/21	< 2.8	< 2.8
04/02/21 - 04/30/21	2.9 ± 1.9	< 2.7
05/07/21 - 05/28/21	2.9 ± 1.6	3.7 ± 1.7
06/04/21 - 06/25/21	< 2.4	< 2.3
07/02/21 - 07/30/21	3.6 ± 1.9	< 2.7
08/07/21 - 08/27/21	3.4 ± 1.6	3.8 ± 1.6
09/03/21 - 09/24/21	3.9 ± 1.7	3.3 ± 1.8
10/02/21 - 10/29/21	< 2.5	< 2.5
11/05/21 - 11/26/21	3.7 ± 1.8	3.3 ± 1.8
12/03/21 - 12/31/21	4.0 ± 1.8	4.1 ± 1.8
MEAN ± 2 STD DEV	3.5 ± 1.0	3.6 ± 0.7

Table C-I.2 CONCENTRATIONS OF TRITIUM, IRON, AND NICKEL IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF QUAD CITIES NUCLEAR POWER STATION, 2021

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	H-3	Fe-55	Ni-63
Q-33	03/12/21 - 03/26/21	< 194	< 155	< 3.8
	04/02/21 - 06/25/21	< 183	< 96	< 4.5
	07/02/21 - 09/24/21	< 193	< 176	< 4.9
	10/02/21 - 12/31/21	< 175	< 72	< 4.3
	MEAN	-	-	-
Q-34	03/12/21 - 03/26/21	< 197	< 54	< 3.6
	04/02/21 - 06/25/21	< 186	< 142	< 4.9
	07/02/21 - 09/24/21	< 195	< 115	< 4.8
	10/02/21 - 12/31/21	< 173	< 146	< 4.4
	MEAN	-	-	-

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

(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

Table C-I.3 **CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF QUAD CITIES NUCLEAR POWER STATION, 2021**

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	I-131	Cs-134	Cs-137	Ba-140	La-140
Q-33	01/01/21 - 01/31/21 *(1)*												
	02/01/21 - 02/28/21 *(1)*												
	03/12/21 - 03/26/21	< 6	< 6	< 12	< 5	< 14	< 6	< 11	< 14	< 6	< 6	< 38	< 9
	04/02/21 - 04/30/21	< 5	< 4	< 10	< 6	< 8	< 4	< 7	< 13	< 5	< 5	< 29	< 11
	05/07/21 - 05/28/21	< 4	< 4	< 9	< 4	< 10	< 5	< 8	< 11	< 4	< 4	< 29	< 10
	06/04/21 - 06/25/21	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 8	< 2	< 2	< 15	< 5
	07/02/21 - 07/30/21	< 3	< 3	< 5	< 2	< 5	< 3	< 5	< 7	< 3	< 2	< 16	< 5
	08/07/21 - 08/27/21	< 6	< 6	< 10	< 7	< 11	< 7	< 7	< 10	< 6	< 5	< 29	< 10
	09/03/21 - 09/24/21	< 6	< 7	< 17	< 7	< 15	< 8	< 11	< 11	< 8	< 7	< 34	< 12
	10/02/21 - 10/29/21	< 5	< 5	< 10	< 4	< 10	< 5	< 10	< 13	< 6	< 5	< 33	< 14
	11/05/21 - 11/26/21	< 5	< 5	< 14	< 6	< 9	< 6	< 9	< 14	< 5	< 4	< 28	< 10
	12/03/21 - 12/31/21	< 4	< 4	< 9	< 5	< 9	< 6	< 9	< 15	< 6	< 5	< 33	< 11
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
Q-34	01/01/21 - 01/31/21 *(1)*												
	02/01/21 - 02/28/21 *(1)*												
	03/12/21 - 03/26/21	< 5	< 6	< 12	< 5	< 12	< 6	< 10	< 14	< 6	< 6	< 35	< 9
	04/02/21 - 04/30/21	< 6	< 7	< 12	< 6	< 8	< 7	< 10	< 14	< 5	< 6	< 29	< 13
	05/07/21 - 05/28/21	< 4	< 5	< 9	< 3	< 10	< 4	< 8	< 10	< 4	< 4	< 27	< 9
	06/04/21 - 06/25/21	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 9	< 2	< 2	< 19	< 6
	07/02/21 - 07/30/21	< 3	< 3	< 6	< 3	< 5	< 3	< 5	< 8	< 3	< 3	< 18	< 6
	08/07/21 - 08/27/21	< 5	< 6	< 11	< 5	< 10	< 5	< 11	< 10	< 8	< 6	< 28	< 8
	09/03/21 - 09/24/21	< 6	< 5	< 11	< 7	< 12	< 7	< 11	< 10	< 6	< 7	< 33	< 12
	10/02/21 - 10/29/21	< 5	< 5	< 12	< 6	< 9	< 6	< 10	< 15	< 6	< 5	< 30	< 11
	11/05/21 - 11/26/21	< 4	< 4	< 10	< 4	< 9	< 4	< 9	< 8	< 3	< 5	< 23	< 9
	12/03/21 - 12/31/21	< 5	< 6	< 10	< 5	< 9	< 6	< 9	< 15	< 5	< 5	< 33	< 12
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-

(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

Table C-II.1 CONCENTRATIONS OF TRITIUM IN GROUND WATER SAMPLES COLLECTED IN THE VICINITY OF QUAD CITIES NUCLEAR POWER STATION, 2021

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	Q-35	Q-36
01/08/21 - 01/08/21	< 190	< 177
04/09/21 - 04/09/21	< 185	< 194
07/09/21 - 07/09/21	< 183	< 174
10/09/21 - 10/09/21	< 173	< 183
MEAN	-	-

Table C-II.2

CONCENTRATIONS OF GAMMA EMITTERS IN GROUND WATER SAMPLES COLLECTED IN THE VICINITY OF QUAD CITIES NUCLEAR POWER STATION, 2021

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	I-131	Cs-134	Cs-137	Ba-140	La-140
Q-35	01/08/21 - 01/08/21	< 5	< 7	< 11	< 6	< 12	< 7	< 12	< 11	< 7	< 7	< 31	< 7
	04/09/21 - 04/09/21	< 6	< 7	< 12	< 8	< 9	< 5	< 8	< 11	< 6	< 7	< 28	< 10
	07/09/21 - 07/09/21	< 5	< 5	< 9	< 5	< 12	< 5	< 8	< 8	< 4	< 6	< 25	< 6
	10/09/21 - 10/09/21	< 7	< 6	< 13	< 9	< 13	< 7	< 10	< 10	< 6	< 6	< 31	< 10
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
Q-36	01/08/21 - 01/08/21	< 6	< 5	< 13	< 9	< 13	< 7	< 13	< 9	< 7	< 7	< 30	< 8
	04/09/21 - 04/09/21	< 7	< 6	< 12	< 8	< 14	< 6	< 9	< 12	< 6	< 8	< 33	< 10
	07/09/21 - 07/09/21	< 5	< 6	< 14	< 3	< 13	< 8	< 10	< 10	< 6	< 7	< 30	< 10
	10/09/21 - 10/09/21	< 7	< 5	< 14	< 6	< 9	< 6	< 11	< 9	< 8	< 5	< 25	< 6
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-

Table C-III.1

CONCENTRATIONS OF GAMMA EMITTERS IN FISH SAMPLES COLLECTED IN THE VICINITY OF QUAD CITIES NUCLEAR POWER STATION, 2021

RESULTS IN UNITS OF PC/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
Q-24												
Largemouth Bass	05/13/21	< 54	< 41	< 74	< 73	< 149	< 80	< 114	< 71	< 59	< 197	< 134
Channel Catfish	05/13/21	< 43	< 59	< 93	< 60	< 127	< 60	< 98	< 60	< 41	< 240	< 76
Common Carp	10/19/21	< 62	< 50	< 104	< 42	< 107	< 59	< 103	< 55	< 60	< 242	< 105
Channel Catfish	10/19/21	< 53	< 42	< 114	< 62	< 116	< 50	< 102	< 52	< 54	< 335	< 131
	MEAN	-	-	-	-	-	-	-	-	-	-	-
Q-29												
Common Carp	05/13/21	< 51	< 54	< 86	< 54	< 138	< 56	< 106	< 68	< 54	< 176	< 96
Largemouth Bass	05/13/21	< 27	< 25	< 57	< 31	< 62	< 28	< 42	< 33	< 28	< 138	< 45
Common Carp	10/19/21	< 56	< 52	< 67	< 61	< 84	< 51	< 95	< 45	< 39	< 254	< 87
Walleye	10/19/21	< 42	< 51	< 113	< 65	< 136	< 58	< 111	< 55	< 56	< 265	< 63
	MEAN	-	-	-	-	-	-	-	-	-	-	-

Table C-IV.1

CONCENTRATIONS OF GAMMA EMITTERS IN SEDIMENT SAMPLES COLLECTED IN THE VICINITY OF QUAD CITIES NUCLEAR POWER STATION, 2021

RESULTS IN UNITS OF PC/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
Q-39	05/28/21	< 62	< 64	< 111	< 57	< 130	< 69	< 98	< 76	< 73	< 261	< 83
	10/16/21	< 45	< 40	< 105	< 43	< 77	< 50	< 74	< 55	< 54	< 221	< 52
	MEAN	-	-	-	-	-	-	-	-	-	-	-
Q-40	05/28/21	< 36	< 35	< 86	< 30	< 77	< 36	< 60	< 51	< 41	< 170	< 52
	10/16/21	< 62	< 67	< 120	< 58	< 129	< 75	< 127	< 85	< 76	< 295	< 72
	MEAN	-	-	-	-	-	-	-	-	-	-	-

Table C-V.1 **CONCENTRATIONS OF GROSS BETA IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF QUAD CITIES NUCLEAR POWER STATION, 2021**

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

COLLECTION PERIOD	GROUP I				GROUP II					GROUP III
	Q-01	Q-02	Q-03	Q-04	Q-13	Q-16	Q-37	Q-38	Q-41	Q-42
12/31/20 - 01/08/21	30 ± 4	28 ± 4	21 ± 4	25 ± 4	29 ± 4	30 ± 4	25 ± 4	26 ± 4	29 ± 4	28 ± 4
01/08/21 - 01/15/21	34 ± 5	31 ± 5	37 ± 5	34 ± 5	28 ± 5	36 ± 5	28 ± 5	29 ± 5	32 ± 5	30 ± 5
01/15/21 - 01/22/21	20 ± 4	22 ± 4	22 ± 4	23 ± 4	22 ± 4	23 ± 4	19 ± 4	21 ± 4	19 ± 4	20 ± 4
01/22/21 - 01/29/21	13 ± 4	14 ± 4	15 ± 4	14 ± 4	17 ± 4	13 ± 4	9 ± 3	10 ± 4	11 ± 4	15 ± 4
01/29/21 - 02/05/21	22 ± 4	25 ± 5	23 ± 4	20 ± 2 (2)	23 ± 4	24 ± 5	22 ± 4	22 ± 4	22 ± 4	24 ± 5
02/05/21 - 02/12/21	28 ± 5	32 ± 5	29 ± 5	*(1)*	26 ± 5	30 ± 5	24 ± 4	32 ± 5	25 ± 4	27 ± 5
02/12/21 - 02/19/21	24 ± 4	25 ± 5	24 ± 4	*(1)*	23 ± 4	25 ± 4	24 ± 4	21 ± 4	25 ± 4	24 ± 4
02/19/21 - 02/26/21	27 ± 5	26 ± 5	25 ± 5	*(1)*	24 ± 5	23 ± 4	27 ± 5	25 ± 5	25 ± 5	22 ± 4
02/26/21 - 03/05/21	18 ± 4	17 ± 4	16 ± 4	*(1)*	21 ± 4	18 ± 4	16 ± 4	15 ± 4	15 ± 4	15 ± 4
03/05/21 - 03/13/21	14 ± 3	15 ± 3	19 ± 4	17 ± 4	15 ± 3	18 ± 4	17 ± 3	16 ± 3	16 ± 3	18 ± 4
03/13/21 - 03/19/21	13 ± 4	12 ± 4	11 ± 4	16 ± 4	16 ± 4	15 ± 4	15 ± 4	13 ± 4	12 ± 4	11 ± 4
03/19/21 - 03/26/21	11 ± 3	14 ± 4	13 ± 4	9 ± 3	11 ± 3	13 ± 3	12 ± 3	13 ± 4	11 ± 3	9 ± 3
03/26/21 - 04/02/21	12 ± 4	15 ± 4	16 ± 4	15 ± 4	16 ± 4	16 ± 4	14 ± 4	18 ± 5	18 ± 5	13 ± 4
04/02/21 - 04/09/21	18 ± 5	17 ± 5	25 ± 5	17 ± 5	18 ± 4	18 ± 4	22 ± 5	19 ± 5	18 ± 4	19 ± 4
04/08/21 - 04/16/21	6 ± 3	8 ± 3	7 ± 3	6 ± 3	8 ± 3	4 ± 3	7 ± 3	5 ± 3	7 ± 3	8 ± 3
04/16/21 - 04/23/21	12 ± 4	14 ± 4	12 ± 4	12 ± 4	14 ± 4	14 ± 4	11 ± 4	18 ± 5	10 ± 4	13 ± 4
04/23/21 - 04/30/21	18 ± 4	20 ± 5	19 ± 4	19 ± 4	23 ± 5	22 ± 5	17 ± 4	22 ± 5	19 ± 4	21 ± 5
04/30/21 - 05/07/21	15 ± 4	15 ± 4	14 ± 4	15 ± 4	15 ± 4	14 ± 4	14 ± 4	13 ± 4	17 ± 4	16 ± 4
05/07/21 - 05/15/21	7 ± 3	10 ± 4	7 ± 3	9 ± 4	11 ± 3	10 ± 3	9 ± 4	11 ± 4	< 4	10 ± 3
05/14/21 - 05/21/21	16 ± 4	16 ± 4	21 ± 4	15 ± 4	20 ± 5	15 ± 4	19 ± 4	17 ± 4	17 ± 4	13 ± 4
05/21/21 - 05/28/21	16 ± 4	10 ± 4	16 ± 4	14 ± 4	13 ± 4	12 ± 4	16 ± 4	14 ± 4	15 ± 4	16 ± 4
05/28/21 - 06/04/21	20 ± 4	17 ± 4	16 ± 4	22 ± 5	18 ± 4	17 ± 4	15 ± 4	15 ± 4	20 ± 4	22 ± 4
06/04/21 - 06/11/21	15 ± 5	14 ± 5	14 ± 5	14 ± 5	12 ± 4	15 ± 4	14 ± 4	14 ± 4	12 ± 4	13 ± 4
06/09/21 - 06/18/21	17 ± 4	18 ± 4	11 ± 3	17 ± 4	19 ± 4	14 ± 4	14 ± 4	15 ± 4	18 ± 4	22 ± 5
06/18/21 - 06/25/21	15 ± 4	16 ± 4	15 ± 4	17 ± 4	16 ± 4	13 ± 4	18 ± 4	15 ± 4	6 ± 3	14 ± 4
06/25/21 - 07/02/21	10 ± 3	13 ± 3	9 ± 3	12 ± 3	12 ± 4	13 ± 4	11 ± 3	14 ± 3	13 ± 4	11 ± 3
07/02/21 - 07/09/21	16 ± 4	16 ± 4	21 ± 5	22 ± 5	17 ± 4	16 ± 4	23 ± 5	21 ± 5	17 ± 4	18 ± 4
07/09/21 - 07/16/21	17 ± 4	13 ± 4	18 ± 4	18 ± 4	21 ± 4	19 ± 4	15 ± 4	17 ± 4	17 ± 4	11 ± 4
07/16/21 - 07/23/21	18 ± 5	22 ± 5	22 ± 5	16 ± 5	19 ± 5	16 ± 4	16 ± 5	16 ± 5	15 ± 4	17 ± 5
07/23/21 - 07/30/21	27 ± 5	26 ± 5	28 ± 5	27 ± 5	27 ± 5	26 ± 5	14 ± 4	28 ± 5	27 ± 5	26 ± 5
07/30/21 - 08/07/21	16 ± 4	16 ± 4	23 ± 4	25 ± 4	20 ± 4	22 ± 4	23 ± 4	20 ± 4	19 ± 4	19 ± 4
08/07/21 - 08/13/21	23 ± 5	18 ± 5	15 ± 5	19 ± 5	20 ± 5	19 ± 5	21 ± 5	23 ± 5	24 ± 5	26 ± 6
08/13/21 - 08/20/21	29 ± 5	21 ± 4	23 ± 4	20 ± 4	23 ± 5	32 ± 5	25 ± 5	25 ± 5	21 ± 4	22 ± 4
08/20/21 - 08/27/21	16 ± 4	17 ± 5	16 ± 4	19 ± 5	17 ± 4	21 ± 5	16 ± 4	19 ± 5	19 ± 4	15 ± 4
08/27/21 - 09/03/21	29 ± 5	31 ± 5	31 ± 5	29 ± 5	27 ± 5	21 ± 4	29 ± 5	28 ± 5	29 ± 5	28 ± 5
09/03/21 - 09/10/21	22 ± 4	25 ± 5	23 ± 5	23 ± 4	27 ± 5	12 ± 4	21 ± 4	20 ± 4	23 ± 5	21 ± 5
09/10/21 - 09/17/21	30 ± 5	26 ± 5	32 ± 6	30 ± 5	27 ± 5	20 ± 4	29 ± 5	30 ± 5	27 ± 5	32 ± 5
09/17/21 - 09/24/21	26 ± 5	26 ± 5	30 ± 5	32 ± 5	28 ± 5	19 ± 4	25 ± 4	18 ± 4	26 ± 5	23 ± 4
09/24/21 - 10/02/21	26 ± 4	26 ± 4	30 ± 5	23 ± 4	27 ± 4	20 ± 4	27 ± 4	26 ± 4	23 ± 4	23 ± 4
10/02/21 - 10/09/21	14 ± 4	14 ± 4	17 ± 5	12 ± 4	14 ± 4	6 ± 4	13 ± 4	13 ± 4	14 ± 4	13 ± 4
10/09/21 - 10/16/21	27 ± 5	23 ± 4	31 ± 5	23 ± 4	28 ± 5	15 ± 4	24 ± 4	26 ± 4	26 ± 4	32 ± 5
10/16/21 - 10/23/21	20 ± 5	25 ± 6	24 ± 5	24 ± 5	26 ± 5	22 ± 5	21 ± 5	21 ± 5	25 ± 5	20 ± 5
10/22/21 - 10/29/21	13 ± 4	14 ± 4	13 ± 4	13 ± 4	9 ± 4	8 ± 4	14 ± 4	14 ± 4	6 ± 3	8 ± 4
10/29/21 - 11/05/21	21 ± 5	18 ± 4	19 ± 4	19 ± 4	19 ± 4	20 ± 4	22 ± 5	16 ± 4	17 ± 4	19 ± 4
11/05/21 - 11/12/21	31 ± 5	31 ± 5	33 ± 6	28 ± 5	31 ± 5	7 ± 4	30 ± 5	32 ± 5	33 ± 6	34 ± 6
11/12/21 - 11/19/21	15 ± 4	17 ± 4	14 ± 4	11 ± 4	18 ± 4	13 ± 4	13 ± 4	13 ± 4	16 ± 4	13 ± 4
11/19/21 - 11/26/21	16 ± 4	18 ± 4	19 ± 4	18 ± 4	17 ± 4	12 ± 4	18 ± 4	20 ± 4	20 ± 4	18 ± 4
11/26/21 - 12/03/21	25 ± 5	26 ± 5	28 ± 5	23 ± 4	28 ± 5	12 ± 4	25 ± 5	25 ± 5	25 ± 5	26 ± 5
12/03/21 - 12/11/21	17 ± 4	17 ± 4	21 ± 4	15 ± 4	16 ± 4	11 ± 4	17 ± 4	20 ± 4	19 ± 4	16 ± 4
12/11/21 - 12/17/21	25 ± 6	22 ± 5	16 ± 5	25 ± 6	19 ± 5	20 ± 5	20 ± 5	20 ± 5	20 ± 5	19 ± 5
12/17/21 - 12/24/21	34 ± 5	28 ± 5	32 ± 5	32 ± 5	33 ± 5	29 ± 5	31 ± 5	36 ± 5	30 ± 5	32 ± 5
12/24/21 - 12/31/21	35 ± 5	34 ± 5	43 ± 6	39 ± 6	42 ± 6	27 ± 5	39 ± 6	39 ± 6	41 ± 6	40 ± 6
MEAN ± 2 STD DEV	20 ± 14	20 ± 13	21 ± 16	20 ± 14	21 ± 13	18 ± 13	19 ± 13	20 ± 14	20 ± 14	20 ± 15

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

(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

(2) Sample dates for Q-04 01/29/21 - 03/05/21

Table C-V.2 **MONTHLY AND YEARLY MEAN VALUES OF GROSS BETA CONCENTRATIONS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF QUAD CITIES NUCLEAR POWER STATION, 2021**

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

GROUP I - NEAR-SITE LOCATIONS				GROUP II - FAR-FIELD LOCATIONS				GROUP III - CONTROL LOCATION			
COLLECTION PERIOD		MIN	MAX	MEAN ± 2SD	COLLECTION PERIOD		MIN	MAX	MEAN ± 2SD	COLLECTION PERIOD		MIN	MAX	MEAN ± 2SD
12/31/20	01/29/21	13	37	24 ± 15	12/31/20	01/29/21	9	36	23 ± 16	12/31/20	01/29/21	15	30	23 ± 14
01/29/21	03/05/21	16	32	24 ± 9	01/29/21	03/05/21	15	32	23 ± 8	01/29/21	03/05/21	15	27	22 ± 10
03/05/21	04/02/21	9	19	14 ± 5	03/05/21	04/02/21	11	18	15 ± 4	03/05/21	04/02/21	9	18	12 ± 7
04/02/21	04/30/21	6	25	14 ± 11	04/02/21	04/30/21	4	23	15 ± 12	04/02/21	04/30/21	8	21	15 ± 12
04/30/21	06/04/21	7	22	15 ± 8	04/30/21	06/04/21	9	20	15 ± 6	04/30/21	06/04/21	10	22	15 ± 8
06/04/21	07/03/21	9	18	14 ± 5	06/04/21	07/03/21	6	19	14 ± 5	06/04/21	07/02/21	11	22	15 ± 9
07/03/21	07/30/21	13	28	20 ± 9	07/02/21	07/30/21	14	28	19 ± 9	07/02/21	07/30/21	11	26	18 ± 12
07/30/21	09/03/21	15	31	22 ± 11	07/30/21	09/03/21	16	32	22 ± 8	07/30/21	09/03/21	15	28	22 ± 11
09/03/21	10/02/21	22	32	27 ± 7	09/03/21	10/02/21	12	30	24 ± 9	09/03/21	10/02/21	21	32	25 ± 10
10/02/21	10/29/21	12	31	19 ± 12	10/02/21	10/29/21	6	28	17 ± 14	10/02/21	10/29/21	8	32	18 ± 21
10/29/21	12/03/21	11	33	21 ± 13	10/29/21	12/03/21	7	33	20 ± 14	10/29/21	12/03/21	13	34	22 ± 16
12/03/21	12/31/21	15	43	27 ± 17	12/03/21	12/31/21	11	42	26 ± 19	12/03/21	12/31/21	16	40	27 ± 23
12/31/20	12/31/21	6	43	20 ± 14	12/31/20	12/31/21	4	42	19 ± 14	12/31/20	12/31/21	8	40	20 ± 15

Table C-V.3 **CONCENTRATIONS OF GAMMA EMITTERS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF QUAD CITIES NUCLEAR POWER STATION, 2021**

RESULTS IN UNITS OF E-3 PCI/CU METER ± 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
Q-01	12/31/20 - 04/02/21	< 2	< 2	< 4	< 3	< 5	< 2	< 3	< 2	< 2	< 9	< 6
	04/02/21 - 07/03/21	< 3	< 2	< 5	< 2	< 5	< 2	< 4	< 2	< 2	< 15	< 5
	07/03/21 - 10/02/21	< 2	< 2	< 5	< 2	< 5	< 2	< 3	< 1	< 2	< 8	< 5
	10/02/21 - 12/31/21	< 3	< 4	< 7	< 4	< 7	< 3	< 5	< 3	< 3	< 18	< 7
	MEAN	-	-	-	-	-	-	-	-	-	-	-
Q-02	12/31/20 - 04/02/21	< 1	< 3	< 4	< 2	< 5	< 2	< 3	< 2	< 2	< 8	< 2
	04/02/21 - 07/03/21	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 2	< 2	< 9	< 4
	07/03/21 - 10/02/21	< 2	< 2	< 5	< 3	< 4	< 2	< 3	< 2	< 2	< 10	< 4
	10/02/21 - 12/31/21	< 2	< 2	< 6	< 2	< 8	< 2	< 4	< 2	< 3	< 17	< 7
	MEAN	-	-	-	-	-	-	-	-	-	-	-
Q-03	12/31/20 - 04/02/21	< 2	< 2	< 3	< 2	< 3	< 2	< 3	< 1	< 1	< 9	< 3
	04/02/21 - 07/03/21	< 1	< 2	< 4	< 2	< 5	< 2	< 3	< 2	< 2	< 11	< 4
	07/03/21 - 10/02/21	< 2	< 2	< 7	< 2	< 7	< 2	< 4	< 3	< 3	< 13	< 6
	10/02/21 - 12/31/21	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 2	< 2	< 10	< 5
	MEAN	-	-	-	-	-	-	-	-	-	-	-
Q-04	12/31/20 - 04/02/21	< 2	< 2	< 6	< 3	< 4	< 3	< 3	< 2	< 2	< 10	< 4
	04/02/21 - 07/03/21	< 2	< 2	< 5	< 2	< 6	< 2	< 4	< 3	< 2	< 14	< 3
	07/03/21 - 10/02/21	< 1	< 2	< 4	< 1	< 3	< 2	< 3	< 1	< 1	< 7	< 4
	10/02/21 - 12/31/21	< 2	< 2	< 6	< 3	< 5	< 3	< 3	< 2	< 2	< 11	< 4
	MEAN	-	-	-	-	-	-	-	-	-	-	-
Q-13	12/31/20 - 04/02/21	< 2	< 3	< 8	< 3	< 7	< 3	< 5	< 3	< 3	< 18	< 9
	04/02/21 - 07/02/21	< 2	< 2	< 5	< 2	< 4	< 1	< 3	< 2	< 1	< 10	< 5
	07/02/21 - 10/02/21	< 3	< 3	< 6	< 3	< 6	< 3	< 5	< 3	< 3	< 14	< 5
	10/02/21 - 12/31/21	< 1	< 2	< 4	< 2	< 4	< 2	< 2	< 2	< 2	< 9	< 4
	MEAN	-	-	-	-	-	-	-	-	-	-	-

Table C-V.3

CONCENTRATIONS OF GAMMA EMITTERS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF QUAD CITIES NUCLEAR POWER STATION, 2021

RESULTS IN UNITS OF E-3 PCI/CU METER ± 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
Q-16	12/31/20 - 04/02/21	< 2	< 2	< 5	< 3	< 5	< 2	< 3	< 2	< 2	< 10	< 5
	04/02/21 - 07/02/21	< 2	< 2	< 4	< 1	< 3	< 2	< 3	< 2	< 2	< 11	< 3
	07/02/21 - 10/02/21	< 2	< 2	< 5	< 3	< 4	< 2	< 3	< 1	< 2	< 9	< 6
	10/02/21 - 12/31/21	< 4	< 3	< 7	< 4	< 6	< 3	< 6	< 3	< 3	< 16	< 9
	MEAN	-	-	-	-	-	-	-	-	-	-	-
Q-37	12/31/20 - 04/02/21	< 2	< 2	< 6	< 3	< 4	< 3	< 4	< 2	< 2	< 13	< 6
	04/02/21 - 07/03/21	< 3	< 2	< 6	< 3	< 5	< 3	< 4	< 3	< 3	< 15	< 5
	07/03/21 - 10/02/21	< 3	< 3	< 6	< 3	< 7	< 2	< 4	< 3	< 2	< 13	< 5
	10/02/21 - 12/31/21	< 1	< 2	< 5	< 2	< 5	< 2	< 3	< 2	< 2	< 9	< 5
	MEAN	-	-	-	-	-	-	-	-	-	-	-
Q-38	12/31/20 - 04/02/21	< 3	< 3	< 8	< 4	< 9	< 3	< 7	< 4	< 3	< 19	< 9
	04/02/21 - 07/03/21	< 3	< 2	< 5	< 2	< 7	< 3	< 3	< 3	< 2	< 16	< 7
	07/03/21 - 10/02/21	< 4	< 3	< 7	< 4	< 9	< 3	< 5	< 3	< 3	< 15	< 6
	10/02/21 - 12/31/21	< 3	< 4	< 6	< 3	< 8	< 3	< 6	< 4	< 3	< 18	< 7
	MEAN	-	-	-	-	-	-	-	-	-	-	-
Q-41	12/31/20 - 04/02/21	< 2	< 2	< 3	< 2	< 4	< 2	< 2	< 2	< 2	< 13	< 5
	04/02/21 - 07/02/21	< 1	< 2	< 4	< 1	< 4	< 2	< 3	< 2	< 2	< 9	< 2
	07/02/21 - 10/02/21	< 2	< 1	< 5	< 3	< 5	< 2	< 3	< 3	< 2	< 9	< 2
	10/02/21 - 12/31/21	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 11	< 3
	MEAN	-	-	-	-	-	-	-	-	-	-	-
Q-42	12/31/20 - 04/02/21	< 1	< 2	< 3	< 3	< 2	< 2	< 2	< 1	< 1	< 6	< 5
	04/02/21 - 07/02/21	< 2	< 3	< 5	< 2	< 5	< 3	< 3	< 2	< 2	< 15	< 6
	07/02/21 - 10/02/21	< 3	< 3	< 5	< 3	< 7	< 3	< 5	< 3	< 3	< 12	< 6
	10/02/21 - 12/31/21	< 2	< 2	< 6	< 2	< 6	< 2	< 4	< 3	< 2	< 12	< 3
	MEAN	-	-	-	-	-	-	-	-	-	-	-

TABLE C-VI.1 **CONCENTRATIONS OF I-131 IN AIR IODINE SAMPLES COLLECTED IN THE VICINITY OF QUAD CITIES NUCLEAR POWER STATION, 2021**

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

COLLECTION	GROUP I				GROUP II					GROUP III
PERIOD	Q-01	Q-02	Q-03	Q-04	Q-13	Q-16	Q-37	Q-38	Q-41	Q-42
12/31/20 - 01/08/21	< 34	< 35	< 35	< 16	< 34	< 51	< 51	< 53	< 51	< 22
01/08/21 - 01/15/21	< 21	< 50	< 50	< 50	< 50	< 35	< 36	< 36	< 35	< 17
01/15/21 - 01/22/21	< 29	< 18	< 29	< 30	< 28	< 36	< 37	< 18	< 36	< 36
01/22/21 - 01/29/21	< 42	< 21	< 42	< 44	< 41	< 20	< 21	< 22	< 20	< 12
01/29/21 - 02/05/21	< 25	< 26	< 15	< 3 (2)	< 26	< 26	< 32	< 33	< 32	< 32
02/05/21 - 02/12/21	< 44	< 38	< 44	*(1)*	< 44	< 44	< 38	< 40	< 38	< 39
02/12/21 - 02/19/21	< 35	< 24	< 35	*(1)*	< 35	< 35	< 31	< 32	< 31	< 31
02/19/21 - 02/26/21	< 40	< 21	< 40	*(1)*	< 40	< 40	< 25	< 26	< 25	< 25
02/26/21 - 03/05/21	< 28	< 29	< 28	*(1)*	< 28	< 30	< 30	< 15	< 30	< 30
03/05/21 - 03/13/21	< 42	< 18	< 42	< 43	< 42	< 26	< 27	< 27	< 26	< 22
03/13/21 - 03/19/21	< 35	< 15	< 35	< 36	< 35	< 41	< 27	< 41	< 41	< 40
03/19/21 - 03/26/21	< 43	< 21	< 43	< 44	< 42	< 32	< 33	< 15	< 31	< 32
03/26/21 - 04/02/21	< 30	< 13	< 30	< 30	< 30	< 25	< 21	< 26	< 25	< 26
04/02/21 - 04/09/21	< 15	< 15	< 15	< 15	< 12	< 44	< 56	< 57	< 45	< 18
04/08/21 - 04/16/21	< 36	< 37	< 36	< 36	< 19	< 32	< 12	< 29	< 32	< 32
04/16/21 - 04/23/21	< 23	< 14	< 23	< 23	< 23	< 28	< 29	< 15	< 28	< 28
04/23/21 - 04/30/21	< 18	< 43	< 42	< 43	< 42	< 29	< 30	< 16	< 29	< 29
04/30/21 - 05/07/21	< 44	< 46	< 44	< 19	< 44	< 40	< 40	< 34	< 39	< 40
05/07/21 - 05/15/21	< 47	< 21	< 47	< 49	< 40	< 27	< 33	< 29	< 27	< 27
05/14/21 - 05/21/21	< 28	< 28	< 28	< 29	< 27	< 39	< 33	< 34	< 26	< 38
05/21/21 - 05/28/21	< 33	< 17	< 33	< 34	< 32	< 35	< 36	< 17	< 35	< 35
05/28/21 - 06/04/21	< 36	< 37	< 36	< 17	< 35	< 62	< 63	< 65	< 62	< 26
06/04/21 - 06/11/21	< 55	< 48	< 55	< 57	< 35	< 38	< 37	< 39	< 37	< 18
06/09/21 - 06/18/21	< 19	< 20	< 9	< 20	< 25	< 29	< 29	< 15	< 29	< 29
06/18/21 - 06/25/21	< 38	< 17	< 38	< 39	< 39	< 17	< 41	< 41	< 41	< 41
06/25/21 - 07/02/21	< 53	< 55	< 53	< 53	< 27	< 56	< 46	< 46	< 37	< 55
07/02/21 - 07/09/21	< 40	< 34	< 40	< 40	< 34	< 38	< 21	< 45	< 38	< 38
07/09/21 - 07/16/21	< 17	< 36	< 35	< 35	< 35	< 27	< 27	< 27	< 16	< 27
07/16/21 - 07/23/21	< 60	< 26	< 60	< 60	< 58	< 44	< 19	< 45	< 44	< 44
07/23/21 - 07/30/21	< 40	< 20	< 40	< 40	< 39	< 26	< 26	< 26	< 26	< 15
07/30/21 - 08/07/21	< 24	< 20	< 24	< 24	< 24	< 23	< 22	< 22	< 15	< 23
08/07/21 - 08/13/21	< 44	< 19	< 44	< 44	< 44	< 41	< 42	< 35	< 41	< 41
08/13/21 - 08/20/21	< 35	< 31	< 36	< 35	< 35	< 36	< 36	< 17	< 36	< 36
08/20/21 - 08/27/21	< 34	< 30	< 34	< 34	< 34	< 32	< 15	< 32	< 32	< 32
08/27/21 - 09/03/21	< 49	< 21	< 49	< 49	< 49	< 41	< 42	< 42	< 41	< 17
09/03/21 - 09/10/21	< 53	< 55	< 53	< 53	< 32	< 44	< 41	< 41	< 53	< 53
09/10/21 - 09/17/21	< 39	< 23	< 39	< 39	< 33	< 41	< 49	< 49	< 20	< 41
09/17/21 - 09/24/21	< 49	< 24	< 49	< 49	< 51	< 37	< 35	< 35	< 22	< 36
09/24/21 - 10/02/21	< 31	< 13	< 31	< 31	< 30	< 24	< 26	< 26	< 16	< 25
10/02/21 - 10/09/21	< 32	< 32	< 32	< 32	< 16	< 34	< 23	< 34	< 34	< 34
10/09/21 - 10/16/21	< 30	< 13	< 30	< 30	< 30	< 24	< 23	< 23	< 10	< 24
10/16/21 - 10/23/21	< 38	< 45	< 44	< 44	< 37	< 36	< 28	< 42	< 36	< 37
10/22/21 - 10/29/21	< 47	< 47	< 19	< 45	< 50	< 38	< 35	< 35	< 38	< 33
10/29/21 - 11/05/21	< 41	< 41	< 17	< 39	< 39	< 32	< 32	< 32	< 32	< 17
11/05/21 - 11/12/21	< 35	< 17	< 35	< 35	< 34	< 26	< 16	< 27	< 26	< 26
11/12/21 - 11/19/21	< 56	< 24	< 54	< 54	< 54	< 31	< 31	< 31	< 31	< 27
11/19/21 - 11/26/21	< 36	< 24	< 35	< 35	< 35	< 57	< 57	< 57	< 24	< 58
11/26/21 - 12/03/21	< 56	< 28	< 54	< 54	< 54	< 40	< 40	< 40	< 39	< 35
12/03/21 - 12/11/21	< 42	< 42	< 42	< 42	< 18	< 27	< 22	< 26	< 28	< 27
12/11/21 - 12/17/21	< 41	< 41	< 39	< 39	< 20	< 36	< 31	< 36	< 36	< 35
12/17/21 - 12/24/21	< 56	< 24	< 54	< 54	< 56	< 33	< 33	< 33	< 22	< 34
12/24/21 - 12/31/21	< 59	< 28	< 57	< 57	< 58	< 34	< 34	< 34	< 20	< 35
MEAN	-	-	-	-	-	-	-	-	-	-

(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

(2) Sample dates for Q-04 01/29/21 - 03/05/21

Table C-VII.1 CONCENTRATIONS OF I-131 IN MILK SAMPLES COLLECTED IN THE VICINITY OF QUAD CITIES NUCLEAR POWER STATION, 2021

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD		INDICATOR FARM Q-26
01/08/21		< 0.8
02/05/21		< 0.9
03/05/21		< 0.9
04/02/21		< 0.9
05/07/21		< 0.8
05/21/21		< 0.4
06/04/21		< 0.8
06/18/21		< 0.9
07/03/21		< 0.9
07/16/21		< 0.7
07/30/21		< 0.9
08/13/21		< 0.7
08/27/21		< 0.8
09/11/21		< 0.9
09/24/21	*(1)*	
10/09/21		< 0.6
10/22/21		< 0.7
11/05/21		< 0.9
12/03/21		< 0.9
MEAN		-

(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

Table C-VII.2

CONCENTRATIONS OF GAMMA EMITTERS IN MILK SAMPLES COLLECTED IN THE VICINITY OF QUAD CITIES NUCLEAR POWER STATION, 2021

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
Q-26	01/08/21	< 11	< 11	< 24	< 10	< 19	< 9	< 16	< 11	< 9	< 36	< 12
	02/05/21	< 9	< 10	< 20	< 11	< 19	< 8	< 13	< 8	< 9	< 39	< 7
	03/05/21	< 8	< 7	< 15	< 7	< 19	< 7	< 15	< 7	< 8	< 32	< 11
	04/02/21	< 10	< 8	< 19	< 11	< 21	< 10	< 12	< 10	< 7	< 44	< 14
	05/07/21	< 6	< 8	< 18	< 9	< 18	< 8	< 12	< 7	< 8	< 27	< 14
	05/21/21	< 7	< 7	< 15	< 7	< 15	< 6	< 13	< 8	< 7	< 32	< 9
	06/04/21	< 9	< 9	< 19	< 9	< 16	< 9	< 15	< 11	< 9	< 50	< 6
	06/18/21	< 7	< 9	< 19	< 9	< 20	< 9	< 11	< 10	< 9	< 41	< 9.9
	07/03/21	< 6	< 8	< 16	< 7	< 20	< 7	< 15	< 9	< 8	< 38	< 13
	07/16/21	< 5	< 6	< 11	< 7	< 13	< 6	< 10	< 6	< 7	< 28	< 7
	07/30/21	< 9	< 8	< 23	< 11	< 15	< 9	< 18	< 11	< 10	< 38	< 10
	08/13/21	< 7	< 7	< 19	< 7	< 15	< 9	< 12	< 8	< 7	< 33	< 8
	08/27/21	< 7	< 7	< 18	< 8	< 21	< 7	< 14	< 8	< 9	< 38	< 9
	09/11/21	< 7	< 8	< 20	< 9	< 21	< 10	< 15	< 9	< 7	< 47	< 8
	09/24/21	< 7	< 8	< 19	< 10	< 17	< 8	< 15	< 10	< 8	< 55	< 14
	10/09/21	< 8	< 9	< 17	< 8	< 21	< 11	< 13	< 11	< 10	< 38	< 11
	10/22/21	< 8	< 8	< 14	< 10	< 19	< 7	< 16	< 8	< 8	< 49	< 9
	11/05/21	< 8	< 7	< 15	< 7	< 17	< 7	< 11	< 7	< 7	< 29	< 8
	12/03/21	< 7	< 5	< 14	< 5	< 14	< 7	< 12	< 7	< 6	< 33	< 8
	MEAN	-	-	-	-	-	-	-	-	-	-	-

Table C-VIII.1 **CONCENTRATIONS OF GAMMA EMITTERS IN FOOD PRODUCT SAMPLES COLLECTED IN THE VICINITY OF QUAD CITIES NUCLEAR POWER STATION, 2021**

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
Q-CONTROL													
Broccoli	07/16/21	< 24	< 20	< 47	< 10	< 47	< 21	< 39	< 35	< 21	< 23	< 99	< 25
Potatoes	07/16/21	< 13	< 12	< 31	< 14	< 36	< 15	< 21	< 23	< 15	< 14	< 63	< 16
Lettuce/Kale	07/23/21	< 32	< 37	< 68	< 35	< 54	< 30	< 64	< 57	< 33	< 39	< 150	< 28
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
Q-QUAD 1													
Lettuce	07/16/21	< 23	< 17	< 52	< 23	< 39	< 22	< 38	< 32	< 26	< 21	< 97	< 18
Potatoes	07/16/21	< 27	< 23	< 51	< 23	< 49	< 22	< 39	< 32	< 19	< 26	< 84	< 30
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
Q-QUAD 2													
Zucchini/Cucumber	07/16/21	< 20	< 20	< 52	< 23	< 58	< 22	< 37	< 36	< 25	< 28	< 92	< 34
Zucchini	07/16/21	< 30	< 28	< 59	< 34	< 46	< 25	< 35	< 40	< 28	< 19	< 124	< 27
Bell Peppers	07/23/21	< 45	< 43	< 80	< 59	< 89	< 38	< 62	< 56	< 45	< 40	< 196	< 67
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
Q-QUAD 3													
Mint	07/23/21	< 27	< 23	< 64	< 33	< 69	< 27	< 44	< 54	< 30	< 33	< 134	< 37
Turnips	07/23/21	< 15	< 12	< 40	< 14	< 33	< 16	< 24	< 22	< 17	< 17	< 65	< 20
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
Q-QUAD 4													
Cabbage	07/16/21	< 17	< 18	< 36	< 16	< 47	< 14	< 28	< 25	< 16	< 14	< 75	< 20
Rhubarb	07/16/21	< 29	< 27	< 46	< 29	< 45	< 27	< 53	< 40	< 36	< 28	< 142	< 40
Betts	07/16/21	< 18	< 15	< 32	< 17	< 45	< 15	< 27	< 24	< 14	< 18	< 78	< 24
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-

Table C-IX.1 QUARTERLY DLR RESULTS FOR QUAD CITIES NUCLEAR POWER STATION, 2021

Monitoring Location		Location Quarterly Baseline, B_Q (mrem)	B_Q + MDD_Q (mrem)	2021 Normalized Net Dose, M_{QX} (mrem/std. Qtr.)				Quarterly Facility Dose, F_Q (mrem)			
				1	2	3	4	1	2	3	4
Other	Q-01	11.6	16.9	9.8	13.0	12.4	13.1	ND	ND	ND	ND
	Q-02	11.6	16.9	9.8	11.1	13.0	12.6	ND	ND	ND	ND
	Q-03	10.6	15.9	9.9	12.3	12.0	11.6	ND	ND	ND	ND
	Q-04	11.9	17.2	10.8	13.5	10.7	11.5	ND	ND	ND	ND
	Q-13	13.1	18.4	9.9	12.1	14.1	12.1	ND	ND	ND	ND
	Q-16	10.8	16.1	8.3	11.2	12.2	10.7	ND	ND	ND	ND
	Q-37	13.7	19.0	11.3	14.4	14.1	14.7	ND	ND	ND	ND
	Q-38	14.5	19.8	11.1	15.8	13.6	15.7	ND	ND	ND	ND
	Q-41	13.8	19.1	11.6	13.9	14.0	13.9	ND	ND	ND	ND
	Q-42	14.5	19.8	10.9	14.3	14.6	12.7	ND	ND	ND	ND
Inner	Q-101-1	12.1	17.4	8.4	12.3	11.4	13.2	ND	ND	ND	ND
	Q-101-2	12.1	17.4	10.0	12.8	13.0	11.9	ND	ND	ND	ND
	Q-102-1	13.2	18.5	11.0	14.6	13.1	14.8	ND	ND	ND	ND
	Q-102-3	12.7	18.0	9.3	13.7	13.3	11.1	ND	ND	ND	ND
	Q-103-1	11.3	16.6	9.1	12.6	10.9	11.4	ND	ND	ND	ND
	Q-103-2	11.6	16.9	8.6	12.2	10.3	13.2	ND	ND	ND	ND
	Q-104-1	11.4	16.7	9.2	11.9	10.4	12.5	ND	ND	ND	ND
	Q-104-2	11.9	17.2	8.5	14.3	11.8	12.5	ND	ND	ND	ND
	Q-105-1	11.7	17.0	9.1	11.3	11.3	*11.3*	ND	ND	ND	ND
	Q-105-2	11.8	17.1	9.4	12.0	10.5	12.8	ND	ND	ND	ND
	Q-106-2	11.9	17.2	9.7	11.8	11.9	12.7	ND	ND	ND	ND
	Q-106-3	11.5	16.8	9.7	11.6	11.3	11.4	ND	ND	ND	ND
	Q-107-2	11.5	16.8	10.4	13.5	12.3	12.1	ND	ND	ND	ND
	Q-107-3	11.6	16.9	9.7	12.1	11.7	10.7	ND	ND	ND	ND
	Q-108-1	11.9	17.2	9.7	14.0	11.3	13.4	ND	ND	ND	ND
	Q-108-2	11.5	16.8	10.2	13.5	11.0	12.5	ND	ND	ND	ND
	Q-109-1	12	17.3	8.9	13.2	12.4	11.5	ND	ND	ND	ND
	Q-109-2	11.9	17.2	9.4	13.9	11.4	11.6	ND	ND	ND	ND
	Q-111-1	12.1	17.4	10.0	*13.8*	*13.9*	13.7	ND	ND	ND	ND
	Q-111-2	12.3	17.6	(1)	11.7	12.3	*13.1*	ND	ND	ND	ND
	Q-112-1	11.9	17.2	10.4	10.8	13.0	12.8	ND	ND	ND	ND
	Q-112-2	11.4	16.7	8.8	11.5	*11.8*	11.7	ND	ND	ND	ND
	Q-113-1	11.5	16.8	9.3	10.9	13.4	11.5	ND	ND	ND	ND
	Q-113-2	10.9	16.2	8.4	10.2	10.2	(1)	ND	ND	ND	ND
	Q-114-1	11	16.3	8.9	11.4	11.8	10.9	ND	ND	ND	ND
	Q-114-2	12.5	17.8	10.7	11.6	15.2	14.7	ND	ND	ND	ND
	Q-115-1	12.1	17.4	9.0	12.8	14.3	13.6	ND	ND	ND	ND
	Q-115-2	11.5	16.8	8.8	12.3	12.6	11.9	ND	ND	ND	ND
	Q-116-1	13.1	18.4	11.1	13.1	14.7	15.5	ND	ND	ND	ND
	Q-116-3	12.1	17.4	10.3	11.1	13.5	11.9	ND	ND	ND	ND
Outer	Q-201-1	12.7	18.0	(1)	12.6	13.2	13.7	ND	ND	ND	ND
	Q-201-2	13.4	18.7	9.3	12.6	*13.1*	*14.7*	ND	ND	ND	ND
	Q-202-1	11.9	17.2	10.7	14.3	11.9	12.9	ND	ND	ND	ND
	Q-202-2	12.9	18.2	10.4	11.6	(1)	12.0	ND	ND	ND	ND
	Q-203-1	13.2	18.5	10.6	12.9	14.2	14.2	ND	ND	ND	ND
	Q-203-2	15.5	20.8	11.4	16.9	16.5	16.1	ND	ND	ND	ND
	Q-204-1	13.8	19.1	10.3	15.8	13.4	13.5	ND	ND	ND	ND
	Q-204-2	15.2	20.5	11.7	17.0	14.7	17.7	ND	ND	ND	ND
	Q-205-1	13.6	18.9	11.6	14.7	14.1	14.5	ND	ND	ND	ND
	Q-205-4	15.3	20.6	10.1	(1)	15.7	17.3	ND	ND	ND	ND

Table C-IX.1 QUARTERLY DLR RESULTS FOR QUAD CITIES NUCLEAR POWER STATION, 2021

Monitoring Location		Location Quarterly Baseline, B_Q (mrem)	B_Q + MDD_Q (mrem)	2021 Normalized Net Dose, M_{QX} (mrem/std. Qtr.)				Quarterly Facility Dose, F_Q (mrem)			
				1	2	3	4	1	2	3	4
Outer (cont'd)	Q-206-1	12.9	18.2	10.3	15.3	12.9	13.4	ND	ND	ND	ND
	Q-206-2	12.5	17.8	10.4	13.9	12.4	13.7	ND	ND	ND	ND
	Q-207-1	13.3	18.6	9.1	15.6	12.5	14.4	ND	ND	ND	ND
	Q-207-4	13.9	19.2	9.6	14.7	14.2	15.4	ND	ND	ND	ND
	Q-208-1	13	18.3	10.4	14.5	12.9	13.3	ND	ND	ND	ND
	Q-208-2	14.1	19.4	11.3	16.5	14.9	15.5	ND	ND	ND	ND
	Q-209-1	14	19.3	13.2	15.1	14.3	*16.6*	ND	ND	ND	ND
	Q-209-4	13.3	18.6	8.3	16.0	12.9	15.3	ND	ND	ND	ND
	Q-210-1	14.7	20.0	10.6	13.8	16.3	14.0	ND	ND	ND	ND
	Q-210-4	14.6	19.9	11.6	16.1	16.3	13.9	ND	ND	ND	ND
	Q-210-5	11	16.3	7.9	9.9	9.4	10.0	ND	ND	ND	ND
	Q-211-1	15.7	21.0	11.7	14.4	17.8	17.4	ND	ND	ND	ND
	Q-211-2	16.3	21.6	12.5	16.6	18.7	15.8	ND	ND	ND	ND
	Q-212-1	13.1	18.4	8.9	16.5	13.6	12.6	ND	ND	ND	ND
	Q-212-2	10.6	15.9	9.9	14.3	11.3	10.6	ND	ND	ND	ND
	Q-213-1	12.5	17.8	8.4	10.9	13.6	12.9	ND	ND	ND	ND
	Q-213-2	12.2	17.5	9.2	11.6	11.9	11.8	ND	ND	ND	ND
	Q-214-1	12.6	17.9	9.5	11.6	15.3	14.0	ND	ND	ND	ND
	Q-214-2	13.2	18.5	12.3	14.4	14.0	12.8	ND	ND	ND	ND
	Q-215-1	12.4	17.7	9.9	13.8	12.4	14.0	ND	ND	ND	ND
	Q-215-2	13.6	18.9	11.4	16.9	16.8	*15.3*	ND	ND	ND	ND
	Q-216-1	15.1	20.4	12.0	16.2	16.6	14.9	ND	ND	ND	ND
	Q-216-2	14.3	19.6	9.6	14.2	15.4	*14.3*	ND	ND	ND	ND

ND = Not Detected

(1) Environmental Dosimetry lost for this period - see Program Exceptions, table D-2 for details

Table C-IX.2 ANNUAL DLR RESULTS FOR QUAD CITIES NUCLEAR POWER STATION, 2021

Monitoring Location		Annual Baseline, B_A (mrem)	$B_A + MDD_A$ (mrem)	Normalized Annual Dose, M_A (mrem/yr)	Annual Facility Dose, F_A
Other	Q-01	47.0	64.0	48.3	ND
	Q-02	46.8	63.8	46.5	ND
	Q-03	39.9	56.9	45.8	ND
	Q-04	44.4	61.4	46.5	ND
	Q-13	49.1	66.1	48.2	ND
	Q-16	41.9	58.9	42.4	ND
	Q-37	57.1	74.1	54.5	ND
	Q-38	53.4	70.4	56.2	ND
	Q-41	49.2	66.2	53.4	ND
	Q-42	55.8	72.8	52.5	ND
Inner	Q-101-1	46.3	63.3	45.3	ND
	Q-101-2	46.8	63.8	47.7	ND
	Q-102-1	52.9	69.9	53.5	ND
	Q-102-3	46.5	63.5	47.4	ND
	Q-103-1	41.2	58.2	44.0	ND
	Q-103-2	43.2	60.2	44.3	ND
	Q-104-1	41.4	58.4	44.0	ND
	Q-104-2	43.0	60.0	47.1	ND
	Q-105-1	40.2	57.2	43.0	ND
	Q-105-2	45.7	62.7	44.7	ND
	Q-106-2	44.8	61.8	46.1	ND
	Q-106-3	43.6	60.6	44.0	ND
	Q-107-2	45.4	62.4	48.3	ND
	Q-107-3	44.0	61.0	44.2	ND
	Q-108-1	43.9	60.9	48.4	ND
	Q-108-2	43.0	60.0	47.2	ND
	Q-109-1	42.7	59.7	46.0	ND
	Q-109-2	45.5	62.5	46.3	ND
	Q-111-1	45.4	62.4	51.4	ND
	Q-111-2	52.9	69.9	37.1	ND
	Q-112-1	47.0	64.0	47.0	ND
	Q-112-2	42.3	59.3	43.8	ND
	Q-113-1	45.1	62.1	45.1	ND
	Q-113-2	40.6	57.6	38.4	ND
	Q-114-1	42.3	59.3	43.0	ND
	Q-114-2	49.3	66.3	52.2	ND
	Q-115-1	49.4	66.4	49.7	ND
	Q-115-2	46.9	63.9	45.6	ND
	Q-116-1	50.8	67.8	54.4	ND
	Q-116-3	49.0	66.0	46.8	ND
Outer	Q-201-1	45.3	62.3	39.5	ND
	Q-201-2	54.3	71.3	49.7	ND
	Q-202-1	45.2	62.2	49.8	ND
	Q-202-2	51.7	68.7	45.3	ND
	Q-203-1	38.2	55.2	51.9	ND
	Q-203-2	58.4	75.4	60.9	ND
	Q-204-1	52.4	69.4	53.0	ND
	Q-204-2	61.8	78.8	61.1	ND
	Q-205-1	51.3	68.3	54.9	ND
	Q-205-4	56.5	73.5	57.5	ND

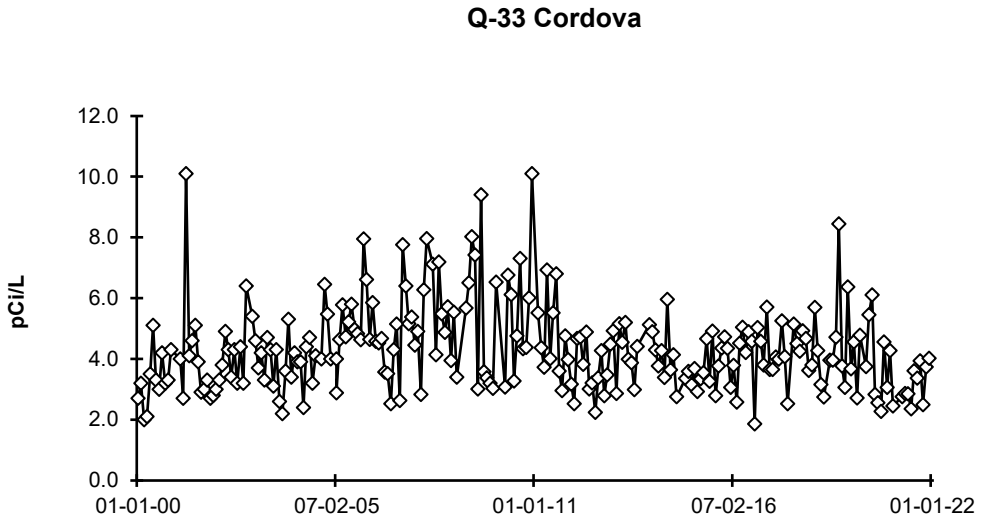
Table C-IX.2 ANNUAL DLR RESULTS FOR QUAD CITIES NUCLEAR POWER STATION, 2021

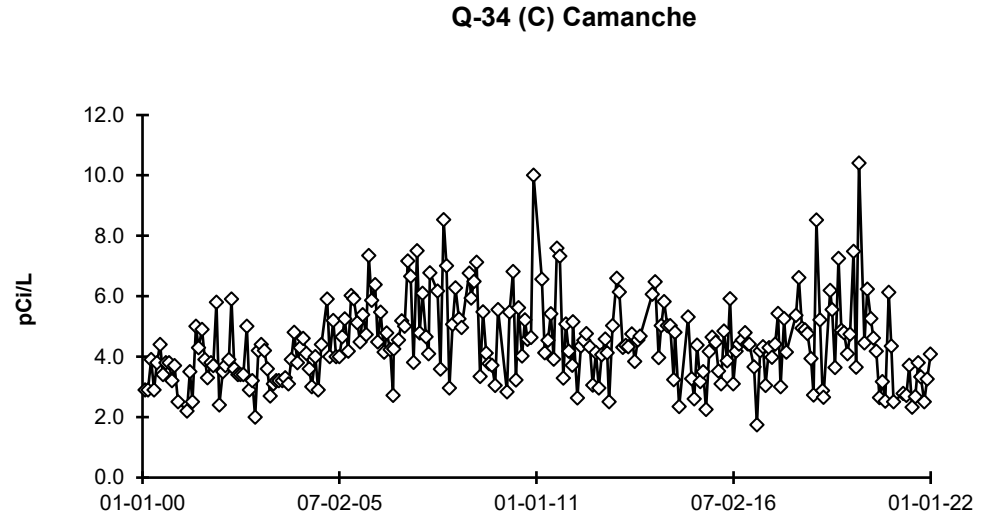
Monitoring Location		Annual Baseline, B_A (mrem)	$B_A + MDD_A$ (mrem)	Normalized Annual Dose, M_A (mrem/yr)	Annual Facility Dose, F_A
Outer	Q-206-1	46.0	63.0	51.9	ND
(cont'd)	Q-206-2	47.8	64.8	50.4	ND
	Q-207-1	53.8	70.8	51.6	ND
	Q-207-4	53.5	70.5	53.9	ND
	Q-208-1	49.6	66.6	51.1	ND
	Q-208-2	52.7	69.7	58.2	ND
	Q-209-1	57.8	74.8	59.2	ND
	Q-209-4	52.7	69.7	52.5	ND
	Q-210-1	42.4	59.4	54.7	ND
	Q-210-4	56.8	73.8	57.9	ND
	Q-210-5	39.0	56.0	37.2	ND
	Q-211-1	60.9	77.9	61.3	ND
	Q-211-2	66.0	83.0	63.6	ND
	Q-212-1	49.2	66.2	51.6	ND
	Q-212-2	42.0	59.0	46.1	ND
	Q-213-1	45.7	62.7	45.8	ND
	Q-213-2	44.6	61.6	44.5	ND
	Q-214-1	48.3	65.3	50.4	ND
	Q-214-2	55.8	72.8	53.5	ND
	Q-215-1	48.2	65.2	50.1	ND
	Q-215-2	53.7	70.7	60.4	ND
	Q-216-1	60.5	77.5	59.7	ND
	Q-216-2	45.4	62.4	53.5	ND

ND = Not Detected

(1) Environmental Dosimetry lost for this period - see Program Exceptions, table D-2 for details

FIGURE C-1
Surface Water - Gross Beta - Stations Q-33 and Q-34 (C)
Collected in the Vicinity of QCNPS, 2000 - 2021

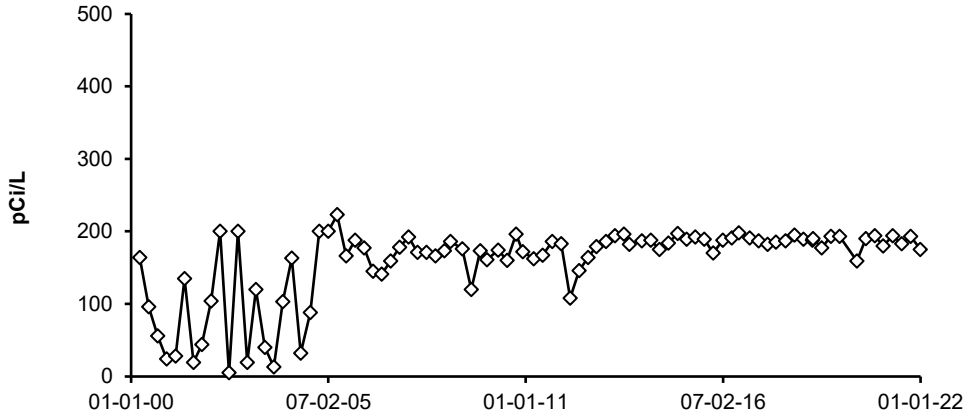




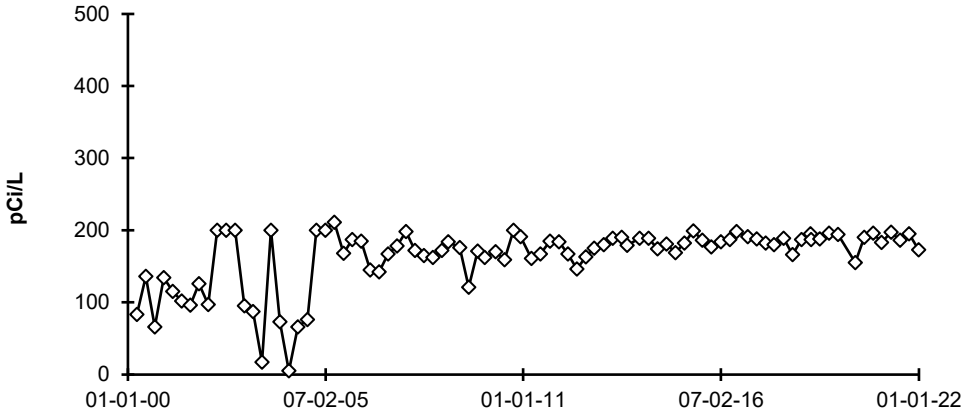
DUE TO VENDOR CHANGE, < VALUES ARE LLD VALUES JANUARY THROUGH JUNE 2005 AND MDC VALUES AFTER JULY 2005

FIGURE C-2
Surface Water - Tritium - Stations Q-33 and Q-34 (C)
Collected in the Vicinity of QCNPS, 2000 - 2021

Q-33 Cordova



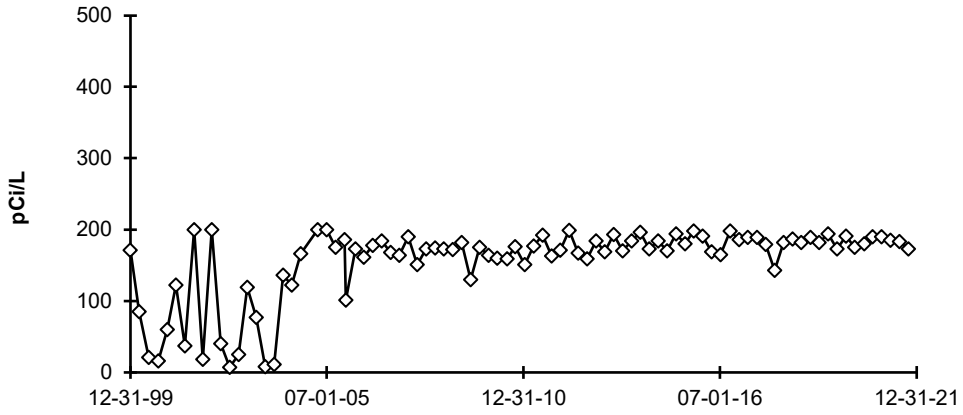
Q-34 (C) Camanche



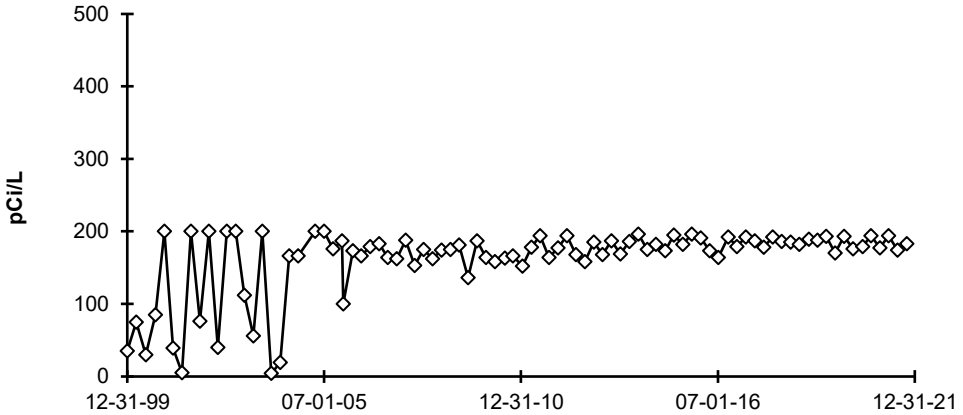
DUE TO VENDOR CHANGE, < VALUES ARE LLD VALUES JANUARY THROUGH JUNE 2005 AND MDC VALUES AFTER JULY 2005

FIGURE C-3
Ground Water - Tritium - Stations Q-35 and Q-36
Collected in the Vicinity of QCNPS, 2000 - 2021

Q-35 McMillan Well



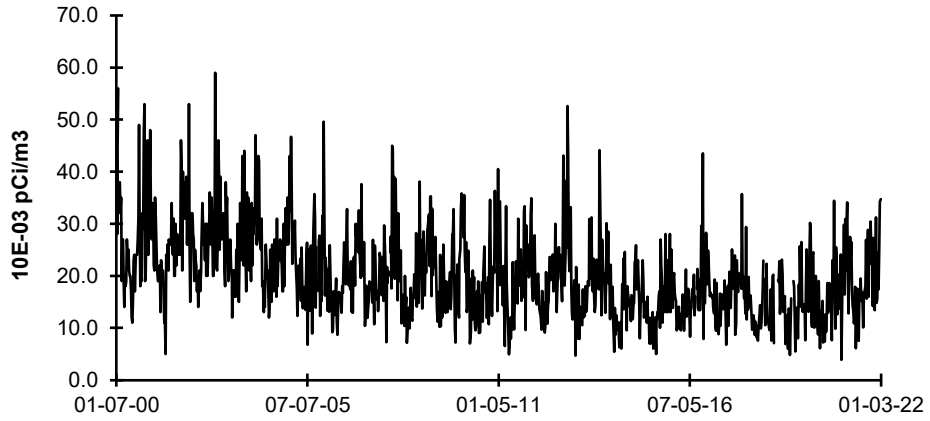
Q-36 Cordova Well



DUE TO VENDOR CHANGE, < VALUES ARE LLD VALUES JANUARY THROUGH JUNE 2005 AND MDC VALUES AFTER JULY 2005

FIGURE C-4
Air Particulates - Gross Beta- Stations Q-01 and Q-02 Collected in the Vicinity of QCNPS, 2000 - 2021

Q-01 Onsite No. 1



Q-02 Onsite No. 2

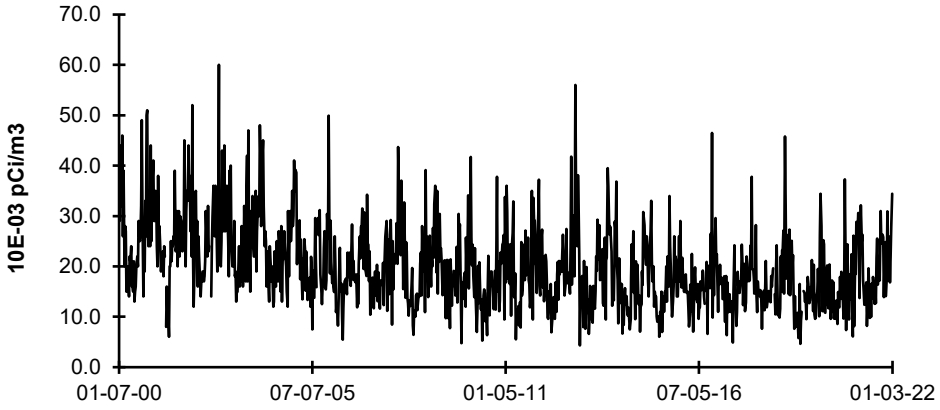
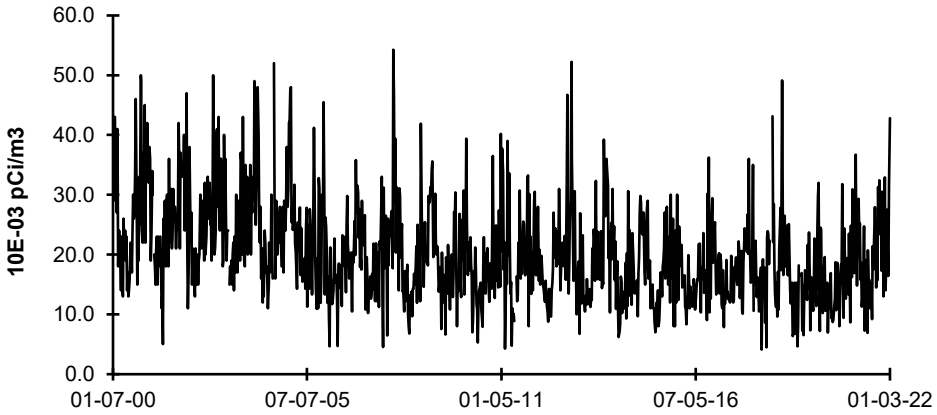


FIGURE C-5
Air Particulates - Gross Beta- Stations Q-03 and Q-04 Collected in the Vicinity of QCNPS, 2000 - 2021

Q-03 Onsite No. 3



Q-04 Nitrin

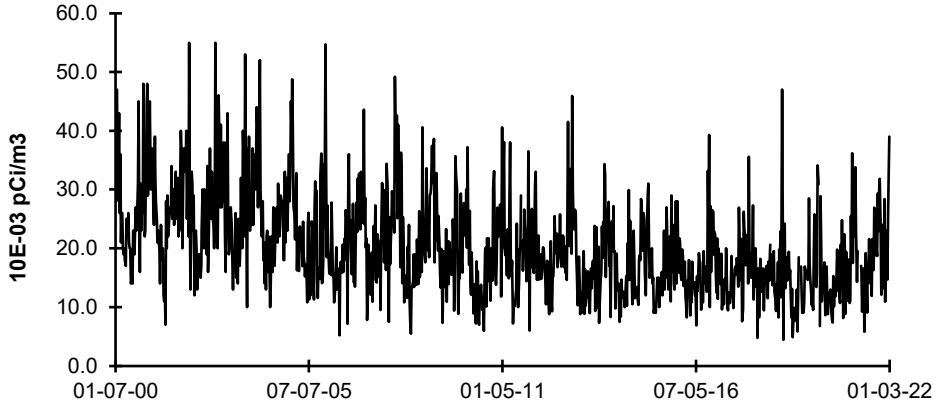
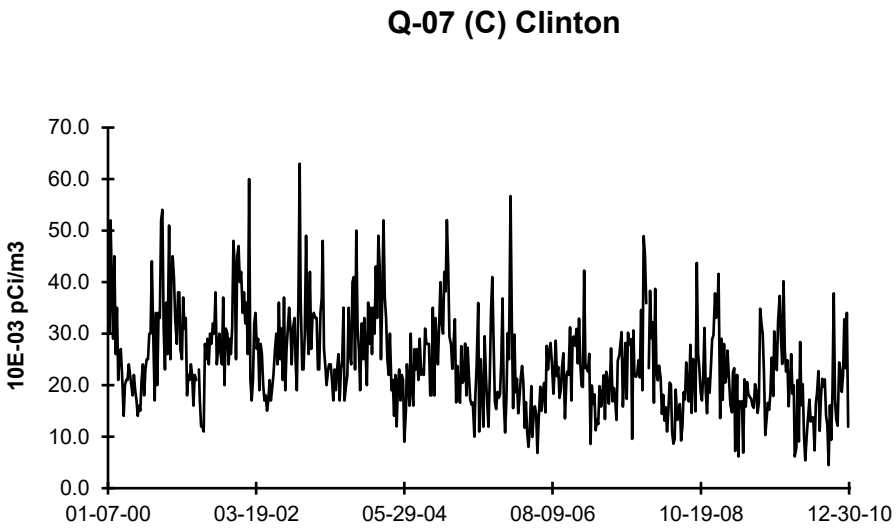
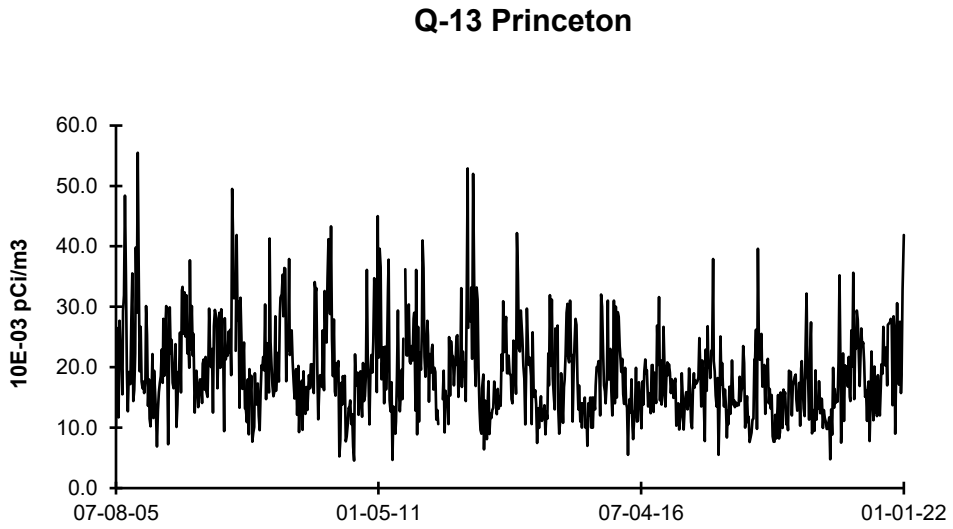


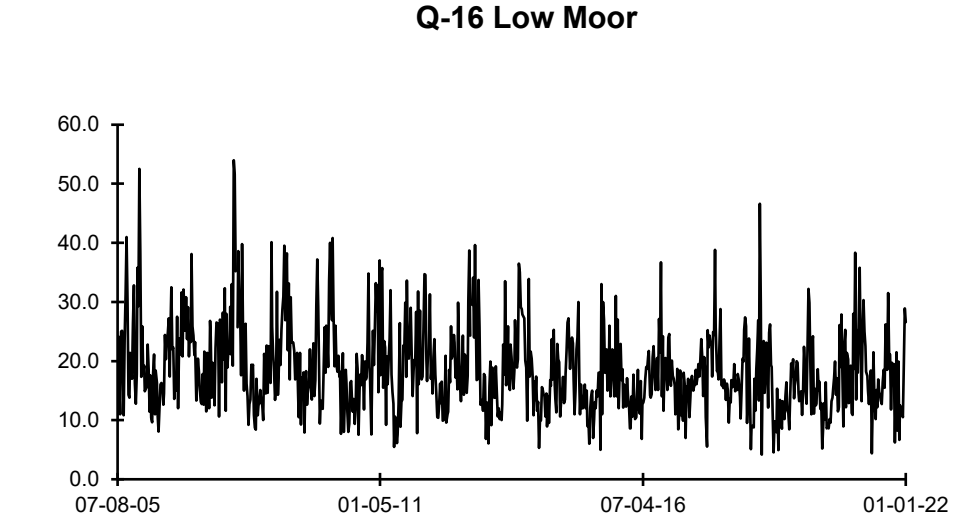
FIGURE C-6
Air Particulates - Gross Beta- Station Q-07 (C)
Collected in the Vicinity of QCNPS, 2000 - 2010



This location was removed from the program in January 2011 due to updated annual average meteorology. This data is retained in the report for historical comparision.

FIGURE C-7
Air Particulates - Gross Beta- Stations Q-13 and Q-16 Collected in the Vicinity of QCNPS, 2005 - 2021

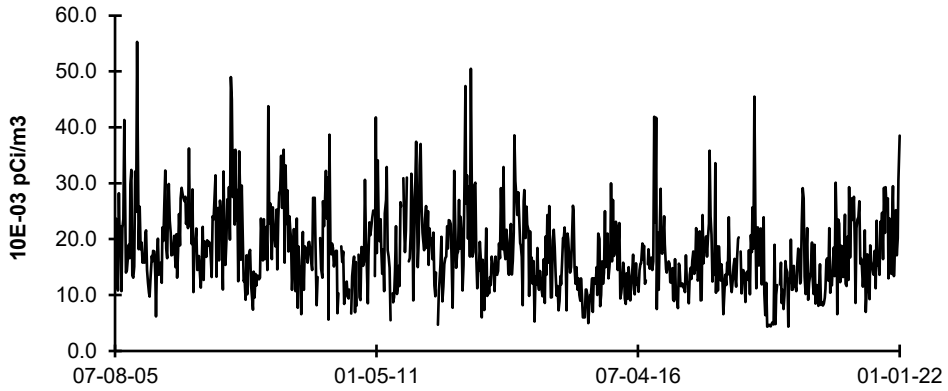




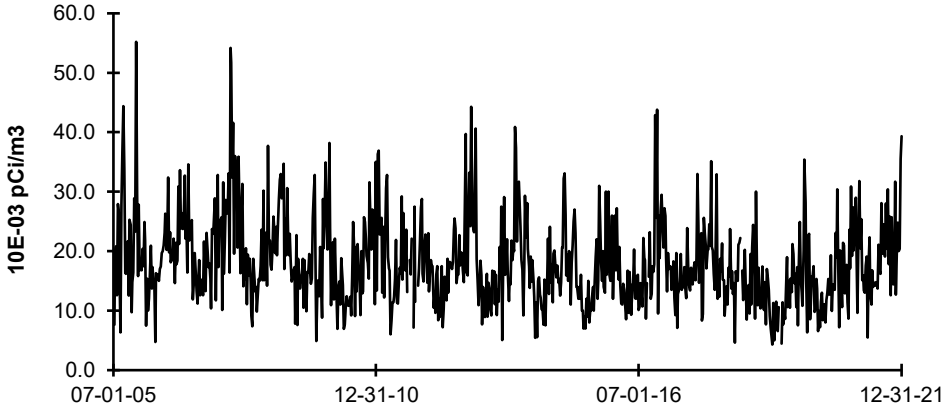
AIR PARTICULATE GROSS BETA ANALYSES OF FAR FIELD LOCATIONS STARTED IN JULY 2005

FIGURE C-8
Air Particulates - Gross Beta- Stations Q-37 and Q-38 Collected in the Vicinity of QCNPS, 2005 - 2021

Q-37 Meredosia Road

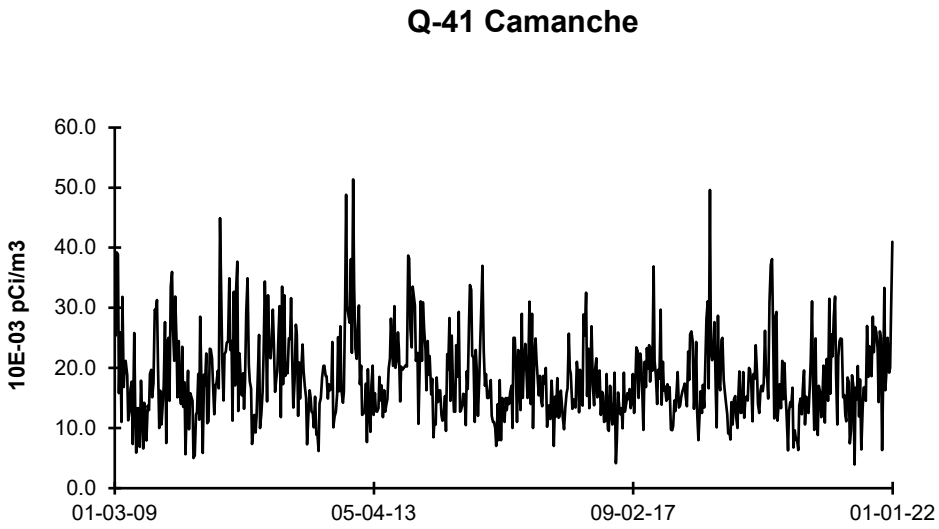


Q-38 Fuller Road

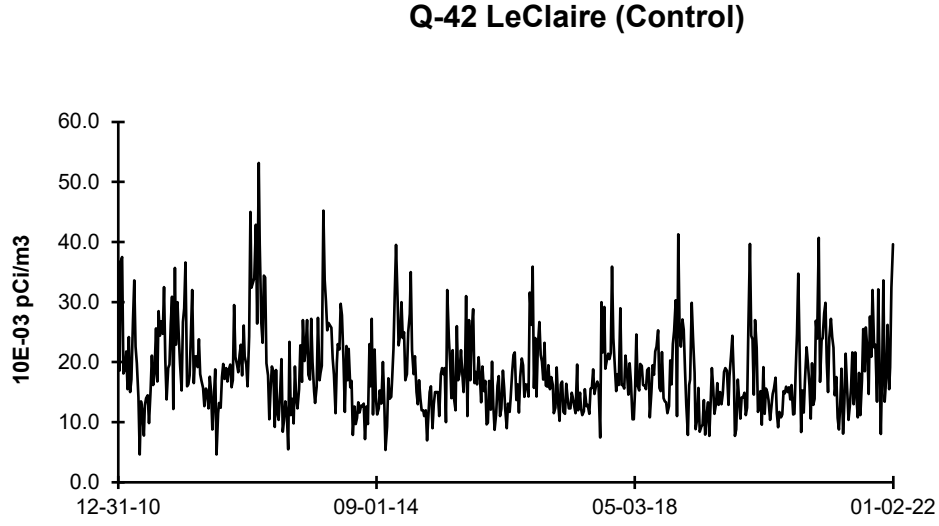


AIR PARTICULATE GROSS BETA ANALYSES OF FAR FIELD LOCATIONS STARTED IN JULY 2005

FIGURE C-9
Air Particulates - Gross Beta- Station Q-41
Collected in the Vicinity of QCNPS, 2009 - 2021



Air Particulates - Gross Beta- Station Q-42 (C)
Collected in the Vicinity of QCNPS, 2010 - 2021



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APPENDIX D

INTER-LABORATORY COMPARISON PROGRAM

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

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [(a)]	Ratio of TBE to Analytics Result	Evaluation [(b)]
March 2021	E13466	Milk	Sr-89	pCi/L	84.6	87.1	0.97	A
			Sr-90	pCi/L	11.5	12.6	0.91	A
	E13467	Milk	Ce-141	pCi/L	111	125	0.89	A
			Co-58	pCi/L	123	128	0.96	A
			Co-60	pCi/L	140	154	0.91	A
			Cr-51	pCi/L	252	242	1.04	A
			Cs-134	pCi/L	130	151	0.86	A
			Cs-137	pCi/L	110	110	1.00	A
			Fe-59	pCi/L	105	109	0.96	A
			I-131	pCi/L	77.6	86.9	0.89	A
			Mn-54	pCi/L	111	112	0.99	A
			Zn-65	pCi/L	200	211	0.95	A
	E13468	Charcoal	I-131	pCi	83.5	88.5	0.94	A
	E13469	AP	Ce-141	pCi	103.0	103	1.00	A
			Co-58	pCi	93.3	105	0.89	A
			Co-60	pCi	136	126	1.08	A
			Cr-51	pCi	213	198	1.07	A
			Cs-134	pCi	123.0	124	0.99	A
			Cs-137	pCi	86.3	90.1	0.96	A
			Fe-59	pCi	81.3	89.6	0.91	A
			Mn-54	pCi	93.5	92.0	1.02	A
			Zn-65	pCi	166	173	0.96	A
	E13470	Soil	Ce-141	pCi/g	0.232	0.262	0.89	A
			Co-58	pCi/g	0.251	0.268	0.94	A
			Co-60	pCi/g	0.306	0.322	0.95	A
			Cr-51	pCi/g	0.517	0.506	1.02	A
			Cs-134	pCi/g	0.263	0.317	0.83	A
			Cs-137	pCi/g	0.278	0.301	0.92	A
			Fe-59	pCi/g	0.228	0.229	1.00	A
			Mn-54	pCi/g	0.221	0.235	0.94	A
			Zn-65	pCi/g	0.448	0.441	1.02	A
	E13471	AP	Sr-89	pCi	92.2	95.5	0.97	A
			Sr-90	pCi	11.7	13.9	0.84	A

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

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

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 2021	E13472	Milk	Sr-89	pCi/L	66.4	85.4	0.78	W
			Sr-90	pCi/L	11.9	14.0	0.85	A
	E13473	Milk	Ce-141	pCi/L	118	114	1.03	A
			Co-58	pCi/L	116	118	0.98	A
			Co-60	pCi/L	142	145	0.98	A
			Cr-51	pCi/L	244	236	1.03	A
			Cs-134	pCi/L	81	93.1	0.87	A
			Cs-137	pCi/L	105	112	0.94	A
			Fe-59	pCi/L	105	102	1.03	A
			I-131	pCi/L	65.1	85.6	0.76	W
			Mn-54	pCi/L	128	128	1.00	A
			Zn-65	pCi/L	158	153	1.03	A
	E13474	Charcoal	I-131	pCi	85.2	90.9	0.94	A
	E13475	AP	Ce-141	pCi	126	135	0.94	A
			Co-58	pCi	148	139	1.07	A
			Co-60	pCi	183	171	1.07	A
			Cr-51	pCi	322	278	1.16	A
			Cs-134	pCi	118	110	1.08	A
			Cs-137	pCi	147	132	1.12	A
			Fe-59	pCi	131	120	1.09	A
			Mn-54	pCi	161	151	1.06	A
			Zn-65	pCi	202	180	1.12	A
	E13476	Soil	Ce-141	pCi/g	0.215	0.219	0.98	A
			Co-58	pCi/g	0.208	0.226	0.92	A
			Co-60	pCi/g	0.277	0.277	1.00	A
			Cr-51	pCi/g	0.388	0.452	0.86	A
			Cs-134	pCi/g	0.157	0.178	0.88	A
			Cs-137	pCi/g	0.270	0.284	0.95	A
			Fe-59	pCi/g	0.218	0.195	1.12	A
			Mn-54	pCi/g	0.239	0.246	0.97	A
			Zn-65	pCi/g	0.312	0.293	1.06	A
	E13477	AP	Sr-89	pCi	85.6	68.3	1.25	W
			Sr-90	pCi	12.6	11.2	1.13	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 2021	21-GrF44	AP	Gross Alpha	Bq/sample	0.371	1.77	0.53 - 3.01	N(3)
			Gross Beta	Bq/sample	0.731	0.65	0.325 - 0.974	A
	21-MaS44	Soil	Ni-63	Bq/kg	310	689.0	482 - 896	N(4)
			Tc-99	Bq/kg	457	638	447 - 829	W
	21-MaSU44	Urine	Cs-134	Bq/L	2.34	2.73	1.91 - 3.55	A
			Cs-137	Bq/L	2.54	2.71	1.90 - 3.52	A
			Co-57	Bq/L	0.4100		*(1)*	A
			Co-60	Bq/L	2.24	2.44	1.71 - 3.17	A
			Mn-54	Bq/L	2.03	2.03	1.42 - 2.64	A
			K-40	Bq/L	52.8	54.0	38 - 70	A
			U-234	Bq/L	0.108	0.0877	0.0614 - 0.114	W
			U-238	Bq/L	0.101	0.091	0.064 - 0.118	A
			Zn-65	Bq/L	1.06	1.34	*(2)*	A
	21-MaW44	Water	Ni-63	Bq/L	6.7	8.2	5.7 - 10.7	A
			Tc-99	Bq/L	3.850	4.01	2.81 - 5.21	A
	21-RdV44	Vegetation	Cs-134	Bq/sample	3.13	3.60	2.5 - 4.7	A
			Cs-137	Bq/sample	4.64	4.69	3.28 - 6.10	A
			Co-57	Bq/sample	5.25	5.05	3.54 - 6.57	A
			Co-60	Bq/sample	2.86	2.99	2.09 - 3.89	A
			Mn-54	Bq/sample	5.02	5.25	3.68 - 6.83	A
			Sr-90	Bq/sample	0.631	0.673	0.471 - 0.875	A
			Zn-65	Bq/sample	-0.233		*(1)*	A
August 2021	21-GrF45	AP	Gross Alpha	Bq/sample	0.368	0.960	0.288 - 1.632	A
			Gross Beta	Bq/sample	0.595	0.553	0.277 - 0.830	A
	21-MaS45	Soil	Ni-63	Bq/kg	546	1280	896 - 1664	N(5)
			Tc-99	Bq/kg	453	777	544 - 1010	N(5)
	21-MaSU45	Urine	Cs-134	Bq/L	3.10	3.62	2.53 - 4.71	A
			Cs-137	Bq/L	0.083		*(1)*	A
			Co-57	Bq/L	0.844	0.87	0.606 - 1.125	A
			Co-60	Bq/L	0.0535		*(1)*	A
			Mn-54	Bq/L	0.459	0.417	*(2)*	A
			K-40	Bq/L	48.8	54.0	38 - 70	A
			U-234	Bq/L	0.133	0.116	0.081 - 0.151	A
			U-238	Bq/L	0.137	0.121	0.085 - 0.157	A
			Zn-65	Bq/L	0.339	0.420	*(2)*	A
	21-MaW45	Water	Ni-63	Bq/L	33.5	39.5	27.7 - 51.4	A
			Tc-99	Bq/L	3.5	3.7	2.60 - 4.82	A
	21-RdV45	Vegetation	Cs-134	Bq/sample	3.42	4.34	3.04 - 5.64	W
			Cs-137	Bq/sample	2.14	2.21	1.55 - 2.87	A
			Co-57	Bq/sample	4.08	4.66	3.26 - 6.06	A
			Co-60	Bq/sample	2.81	3.51	2.46 - 4.56	A
			Mn-54	Bq/sample	0.035		*(1)*	A
			Sr-90	Bq/sample	1.15	1.320	0.92 - 1.72	A
			Zn-65	Bq/sample	2.05	2.43	1.70 - 3.16	A

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

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

(1) False positive test
(2) Sensitivity evaluation
*(3) See **NCR 21-02***
*(4) See **NCR 21-03***
*(5) See **NCR 21-13***
(6) Tc-99 cross-checks done for TBE information only - not required

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 2021	MRAD-34	Water	Am-241	pCi/L	175	157	108 - 201	A
			Fe-55	pCi/L	579	275	162 - 400	N(1)
			Pu-238	pCi/L	181	171	103 - 222	A
			Pu-239	pCi/L	153	142	87.9 - 175	A
		Soil	Sr-90	pCi/kg	6570	9190	2860 - 14,300	A
		AP	Fe-55	pCi/filter	107	121	44.2 - 193	A
			U-234	pCi/filter	25.99	25.5	18.9 - 29.9	A
			U-238	pCi/filter	24.7	25.3	19.1 - 30.2	A
April 2021	RAD-125	Water	Ba-133	pCi/L	92.3	90.5	76.2 - 99.6	A
			Cs-134	pCi/L	62.9	70.5	57.5 - 77.6	A
			Cs-137	pCi/L	161	168	151 - 187	A
			Co-60	pCi/L	22.5	20.9	17.7 - 25.8	A
			Zn-65	pCi/L	183	177.0	159 - 208	A
			GR-A	pCi/L	30.8	30.2	15.4 - 39.4	A
			GR-B	pCi/L	60.1	67.5	46.8 - 74.2	A
			U-Nat	pCi/L	36.45	36.9	30.0 - 40.8	A
			H-3	pCi/L	13,400	14,600	12,800 - 16,100	A
			Sr-89	pCi/L	64.5	63.5	51.4 - 71.5	A
			Sr-90	pCi/L	22.8	23.0	16.5 - 27.0	A
			I-131	pCi/L	28.2	26.7	22.2 - 31.4	A
September 2021	MRAD-35	Water	Am-241	pCi/L	68	63.7	43.7 - 81.5	A
			Fe-55	pCi/L	179	246	145 - 358	A
			Pu-238	pCi/L	102	114	68.5 - 148	A
			Pu-239	pCi/L	32	34.3	21.2 - 42.3	A
		Soil	Sr-90	pCi/kg	6160	6090	1,900 - 9,490	A
		AP	Fe-55	pCi/filter	493	548	200 - 874	A
			Pu-238	pCi/filter	28	28.5	21.5 - 35.0	A
			Pu-239	pCi/filter	21	21.6	16.1 - 26.1	A
			U-234	pCi/filter	7.95	7.76	5.75 - 9.09	A
			U-238	pCi/filter	8.0	7.69	5.81 - 9.17	A
October 2021	RAD-127	Water	Ba-133	pCi/L	82.8	87.5	73.6 - 96.2	A
			Cs-134	pCi/L	64.0	70.1	57.1 - 77.1	A
			Cs-137	pCi/L	145	156	140 - 174	A
			Co-60	pCi/L	83.2	85.9	77.3 - 96.8	A
			Zn-65	pCi/L	133	145	130 - 171	A
			GR-A	pCi/L	76.0	66.7	35.0 - 82.5	A
			GR-B	pCi/L	63.0	55.7	38.1 - 62.6	N(2)
			U-Nat	pCi/L	52.88	55.5	45.3 - 61.1	A
			H-3	pCi/L	13,800	17,200	15,000 - 18,900	N(3)
			Sr-89	pCi/L	54.9	61.0	49.1 - 68.9	A
			Sr-90	pCi/L	24.8	29.3	21.3 - 34.0	A
			I-131	pCi/L	27.4	26.4	21.9 - 31.1	A
December 2021	QR 120121Y	Water	GR-B	pCi/L	47.6	39.8	26.4 - 47.3	N(4)
			H-3	pCi/L	17,500	17,800	15,600 - 19,600	A

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

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

*(1) See **NCR 21-01***
*(2) See **NCR 21-10***
*(3) See **NCR 21-11***
*(4) See **NCR 21-14***

APPENDIX E

ERRATA DATA

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There is no errata data for 2021.

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APPENDIX F

ANNUAL RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM REPORT (ARGPPR)

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Docket No: 50-254
50-265

QUAD CITIES NUCLEAR POWER STATION
UNITS 1 and 2

Annual Radiological
Groundwater Protection Program Report

1 January through 31 December 2021

Prepared By
Teledyne Brown Engineering
Environmental Services

Exelon Generation®

Quad Cities Nuclear Power Station
Cordova, IL 61242

April 2022

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Table Of Contents

Appendices

I. Summary and Conclusions

In 2006, Exelon undertook a Fleetwide Assessment of groundwater at and in the vicinity of its nuclear power generating facilities for the presence of radionuclides. The data collected from the Quad Cities Station as part of the Fleetwide Assessment was summarized in a report entitled "Hydrogeologic Investigation Report, Fleetwide Assessment, Quad Cities Generation Station, Cordova, Illinois", dated September 2006. This report on the Radiological Groundwater Protection Program (RGPP) conducted for the Quad Cities Nuclear Power Station (QCNPS) by Exelon Nuclear covers the period 01 January 2021 through 31 December 2021.

The Quad Cities Nuclear Power Station (QCNPS) has experienced leaks from underground piping and spills from systems containing radioactive water over its 40+ year history. These incidents have created a few areas of localized contamination within the owner-controlled area. The liquid scintillation analyses of groundwater in some of these areas show measurable concentrations of tritium (H-3).

On March 28, 2018, approximately three to four feet of water was observed in a Radwaste Piping Vault, located adjacent to monitoring well QC-GP-18. Samples were collected from the water in the vault as well as the groundwater in QC-GP-18. Both samples had tritium concentration of approximately 4.5 million pCi/L. Approximately 5,000 gallons of water was pumped from the vault and processed through the Station’s Radwaste System on March 28, 2018. Remediation of the groundwater near the RW Pipe Vault began on March 29, 2018 via pumping from monitoring well QC-GP-18 and processing through the Stations Radwaste System.

On March 29, 2018, the station contacted the Illinois Environmental Protection Agency (IEPA) and Illinois Emergency Management Agency (IEMA) to report a release of a radionuclide pursuant to 35 Ill. Adm. Code 1010.202. The station also notified the Nuclear Regulatory Commission (NRC) of these reports to state agencies to satisfy 10CFR50.72(b)(2)(xi), notification of the NRC for any event related to the health and safety of the public for which a notification to other government agencies has been or will be made (EN #53299).

The cause of release into the vault and QC-GP-18 was determined to be a leaking pipe clamp located within the RW Pipe Vault and degraded seams in the concrete vault which allowed water to seep from the vault into the surrounding groundwater. The pipe clamp was repaired and the concrete/degraded seams in the vault sealed.

On April 2, 2018, a remediation well (RW-1) was installed near the vault and QC-GP-18 to assist in remediating the tritium activity in groundwater. The remediation well began pumping groundwater on April 10, 2018 for processing through the Station’s Radwaste System. On May 2, 2018 effluent from RW-1 was routed to the Discharge bay for release. On May 7, 2018 effluent from QC-GP-18 was routed to the Discharge Bay for release. On November 24, 2018,

both well remediation pumps were shut down for the winter season.

Between April 16, 2019 and November 6, 2019, approximately 1.1 million gallons of groundwater was pumped from the vicinity of the RW Pipe Vault for remediation purposes. Between March 12, 2020 and December 22, 2020, approximately 1.8 million gallons of groundwater was pumped from the vicinity of the RW Pipe Vault for remediation purposes. There was no active pumping for remediation in the vicinity of the RW Pipe Vault in 2021 due to an underground Fire Protection modification in the vicinity of the RW Pipe Vault.

On March 10, 2021, groundwater sample results from well QC-GP-12 showed a tritium concentration of 2.8 million pCi/L. Sample results from nearby well QC-GP-16 showed a tritium concentration of 1.9 million pCi/L. QC-GP-12 and QC-GP-16 are located in the Condensate Storage Tank and ancillary piping area. Five additional groundwater monitoring wells were installed (Stick wells #1, #2, #4, and #5, and groundwater monitoring well MW-QC-117S) for assistance with leak detection location and groundwater monitoring. A new remediation well was installed (MW-R-2D2) and remediation commenced on March 15, 2021.

On March 10, 2021, the station contacted the Illinois Environmental Protection Agency (IEPA) and Illinois Emergency Management Agency (IEMA) to report a release of a radionuclide pursuant to 35 Ill. Adm. Code 1010.202. The station also notified the Nuclear Regulatory Commission (NRC) of the report to state agencies to satisfy 10CFR50.72(b)(2)(xi), notification of the NRC for any event related to the health and safety of the public for which a notification to other government agencies has been or will be made (EN #55132).

As part of the investigation to identify the source, the “B” Condensate Storage Tank was drained and inspected. During the inspection a hole measuring 1/4” x 5/16” (approximately the width of a pencil) was discovered on the tank floor which allowed water to seep into the surrounding groundwater. The hole was repaired prior to returning to service. In October 2021 the “B” Condensate Storage Tank floor was restored to original tank floor thickness and “A” Condensate Storage Tank floor was returned to original tank floor thickness in January 2022.

On March 12, 2021, an extraction well (MW-R-2D2) was installed near the Contaminated Condensate Storage Tank area to assist in remediating the tritium activity in groundwater. The extraction well began pumping groundwater on March 15, 2021, with effluent routed to Quad Cities Station’s permitted outfall 001/002. Between March 15, 2021, and December 20, 2021, approximately 14.9 million gallons of groundwater was pumped from the vicinity of the Condensate Storage Tank and ancillary piping area for remediation purposes. Remediation out of MW-R-2D2 is on-going. Prior to remediation QC-GP-12 tritium concentration was 3.2 million pCi/L. As of December 9, 2021, QC-GP-12 tritium concentration was 57,400pCi/L.

The RGPP designates wells into categories. Well designation categories include background, mid-field, perimeter, source and idle.

This report covers groundwater samples collected from the environment on station property in 2021. During that period, RGPP samples were collected from 39 locations.

2021 sample locations included 33 designated monitoring wells and 4 production wells (two of which are used for site drinking water), and 2 remediation wells. Sample frequency and analysis varies with well designation. Typical frequency/analysis include quarterly for tritium, annual for strontium, biennial for gamma, gross alpha, and every five years for iron-55 (Fe-55) and nickel-63 (Ni-63), depending on the designated well category. Samples from 19 of the designated monitoring wells were collected by a contractor (Environmental Inc.) and analyzed by a contract lab (Teledyne Brown) and onsite station personnel. The remaining sample locations were collected by site personnel and analyzed for tritium onsite by station personnel and by Teledyne Brown for tritium and other parameters.

In the case of tritium, Exelon specified that its contract laboratories achieve a lower limit of detection 10 times lower than that required by federal regulation. Most of the tritium that was detected in groundwater at the Station is on the south and west side of the Reactor/Turbine buildings. Tritium concentrations ranged from less than the LLD of 200 pCi/L up to 3,180,000 pCi/L in a monitoring well.

Gamma-emitting radionuclides analyses were performed on groundwater samples in 2020.

Strontium-89 (Sr-89) was not detected at concentrations greater than the Lower Limit of Detection (LLD) of 10.0 pCi/L. Strontium-90 (Sr-90) was detected at one location with concentrations ranging from 3.6 - 9.6 pCi/L.

Gross Alpha analyses in the dissolved and suspended fractions were performed on groundwater samples in 2020. However, due to the “B” CCST event Gross Alpha analyses were performed at one location. Gross Alpha (dissolved) was not detected at concentrations greater than the Lower Limit of Detection (LLD). Gross Alpha (suspended) was not detected at concentrations greater than the Lower Limit of Detection (LLD).

Select Transuranic/Hard-To-Detect analyses were performed on 1 monitoring well. The analyses included Am-241, Cm-242, Cm-243/244, Pu-238, Pu-239/240, U-234, U-235, U-238, Fe-55 and Ni-63. U-234 was detected at one location with a concentration of 0.49 pCi/L. U-238 was detected at one location at a concentration of 0.60 pCi/L. U-234 and U-238 are commonly found in groundwater at low concentrations due to the naturally-occurring Radium (Uranium) Decay Series. All other Select Transuranic/Hard-To-Detect nuclides were not detected at concentrations greater than their respective MDCs.

In assessing all the data gathered for this report, it was concluded that the operation of QCNPS had no adverse radiological impact on the environment offsite of QCNPS.

II. Introduction

The Quad Cities Nuclear Power Station (QCNPS), consisting of two 2957 MWth boiling water reactor owned and operated by Exelon Corporation, is located in Cordova, Illinois along the Mississippi River. Unit No. 1 went critical on 16 March 1972. Unit No. 2 went critical on 02 December 1973. The site is located in northern Illinois, approximately 182 miles west of Chicago, Illinois.

A. Objectives of the RGPP

The long-term objectives of the RGPP are as follows:

1. Identify suitable locations to monitor and evaluate potential impacts from station operations before significant radiological impact to the environment and potential drinking water sources.
2. Understand the local hydrogeologic regime in the vicinity of the station and maintain up-to-date knowledge of flow patterns on the surface and shallow subsurface.
3. Perform routine water sampling and radiological analysis of water from selected locations.
4. 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 QCNPS as discussed below:

1. Exelon and its consultant identified locations as described in the Phase 1 study. Phase 1 studies were conducted by Conestoga Rovers and Associates (CRA) and the results and conclusions were made available to state and federal regulators in station specific reports.
2. The QCNPS reports describe the local hydrogeologic regime. Periodically, the flow patterns on the surface and shallow subsurface are updated based on ongoing measurements.
3. QCNPS will continue to perform routine sampling and radiological analysis of water from selected locations.
4. QCNPS has implemented procedures to identify and report leaks, spills, or other detections with potential radiological significance in a timely manner.

5. QCNPS 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, Appendix A.

Groundwater

Samples of water are collected, managed, transported and analyzed in accordance with approved procedures following regulatory methods. 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, analysis and shipment of samples, as well as in documentation of sampling events. Analytical laboratories are subject to internal quality assurance programs, 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.

III. Program Description

This section covers those analyses performed by Teledyne Brown Engineering (TBE) on samples collected in 2021.

A. Sample Analysis

This section describes the general analytical methodologies used by TBE and station personnel to analyze the environmental samples for radioactivity for the Quad Cities Nuclear Power Station RGPP in 2021. Sample analysis and frequency is based upon well location, assessed risk, and site hydrogeology as described in the RGPP.

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

1. Concentrations of gamma emitters in groundwater
2. Concentrations of strontium in groundwater
3. Concentrations of tritium in groundwater
4. Concentration of gross alpha 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 QCNPS becoming operational were used as a baseline with which these operational data were compared. For the purpose of this report, QCNPS 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 specified by federal regulation as a minimum sensitivity value that must be achieved routinely by the analytical parameter.

2. Laboratory Measurements Uncertainty

   The estimated uncertainty in measurement of tritium in environmental

samples is frequently on the order of 50% of the measurement value.

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

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

For groundwater 14 nuclides, Be-7, K-40, Mn-54, Co-58, Fe-59, Co-60, Zn-65, Nb-95, Zr-95, I-131, Cs-134, Cs-137, Ba-140 and La-140 were reported in 2020.

IV. Results and Discussion

A. Groundwater Results

Groundwater samples were collected from on-site wells in accordance with the station RGPP. Analytical results and anomalies are discussed below:

Tritium

Samples from all locations were analyzed for tritium activity (Table B–I.1 & B-II.1 Appendix B). Tritium values ranged from less than LLD of 200 pCi/L to 3,180,000 pCi/L. Samples obtained near the site boundaries were <200 pCi/L. Based on Quad Cities 2017 GHD Hydrogeological Investigation Report, “there is no risk of exposure associated with groundwater ingestion off Station property”, “there is no risk of exposure associated with groundwater ingestion at the Station” and “there is no current risk of exposure associated with surface water users off the Station property. The location most representative of potential offsite user of drinking water was <200 pCi/L.

Strontium

Sr-89 was not detected above the Lower Limit of Detection of 10.0 pCi/L. Sr-90 was detected at one location with concentrations ranging from 3.6 – 9.6 pCi/L. All other sample results were not above the Lower Limit of Detection (LLD) of 1.0 pCi/L. (Table B–I.1 Appendix B)

Gross Alpha (dissolved and suspended)

Gross Alpha analyses in the dissolved and suspended fractions were performed on designated groundwater locations in 2021. Gross Alpha (dissolved) was not detected at concentrations greater than the LLD. Gross Alpha (suspended) was not detected at concentrations greater than the LLD. However, due to the “B” CCST event Gross Alpha analyses were performed at one location. Gross Alpha (dissolved) was not detected at concentrations greater than the Lower Limit of Detection (LLD). Gross Alpha (suspended) was not detected at concentrations greater than the Lower Limit of Detection (LLD).

Gamma Emitters

Gamma analyses were performed on designated groundwater locations in 2020. (Table B–I.2, Appendix B).

Select Transuranics/Hard-To-Detect

Select Transuranic/Hard-To-Detect analyses were performed on 1 groundwater location. The analyses included Am-241, Cm-242, Cm-243/244, Pu-238, Pu-239/240, U-234, U-235, U-238, Fe-55 and Ni-63. U-234 was detected at one location with a concentration of 0.49 pCi/L. U-238 was detected at one location with a concentration of 0.60 pCi/L.

U-234 and U-238 are commonly found in groundwater at low concentrations due to the naturally-occurring Radium (Uranium) Decay Series. The concentrations of U-234 and U-238 discussed above are considered to be background and are not the result of station effluents. All other Select Transuranic/Hard-To-Detect nuclides were not detected at concentrations greater than their respective MDCs.
(Table B–I.3 Appendix B).

B. Summary of Results – Inter-Laboratory Comparison Program

Inter-Laboratory Comparison Program results for TBE are presented in the Annual Radiological Environmental Operating Report.

C. Leaks, Spills, and Releases

There was one leak/release identified during the year. On March 10, 2021, groundwater sample results from well QC-GP-12 showed a tritium concentration of 2.8 million pCi/L. Sample results from nearby well QC-GP-16 showed a tritium concentration of 1.9 million pCi/L. QC-GP-12 and QC-GP-16 are located in the Condensate Storage Tank and ancillary piping area. Five additional groundwater monitoring wells were installed (Stick wells #1, #2, #4, and #5, and groundwater monitoring well MW-QC-117S) for assistance with leak detection location and groundwater monitoring. A new remediation well was installed (MW-R-2D2) and remediation commenced on March 15, 2021.

On March 10, 2021, the station contacted the Illinois Environmental Protection Agency (IEPA) and Illinois Emergency Management Agency (IEMA) to report a release of a radionuclide pursuant to 35 Ill. Adm. Code 1010.202. The station also notified the Nuclear Regulatory Commission (NRC) of the report to state agencies to satisfy 10CFR50.72(b)(2)(xi), notification of the NRC for any event related to the health and safety of the public for which a notification to other government agencies has been or will be made (EN #55132).

D. Trends

Overall, groundwater tritium concentrations have been decreasing over time at the Station.

E. Investigations

Currently no investigations are on-going.

F. Actions Taken

1. Compensatory Actions

   There have been no station events requiring compensatory actions at the Quad Cities Nuclear Power Station in 2021.

2. Actions to Recover/Reverse Plumes

   Remediation of the March 28, 2018 Radwaste Pipe Vault began on March 29, 2018 via pumping of groundwater from monitoring well QC-GP-18 and processing through the Stations Radwaste System. On April 2, 2018, a remediation well (RW-1) was installed near the vault and QC-GP-18 to assist in remediating the tritium activity in groundwater. The remediation well began pumping groundwater on April 10, 2018 for processing through the Station's Radwaste System. On May 2, 2018 effluent from RW-1 was routed to the Discharge bay for release. On May 7, 2018 effluent from QC-GP-18 was routed to the Discharge Bay for release. On November 24, 2018, both well remediation pumps were shut down for the winter season. Between March 29, 2018, and November 24, 2018, approximately 1.8 million gallons of groundwater was pumped from the vicinity of the RW Pipe Vault for remediation purposes. Between April 16, 2019 and November 6, 2019, approximately 1.1 million gallons of groundwater was pumped from the vicinity of the RW Pipe Vault for remediation purposes. Between March 12, 2020 and December 22, 2020, approximately 1.8 million gallons of groundwater was pumped from the vicinity of the RW Pipe Vault for remediation purposes. There was no active pumping for remediation in the vicinity of the RW Pipe Vault in 2021 due to an underground Fire Protection modification in the vicinity of the RW Pipe Vault.

   On March 12, 2021, an extraction well (MW-R-2D2) was installed near the Contaminated Condensate Storage Tank area to assist in remediating the tritium activity in groundwater. The extraction well began pumping groundwater on March 15, 2021, with effluent routed to Quad Cities Station's permitted outfall 001/002. Between March 15, 2021, and December 20, 2021, approximately 14.9 million gallons of groundwater was pumped from the vicinity of the Condensate Storage Tank and ancillary piping area for remediation purposes. Remediation out of MW-R-2D2 is on-going. Quad Cities Station Migration Control Plan (MCP) continues to employ Monitored Natural Attenuation for remediation of legacy H-3 plumes.

APPENDIX A

LOCATION DESIGNATION

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TABLE A-1: Radiological Groundwater Protection Program - Sampling Locations
Quad Cities Nuclear Power Station, 2021

Site	Site Type	Well Designation	Minimum Sample Frequency
MW-QC-1	Monitoring Well	Source	Quarterly
MW-QC-2	Monitoring Well	Mid-Field	Semi-Annual
MW-QC-3	Monitoring Well	Source	Quarterly
MW-QC-101I	*Monitoring Well*	*Idle*	*Not Required*
MW-QC-101S	*Monitoring Well*	*Idle*	*Not Required*
MW-QC-102D	Monitoring Well	Perimeter	Annual
MW-QC-102I	Monitoring Well	Mid-Field	Semi-Annual
MW-QC-102S	Monitoring Well	Perimeter	Annual
MW-QC-103I	Monitoring Well	Source	Quarterly
MW-QC-104S	Monitoring Well	Source	Quarterly
MW-QC-105I	Monitoring Well	Source	Quarterly
MW-QC-106I	Monitoring Well	Mid-Field	Semi-Annual
MW-QC-106S	Monitoring Well	Mid-Field	Semi-Annual
MW-QC-107I	Monitoring Well	Background	Annual
MW-QC-108D	Monitoring Well	Perimeter	Annual
MW-QC-108I	Monitoring Well	Mid-Field	Semi-Annual
MW-QC-108S	Monitoring Well	Perimeter	Annual
MW-QC-109I	Monitoring Well	Mid-Field	Semi-Annual
MW-QC-109S	Monitoring Well	Perimeter	Annual
MW-QC-110I	*Monitoring Well*	*Idle*	*Not Required*
MW-QC-111D1	*Monitoring Well*	*Idle*	*Not Required*
MW-QC-111D2	*Monitoring Well*	*Idle*	*Not Required*
MW-QC-111I	*Monitoring Well*	*Idle*	*Not Required*
MW-QC-112I	Monitoring Well	Perimeter	Annual
MW-QC-113I	*Monitoring Well*	*Idle*	*Not Required*
MW-QC-114I	*Monitoring Well*	*Idle*	*Not Required*
MW-QC-115S	*Monitoring Well*	*Idle*	*Not Required*
MW-QC-116S	*Monitoring Well*	*Idle*	*Not Required*
MW-QC-117S	Monitoring Well	Source	Quarterly
MW-R-2D2	Remediation Well	Mid-Field	Semi-Annual
SURFACE WATER #1	*Surface Water*	*Idle*	*Not Required*
SURFACE WATER #2	*Surface Water*	*Idle*	*Not Required*
WELL #1	Production Well	*Idle*	*Not Required*
WELL #5	Production Well	*Idle*	*Not Required*
WELL #6 LITTLE FISH	*Production Well*	*Idle*	*Not Required*
WELL #7 BIG FISH WELL	Production Well	Mid-Field	Semi-Annual
WELL #8 FIRE TRAINING WELL	*Production Well*	*Idle*	*Not Required*
WELL #9 Dry Cask Storage	Production Well	Background	Annual
WELL #10 FISH HOUSE WELL	*Production Well*	*Idle*	*Not Required*
WELL #11 SPRAY CANAL WELL	*Production Well*	*Idle*	*Not Required*
STP SAND POINT WELL	*Production Well*	*Idle*	*Not Required*
QC-GP-1	Sentinel Well	Source	Quarterly
QC-GP-2	Sentinel Well	Source	Quarterly
QC-GP-3	*Sentinel Well*	*Idle*	*Not Required*
QC-GP-4	Sentinel Well	Source	Quarterly
QC-GP-5	Sentinel Well	Source	Quarterly
QC-GP-6	*Sentinel Well*	*Idle*	*Not Required*
QC-GP-7	Sentinel Well	*Idle*	*Not Required*
QC-GP-8	*Sentinel Well*	*Idle*	*Not Required*
QC-GP-9	Sentinel Well	Source	Quarterly
QC-GP-10	Sentinel Well	Source	Quarterly
QC-GP-11	*Sentinel Well*	*Idle*	*Not Required*
QC-GP-12	Sentinel Well	Source	Quarterly
QC-GP-13	Sentinel Well	*Idle*	*Not Required*
QC-GP-14	Sentinel Well	Mid-Field	Semi-Annual
QC-GP-15	Sentinel Well	Source	Quarterly
QC-GP-16	Sentinel Well	*Idle*	*Not Required*
QC-GP-17	Sentinel Well	Source	Quarterly
QC-GP-18	Sentinel Well	Source	Quarterly
QC-RW-1	Remediation Well	Mid-Field	Semi-Annual

Note: Idle designated wells are not required to be sampled as part of the RGPP

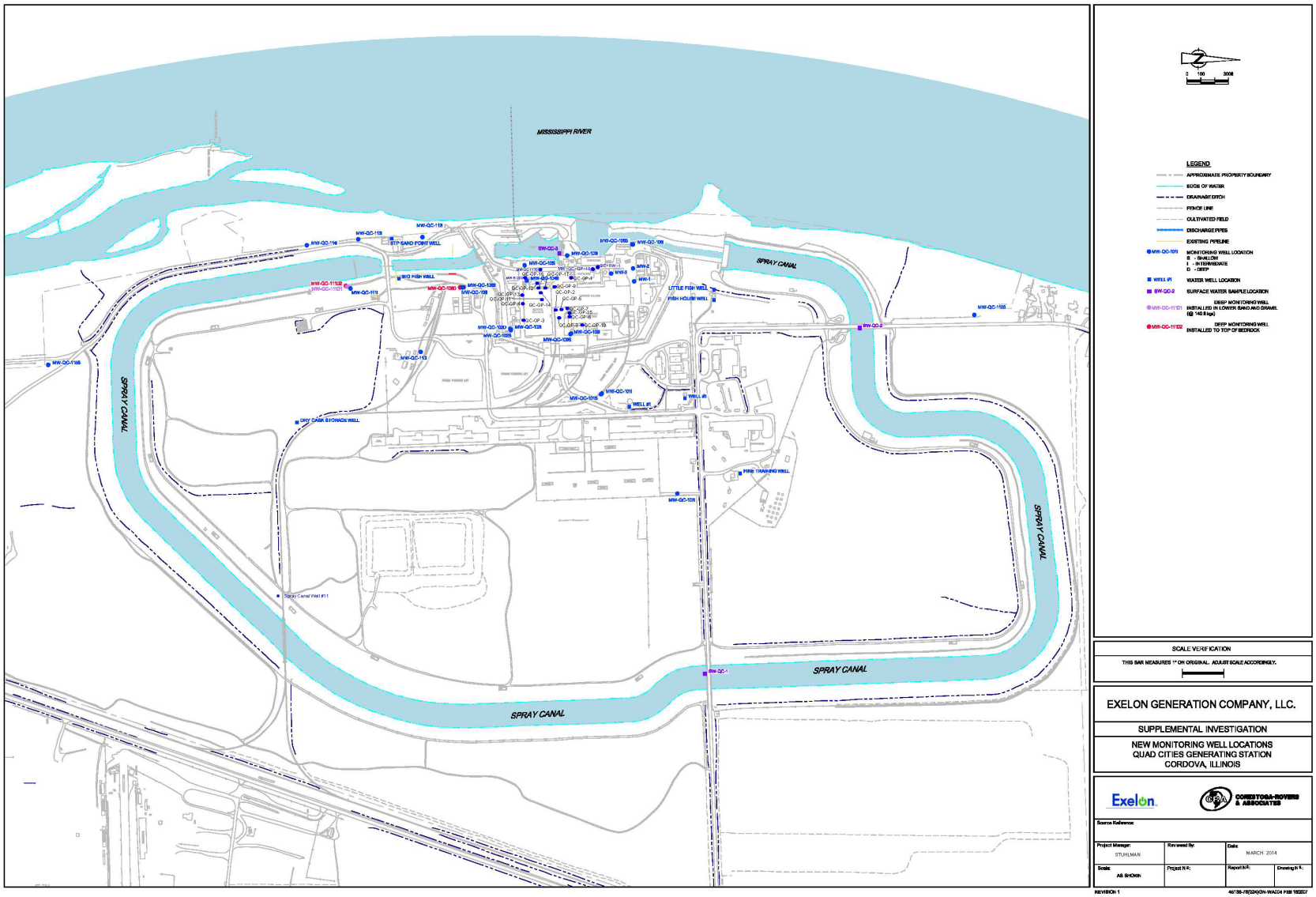

FIGURE A-1
Sampling Locations Near the Site Boundary of the Quad Cities Nuclear Power Station, 2021

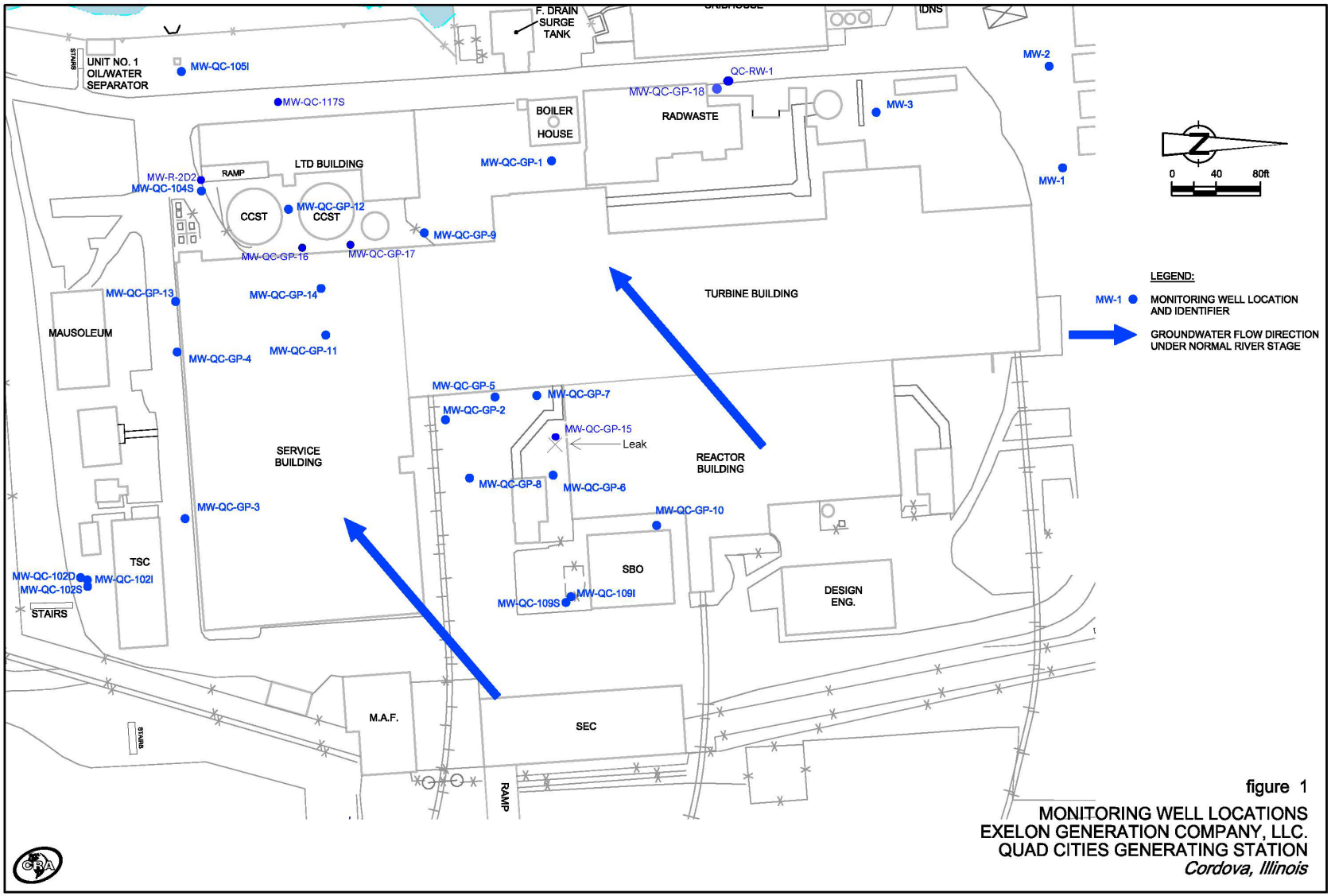

FIGURE A-2
Sentinel Monitoring Point Locations, Quad Cities Nuclear Power Station, 2021

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APPENDIX B

DATA TABLES

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TABLE B-I.1 **CONCENTRATIONS OF TRITIUM, STRONTIUM AND GROSS ALPHA IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF QUAD CITIES NUCLEAR POWER STATION, 2021**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	H-3	Sr-89	Sr-90	Gr-A (Dis)	Gr-A (Sus)
MW-QC-1	03/01/21	< 182	< 6.6	< 0.7		
MW-QC-1	05/26/21	< 190				
MW-QC-1	09/09/21	201 ± 117				
MW-QC-1	11/03/21	< 179				
MW-QC-2	03/01/21	< 181				
MW-QC-2	09/09/21	< 181				
MW-QC-3	03/01/21	655 ± 143	< 7.9	< 0.8		
MW-QC-3	05/26/21	1370 ± 209				
MW-QC-3	09/09/21	2830 ± 348				
MW-QC-3	11/03/21	1750 ± 245				
MW-QC-102D	03/02/21	< 179				
MW-QC-102I	03/02/21	< 185				
MW-QC-102I	09/09/21	< 186				
MW-QC-102S	03/02/21	< 180				
MW-QC-103I	03/02/21	< 179	< 5.8	< 0.8		
MW-QC-103I	05/26/21	< 188				
MW-QC-103I	09/09/21	< 182				
MW-QC-103I	11/04/21	< 184				
MW-QC-104S	03/02/21	499 ± 136	< 5.8	< 0.8		
MW-QC-104S	05/25/21	503000 ± 49000				
MW-QC-104S	09/09/21	3220 ± 389				
MW-QC-104S	11/04/21	14200 ± 1470				
MW-QC-105I	03/02/21	1520 ± 222	< 5.2	< 0.8		
MW-QC-105I	05/26/21	< 188				
MW-QC-105I	09/09/21	< 186				
MW-QC-105I	11/04/21	< 188				
MW-QC-106I	03/01/21	< 175				
MW-QC-106I	09/09/21	< 183				
MW-QC-106S	03/01/21	< 178				
MW-QC-106S	09/09/21	< 186				
MW-QC-107I	03/01/21	< 182				
MW-QC-108D	03/01/21	< 182				
MW-QC-108I	03/01/21	< 182				
MW-QC-108I	09/09/21	< 186				
MW-QC-108S	03/01/21	223 ± 120				
MW-QC-109I	03/01/21	< 184				
MW-QC-109I	09/09/21	< 187				
MW-QC-109S	03/01/21	< 181				
MW-QC-112I	03/01/21	< 179				
MW-QC-117S	09/09/21	< 178	< 7.3	< 0.4		
MW-QC-117S	11/04/21	< 186				
MW-R-2D2	09/15/21	4680 ± 526				
QC-GP-1	03/02/21	1810 ± 243	< 9.4	< 0.9		
QC-GP-1	05/25/21	824 ± 161				
QC-GP-1	09/14/21	630 ± 141				
QC-GP-1	11/03/21	814 ± 147				

TABLE B-I.1 **CONCENTRATIONS OF TRITIUM, STRONTIUM AND GROSS ALPHA IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF QUAD CITIES NUCLEAR POWER STATION, 2021**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	H-3	Sr-89	Sr-90	Gr-A (Dis)	Gr-A (Sus)
QC-GP-2	03/03/21	< 173	< 8.0	< 0.8		
QC-GP-2	05/25/21	< 191				
QC-GP-2	09/14/21	< 193				
QC-GP-2	11/03/21	< 177				
QC-GP-4	03/02/21	7500 ± 804	< 5.9	< 0.9		
QC-GP-4	05/25/21	5280 ± 590				
QC-GP-4	09/15/21	4490 ± 512				
QC-GP-4	11/03/21	5400 ± 596				
QC-GP-5	03/03/21	1460 ± 210	< 7.4	4.6 ± 1		
QC-GP-5	05/25/21	1670 ± 239	< 7.4	3.6 ± 1		
QC-GP-5	09/14/21	< 182	< 9.1	9.6 ± 1		
QC-GP-5	11/03/21	< 177	< 2.3	5.2 ± 1		
QC-GP-9	03/02/21	1450 ± 210	< 8.4	< 0.8		
QC-GP-9	05/25/21	2020 ± 274				
QC-GP-9	09/14/21	902 ± 163				
QC-GP-9	11/03/21	565 ± 140				
QC-GP-10	03/03/21	< 171	< 5.5	< 0.9		
QC-GP-10	05/25/21	< 191				
QC-GP-10	09/14/21	< 177				
QC-GP-10	11/03/21	< 175				
QC-GP-12	03/03/21	3180000 ± 298000	< 8.7	< 1.0	< 0.5	< 0.9
QC-GP-12	05/24/21	676000 ± 61300				
QC-GP-12	09/14/21	184000 ± 18000				
QC-GP-12	11/04/21	141000 ± 14000				
QC-GP-12	11/04/21	145000 ± 14400				
QC-GP-12	11/04/21	142000 ± 14200				
QC-GP-12	12/09/21	57400 ± 5770				
QC-GP-14	03/04/21	< 184				
QC-GP-14	09/15/21	< 183				
QC-GP-15	03/03/21	< 182	< 6.2	< 0.9		
QC-GP-15	05/25/21	< 188				
QC-GP-15	09/14/21	< 187				
QC-GP-15	11/03/21	< 167				
QC-GP-17	03/03/21	682 ± 147	< 8.4	< 0.9		
QC-GP-17	05/24/21	268 ± 125				
QC-GP-17	09/14/21	1230 ± 192				
QC-GP-17	11/04/21	2750 ± 336				
QC-GP-18	03/03/21	1750 ± 244	< 6.7	< 0.8		
QC-GP-18	05/26/21	2090 ± 269				
QC-GP-18	09/15/21	1960 ± 259				
QC-GP-18	11/03/21	601 ± 142				
QC-RW-1	03/03/21	29700 ± 3020				
QC-RW-1	09/15/21	35900 ± 3630				
WELL #7 BIG FISH	03/01/21	< 186				
WELL #7 BIG FISH	09/14/21	< 175				
WELL #9 DRY CASK STORAGE	03/03/21	< 181				

TABLE B-I.2

CONCENTRATIONS OF GAMMA EMITTERS IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF QUAD CITIES NUCLEAR POWER STATION, 2021

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

No Groundwater Samples Analyzed for Gamma Nuclides in 2021

TABLE B-I.3 **CONCENTRATIONS OF HARD-TO-DETECTS IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF QUAD CITIES NUCLEAR POWER STATION, 2021**

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-QC-1	03/01/21									< 134	< 4.0
MW-QC-3	03/01/21									< 82	< 3.7
MW-QC-103I	03/02/21									< 62	< 4.9
MW-QC-104S	03/02/21									< 131	< 4.9
MW-QC-105I	03/02/21									< 185	< 3.9
MW-QC-117S	09/09/21									< 86	< 5.0
QC-GP-1	03/02/21									< 39	< 4.6
QC-GP-2	03/03/21									< 39	< 4.2
QC-GP-4	03/02/21									< 97	< 4.2
QC-GP-5	03/03/21									< 104	< 4.2
QC-GP-9	03/02/21									< 71	< 4.2
QC-GP-10	03/03/21									< 51	< 4.6
QC-GP-12	03/03/21									< 189	< 4.0
QC-GP-15	03/03/21									< 103	< 4.1
QC-GP-17	03/03/21									< 83	< 4.0
QC-GP-18	03/03/21	< 0.13	< 0.03	< 0.05	< 0.04	< 0.07	0.49 ± 0.24	< 0.13	0.60 ± 0.27	< 103	< 4.1

TABLE B-II.1 CONCENTRATIONS OF TRITIUM IN GROUNDWATER SAMPLES COLLECTED AND ANALYZED BY QUAD CITIES STATION PERSONNEL, 2021

RESULTS IN UNITS OF PCI/LITER

SITE	COLLECTION DATE	ACTIVITY	AQUIFER
QC-GP-1	03/02/21	<2,000	Sentinel Well
QC-GP-1	05/25/21	<2,000	Sentinel Well
QC-GP-1	09/14/21	<2,000	Sentinel Well
QC-GP-1	11/03/21	<2,000	Sentinel Well
QC-GP-2	03/03/21	<2,000	Sentinel Well
QC-GP-2	05/25/21	<2,000	Sentinel Well
QC-GP-2	09/14/21	<2,000	Sentinel Well
QC-GP-2	11/03/21	<2,000	Sentinel Well
QC-GP-4	03/02/21	8,190	Sentinel Well
QC-GP-4	03/30/21	6,310	Sentinel Well
QC-GP-4	04/06/21	5,480	Sentinel Well
QC-GP-4	04/19/21	5,080	Sentinel Well
QC-GP-4	05/04/21	5,380	Sentinel Well
QC-GP-4	05/18/21	4,670	Sentinel Well
QC-GP-4	05/25/21	5,490	Sentinel Well
QC-GP-4	06/01/21	6,370	Sentinel Well
QC-GP-4	07/01/21	6,100	Sentinel Well
QC-GP-4	08/09/21	6,540	Sentinel Well
QC-GP-4	09/15/21	5,270	Sentinel Well
QC-GP-4	11/03/21	5,500	Sentinel Well
QC-GP-5	03/03/21	<2,000	Sentinel Well
QC-GP-5	05/25/21	<2,000	Sentinel Well
QC-GP-5	09/14/21	<2,000	Sentinel Well
QC-GP-5	11/03/21	<2,000	Sentinel Well
QC-GP-7	03/27/21	2,154	Sentinel Well
QC-GP-7	09/14/21	2,033	Sentinel Well
QC-GP-9	03/02/21	< 2000	Sentinel Well
QC-GP-9	03/22/21	2,430	Sentinel Well
QC-GP-9	03/30/21	< 2000	Sentinel Well
QC-GP-9	04/06/21	2,180	Sentinel Well
QC-GP-9	04/19/21	< 2000	Sentinel Well
QC-GP-9	05/04/21	2,490	Sentinel Well
QC-GP-9	05/18/21	< 2000	Sentinel Well
QC-GP-9	05/25/21	< 2000	Sentinel Well
QC-GP-9	06/01/21	< 2000	Sentinel Well
QC-GP-9	07/01/21	2,160	Sentinel Well
QC-GP-9	08/09/21	2,040	Sentinel Well
QC-GP-9	09/14/21	< 2000	Sentinel Well
QC-GP-9	11/03/21	< 2000	Sentinel Well
QC-GP-10	03/03/21	< 2000	Sentinel Well
QC-GP-10	05/25/21	< 2000	Sentinel Well
QC-GP-10	09/14/21	< 2000	Sentinel Well
QC-GP-10	11/03/21	< 2000	Sentinel Well
QC-GP-12	03/03/21	2,640,000	Sentinel Well
QC-GP-12	03/07/21	2,780,000	Sentinel Well
QC-GP-12	03/10/21	2,760,000	Sentinel Well
QC-GP-12	03/12/21	2,820,000	Sentinel Well
QC-GP-12	03/14/21	2,710,000	Sentinel Well
QC-GP-12	03/16/21	2,680,000	Sentinel Well
QC-GP-12	03/17/21	2,680,000	Sentinel Well
QC-GP-12	03/18/21	2,700,000	Sentinel Well
QC-GP-12	03/19/21	2,680,000	Sentinel Well

TABLE B-II.1 CONCENTRATIONS OF TRITIUM IN GROUNDWATER SAMPLES COLLECTED AND ANALYZED BY QUAD CITIES STATION PERSONNEL, 2021

RESULTS IN UNITS OF PCI/LITER

SITE	COLLECTION DATE	ACTIVITY	AQUIFER
QC-GP-12	03/20/21	2,710,000	Sentinel Well
QC-GP-12	03/21/21	2,700,000	Sentinel Well
QC-GP-12	03/22/21	2,680,000	Sentinel Well
QC-GP-12	03/24/21	2,660,000	Sentinel Well
QC-GP-12	03/26/21	2,630,000	Sentinel Well
QC-GP-12	03/28/21	2,650,000	Sentinel Well
QC-GP-12	03/29/21	2,430,000	Sentinel Well
QC-GP-12	03/31/21	2,660,000	Sentinel Well
QC-GP-12	04/02/21	2,710,000	Sentinel Well
QC-GP-12	04/04/21	2,700,000	Sentinel Well
QC-GP-12	04/05/21	2,690,000	Sentinel Well
QC-GP-12	04/07/21	2,690,000	Sentinel Well
QC-GP-12	04/09/21	2,670,000	Sentinel Well
QC-GP-12	04/13/21	2,720,000	Sentinel Well
QC-GP-12	04/19/21	2,650,000	Sentinel Well
QC-GP-12	04/27/21	1,810,000	Sentinel Well
QC-GP-12	05/04/21	701,000	Sentinel Well
QC-GP-12	05/10/21	899,000	Sentinel Well
QC-GP-12	05/18/21	712,000	Sentinel Well
QC-GP-12	05/24/21	632,000	Sentinel Well
QC-GP-12	06/01/21	741,000	Sentinel Well
QC-GP-12	06/09/21	416,000	Sentinel Well
QC-GP-12	07/01/21	512,000	Sentinel Well
QC-GP-12	08/09/21	462,000	Sentinel Well
QC-GP-12	09/14/21	173,000	Sentinel Well
QC-GP-12	11/04/21	73,900	Sentinel Well
QC-GP-12	12/09/21	64,400	Sentinel Well
QC-GP-13	03/07/21	<2,000	Sentinel Well
QC-GP-13	03/12/21	32,300	Sentinel Well
QC-GP-13	03/16/21	2,420	Sentinel Well
QC-GP-13	03/18/21	<2,000	Sentinel Well
QC-GP-13	03/22/21	<2,000	Sentinel Well
QC-GP-14	03/04/21	<2,000	Sentinel Well
QC-GP-14	03/07/21	<2,000	Sentinel Well
QC-GP-14	03/11/21	<2,000	Sentinel Well
QC-GP-14	03/13/21	<2,000	Sentinel Well
QC-GP-14	03/18/21	<2,000	Sentinel Well
QC-GP-14	03/22/21	<2,000	Sentinel Well
QC-GP-14	03/30/21	<2,000	Sentinel Well
QC-GP-14	04/06/21	<2,000	Sentinel Well
QC-GP-14	04/19/21	<2,000	Sentinel Well
QC-GP-14	05/04/21	<2,000	Sentinel Well
QC-GP-14	05/18/21	<2,000	Sentinel Well
QC-GP-14	06/01/21	<2,000	Sentinel Well
QC-GP-14	07/01/21	<2,000	Sentinel Well
QC-GP-14	08/09/21	<2,000	Sentinel Well
QC-GP-14	09/15/21	<2,000	Sentinel Well
QC-GP-14	10/27/21	<2,000	Sentinel Well
QC-GP-15	03/03/21	<2,000	Sentinel Well
QC-GP-15	05/25/21	<2,000	Sentinel Well
QC-GP-15	09/14/21	<2,000	Sentinel Well
QC-GP-15	11/03/21	<2,000	Sentinel Well

TABLE B-II.1 CONCENTRATIONS OF TRITIUM IN GROUNDWATER SAMPLES COLLECTED AND ANALYZED BY QUAD CITIES STATION PERSONNEL, 2021

RESULTS IN UNITS OF PCI/LITER

SITE	COLLECTION DATE	ACTIVITY	AQUIFER
QC-GP-16	03/07/21	657,000	Sentinel Well
QC-GP-16	03/08/21	1,120,000	Sentinel Well
QC-GP-16	03/10/21	1,940,000	Sentinel Well
QC-GP-16	03/12/21	2,810,000	Sentinel Well
QC-GP-16	03/14/21	2,840,000	Sentinel Well
QC-GP-16	03/16/21	831,000	Sentinel Well
QC-GP-16	03/17/21	1,110,000	Sentinel Well
QC-GP-16	03/18/21	1,680,000	Sentinel Well
QC-GP-16	03/19/21	1,620,000	Sentinel Well
QC-GP-16	03/20/21	1,260,000	Sentinel Well
QC-GP-16	03/21/21	751,000	Sentinel Well
QC-GP-16	03/22/21	461,000	Sentinel Well
QC-GP-16	03/24/21	181,000	Sentinel Well
QC-GP-16	03/26/21	84,300	Sentinel Well
QC-GP-16	03/28/21	47,100	Sentinel Well
QC-GP-16	03/29/21	28,400	Sentinel Well
QC-GP-16	03/31/21	9,550	Sentinel Well
QC-GP-16	04/02/21	<2,000	Sentinel Well
QC-GP-16	04/04/21	<2,000	Sentinel Well
QC-GP-16	04/05/21	<2,000	Sentinel Well
QC-GP-16	04/07/21	<2,000	Sentinel Well
QC-GP-16	04/09/21	3,570	Sentinel Well
QC-GP-16	04/13/21	4,570	Sentinel Well
QC-GP-16	04/19/21	<2,000	Sentinel Well
QC-GP-16	04/27/21	<2,000	Sentinel Well
QC-GP-16	05/10/21	<2,000	Sentinel Well
QC-GP-16	05/24/21	<2,000	Sentinel Well
QC-GP-16	06/09/21	<2,000	Sentinel Well
QC-GP-16	07/01/21	<2,000	Sentinel Well
QC-GP-16	08/09/21	<2,000	Sentinel Well
QC-GP-16	09/14/21	<2,000	Sentinel Well
QC-GP-16	10/27/21	<2,000	Sentinel Well
QC-GP-17	03/03/21	<2,000	Sentinel Well
QC-GP-17	03/07/21	<2,000	Sentinel Well
QC-GP-17	03/10/21	<2,000	Sentinel Well
QC-GP-17	03/12/21	<2,000	Sentinel Well
QC-GP-17	03/16/21	<2,000	Sentinel Well
QC-GP-17	03/18/21	<2,000	Sentinel Well
QC-GP-17	03/25/21	<2,000	Sentinel Well
QC-GP-17	03/31/21	<2,000	Sentinel Well
QC-GP-17	04/13/21	<2,000	Sentinel Well
QC-GP-17	04/27/21	<2,000	Sentinel Well
QC-GP-17	05/10/21	<2,000	Sentinel Well
QC-GP-17	05/24/21	<2,000	Sentinel Well
QC-GP-17	06/09/21	<2,000	Sentinel Well
QC-GP-17	07/01/21	<2,000	Sentinel Well
QC-GP-17	08/09/21	<2,000	Sentinel Well
QC-GP-17	09/14/21	<2,000	Sentinel Well
QC-GP-17	11/04/21	2,250	Sentinel Well
QC-GP-18	03/03/21	2,060	Sentinel Well
QC-GP-18	05/26/21	2,260	Sentinel Well
QC-GP-18	09/15/21	<2,000	Sentinel Well

TABLE B-II.1 CONCENTRATIONS OF TRITIUM IN GROUNDWATER SAMPLES COLLECTED AND ANALYZED BY QUAD CITIES STATION PERSONNEL, 2021

RESULTS IN UNITS OF PCI/LITER

SITE	COLLECTION DATE	ACTIVITY	AQUIFER
QC-GP-18	11/03/21	<2,000	Sentinel Well
QC-RW-1	03/03/21	29,600	Remediation Well
QC-RW-1	05/26/21	61,900	Remediation Well
QC-RW-1	09/15/21	36,400	Remediation Well
Well #7	03/01/21	<2,000	Production Well
Well #7	09/14/21	<2,000	Production Well
Well #9	03/03/21	<200	Production Well
Well #1	05/27/21	<200	Production Well
Well #1	10/04/21	<200	Production Well
Well #5	05/27/21	<200	Production Well
Well #5	10/04/21	<200	Production Well
MW-R-2D2	03/13/21	<2,000	Remediation Well
MW-R-2D2	03/15/21	<2,000	Remediation Well
MW-R-2D2	03/15/21	9,290	Remediation Well
MW-R-2D2	03/16/21	63,900	Remediation Well
MW-R-2D2	03/17/21	44,100	Remediation Well
MW-R-2D2	03/18/21	28,900	Remediation Well
MW-R-2D2	03/19/21	26,800	Remediation Well
MW-R-2D2	03/20/21	17,500	Remediation Well
MW-R-2D2	03/21/21	18,100	Remediation Well
MW-R-2D2	03/22/21	19,400	Remediation Well
MW-R-2D2	03/23/21	20,300	Remediation Well
MW-R-2D2	03/24/21	22,200	Remediation Well
MW-R-2D2	03/25/21	18,400	Remediation Well
MW-R-2D2	03/26/21	16,300	Remediation Well
MW-R-2D2	03/27/21	15,300	Remediation Well
MW-R-2D2	03/28/21	17,300	Remediation Well
MW-R-2D2	03/29/21	16,000	Remediation Well
MW-R-2D2	03/30/21	17,400	Remediation Well
MW-R-2D2	03/31/21	20,500	Remediation Well
MW-R-2D2	04/01/21	19,500	Remediation Well
MW-R-2D2	04/02/21	19,700	Remediation Well
MW-R-2D2	04/03/21	32,800	Remediation Well
MW-R-2D2	04/04/21	35,500	Remediation Well
MW-R-2D2	04/05/21	30,400	Remediation Well
MW-R-2D2	04/06/21	32,000	Remediation Well
MW-R-2D2	04/07/21	28,200	Remediation Well
MW-R-2D2	04/08/21	38,000	Remediation Well
MW-R-2D2	04/09/21	37,800	Remediation Well
MW-R-2D2	04/10/21	48,700	Remediation Well
MW-R-2D2	04/11/21	45,700	Remediation Well
MW-R-2D2	04/12/21	46,600	Remediation Well
MW-R-2D2	04/13/21	39,300	Remediation Well
MW-R-2D2	04/14/21	51,400	Remediation Well
MW-R-2D2	04/15/21	53,100	Remediation Well
MW-R-2D2	04/16/21	57,800	Remediation Well
MW-R-2D2	04/17/21	50,400	Remediation Well
MW-R-2D2	04/18/21	51,900	Remediation Well
MW-R-2D2	04/19/21	57,400	Remediation Well
MW-R-2D2	04/20/21	48,300	Remediation Well
MW-R-2D2	04/21/21	51,500	Remediation Well
MW-R-2D2	04/22/21	48,600	Remediation Well

TABLE B-II.1 CONCENTRATIONS OF TRITIUM IN GROUNDWATER SAMPLES COLLECTED AND ANALYZED BY QUAD CITIES STATION PERSONNEL, 2021

RESULTS IN UNITS OF PCI/LITER

SITE	COLLECTION DATE	ACTIVITY	AQUIFER
MW-R-2D2	04/23/21	53,700	Remediation Well
MW-R-2D2	04/24/21	51,000	Remediation Well
MW-R-2D2	04/25/21	54,300	Remediation Well
MW-R-2D2	04/26/21	54,600	Remediation Well
MW-R-2D2	04/27/21	58,800	Remediation Well
MW-R-2D2	04/28/21	51,900	Remediation Well
MW-R-2D2	04/29/21	50,900	Remediation Well
MW-R-2D2	04/30/21	53,300	Remediation Well
MW-R-2D2	05/01/21	57,200	Remediation Well
MW-R-2D2	05/02/21	54,400	Remediation Well
MW-R-2D2	05/03/21	65,100	Remediation Well
MW-R-2D2	05/04/21	73,600	Remediation Well
MW-R-2D2	05/05/21	60,300	Remediation Well
MW-R-2D2	05/06/21	63,400	Remediation Well
MW-R-2D2	05/07/21	70,200	Remediation Well
MW-R-2D2	05/08/21	69,600	Remediation Well
MW-R-2D2	05/09/21	72,300	Remediation Well
MW-R-2D2	05/10/21	78,800	Remediation Well
MW-R-2D2	05/11/21	80,500	Remediation Well
MW-R-2D2	05/12/21	74,400	Remediation Well
MW-R-2D2	05/13/21	84,800	Remediation Well
MW-R-2D2	05/14/21	82,500	Remediation Well
MW-R-2D2	05/15/21	82,500	Remediation Well
MW-R-2D2	05/16/21	95,400	Remediation Well
MW-R-2D2	05/17/21	86,600	Remediation Well
MW-R-2D2	05/18/21	79,900	Remediation Well
MW-R-2D2	05/19/21	86,600	Remediation Well
MW-R-2D2	05/20/21	77,500	Remediation Well
MW-R-2D2	05/21/21	76,000	Remediation Well
MW-R-2D2	05/22/21	72,000	Remediation Well
MW-R-2D2	05/23/21	76,500	Remediation Well
MW-R-2D2	05/24/21	71,500	Remediation Well
MW-R-2D2	05/26/21	69,600	Remediation Well
MW-R-2D2	05/28/21	61,800	Remediation Well
MW-R-2D2	06/01/21	51,600	Remediation Well
MW-R-2D2	06/02/21	46,400	Remediation Well
MW-R-2D2	06/04/21	45,500	Remediation Well
MW-R-2D2	06/07/21	34,800	Remediation Well
MW-R-2D2	06/09/21	36,300	Remediation Well
MW-R-2D2	06/11/21	37,600	Remediation Well
MW-R-2D2	06/14/21	33,800	Remediation Well
MW-R-2D2	06/16/21	33,300	Remediation Well
MW-R-2D2	06/18/21	26,000	Remediation Well
MW-R-2D2	06/21/21	22,200	Remediation Well
MW-R-2D2	06/23/21	22,800	Remediation Well
MW-R-2D2	06/25/21	20,300	Remediation Well
MW-R-2D2	06/28/21	15,500	Remediation Well
MW-R-2D2	06/30/21	20,500	Remediation Well
MW-R-2D2	07/01/21	20,100	Remediation Well
MW-R-2D2	07/05/21	13,600	Remediation Well
MW-R-2D2	07/07/21	17,700	Remediation Well
MW-R-2D2	07/09/21	11,700	Remediation Well

TABLE B-II.1 CONCENTRATIONS OF TRITIUM IN GROUNDWATER SAMPLES COLLECTED AND ANALYZED BY QUAD CITIES STATION PERSONNEL, 2021

RESULTS IN UNITS OF PCI/LITER

SITE	COLLECTION DATE	ACTIVITY	AQUIFER
MW-R-2D2	07/12/21	10,700	Remediation Well
MW-R-2D2	07/14/21	10,000	Remediation Well
MW-R-2D2	07/16/21	9,430	Remediation Well
MW-R-2D2	07/19/21	6,460	Remediation Well
MW-R-2D2	07/21/21	7,560	Remediation Well
MW-R-2D2	07/23/21	6,730	Remediation Well
MW-R-2D2	07/26/21	7,870	Remediation Well
MW-R-2D2	07/28/21	6,570	Remediation Well
MW-R-2D2	07/29/21	5,780	Remediation Well
MW-R-2D2	08/02/21	6,130	Remediation Well
MW-R-2D2	08/05/21	5,190	Remediation Well
MW-R-2D2	08/09/21	4,300	Remediation Well
MW-R-2D2	08/16/21	4,130	Remediation Well
MW-R-2D2	08/23/21	4,880	Remediation Well
MW-R-2D2	08/30/21	3,750	Remediation Well
MW-R-2D2	09/07/21	3,710	Remediation Well
MW-R-2D2	09/15/21	5,020	Remediation Well
MW-R-2D2	09/20/21	5,110	Remediation Well
MW-R-2D2	09/27/21	4,880	Remediation Well
MW-R-2D2	10/04/21	4,400	Remediation Well
MW-R-2D2	10/11/21	< 2000	Remediation Well
MW-R-2D2	10/18/21	3,590	Remediation Well
MW-R-2D2	10/25/21	3,470	Remediation Well
MW-R-2D2	11/01/21	2,910	Remediation Well
MW-R-2D2	11/08/21	2,780	Remediation Well
MW-R-2D2	11/15/21	<2,000	Remediation Well
MW-R-2D2	11/22/21	2,320	Remediation Well
MW-R-2D2	11/29/21	3,040	Remediation Well
MW-R-2D2	12/06/21	3,260	Remediation Well
MW-R-2D2	12/20/21	2,200	Remediation Well
MW-QC-103I	05/26/21	<2,000	Monitoring Well
MW-QC-103I	11/04/21	<2,000	Monitoring Well
MW-QC-104S	03/07/21	<2,000	Monitoring Well
MW-QC-104S	03/10/21	<2,000	Monitoring Well
MW-QC-104S	03/12/21	<2,000	Monitoring Well
MW-QC-104S	03/22/21	406,000	Monitoring Well
MW-QC-104S	03/30/21	385,000	Monitoring Well
MW-QC-104S	04/06/21	325,000	Monitoring Well
MW-QC-104S	04/19/21	382,000	Monitoring Well
MW-QC-104S	05/04/21	674,000	Monitoring Well
MW-QC-104S	05/18/21	509,000	Monitoring Well
MW-QC-104S	05/25/21	483,000	Monitoring Well
MW-QC-104S	06/01/21	247,000	Monitoring Well
MW-QC-104S	07/01/21	318,000	Monitoring Well
MW-QC-104S	08/09/21	23,400	Monitoring Well
MW-QC-104S	11/04/21	17,500	Monitoring Well
MW-QC-105I	03/07/21	<2,000	Monitoring Well
MW-QC-105I	03/10/21	<2,000	Monitoring Well
MW-QC-105I	03/12/21	<2,000	Monitoring Well
MW-QC-105I	03/18/21	<2,000	Monitoring Well
MW-QC-105I	03/22/21	<2,000	Monitoring Well
MW-QC-105I	03/30/21	<2,000	Monitoring Well

TABLE B-II.1 CONCENTRATIONS OF TRITIUM IN GROUNDWATER SAMPLES COLLECTED AND ANALYZED BY QUAD CITIES STATION PERSONNEL, 2021

RESULTS IN UNITS OF PCI/LITER

SITE	COLLECTION DATE	ACTIVITY	AQUIFER
MW-QC-105I	04/06/21	<2,000	Monitoring Well
MW-QC-105I	04/19/21	<2,000	Monitoring Well
MW-QC-105I	05/04/21	<2,000	Monitoring Well
MW-QC-105I	05/18/21	<2,000	Monitoring Well
MW-QC-105I	05/26/21	<2,000	Monitoring Well
MW-QC-105I	06/01/21	<2,000	Monitoring Well
MW-QC-105I	07/01/21	<2,000	Monitoring Well
MW-QC-105I	08/09/21	<2,000	Monitoring Well
MW-QC-105I	11/04/21	<2,000	Monitoring Well
MW-QC-1	05/26/21	<2,000	Monitoring Well
MW-QC-1	11/03/21	<2,000	Monitoring Well
MW-QC-3	05/26/21	<2,000	Monitoring Well
MW-QC-3	11/03/21	<2,000	Monitoring Well
MW-QC-117S	03/12/21	<2,000	Monitoring Well
MW-QC-117S	03/16/21	<2,000	Monitoring Well
MW-QC-117S	03/18/21	<2,000	Monitoring Well
MW-QC-117S	03/22/21	<2,000	Monitoring Well
MW-QC-117S	03/30/21	<2,000	Monitoring Well
MW-QC-117S	04/07/21	<2,000	Monitoring Well
MW-QC-117S	04/19/21	<2,000	Monitoring Well
MW-QC-117S	05/04/21	<2,000	Monitoring Well
MW-QC-117S	05/18/21	<2,000	Monitoring Well
MW-QC-117S	06/01/21	<2,000	Monitoring Well
MW-QC-117S	07/01/21	<2,000	Monitoring Well
MW-QC-117S	08/09/21	<2,000	Monitoring Well
MW-QC-117S	11/04/21	<2,000	Monitoring Well

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