



**Dominion  
Energy®**

**2021  
Annual  
Radiological  
Environmental  
Operating  
Report**

*Kewaunee Power Station*

**Dominion Energy Kewaunee, Inc.**



**Dominion  
Energy<sup>®</sup>**

**2021  
Annual  
Radiological  
Environmental  
Operating  
Report**

*Kewaunee Power Station*

*Part I*

*Summary and  
Interpretation*

**Dominion Energy Kewaunee, Inc.**



700 Landwehr Road • Northbrook, IL 60062-2310  
phone (847) 564-0700 • fax (847) 564-4517

ANNUAL RADIOLOGICAL ENVIRONMENTAL  
OPERATING REPORT

TO

DOMINION NUCLEAR

RADIOLOGICAL MONITORING PROGRAM FOR  
THE KEWAUNEE POWER STATION  
KEWAUNEE, WISCONSIN

PART I - SUMMARY AND INTERPRETATION

January 1 to December 31, 2021

Prepared and submitted by:

ATI ENVIRONMENTAL Inc.  
Midwest Laboratory  
Project No. 8002

Approved :

A handwritten signature in black ink, appearing to read "Ashok D. Banavali", written over a horizontal line.

Ashok D. Banavali, Ph.D.  
Laboratory Manager

A handwritten signature in black ink, appearing to read "Daniel J. Shannon", written over a horizontal line.

Daniel J. Shannon  
Manager - Radiological Protection  
and Chemistry, KPS

## PREFACE

The staff of ATI Environmental, Inc., Midwest Laboratory were responsible for the acquisition of data presented in this report. Assistance in sample collection was provided by Kewaunee Power Station personnel. The report was prepared by staff members of ATI Environmental, Inc., Midwest Laboratory.

## TABLE OF CONTENTS

	<u>Page</u>
Preface .....	ii
List of Figures .....	iv
List of Tables .....	iv
1.0 INTRODUCTION .....	1
2.0 SUMMARY .....	2
3.0 RADIOLOGICAL SURVEILLANCE PROGRAM .....	3
3.1 Methodology .....	3
3.1.1 The Air Program .....	3
3.1.2 The Terrestrial Program .....	4
3.1.3 The Aquatic Program .....	5
3.1.4 Program Execution .....	6
3.1.5 Program Modifications .....	6
3.2 Results and Discussion .....	7
3.2.1 Atmospheric Nuclear Detonations and Nuclear Accidents .....	7
3.2.2 The Air Environment .....	7
3.2.3 The Terrestrial Environment .....	10
3.2.4 The Aquatic Environment .....	11
3.3 Land Use Census .....	12
3.4 Laboratory Procedures .....	12
4.0 FIGURES AND TABLES .....	13
5.0 REFERENCES .....	25

### APPENDICES

A Interlaboratory Comparison Program Results .....	A-1
B Data Reporting Conventions .....	B-1
C Effluent Concentrations .....	C-1

LIST OF FIGURES

<u>No.</u>	<u>Caption</u>	<u>Page</u>
4-1	Sampling locations, Kewaunee Power Station.....	14
4-2	Groundwater Monitoring Wells, Kewaunee Power Station.....	15

LIST OF TABLES

<u>No.</u>	<u>Title</u>	<u>Page</u>
4.1	Sampling locations, Kewaunee Power Station.....	16
4.2	Type and frequency of collection.....	17
4.3	Sample codes used in Table 4.2.....	17
4.4	Sampling summary, January - December, 2021.....	18
4.5	Environmental Radiological Monitoring Program Summary.....	19
4.6	Land Use Census.....	24

In addition, the following tables are in the Appendices:

Appendix A

	Attachment A: Acceptance criteria for spiked samples .....	A-2
A-1	Interlaboratory Comparison Crosscheck Program, Environmental Resource Associates RAD study (substitute program for EPA) .....	A-3
A-2	Interlaboratory Comparison Crosscheck Program, New York Department of Health (ELAP) .....	A-4
A-3	Interlaboratory Comparison Program Results, Thermoluminescent Dosimeters (TLDs) .....	A-5
A-4	In-house Spiked Samples.....	A-7
A-5	In-house "Blank" Samples .....	A-10
A-6	In-house "Duplicate" Samples .....	A-12
A-7	Department of Energy MAPEP comparison results.....	A-16
A-8	Interlaboratory Comparison Crosscheck Program, Environmental Resource Associates (substitute program for EML).....	A-19

## 1.0 INTRODUCTION

The Kewaunee Power Station was a 598 megawatt pressurized water reactor located on the Wisconsin shore of Lake Michigan in Kewaunee County. The Plant became critical on March 7, 1974. Initial power generation was achieved on April 8, 1974, and the Plant was declared commercial on June 16, 1974.

On February 25, 2013, Dominion Energy Kewaunee submitted a certification of intent to cease power operations to the Nuclear Regulatory Commission. Power Operation of the Kewaunee Power Station ceased on May 7, 2013. The fuel was permanently removed from the reactor and placed in the spent fuel pool for storage on May 14, 2013. On June 15, 2017, the transfer of all spent fuel from the KPS Spent Fuel Pool (SFP) to the Independent Spent Fuel Storage Installation (ISFSI) was completed. All remaining irradiated materials were removed from the SFP in October of 2017. All radioactive liquid was drained from systems in the Auxiliary Building by the end of the first week of August 2018.

This report summarizes the environmental operation data collected during the period January - December 2021.

Dominion Energy Kewaunee, operator and owner of the Kewaunee Power Station, assumes responsibility for the environmental program at the Plant. Any questions should be directed to Mr. Daniel J. Shannon, Manager Radiological Protection and Chemistry, at (920) 304-1129.

## 2.0 SUMMARY

Results of sample analyses during the period January - December 2021 are summarized in Table 4.5. Radionuclide concentrations measured at indicator locations are compared with levels measured at control locations and in preoperational studies. In no instance were REMP threshold reporting levels exceeded.

### 3.0 RADIOLOGICAL SURVEILLANCE PROGRAM

Following is a description of the Radiological Surveillance Program and its execution.

#### 3.1 METHODOLOGY

The sampling locations are shown in Figure 4-1. Table 4.1 describes the locations, lists for each direction and distance from the reactor, and defines which are the indicator and control locations.

The sampling program monitors the air, terrestrial, and aquatic environments. The types of samples collected at each location and the frequency of collections are presented in Table 4.2, using sample codes defined in Table 4.3. The collections and analyses that comprise the program are described below. Finally, the execution of the program in the current reporting year is discussed.

##### 3.1.1 The Air Program

###### Ambient Gamma Radiation – TLDs

Ambient gamma radiation is monitored at the one control location (K-2), at four inner ring locations (K-1f, K-25, K-27 and K-30), and from six outer ring locations (K-3, K-5, K-8, K-17, K-39 and K-43) by thermoluminescent dosimetry (TLD). Two TLD cards, each having four main readout areas containing CaSO<sub>4</sub>:Dy phosphor, are placed at each location (eight readout areas per each location). One card is exchanged quarterly, the other card is exchanged annually and read only on an emergency basis.

Dosimeters have also been placed at four additional locations (K-1m, K-1o, K-1q and K-1r), to monitor an Independent Spent Fuel Storage Installation (ISFSI) as part of the inner ring locations. They are replaced and measured quarterly.

###### Airborne Particulates

Airborne particulates are collected on 47 mm diameter filters, at a volumetric rate of approx. one cubic foot per minute. The filters are collected weekly from four locations (K-1f, K-2(control), K-8 and K-43), and dispatched by mail to ATI Environmental, Inc. for radiometric analysis. The particulate filters are counted for gross beta activity, a minimum of three days after the date of collection, to allow for the decay of naturally-occurring short-lived radionuclides.

Quarterly composites from each sampling location are analyzed for gamma-emitting isotopes on a high-purity germanium (HPGe) detector.

###### Airborne Iodine

Airborne iodine analysis was discontinued beginning in 2018 due to the cessation of power operations (see Introduction on page 1).

###### Precipitation

The collection and analysis of precipitation samples was discontinued beginning in 2018 due to the cessation of power operations (see Introduction on page 1).

### 3.1.2 The Terrestrial Program

#### Milk

The collection and analysis of milk samples was discontinued beginning in 2018 due to the cessation of power operations (see Introduction on page 1).

#### Well Water

Well water is collected quarterly from one off-site well location K-13 and from three on-site wells located at K-1h, K-1t and K-1u. Samples are only collected at locations K-1t and K-1u when these sources are tapped for drinking or irrigation purposes in areas where the hydraulic gradient or recharge properties are suitable for contamination.

Gamma spectroscopic analysis, tritium and gross beta on the total residue are performed for each water sample. The concentration of potassium-40 is calculated from total potassium. Samples of water from the three on-site wells (K-1h, K-1t and K-1u) are analyzed for gross alpha. The water sample from K-1h is also tested for strontium-90.

Monitoring wells and results associated with the Ground Water Protection Program (GWPP) are reported in the KPS Annual Radioactive Effluent Release Report (ARERR). The groundwater monitoring well locations associated with the GWPP are included in Figure 4-2 along with the onsite well water sampling locations associated with the REMP.

#### Domestic Meat

The collection and analysis of domestic meat was discontinued in 2018 due to the cessation of power operations (see Introduction on page 1).

#### Eggs

The collection and analysis of eggs was discontinued in 2018 due to the cessation of power operations (see Introduction on page 1).

#### Broad leaf Vegetation

Annually, during the third quarter, samples of broad leaf vegetation are collected from location K-26. Samples may also be obtained from other local sources to supplement the program. In addition, two samples of broad leaf vegetation are collected annually from farmland owned by Dominion Energy Kewaunee (K-23a and K-23b) and rented to a private individual for growing crops. The samples are analyzed for gamma emitting isotopes.

#### Cattle Feed

Cattle feed (e.g., hay and silage) is collected during the first quarter from dairy farm locations (K-3, K-34, K-35, K-38 and K-45). The samples are analyzed for gross beta, strontium-90 and gamma emitting isotopes.

#### Grass

Grass is collected during the second, third and fourth quarters from two on-site locations (K-1b and K-1f) and from the dairy farm locations (K-3, K-5, K-34, K-35, K-38 and K-39). The samples are analyzed for gross beta, strontium-90 and gamma emitting isotopes.

#### Soil

Soil samples are collected twice a year on-site at K-1f and from the dairy farm locations (K-3, K-34, K-35 and K-38). The samples are analyzed for gross alpha, gross beta, strontium-90 and gamma emitting isotopes.

### 3.1.3 The Aquatic Program

#### Surface Water

Surface water samples are taken quarterly from two locations on Lake Michigan: 1) at the point where plant effluent water is discharged into Lake Michigan (K-1d); and 2) at the main pumping station located approximately equidistant from Kewaunee and Green Bay, which pumps water from the Rostok water intake (K-9) located 11.5 miles NNE of the reactor site. Both raw and tap water are collected at K-9. One-gallon water samples are taken quarterly from two creeks that pass through the site (K-1b and K- 1e). Samples from the Middle Creek (K-1b) are collected near the mouth of the creek. Samples from the South Creek (K-1e) are collected about ten feet downstream from the point where the outflow from the two drain pipes meets.

The water is analyzed for gamma emitting isotopes, gross beta activity in total residue, dissolved and suspended solids, and potassium-40, tritium and strontium-90. The concentration of potassium-40 is calculated from the total potassium concentration.

#### Fish

Fish samples are collected during the third quarter near location K-1d. The flesh is separated from the bones, gamma scanned and analyzed for gross beta activity. Bone samples are analyzed for gross beta, and strontium-90. A local fish market, (e.g., Lafond's in Kewaunee), may be used for backup fish samples, if needed.

#### Aquatic Slime

The collection and analysis of aquatic slime was discontinued in 2018 due to the cessation of power operations (see Introduction on page 1).

#### Shoreline Sediment

Shoreline sediments are collected in May and November from three locations (K-1c, K-1j and K-9) in areas with potential for recreational value. The samples are analyzed for gross beta, strontium-90 and gamma emitting isotopes.

#### 3.1.4 Program Execution

Program execution is summarized in Table 4.4. The program was executed for the year 2021 as described in the preceding sections, with the following exceptions:

##### Air Particulates

No air particulate sample was able to be collected at location K-8, for the sample period ending 8/10/21. The circuit breaker to the pump was found open (CR#2217).

##### Well Water

Location K-43 was substituted for location K-13 for the 10/04/21 collection due to the sickness of the owner at location K-13; K-43 is located in the same sector and 0.3 mile from K-13; therefore it is an acceptable replacement sampling location.

##### Cattle Feed

Collection of cattle feed was discontinued at locations K-5 and K-39 due to the suspension of dairy activities at both locations at the time of collection. New sampling location K-45 was identified and implemented for collecting cattle feed samples (CR#2182).

#### 3.1.5 Program Modifications

##### Cattle Feed

Location K-45, Wakker's Dairy, was added as a cattle feed location and samples were collected in August 2021 as a replacement for the samples that had been previously collected at discontinued cattle feed locations K-5 and K-39. The change to the cattle feed sampling locations was included in REMM revision 23.

### 3.2 RESULTS AND DISCUSSION

Results for the reporting period January to December, 2021 are presented in summary form in Table 4.5. For each type of analysis, of each sampled medium, the table shows the annual mean and range for all indicator and control locations. The location with the highest annual mean and the results for this location are also given.

The discussion of the results has been divided into three broad categories: the air, terrestrial, and aquatic environments. Within each category, samples will be discussed in the order listed in Table 4.4. Any discussion of previous environmental data for the Kewaunee Power Station refers to data collected by Environmental Inc., Midwest Laboratory.

Results of all measurements made in 2021 are not included in this section, although references to these results will be made in the discussion. A complete tabulation of results is provided in Part II of the 2021 annual report on the Radiological Monitoring Program for the Kewaunee Power Station.

#### 3.2.1 Atmospheric Nuclear Detonations and Nuclear Accidents

There were no atmospheric nuclear tests or accidents reported in 2021. The Chernobyl and Fukushima Daiichi nuclear accidents occurred on April 26, 1986 and March 11, 2011, respectively. The last reported atmospheric nuclear test was conducted by the People's Republic of China on October 16, 1980. Contributions from these events have resulted in the presence of long-lived radioisotopes of cesium and strontium still detectable in the environment.

#### 3.2.2 The Air Environment

##### Ambient Gamma Radiation – TLDs

Ambient gamma radiation was monitored by TLDs at eleven locations, ten indicators (K-1f, K-3, K-5, K-8, K-17, K-25, K-27, K-30, K-39 and K-43) and one control (K-2). TLDs at the indicator locations measured a mean dose equivalent of 16.4 mR/91 days, in close agreement with the control location 16.5 mR/91 days. The readings are similar to the averages obtained from 2002 (and prior to) through 2020.

These results support the conclusion that no plant effect on ambient gamma radiation was indicated. These values are lower than the United States average value of 19.5 mR/91 days due to natural background radiation (National Council on Radiation Protection and Measurements, 1975). The highest annual mean was 18.6 mR/91 days, measured at indicator location K-25.

Year	Average (Indicators)	Average (Controls)
Dose rate (mR/91 days)		
2007	16.2	15.2
2008	15.6	14.2
2009	15.2	13.9
2010	15.2	14.3
2011	15.0	14.5
2012	16.1	15.3
2013	16.2	15.5
2014	15.0	14.8
2015	16.2	16.1
2016	16.5	15.9
2017	16.1	15.4
2018	16.4	17.1
2019	15.8	16.6
2020	16.4	16.7
2021	16.4	16.5

Ambient gamma radiation as measured by thermoluminescent dosimetry. Average quarterly dose rates.

Using ANSI/HPS N13.37-2014 as guidance, a determination of facility related dose was performed using quarterly TLD data from control and indicator locations from 2011 through 2020. A baseline background dose ( $B_Q$ ) was computed for each TLD location. Then a Quarterly Minimum Differential Dose ( $MDD_Q$ ) was calculated as 3 times the 90th percentile of the standard deviations of the historical quarterly results. The result of this calculation was 5.5 mrem. Transit and storage doses weren't considered since the TLD's currently are, and have historically been, collected in the field and delivered to the laboratory for immediate processing.

2021 results at all locations, both indicator and control, were lower than the sum of the Baseline Background Dose ( $B_Q$ ) and the Quarterly Minimum Differential Dose ( $MDD_Q$ ), which according to ANSI/HPS N13.37-2014 indicates no detection (ND) and which supports the conclusion that there is no plant effect.

Monitoring Location	Quarterly Baseline $B_Q$ (mrem)	Normalized Quarterly Monitoring Data $M_Q$ (mrem per standard quarter)				Quarterly Facility Dose $F_Q = M_Q - [B_Q + MDD_Q]$ (mrem)			
		1 <sup>st</sup> Qtr	2 <sup>nd</sup> Qtr	3 <sup>rd</sup> Qtr	4 <sup>th</sup> Qtr	1 <sup>st</sup> Qtr	2 <sup>nd</sup> Qtr	3 <sup>rd</sup> Qtr	4 <sup>th</sup> Qtr
<i>Indicators</i>									
K-1f	14.1	14.2	14.4	13.7	15.0	ND	ND	ND	ND
K-3	17.2	16.1	15.3	16.2	17.6	ND	ND	ND	ND
K-5	16.3	15.7	16.9	15.5	15.6	ND	ND	ND	ND
K-8	15.6	15.4	16.6	16.3	18.5	ND	ND	ND	ND
K-17	16.5	17.6	18.4	17.6	18.2	ND	ND	ND	ND
K-25	17.8	16.7	18.6	18.4	20.6	ND	ND	ND	ND
K-27	16.2	16.3	16.8	17.2	18.7	ND	ND	ND	ND
K-30	16.0	16.2	15.5	15.4	16.2	ND	ND	ND	ND
K-39	16.2	16.1	17.2	16.8	19.4	ND	ND	ND	ND
K-43	14.3	13.8	13.4	14.2	15.3	ND	ND	ND	ND
<i>Control</i>									
K-2	16.5	15.9	15.9	16.0	18.1	ND	ND	ND	ND

Table assumes 1 roentgen = 1 rem.

### Airborne Particulates

The annual gross beta concentration in air particulates averaged 0.025 pCi/m<sup>3</sup> at the indicator location and 0.023 pCi/m<sup>3</sup> at the control location, similar to the means observed from 2002 (and prior to) through 2020. There is no indication of a plant effect, the average readings were evenly distributed between indicator and control locations.

Year	Average (Indicators)	Average (Controls)
Concentration (pCi/m <sup>3</sup> )		
2002	0.023	0.023
2003	0.022	0.022
2004	0.019	0.020
2005	0.023	0.023
2006	0.021	0.021
2007	0.022	0.021
2008	0.022	0.022
2009	0.023	0.023
2010	0.023	0.022
2011	0.029	0.029
2012	0.029	0.030
2013	0.024	0.025
2014	0.019	0.019
2015	0.022	0.022
2016	0.021	0.020
2017	0.021	0.021
2018	0.023	0.024
2019	0.021	0.019
2020	0.023	0.023
2021	0.025	0.023

Average annual gross beta concentrations in airborne particulates.

Variation in the gross beta activity throughout the year is not unusual. Typically, higher beta averages occur during the months of January and December, and the first and fourth quarters, as noted in data from 2002 through 2021.

Gamma spectroscopic analysis of quarterly composites of air particulate filters yielded similar results for indicator and control locations. Beryllium-7, produced continuously in the upper atmosphere by cosmic radiation, was detected in all samples, with an average activity of 0.086 pCi/m<sup>3</sup> at the indicator locations and an average of 0.087 pCi/m<sup>3</sup> at the control location. All other gamma-emitting isotopes were below their respective MDC levels.

### 3.2.3 The Terrestrial Environment

#### Well Water

Three of twelve samples tested positive for gross alpha at an average of 1.9 pCi/L. Detectable gross beta activity was measured in four of the twelve indicator samples and also in one of the four control samples tested. The average of indicator samples concentration measured 1.9 pCi/L versus a measurement of 1.0 pCi/L for the positive control sample. These levels are consistent with the concentrations of potassium-40 measured (1.98 pCi/L average for indicators versus 1.07 pCi/L average for controls). It is not unusual to see high potassium-40 levels in an agricultural setting. Potassium-40 is present wherever stable potassium is found. Therefore positive results can be attributed to agricultural runoff. The gross alpha activities are most likely contributions from naturally-occurring daughters of radium and thorium when detected in the well water.

No strontium-90 was detected in any of the four samples tested. All concentrations measured below an MDC value 0.5 pCi/L.

Sixteen well water samples were tested for tritium and gamma emitting isotopes. All tritium concentrations measured below a detection level of 159 pCi/L. Gamma-emitting isotopes measured below respective MDC levels.

#### Broad Leaf Vegetation

Three samples of broad leaf vegetation were analyzed for gamma emitters. Only naturally occurring potassium-40 and beryllium-7 were detected.

#### Cattle Feed

In the ten cattle feed samples analyzed in 2021 the gross beta average concentrations of 13.70 pCi/g wet indicator and 10.60 pCi/g wet control which agrees well with the potassium-40 average concentration results of 8.62 pCi/g wet indicator and 8.28 pCi/g wet control. Strontium-90 was detected in three of the six indicator samples at an average level of 0.003 pCi/g wet and at one of the four control samples at a level of 0.004 pCi/g wet. Trace levels of strontium-90 in the environment can be attributed to nuclear testing and accidents. With the exception of naturally occurring beryllium and potassium, all gamma emitting isotopes were below MDC levels. These results are also comparable to historical results for analysis of cattle feed. No plant effect is indicated.

#### Grass

Eight grass samples were collected in June, August and October at six indicator locations and two control locations for a total of twenty-four samples for the year. The samples were analyzed for gross beta, strontium-90 and gamma emitting isotopes. Analysis results show very good agreement between the gross beta results and the potassium-40 results. Naturally occurring beryllium-7 was also detected in all of the samples. Trace levels of strontium-90 were detected in two of the twenty-four samples tested at an average concentration of 0.002 pCi/g wet. As mentioned previously, trace levels of strontium-90 in the environment can be attributed to nuclear testing and accidents.

With the exception of the naturally-occurring beryllium and potassium, all gamma-emitting isotopes were below MDC levels. These results are comparable to historical results for analysis of grass. No plant effect is indicated.

#### Soil

Gross alpha concentrations in soil averaged 6.68 pCi/g dry in the six indicator samples and 7.25 pCi/g dry in the four control samples. Mean gross beta levels measured at indicator and control locations averaged 24.72 and 24.26 pCi/g dry, respectively, primarily due to potassium-40 activity. A trace amount of strontium-90 was detected in one of the ten soil samples tested at a concentration of 0.029 pCi/g dry. Trace levels of strontium-90 in the environment can be attributed to nuclear testing and accidents.

Cesium-137 was detected in all ten samples tested. Concentrations ranged from 0.05 pCi/g dry to 0.14 pCi/g dry with an average of 0.11 pCi/g dry at both the indicator and control locations. Trace levels of Cs-137 in the environment can be attributed to nuclear testing and accidents. Potassium-40 was detected in all samples and averaged 20.30 and 17.93 pCi/g dry for indicator and control locations, respectively. All other gamma-emitting isotopes were below respective MDC levels. The levels of detected activities are similar to those observed from 1990 through 2020. The data suggests no evidence of a plant effect.

### 3.2.4 The Aquatic Environment

#### Surface Water

Average gross beta activity in surface water measured slightly higher at the indicator locations (2.2 pCi/L) than at the control locations (1.1 pCi/L). A similar pattern of activity has been observed since 1978. The highest gross beta activities measured in 2021 were sampled from location K-1b. The average activity was 3.1 pCi/L, with a range of 1.7 to 5.1 pCi/L. The highest average potassium-40 concentrations were also observed at location K-1b at 4.0 pCi/L and ranged from 3.4 to 5.0 pCi/L. These levels were comparable to the indicator and control average levels of potassium-40 which were measured at 2.8 and 1.3 pCi/L respectively.

Year	Average (Indicators)	Average (Controls)
<u>Gross Beta (pCi/L)</u>		
2002	5.7	2.2
2003	7.3	2.4
2004	6.2	2.3
2005	5.2	1.7
2006	5.5	1.8
2007	5.7	1.8
2008	4.7	1.5
2009	4.7	1.5
2010	4.7	1.4
2011	5.0	1.5
2012	6.1	1.4
2013	5.7	1.5
2014	4.4	1.9
2015	4.2	1.4
2016	5.2	1.6
2017	4.2	1.4
2018	2.8	1.1
2019	3.1	1.2
2020	3.3	0.9
2021	2.2	1.1

**Average annual gross beta concentrations in surface water.**

These results that are comparable with historical results.

Tritium and Sr-90 were measured below their respective MDC's of 163 pCi/L and 0.8 pCi/ L for all twenty quarterly samples taken in 2021.

With the exception of naturally occurring potassium-40, gamma-emitting isotopes measured below their respective MDC levels in all samples.

### Fish

In the fish sample, the gross beta concentration was 5.29 pCi/g wet in flesh and 4.52 pCi/g wet in bone fractions. In flesh, the gross beta concentration was primarily due to the potassium-40 concentration of 3.71 pCi/g wet.

Strontium-90 was measured below an MDC of 0.07 pCi/g wet in the bone fractions.

Excluding potassium-40, gamma-emitting isotopes measured below their respective MDC levels.

### Shoreline Sediments

In shoreline sediment samples, the mean gross beta concentrations measured an average 9.39 pCi/g dry at the indicator locations versus an average of 11.55 pCi/g dry at the control location. These results are consistent with the average levels of potassium-40 measured in these samples (5.99 pCi/g dry and 8.74 pCi/g dry respectively).

Other gamma-emitting isotopes, with the exception of naturally-occurring potassium-40, were below their respective MDC levels.

Strontium-90 was measured below an MDC of 0.067 pCi/g dry for all locations.

These results support the conclusion that there is no plant effect.

## 3.3 LAND USE CENSUS

The Land Use Census satisfies the requirements of the KPS Radiological Environmental Monitoring Manual. Section 2.2.2 states:

"A land use census shall be conducted and shall identify within a distance of 8 km (5 mi.) the location, in each of the 10 meteorological sectors, of the nearest residence and the nearest garden of greater than 50m<sup>2</sup> (500 ft<sup>2</sup>) producing broad leaf vegetation." (Figure 4-1)

The 2021 Land Use Census was completed to identify the presence of the nearest residences and gardens surrounding the Kewaunee Power Station. The Land Use Census was conducted on September 1, 2021. The census is performed annually during the growing season per Radiation Protection Procedure RP-KW-001-014.

The 2021 Land Use Census did not identify any obvious changes. A summary of the Land Use Census is shown in table 4.6.

## 3.4 LABORATORY PROCEDURES

Analytical Procedures used by Environmental, Inc. are on file and are available for inspection. Procedures are based on those prescribed by the Health and Safety Laboratory of the U.S. Dep't of Energy, Edition 28, 1997, U.S. Environmental Protection Agency for Measurement of Radioactivity in Drinking Water, 1980, and the U.S. Environmental Protection Agency, EERF, Radiochemical Procedures Manual, 1984.

Environmental, Inc., Midwest Laboratory has a comprehensive quality control/quality assurance program designed to assure the reliability of data obtained. Details of the QA Program are presented elsewhere (Environmental, Inc., Midwest Laboratory, 2022). The QA Program includes participation in Interlaboratory Comparison (crosscheck) Programs. Results obtained are presented in Appendix A.

## 4.0 FIGURES AND TABLES

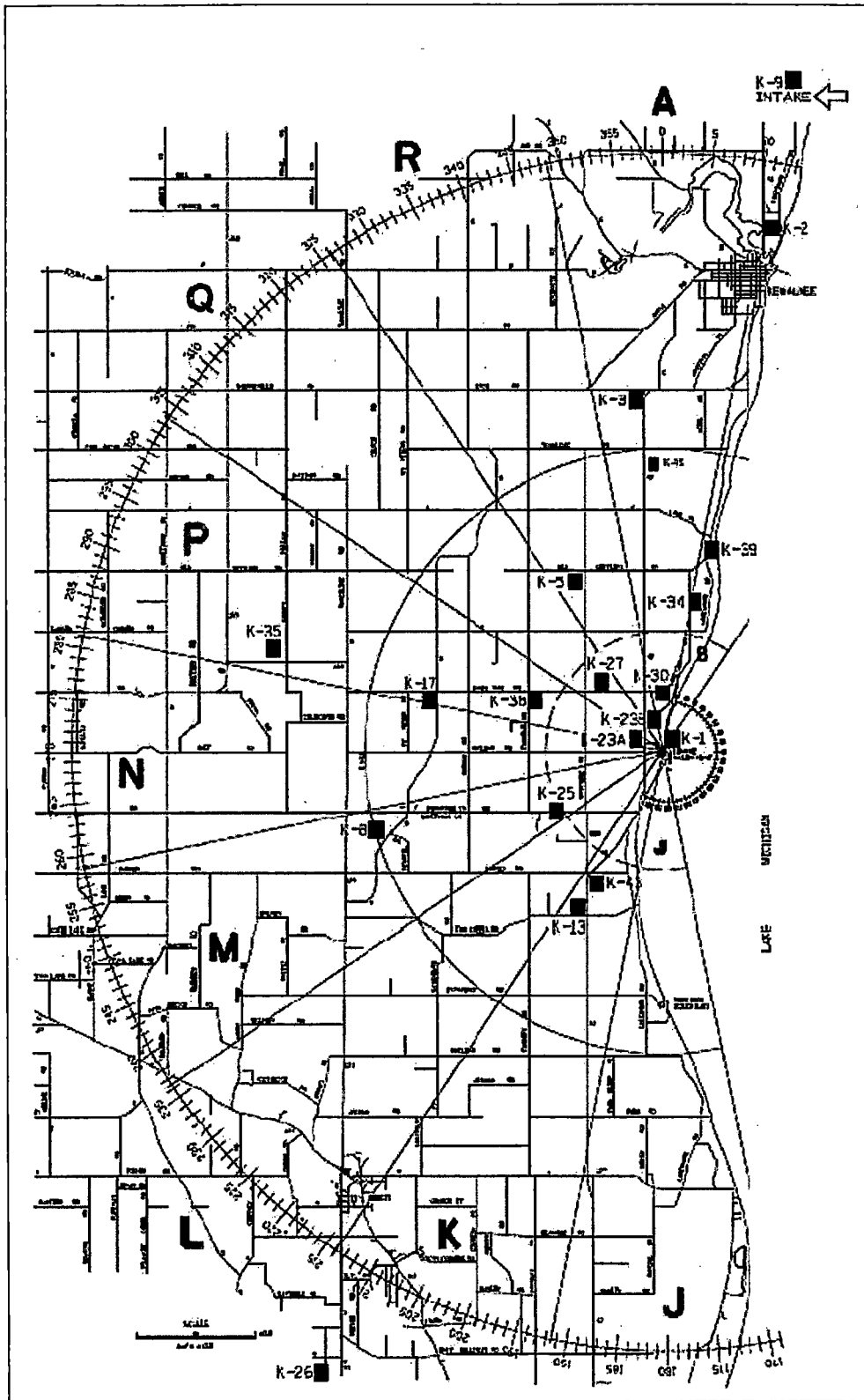
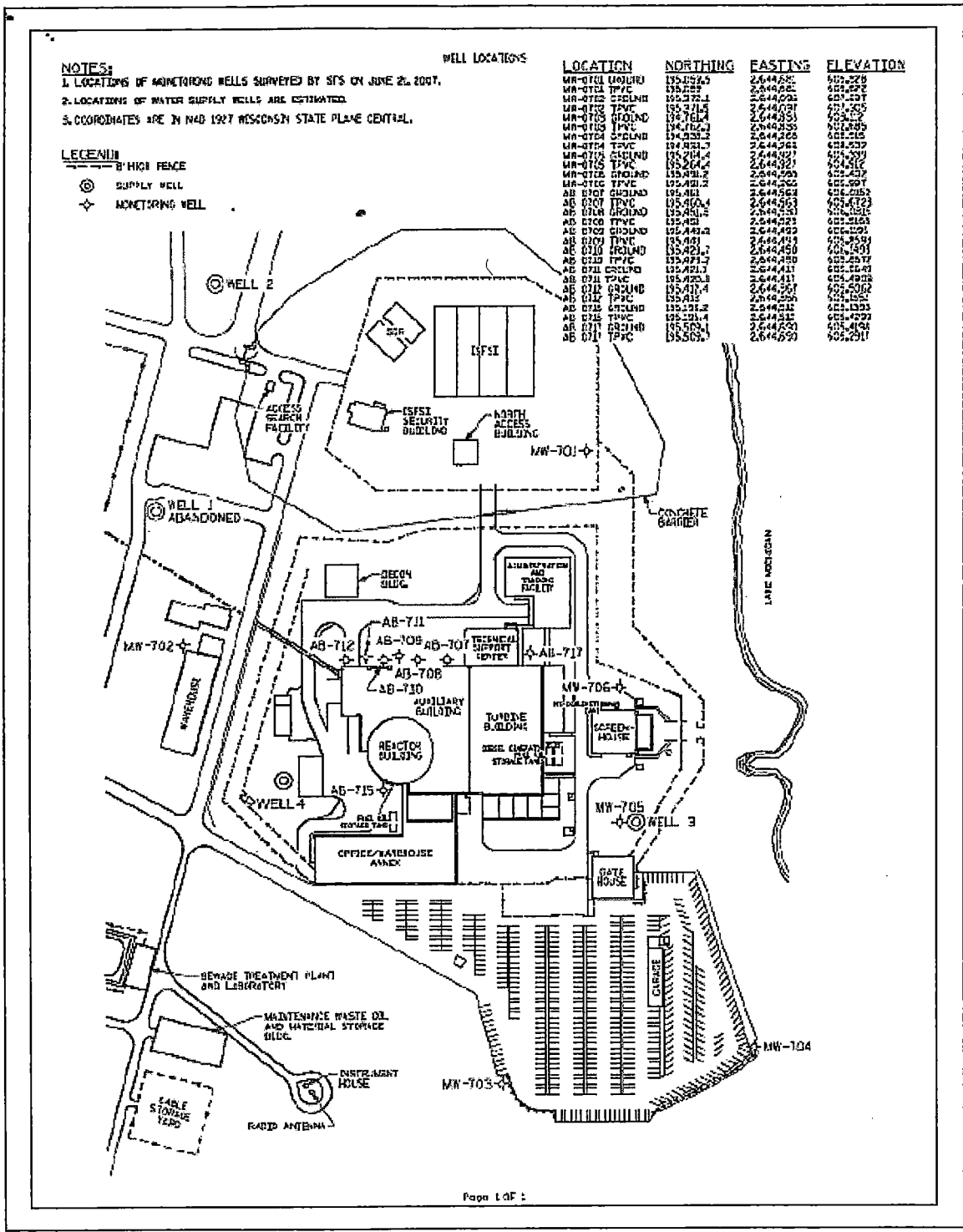


Figure 4-1. Sampling locations, Kewaunee Power Station.



envsl.dgn 12/13/2017 11:28:40 AM

Figure 4-2. Groundwater Monitoring Wells, Kewaunee Power Station.

Table 4.1. Sampling locations, Kewaunee Power Station.

Code	Type <sup>a</sup>	Distance (miles) <sup>b</sup> and Sector	Location
K-1	I		Onsite
K-1b	I	0.12 N	Middle Creek
K-1c	I	0.10 N	500' north of condenser discharge
K-1d	I	0.10 E	Condenser discharge
K-1e	I	0.12 S	South Creek
K-1f	I	0.12 S	Maintenance Waste Oil and Material Storage Building
K-1h	I	0.12 NNW	North Well
K-1j	I	0.10 S	500' south of condenser discharge
K-1m	I	0.15 N	ISFSI East
K-1o	I	0.16 N	ISFSI North
K-1q	I	0.16 N	ISFSI West
K-1r	I	0.13 N	ISFSI West
K-1t	I	0.10 ESE	Gatehouse
K-1u	I	0.05 SSW	Maintenance Building
K-2	C	8.91 NNE	WPS Operations Building in Kewaunee
K-3 <sup>c</sup>	I/C	5.9 N	Lyle and John Siegmund Farm, N2815 Hwy 42, Kewaunee
K-5	I	3.2 NNW	Ed Paplham Farm, E4160 Old Settlers Rd, Kewaunee
K-8	I	4.85 WSW	St. Isadore the Farmer Church, 18424 Tisch Mills Rd, Tisch Mills
K-9	C	11.5 NNE	Green Bay Municipal Pumping Station, six miles east of Green Bay (sample source is Lake Michigan from Rostok Intake two miles north of Kewaunee.
K-13	C	3.0 SSW	Rand's General Store, Two Creeks
K-17	I	4.0 W	Klimesh's' Farm, N885 Tk B, Kewaunee
K-23a	I	0.5 W	0.5 miles west of plant, Kewaunee site
K-23b	I	0.6 N	0.6 miles north of plant, Kewaunee site
K-25	I	1.9 SW	Wotachek Farm, 3968 E. Cty Tk BB, Two Rivers
K-26	C	9.1 SSW	Wilfert Farms Vegetable Stand (9.1 miles south of "BB")
K-27	I	1.53 NW	Schleis Farm, E4298 Sandy Bay Rd, Kewaunee
K-30	I	0.8 N	End of site boundary
K-34	I	2.7 N	Leon and Vicky Struck, N1549 Lakeshore Dr., Kewaunee
K-35	C	6.71 WNW	Duane Ducat, N1215 Sleepy Hollow Rd., Kewaunee
K-38	I	2.45 WNW	Dave Sinkula Farm, N890 Town Hall Road, Kewaunee
K-39	I	3.46 N	Francis Wojta, N1859 Lakeshore Dr., Kewaunee
K-43	I	2.71 SSW	Gary Maigatter Property, 17333 Hwy 42, Two Rivers
K-45	I	5.1 N	Wakker's Dairy, N2348 Highway 42, Kewaunee

<sup>a</sup> I = indicator; C = control

<sup>b</sup> Distances are measured from reactor stack.

<sup>c</sup> Location K-3 is an indicator for ambient radiation and a control for soil, cattle feed, and grass.

Table 4.2. Type and frequency of collection.

Location	Weekly	Quarterly	Semiannually	Annually
K-1b		SW GR <sup>a</sup>		
K-1c			SS <sup>b</sup>	
K-1d		SW		FI <sup>c</sup>
K-1e		SW		
K-1f	AP <sup>g</sup>	GR <sup>a</sup> TLD	SO	
K-1h		WW		
K-1j			SS <sup>b</sup>	
K-1m		TLD		
K-1o		TLD		
K-1q		TLD		
K-1r		TLD		
K-1t		WW <sup>h</sup>		
K-1u		WW <sup>h</sup>		
K-2	AP <sup>g</sup>	TLD		
K-3		GR <sup>a</sup> TLD	SO	CF <sup>d</sup>
K-5		GR <sup>a</sup> TLD		
K-8	AP <sup>g</sup>	TLD		
K-9		SW <sup>f</sup>	SS <sup>b</sup>	
K-13		WW		
K-17		TLD		
K-23a				BLV <sup>e</sup>
K-23b				BLV <sup>e</sup>
K-25		TLD		
K-26				BLV <sup>e</sup>
K-27		TLD		
K-30		TLD		
K-34		GR <sup>a</sup>	SO	CF <sup>d</sup>
K-35		GR <sup>a</sup>	SO	CF <sup>d</sup>
K-38		GR <sup>a</sup>	SO	CF <sup>d</sup>
K-39		GR <sup>a</sup> TLD		
K-43	AP <sup>g</sup>	TLD		
K-45				CF <sup>d</sup>

<sup>a</sup> Three times a year, second (April, May, June), third (July, August, September), and fourth (October, November, December) quarters

<sup>b</sup> To be collected in May and November

<sup>c</sup> Annually in the third quarter (July, August, or September).

<sup>d</sup> First (January, February or March) quarter only.

<sup>e</sup> Alternate, since milk sampling is no longer performed.

<sup>f</sup> Two samples, raw and treated

<sup>g</sup> The frequency may be increased dependent on the dust loading.

<sup>h</sup> Well water shall be taken when this source is tapped for drinking or irrigation purposes in areas where the hydraulic gradient or recharge properties are suitable for contamination.

Table 4.3. Sample Codes:

Code	Description
AP	Airborne particulates
BLV	Broad leaf vegetation
CF	Cattle feed
FI	Fish
GR	Grass
SO	Soil
SW	Surface water
SS	Shoreline sediment
TLD	Thermoluminescent dosimeter
WW	Well water

Table 4.4. Sampling Summary, January – December, 2021.

Sample Type	Collection Type and Frequency <sup>a</sup>	Number of Locations	Number of Samples Collected	Number of Samples Missed
<u>Air Environment</u>				
TLD's	C/Q	15	60	0
Airborne particulates	C/W	4	207	1
<u>Terrestrial Environment</u>				
Well water	G/Q	4	16	0
Broad Leaf Vegetation	G/A	3	3	0
Cattle Feed	G/A	5	10	0
Grass	G/TA	8	24	0
Soil	G/SA	5	10	0
<u>Aquatic Environment</u>				
Surface water	G/M	4	20	0
Fish	G/A	1	1	0
Shoreline sediments	G/SA	3	6	0

<sup>a</sup> Type of collection is coded as follows: C = continuous; G = grab.

Frequency is coded as follows: W = weekly; BW = bi-weekly; SM = semimonthly; M = monthly;

Q = quarterly; SA = semiannually; TA = three times per year; A = annually.

Table 4.5 Environmental Radiation Monitoring Program Summary.

Name of Facility Kewaunee Power Station Docket No. 50-305  
 Location of Facility Kewaunee County, Wisconsin Reporting Period January-December, 2021  
 (County, State)

Sample Type (Units)	Type and Number of Analyses <sup>a</sup>	MDC <sup>b</sup>	Indicator Locations Mean (F) <sup>c</sup> Range <sup>e</sup>	Location with Highest Annual Mean		Control Locations Mean (F) <sup>c</sup> Range <sup>e</sup>	Number Non-Routine Results <sup>e</sup>
				Location <sup>d</sup>	Mean (F) <sup>c</sup> Range <sup>e</sup>		
TLDs (Quarterly) (mR/91days)	Gamma 44	5.5 <sup>f</sup>	16.4 (40/40) (13.4-20.6)	K-25, Wotachek Farm 1.9 SW	18.6 (4/4) (16.7-20.6)	16.5 (4/4) (15.9-18.1)	0
TLDs, Quarterly (Protected Area) (mR/91days)	Gamma 16	5.5 <sup>f</sup>	80.3 (16/16) (15.2-160.9)	K-1m, ISFSI E 0.15 N	147.6 (4/4) (136.2 -160.9)	none	0
Airborne Particulates (pCi/m <sup>3</sup> )	GB 207	0.010	0.025 (155/155) (0.005-0.052)	K-8, St. Isadore The Farmer Church, 4.85 WSW	0.026 (52/52) (0.006-0.052)	0.023 (52/52) (0.004-0.057)	0
	GS 16						
	Be-7	0.020	0.086 (12/12) (0.057-0.107)	K-43, Maigatter Property 2.71 SSW	0.093 (4/4) (0.072-0.107)	0.087 (4/4) (0.073-0.102)	0
	Nb-95	0.0021	< MDC	-	-	< MDC	0
	Zr-95	0.0025	< MDC	-	-	< MDC	0
	Ru-103	0.0017	< MDC	-	-	< MDC	0
	Ru-106	0.0089	< MDC	-	-	< MDC	0
	Cs-134	0.0011	< MDC	-	-	< MDC	0
	Cs-137	0.0010	< MDC	-	-	< MDC	0
	Ce-141	0.0033	< MDC	-	-	< MDC	0
Ce-144	0.0055	< MDC	-	-	< MDC	0	

Table 4.5 Environmental Radiation Monitoring Program Summary.

Name of Facility Kewaunee Power Station  
 Location of Facility Kewaunee County, Wisconsin  
 (County, State)

Docket No. 50-305  
 Reporting Period January-December, 2021

Sample Type (Units)	Type and Number of Analyses <sup>a</sup>	MDC <sup>b</sup>	Indicator Locations Mean (F) <sup>c</sup> Range <sup>c</sup>	Location with Highest Annual Mean		Control Locations Mean (F) <sup>c</sup> Range <sup>c</sup>	Number Non-Routine Results <sup>e</sup>
				Location <sup>d</sup>	Mean (F) <sup>c</sup> Range <sup>c</sup>		
Well Water (pCi/L)	GA 16	4.0	1.9 (3/12) (1.7-2.7)	K-1t, Gatehouse 0.10 mi, ESE	2.7 (1/4)	None	0
	GB 16	3.7	1.9 (4/12) (1.4-2.1)	K-1h, North Well 0.2 mi, NW	2.1 (1/4)	1.0 (1/4)	0
	H-3 16	159	< MDC	K-1t, Gatehouse 0.10 mi, ESE	2.1 (1/4)	< MDC	0
	K-40 16	0.3	1.98 (12/12) (2.79-3.12)	-	-	< MDC	0
	Sr-90 4	0.5	< MDC	K-1t, Gatehouse 0.10 mi, ESE	2.95 (4/4) (2.79-3.12)	1.07 (4/4) (0.98-1.07)	0
	GS 16			-	-	None	0
	Mn-54	5.5	< MDC	-	-	< MDC	0
	Fe-59	9.0	< MDC	-	-	< MDC	0
	Co-58	4.7	< MDC	-	-	< MDC	0
	Co-60	6.2	< MDC	-	-	< MDC	0
	Zn-65	14.2	< MDC	-	-	< MDC	0
	Zr-Nb-95	8.3	< MDC	-	-	< MDC	0
	Cs-134	5.8	< MDC	-	-	< MDC	0
	Cs-137	6.4	< MDC	-	-	< MDC	0
Ba-La-140	15.5	< MDC	-	-	< MDC	0	
Broad leaf Vegetation (pCi/gwet)	GS 3						
	Be-7	0.100	2.00 (2/2) (1.57-2.43)	K-23a 0.5 mi W. of Plant	2.43 (1/1)	< MDC	0
	K-40	0.50	7.05 (2/2) (3.98-10.11)	K-23b 0.6 mi N. of Plant	10.11 (1/1)	2.39 (1/1)	0
	Nb-95	0.027	< MDC	-	-	< MDC	0
	Zr-95	0.033	< MDC	-	-	< MDC	0
	Ru-103	0.023	< MDC	-	-	< MDC	0
	Ru-106	0.207	< MDC	-	-	< MDC	0
	Cs-134	0.023	< MDC	-	-	< MDC	0
	Cs-137	0.025	< MDC	-	-	< MDC	0
	Ce-141	0.040	< MDC	-	-	< MDC	0
Ce-144	0.166	< MDC	-	-	< MDC	0	
Cattle feed (pCi/gwet)	GB 10	0.008	13.70(6/6) (2.39-25.15)	K-45, Wakker's Dairy 5.1 mi. N	15.29 (2/2) (11.84-18.74)	10.60 (4/4) (2.43-18.20)	0
	Sr-90 10	0.026	0.003 (3/6) (0.001-0.004)	K-35, Ducat Residence 6.71 mi. WNW	0.004 (1/2)	0.004 (1/4)	0
	GS 10						
	Be-7	0.269	0.72 (3/6) (0.43-1.21)	K-35, Ducat Residence 6.71 mi. N	1.98 (1/2)	1.98(1/4)	0
	K-40	0.50	8.62 (6/6) (2.42-14.91)	K-45, Wakker's Dairy 5.1 mi. N	12.28 (2/2) (9.65-14.91)	8.28 (4/4) (3.05-13.43)	0
	Nb-95	0.040	< MDC	-	-	< MDC	0
	Zr-95	0.048	< MDC	-	-	< MDC	0
	Ru-103	0.037	< MDC	-	-	< MDC	0
	Ru-106	0.316	< MDC	-	-	< MDC	0
	Cs-134	0.042	< MDC	-	-	< MDC	0
	Cs-137	0.036	< MDC	-	-	< MDC	0
	Ce-141	0.066	< MDC	-	-	< MDC	0
	Ce-144	0.313	< MDC	-	-	< MDC	0

Table 4.5 Environmental Radiation Monitoring Program Summary.

Name of Facility	<u>Kewaunee Power Station</u>	Docket No.	<u>50-305</u>
Location of Facility	<u>Kewaunee County, Wisconsin</u> (County, State)	Reporting Period	<u>January-December, 2021</u>

Sample Type (Units)	Type and Number of Analyses <sup>a</sup>		MDC <sup>b</sup>	Indicator Locations Mean (F) <sup>c</sup> Range <sup>e</sup>	Location with Highest Annual Mean		Control Locations Mean (F) <sup>c</sup> Range <sup>e</sup>	Number Non-Routine Results <sup>e</sup>
					Location <sup>d</sup>	Mean (F) <sup>c</sup> Range <sup>e</sup>		
Grass (pCi/gwet)	GB	24	0.10	6.72 (18/18) (3.37-9.99)	K-38, Sinkula Farm 2.4 mi WNW	7.56 (3/3) (3.37-9.88)	7.35 (6/6) (4.08-9.02)	0
	Sr-90	24	0.006	0.002 (2/18) (0.001-0.003)	K-34, Struck Residence 2.7 mi N	0.0002 (2/3) (0.001-0.003)	< MDC	0
	GS	24						
	Be-7		0.26	3.23 (18/18) (0.80-7.89)	K-39, Wojta Residence 3.46 mi N	4.17 (3/3) (2.00-5.64)	1.90 (6/6) (0.52-3.71)	0
	K-40		0.50	6.57 (18/18) (2.82-10.74)	K-5, Papham Farm 3.2 mi. NNW	7.66 (3/3) (5.49-10.74)	6.39 (6/6) (4.65-8.43)	0
	Mn-54		0.035	< MDC	-	-	< MDC	0
	Co-58		0.042	< MDC	-	-	< MDC	0
	Co-60		0.027	< MDC	-	-	< MDC	0
	Nb-95		0.033	< MDC	-	-	< MDC	0
	Zr-95		0.050	< MDC	-	-	< MDC	0
	Ru-103		0.045	< MDC	-	-	< MDC	0
	Ru-106		0.323	< MDC	-	-	< MDC	0
	Cs-134		0.034	< MDC	-	-	< MDC	0
	Cs-137		0.049	< MDC	-	-	< MDC	0
	Ce-141		0.075	< MDC	-	-	< MDC	0
Ce-144		0.267	< MDC	-	-	< MDC	0	
Soil (pCi/gdry)	GA	10	5.6	6.68 (6/6) (6.01-7.06)	K-3, Siegmund Farm 5.9 mi N	7.83 (2/2) (7.52-8.13)	7.25 (4/4) (5.78-8.13)	0
	GB	10	2.0	24.72 (6/6) (15.63-30.85)	K-38, Sinkula Farm 2.4 mi. WNW	29.49 (2/2) (28.12-30.85)	24.26 (4/4) (17.77-30.13)	0
	Sr-90	10	0.056	0.029 (1/6)	K-38, Sinkula Farm 2.4 mi WNW	0.029 (1/2)	< MDC	0
	GS	10						
	Be-7		0.48	< MDC	-	-	< MDC	0
	K-40		1.4	20.30 (6/6) (17.93-23.10)	K-38, Sinkula Farm 2.4 mi WNW	22.91 (2/2) (22.72-23.10)	17.93 (4/4) (13.73-21.65)	0
	Nb-95		0.088	< MDC	-	-	< MDC	0
	Zr-95		0.109	< MDC	-	-	< MDC	0
	Ru-103		0.067	< MDC	-	-	< MDC	0
	Ru-106		0.377	< MDC	-	-	< MDC	0
	Cs-134		0.036	< MDC	-	-	< MDC	0
	Cs-137		0.024	0.11 (6/6) (0.05-0.14)	K-38, Sinkula Farm 2.4 mi WNW & K-3, Siegmund Farm 5.9 mi N	0.12 (2/2) (0.10-0.14) 0.12 (2/2) (0.11-0.13)	0.11 (4/4) (0.06-0.13)	0
	Ce-141		0.128	< MDC	-	-	< MDC	0
	Ce-144		0.257	< MDC	-	-	< MDC	0

Table 4.5 Environmental Radiation Monitoring Program Summary.

Name of Facility Kewaunee Power Station  
 Location of Facility Kewaunee County, Wisconsin  
 (County, State)

Docket No. 50-305  
 Reporting Period January-December, 2021

Sample Type (Units)	Type and Number of Analyses <sup>a</sup>	MDC <sup>b</sup>	Indicator Locations Mean (F) <sup>c</sup> Range <sup>d</sup>	Location with Highest Annual Mean		Control Locations Mean (F) <sup>c</sup> Range <sup>e</sup>	Number Non-Routine Results <sup>a</sup>
				Location <sup>d</sup>	Mean (F) <sup>c</sup> Range <sup>e</sup>		
Surface Water (pCi/L)	GB (TR) 20	1.3	2.2 (12/12) (0.9 - 5.1)	K-1b, Middle Creek 0.12 N	3.1 (4/4) (1.7 - 5.1)	1.1 (8/8) (0.7 - 1.5)	0
	GS 20						
	Mn-54	4.8	< MDC	-	-	< MDC	0
	Fe-59	9.0	< MDC	-	-	< MDC	0
	Co-58	5.5	< MDC	-	-	< MDC	0
	Co-60	3.9	< MDC	-	-	< MDC	0
	Zn-65	8.0	< MDC	-	-	< MDC	0
	Zr-Nb-95	5.8	< MDC	-	-	< MDC	0
	Cs-134	4.8	< MDC	-	-	< MDC	0
	Cs-137	5.9	< MDC	-	-	< MDC	0
	Ba-La-140	6.5	< MDC	-	-	< MDC	0
	H-3 20	163	< MDC	-	-	< MDC	0
	Sr-90 20	0.8	< MDC	-	-	< MDC	0
K-40 20	2.30		2.8 (11/12) (1.2 - 5.0)	K-1b, Middle Creek 0.12 N	4.0 (3/4) (3.4 - 5.0)	1.3 (8/8) (1.2 - 1.5)	0
Fish (Flesh) (pCi/gwet)	GB 1	0.5	5.29 (1/1)	K-1d, Cond. Discharge 0.10 mi. E	5.29 (1/1)	None	0
	GS 1						
	K-40	0.5	3.71 (1/1)	K-1d, Cond. Discharge 0.10 mi. E	3.71 (1/1)	None	0
	Mn-54	0.020	< MDC	-	-	None	0
	Fe-59	0.046	< MDC	-	-	None	0
	Co-58	0.022	< MDC	-	-	None	0
	Co-60	0.018	< MDC	-	-	None	0
	Cs-134	0.017	< MDC	-	-	None	0
	Cs-137	0.018	< MDC	-	-	None	0
Fish (Bones) (pCi/gwet)	GB 1	0.5	4.52 (1/1)	K-1d, Cond. Discharge 0.10 mi. E	4.52 (1/1)	None	0
	Sr-90 1	0.07	< MDC	-	-	None	0

Table 4.5 Environmental Radiation Monitoring Program Summary.

Name of Facility	<u>Kewaunee Power Station</u>	Docket No.	<u>50-305</u>
Location of Facility	<u>Kewaunee County, Wisconsin</u> (County, State)	Reporting Period	<u>January-December, 2021</u>

Sample Type (Units)	Type and Number of Analyses <sup>a</sup>		MDC <sup>b</sup>	Indicator Locations Mean (F) <sup>c</sup> Range <sup>c</sup>	Location with Highest Annual Mean		Control Locations Mean (F) <sup>c</sup> Range <sup>c</sup>	Number Non- Routine Results <sup>e</sup>
					Location <sup>d</sup>	Mean (F) <sup>c</sup> Range <sup>c</sup>		
Shoreline Sediments	GB	6	1.0	9.39 (4/4) (8.11 - 12.12)	K-9, Rostok Intake 11.5 mi. NNE	11.55 (2/2) (9.50 - 13.59)	11.55 (2/2) (9.50 - 13.59)	0
	Sr-90	6	0.067	< MDC	-	-	< MDC	0
	GS	6						
	K-40		0.5	5.99 (4/4) (3.91 - 8.44)	K-9, Rostok Intake 11.5 mi. NNE	8.74 (2/2) (7.70 - 9.78)	8.74 (2/2) (7.70 - 9.78)	0
	Co-58		0.023	< MDC	-	-	< MDC	0
	Co-60		0.017	< MDC	-	-	< MDC	0
	Cs-134		0.021	< MDC	-	-	< MDC	0
	Cs-137		0.019	< MDC	-	-	< MDC	0

<sup>a</sup> GA = gross alpha, GB = gross beta, GS = gamma spectroscopy, TR = total residue.

<sup>b</sup> MDC = Minimum Detectable Concentration based on a 4.66 sigma counting error for background sample.

<sup>c</sup> Mean and range are based on detectable measurements only (i.e., >MDC) Fraction of detectable measurements at specified locations is indicated in parentheses (F).

<sup>d</sup> Locations are specified by station code (Table 4.1) and distance (miles) and direction relative to reactor site.

<sup>e</sup> Non-routine results are those which exceed ten times the control station value. If no control station value is available, the result is considered non-routine if it exceeds ten times the preoperational value for the location.

<sup>f</sup> For TLD's this value is the Quarterly Minimum Differential Dose(MDD<sub>Q</sub>). See page 8 of this report for the details of how it is computed.

Table 4.6 Land Use Census

The following table lists an inventory of residences and gardens found nearest the plant in each of the 10 meteorological sectors within a five mile radius of the Kewaunee Power Station.

Sector	Township No.	Residence	Garden	Distance From Plant (miles)	Location ID
A	24	X		1.12	
A	12		X	3.71	
B	24	X	(Note 2)	1.01	
R	26	X		0.96	
R	23		X	2.16	
Q	23	X		1.27	
Q	23		X	1.53	K-27
P	26	X		1.35	
P	26		X	1.41	
N	35	X		0.94	
N	28		X	2.37	
M	35	X	(Note 3)	1.38	
L	35	X		1.00	
L	2		X	2.04	
K	36	X	(Note 4)	0.91	
J	11	X	(Note 5)	2.72	

Note 1. There were no changes identified during the 2021 Land Use Census.

Note 2. There were no gardens located in Sector B within five miles of the Kewaunee Power Station.

Note 3. There were no gardens located in Sector M within five miles of the Kewaunee Power Station.

Note 4. There was no garden located in Sector K within five miles of the Kewaunee Power Station.

Note 5. There were no gardens located in Sector J within five miles of the Kewaunee Power Station.

Note 6. The requirement for inventory of milk animals was removed in 2018 (REMM revision 21) due to the cessation of power operations (see introduction on page 1).

## 5.0 REFERENCES

- Arnold, J. R. and H. A. Al-Salih. 1955. Beryllium-7 Produced by Cosmic Rays. *Science* 121: 451-453.
- Eisenbud, M. 1963. *Environmental Radioactivity*, McGraw-Hill, New York, New York, pp. 213, 275, and 276.
- Gold, S., H. W. Barkhau, B. Shlein, and B. Kahn, 1964 Measurement of Naturally Occurring Radionuclides in Air, in the Natural Radiation Environment, University of Chicago Press, Chicago, Illinois, 369-382.
- ATI Environmental, Inc., Midwest Laboratory.
- \_\_\_\_\_ 2001 to 2020. Annual Report. Radiological Monitoring Program for the Kewaunee Power Station; Kewaunee, Wisconsin, Final Report, Part II, Data Tabulations and Analysis, January - December 2000 – 2016.
- \_\_\_\_\_ 1984 to 2000. (formerly Teledyne Brown Engineering Environmental Services, Midwest Laboratory) Annual Reports. Radiological Monitoring Program for the Kewaunee Power Station, Kewaunee, Wisconsin, Final Report, Part II, Data Tabulations and Analysis, January - December 1983 through January - December 1999.
- \_\_\_\_\_ 1979 to 1983. (formerly Hazleton Environmental Sciences Corporation) Annual Reports. Radiological Monitoring for the Kewaunee Power Station, Kewaunee, Wisconsin, Final Report - Part II, Data Tabulations and Analysis, January - December, 1978 through 1982.
- \_\_\_\_\_ 1977 to 1978. (formerly NALCO Environmental Sciences Corporation) Annual Reports. Radiological Monitoring for the Kewaunee Power Station, Kewaunee, Wisconsin, Final Report - Part II, Data Tabulations and Analysis, January - December, 1976 to 1977.
- \_\_\_\_\_ 2022. Quality Manual, Rev. 7, 15 January 2022.
- \_\_\_\_\_ 2020. Quality Control Procedures Manual, Rev. 4, 15 January 2020.
- \_\_\_\_\_ 2012. Quality Assurance Program Manual, Rev. 3, 14 November 2012.
- \_\_\_\_\_ 2009. Quality Control Program, Rev. 2, 12 November 2009.
- Industrial BIO-TEST Laboratories, Inc. 1974. Annual Report. Pre-operational Radiological Monitoring Program for the Kewaunee Power Station. Kewaunee, Wisconsin. January - December 1973.
- Industrial BIO-TEST Laboratories, Inc. 1975. Semi-annual Report. Radiological Monitoring Program for the Kewaunee Power Station, Kewaunee, Wisconsin. Jan. - June, 1975.
- Kewaunee Power Station. 2021. Radiological Environmental Monitoring Manual (REMM). Revision 23, 20 October 2021
- National Center for Radiological Health. 1968. Section 1. Milk Surveillance. *Radiological Health Data Rep.*, December 9: 730-746.
- National Council on Radiation Protection and Measurements. 1975. *Natural Radiation Background in the United States*. NCRP Report No. 45.
- Solon, L. R., W. M. Lowder, A. Shambron, and H. Blatz. 1960. Investigations of Natural Environmental Radiation. *Science*. 131: 903-906.
- U.S. Environmental Protection Agency, 2007. RadNet, formerly Environmental Radiation Ambient Monitoring System, Gross Beta in Air (WI) 1981 – 2000.
- Wilson, D.W., G. M. Ward, and J. E. Johnson, 1969. Environmental Contamination by Radioactive Materials. *International Atomic Energy Agency*, p. 125
- American National Standards Institute/Health Physics Society (ANSI/HPS) N13.37 - 2014, *Environmental Dosimetry – Criteria for System Design and Implementation*



## APPENDIX A

### INTERLABORATORY AND INTRALABORATORY COMPARISON PROGRAM RESULTS

NOTE: Appendix A is updated four times a year. The complete appendix is included in March, June, September and December monthly progress reports only.

January, 2021 through December, 2021

## Appendix A

### Interlaboratory/ Intralaboratory Comparison Program Results

Environmental, Inc., Midwest Laboratory has participated in interlaboratory comparison (crosscheck) programs since the formulation of its quality control program in December 1971. These programs are operated by agencies which supply environmental type samples containing concentrations of radionuclides known to the issuing agency but not to participant laboratories. The purpose of such a program is to provide an independent check on a laboratory's analytical procedures and to alert it of any possible problems.

Participant laboratories measure the concentration of specified radionuclides and report them to the issuing agency. Several months later, the agency reports the known values to the participant laboratories and specifies control limits. Results consistently higher or lower than the known values or outside the control limits indicate a need to check the instruments or procedures used.

Results in Table A-1 were obtained through participation in the RAD PT Study Proficiency Testing Program administered by Environmental Resource Associates, serving as a replacement for studies conducted previously by the U.S. EPA Environmental Monitoring Systems Laboratory, Las Vegas, Nevada.

Table A-2 lists results for thermoluminescent dosimeters (TLDs), via irradiation and evaluation by the University of Wisconsin-Madison Radiation Calibration Laboratory at the University of Wisconsin Medical Radiation Research Center.

Table A-3 lists results of the analyses on intralaboratory "spiked" samples for the past twelve months. All samples are prepared using NIST traceable sources. Data for previous years available upon request.

Table A-4 lists results of the analyses on intralaboratory "blank" samples for the past twelve months. Data for previous years available upon request.

Table A-5 lists analytical results from the intralaboratory "duplicate" program for the past twelve months. Acceptance is based on each result being within 25% of the mean of the two results or the two sigma uncertainties of each result overlap.

The results in Table A-6 were obtained through participation in the Mixed Analyte Performance Evaluation Program.

Results in Table A-7 were obtained through participation in the MRAD PT Study Proficiency Testing Program administered by Environmental Resource Associates, serving as a replacement for studies conducted previously by the Environmental Measurement Laboratory Quality Assessment Program (EML).

Attachment A lists the laboratory acceptance criteria for various analyses.

Out-of-limit results are explained directly below the result.

Attachment A

ACCEPTANCE CRITERIA FOR INTRALABORATORY "SPIKED" SAMPLES

---

<u>Analysis</u>	<u>Ratio of lab result to known value.</u>
Gamma Emitters	0.8 to 1.2
Strontium-89, Strontium-90	0.8 to 1.2
Potassium-40	0.8 to 1.2
Gross alpha	0.5 to 1.5
Gross beta	0.8 to 1.2
Tritium	0.8 to 1.2
Radium-226, Radium-228	0.7 to 1.3
Plutonium	0.8 to 1.2
Iodine-129, Iodine-131	0.8 to 1.2
Nickel-63, Technetium-99, Uranium-238	0.7 to 1.3
Iron-55	0.8 to 1.2
Other Analyses	0.8 to 1.2

---

TABLE A-1. Interlaboratory Comparison Crosscheck program, Environmental Resource Associates (ERA)<sup>a</sup>.  
RAD study

Lab Code	Date	Analysis	Concentration (pCi/L)			Acceptance
			Laboratory Result	ERA Result	Control Limits	
RAD-124 Study						
ERW-94	1/11/2021	Ba-133	24.1 ± 3.5	23.8	18.4 - 27.4	Pass
ERW-94	1/11/2021	Cs-134	46.1 ± 3.1	42.8	34.2 - 47.1	Pass
ERW-94	1/11/2021	Cs-137	154 ± 6.0	148	133 - 165	Pass
ERW-94	1/11/2021	Co-60	39.4 ± 3.2	34.6	30.8 - 40.8	Pass
ERW-94	1/11/2021	Zn-65	66.2 ± 6.3	61.6	54.6 - 75.0	Pass
ERDW-96	1/11/2021	Gr. Alpha	58.4 ± 2.6	63.3	33.2 - 78.5	Pass
ERDW-96	1/11/2021	Gr. Beta	38.1 ± 1.3	39.8	26.4 - 47.3	Pass
ERDW-98	1/11/2021	Ra-226	16.3 ± 0.5	15.5	11.5 - 17.8	Pass
ERDW-98	1/11/2021	Ra-228	12.3 ± 1.2	12.9	8.54 - 15.8	Pass
ERDW-98	1/11/2021	Uranium	33.2 ± 1.8	30.1	24.4 - 33.4	Pass
ERW-100	1/11/2021	H-3	2,100 ± 160	2,120	1,750 - 2,350	Pass
RAD-126 Study						
ERDW-2194	7/12/2021	Ba-133	44.1 ± 4.0	45.5	37.2 - 50.6	Pass
ERDW-2194	7/12/2021	Cs-134	85.2 ± 3.9	87.5	71.8 - 96.2	Pass
ERDW-2194	7/12/2021	Cs-137	218 ± 8	208	187 - 230	Pass
ERDW-2194	7/12/2021	Co-60	91.7 ± 4.0	87.1	78.4 - 98.1	Pass
ERDW-2194	7/12/2021	Zn-65	114 ± 9	102	91.8 - 122.0	Pass
ERDW-2196	7/12/2021	Gr. Alpha	61.5 ± 2.9	49.1	25.6 - 61.7	Pass
ERDW-2196	7/12/2021	Gr. Beta	31.7 ± 1.3	31.5	20.3 - 39.2	Pass
ERDW-2200	7/12/2021	Ra-226	16.5 ± 0.5	13.4	10.0 - 15.4	Fail <sup>b</sup>
ERDW-2200	7/12/2021	Ra-228	8.7 ± 1.0	7.6	4.81 - 9.7	Pass
ERDW-2200	7/12/2021	Uranium	71.7 ± 2.3	62.3	50.9 - 68.5	Fail <sup>c</sup>
ERDW-2202	7/12/2021	H-3	11,300 ± 300	10,400	9,050 - 11,400	Pass
ERDW-2198	7/12/2021	I-131	22.3 ± 1.1	20.8	17.2 - 25.0	Pass

<sup>a</sup> Results obtained by Environmental, Inc., Midwest Laboratory as a participant in the crosscheck program for proficiency testing in drinking water conducted by Environmental Resource Associates (ERA).

<sup>b</sup> The radium-226 result did not meet ERA acceptance criteria.

<sup>c</sup> The uranium result did not meet ERA acceptance criteria.

TABLE A-2. Thermoluminescent Dosimetry, (TLD, CaSO<sub>4</sub>: Dy Cards).<sup>a</sup>

Lab Code	Irradiation Date	Description	Delivered Dose	mrem		Performance <sup>c</sup> Quotient (P)	
				Reported <sup>b</sup> Dose			
<u>Environmental, Inc.</u>		Group 1					
2021-1	11/8/2021	Spike 1	167.0	171.4		0.03	
2021-1	11/8/2021	Spike 2	167.0	159.4		-0.05	
2021-1	11/8/2021	Spike 3	167.0	160.8		-0.04	
2021-1	11/8/2021	Spike 4	167.0	164.5		-0.01	
2021-1	11/8/2021	Spike 5	167.0	156.7		-0.06	
2021-1	11/8/2021	Spike 6	167.0	152.3		-0.09	
2021-1	11/8/2021	Spike 7	167.0	158.7		-0.05	
2021-1	11/8/2021	Spike 8	167.0	161.6		-0.03	
2021-1	11/8/2021	Spike 9	167.0	152.4		-0.09	
2021-1	11/8/2021	Spike 10	167.0	155.7		-0.07	
2021-1	11/8/2021	Spike 11	167.0	158.8		-0.05	
2021-1	11/8/2021	Spike 12	167.0	163.1		-0.02	
2021-1	11/8/2021	Spike 13	167.0	162.2		-0.03	
2021-1	11/8/2021	Spike 14	167.0	158.8		-0.05	
2021-1	11/8/2021	Spike 15	167.0	173.5		0.04	
2021-1	11/8/2021	Spike 16	167.0	158.7		-0.05	
2021-1	11/8/2021	Spike 17	167.0	162.9		-0.02	
2021-1	11/8/2021	Spike 18	167.0	159.3		-0.05	
2021-1	11/8/2021	Spike 19	167.0	158.2		-0.05	
2021-1	11/8/2021	Spike 20	167.0	161.7		-0.03	
Mean (Spike 1-20)				160.5		-0.04	Pass <sup>d</sup>
Standard Deviation (Spike 1-20)				5.2		0.03	Pass <sup>d</sup>

a TLD's were irradiated by the University of Wisconsin-Madison Radiation Calibration Laboratory following ANSI N13.37 protocol from a known air kerma rate. TLD's were read and the results were submitted by Environmental Inc. to the University of Wisconsin-Madison Radiation Calibration Laboratory for comparison to the delivered dose.

b Reported dose was converted from exposure (R) to Air Kerma (cGy) using a conversion of 0.876. Conversion from air kerma to ambient dose equivalent for Cs-137 at the reference dose point  $H^*(10)K_a = 1.20$  . mrem/cGy = 1000.

c Performance Quotient (P) is calculated as ((reported dose - conventionally true value) ÷ conventionally true value) where the conventionally true value is the delivered dose.

d Acceptance is achieved when neither the absolute value of the mean of the P values, nor the standard deviation of the P values exceed 0.15.

TABLE A-2. Thermoluminescent Dosimetry, (TLD, CaSO<sub>4</sub>: Dy Cards).<sup>a</sup>

Lab Code	Irradiation Date	Description	mrem		Performance <sup>c</sup> Quotient (P)	
			Delivered Dose	Reported <sup>b</sup> Dose		
<u>Environmental, Inc.</u>		Group 2				
2021-2	11/8/2021	Spike 21	102.0	98.3	-0.04	
2021-2	11/8/2021	Spike 22	102.0	88.4	-0.13	
2021-2	11/8/2021	Spike 23	102.0	96.7	-0.05	
2021-2	11/8/2021	Spike 24	102.0	101.4	-0.01	
2021-2	11/8/2021	Spike 25	102.0	98.5	-0.03	
2021-2	11/8/2021	Spike 26	102.0	96.3	-0.06	
2021-2	11/8/2021	Spike 27	102.0	95.8	-0.06	
2021-2	11/8/2021	Spike 28	102.0	94.3	-0.08	
2021-2	11/8/2021	Spike 29	102.0	93.5	-0.08	
2021-2	11/8/2021	Spike 30	102.0	95.7	-0.06	
2021-2	11/8/2021	Spike 31	102.0	101.7	0.00	
2021-2	11/8/2021	Spike 32	102.0	98.5	-0.03	
2021-2	11/8/2021	Spike 33	102.0	96.7	-0.05	
2021-2	11/8/2021	Spike 34	102.0	87.2	-0.15	
2021-2	11/8/2021	Spike 35	102.0	89.7	-0.12	
2021-2	11/8/2021	Spike 36	102.0	88.5	-0.13	
2021-2	11/8/2021	Spike 37	102.0	85.4	-0.16	
2021-2	11/8/2021	Spike 38	102.0	90.0	-0.12	
2021-2	11/8/2021	Spike 39	102.0	90.9	-0.11	
2021-2	11/8/2021	Spike 40	102.0	92.6	-0.09	
Mean (Spike 21-40)				94.0	-0.08	Pass <sup>d</sup>
Standard Deviation (Spike 21-40)				4.7	0.05	Pass <sup>d</sup>

a TLD's were irradiated by the University of Wisconsin-Madison Radiation Calibration Laboratory following ANSI N13.37 protocol from a known air kerma rate. TLD's were read and the results were submitted by Environmental Inc. to the University of Wisconsin-Madison Radiation Calibration Laboratory for comparison to the delivered dose.

b Reported dose was converted from exposure (R) to Air Kerma (cGy) using a conversion of 0.876. Conversion from air kerma to ambient dose equivalent for Cs-137 at the reference dose point  $H^*(10)K_a = 1.20$ .  $mrem/cGy = 1000$ .

c Performance Quotient (P) is calculated as  $((\text{reported dose} - \text{conventionally true value}) \div \text{conventionally true value})$  where the conventionally true value is the delivered dose.

d Acceptance is achieved when neither the absolute value of the mean of the P values, nor the standard deviation of the P values exceed 0.15.

TABLE A-3. Intralaboratory "Spiked" Samples

Lab Code <sup>b</sup>	Date	Analysis	Concentration <sup>a</sup>			Acceptance	Ratio Lab/Known
			Laboratory results 2s, n=1 <sup>c</sup>	Known Activity	Control Limits <sup>d</sup>		
SPW-55	1/8/2021	H-3	1,889 ± 150	2,110	1,688 - 2,532	Pass	0.90
SPDW-62	1/11/2021	Gr. Alpha	34.3 ± 1.7	64.9	34.0 - 80.4	Pass	0.53
SPDW-62	1/11/2021	Gr. Beta	9.2 ± 0.8	8.9	3.6 - 17.4	Pass	1.04
SPW-131	1/19/2021	Sr-90	18.0 ± 1.1	17.9	14.3 - 21.5	Pass	1.00
SPW-133	1/19/2021	H-3	1,842 ± 150	2,110	1,688 - 2,532	Pass	0.87
SPW-188	1/18/2021	Ra-228	14.2 ± 1.7	14.9	10.4 - 19.3	Pass	0.96
SPW-236	1/26/2021	Ra-228	12.2 ± 1.9	15.3	10.7 - 19.9	Pass	0.80
SPW-305	2/5/2021	H-3	1,785 ± 147	2,110	1,688 - 2,532	Pass	0.85
SPW-372	2/12/2021	H-3	1,742 ± 145	2,110	1,688 - 2,532	Pass	0.83
SPW-526	3/5/2021	H-3	1,899 ± 150	2,110	1,688 - 2,532	Pass	0.90
SPW-692	3/19/2021	H-3	1,953 ± 151	2,110	1,688 - 2,532	Pass	0.93
SPW-694	1/4/2021	Ra-226	9.7 ± 0.4	12.3	8.6 - 16.0	Pass	0.79
SPW-800	3/30/2021	Ra-228	15.8 ± 2.0	15.3	10.7 - 19.9	Pass	1.03
SPW-802	3/31/2021	H-3	1,878 ± 150	2,110	1,688 - 2,532	Pass	0.89
SPW-810	3/19/2021	Ra-226	11.4 ± 0.3	12.3	8.6 - 16.0	Pass	0.93
SPDW-30103	3/31/2021	Ra-226	13.5 ± 0.4	12.3	8.6 - 16.0	Pass	1.10
SPW-812	4/1/2021	H-3	2,005 ± 155	2,110	1,688 - 2,532	Pass	0.95
SPW-919	4/7/2021	H-3	1,877 ± 149	2,110	1,688 - 2,532	Pass	0.89
SPW-944	4/9/2021	Gr. Alpha	56.7 ± 2.5	58.4	29.2 - 87.6	Pass	0.97
SPW-944	4/9/2021	Gr. Beta	35.1 ± 1.3	38.1	30.5 - 45.7	Pass	0.92
SPW-1048	4/15/2021	H-3	1,915 ± 152	2,110	1,688 - 2,532	Pass	0.91
SPW-1250	4/30/2021	H-3	2,015 ± 154	2,110	1,688 - 2,532	Pass	0.95
SPW-1373	5/11/2021	Gr. Alpha	63.5 ± 2.9	58.4	29.2 - 87.6	Pass	1.09
SPW-1373	5/11/2021	Gr. Beta	38.5 ± 1.3	38.1	30.5 - 45.7	Pass	1.01
SPW-1377	5/11/2021	Sr-90	17.4 ± 1.2	17.9	14.3 - 21.5	Pass	0.97
SPDW-30108	5/28/2021	H-3	2,222 ± 161	2,110	1,688 - 2,532	Pass	1.05
SPDW-30125	5/13/2021	Ra-226	10.9 ± 0.3	12.3	8.6 - 16.0	Pass	0.89
SPDW-30118	6/4/2021	H-3	2,230 ± 163	2,110	1,688 - 2,532	Pass	1.06
SPMI-1672	6/8/2021	Sr-90	14.2 ± 0.9	13.6	10.9 - 16.3	Pass	1.04
SPDW-30160	6/11/2021	Ra-226	11.4 ± 0.3	12.3	8.6 - 16.0	Pass	0.93
SPDW-30129	6/15/2021	H-3	2,238 ± 162	2,110	1,688 - 2,532	Pass	1.06
SPDW-30134	6/18/2021	Gr. Alpha	17.9 ± 1.4	23.5	11.8 - 35.3	Pass	0.76
SPDW-30134	6/18/2021	Gr. Beta	60.9 ± 1.6	67.6	54.1 - 81.1	Pass	0.90
SPDW-30148	6/25/2021	Ra-228	15.1 ± 2.9	15.3	10.7 - 19.9	Pass	0.98
SPDW-30206	7/8/2021	Ra-226	12.7 ± 0.4	12.3	8.6 - 16.0	Pass	1.03
SPDW-3001	7/29/2021	Ra-226	11.6 ± 0.3	12.3	8.6 - 16.0	Pass	0.95

<sup>a</sup> Liquid sample results are reported in pCi/Liter, air filters (pCi/m3), charcoal (pCi/charcoal canister), and solid samples (pCi/kg).

<sup>b</sup> Laboratory codes : W & SPW (Water), MI (milk), AP (air filter), SO (soil), VE (vegetation), CH (charcoal canister), F (fish), U (urine).

<sup>c</sup> Results are based on single determinations.

<sup>d</sup> Acceptance criteria are listed in Attachment A of this report.

TABLE A-3. Intralaboratory "Spiked" Samples

Lab Code <sup>b</sup>	Date	Analysis	Concentration <sup>a</sup>		Control Limits <sup>d</sup>	Acceptance	Ratio Lab/Known
			Laboratory results 2s, n=1 <sup>c</sup>	Known Activity			
SPDW-30224	8/2/2021	Gr. Alpha	38.6 ± 2.1	49.1	24.6 - 73.7	Pass	0.79
SPDW-30224	8/2/2021	Gr. Beta	27.8 ± 1.2	31.5	25.2 - 37.8	Pass	0.88
SPDW-30226	8/13/2021	H-3	2,074 ± 157	2,110	1,688 - 2,532	Pass	0.98
SPDW-30231	8/18/2021	Ra-228	14.5 ± 2.2	15.3	10.7 - 19.9	Pass	0.95
SPW-2783	9/3/2021	Sr-90	18.9 ± 1.2	17.1	13.7 - 20.5	Pass	1.10
SPDW-2785	9/3/2021	H-3	2,135 ± 158	2,110	1,688 - 2,532	Pass	1.01
SPDW-2891	9/10/2021	H-3	2,159 ± 160	2,110	1,688 - 2,532	Pass	1.02
SPDW-3115	9/17/2021	Ra-226	11.3 ± 0.3	12.3	8.6 - 16.0	Pass	0.92
SPDW-3036	9/23/2021	Ra-228	18.0 ± 2.6	15.3	10.7 - 19.9	Pass	1.17
SPDW-3223	9/28/2021	Ra-228	16.6 ± 2.5	15.3	10.7 - 19.9	Pass	1.08
SPDW-3288	9/29/2021	U-234	29.2 ± 1.6	23.0	16.1 - 29.9	Pass	1.27
SPDW-3288	9/29/2021	U-238	28.2 ± 1.6	23.2	16.3 - 30.2	Pass	1.21
SPDW-30276	9/29/2021	Ra-226	9.4 ± 0.4	12.3	8.6 - 16.0	Pass	0.76
SPDW-3157	10/1/2021	H-3	2,111 ± 158	2,110	1,688 - 2,532	Pass	1.00
SPDW-3393	10/15/2021	H-3	2,184 ± 161	2,110	1,688 - 2,532	Pass	1.04
SPDW-3604	10/28/2021	H-3	2,104 ± 15	2,110	1,688 - 2,532	Pass	1.00
SPDW-30283	11/4/2021	Ra-226	11.7 ± 0.3	12.3	8.6 - 16.0	Pass	0.95
SPDW-3769	11/10/2021	H-3	2,026 ± 156	2,110	1,688 - 2,532	Pass	0.96
SPDW-3860	11/18/2021	H-3	2,161 ± 161	2,110	1,688 - 2,532	Pass	1.02
SPDW-30290	11/22/2021	Ra-226	12.0 ± 0.3	12.3	8.6 - 16.0	Pass	0.97
SPDW-3958	12/3/2021	H-3	2,126 ± 160	2,110	1,688 - 2,532	Pass	1.01
SPW-3971	12/7/2021	Sr-90	19.0 ± 1.2	17.1	13.7 - 20.5	Pass	1.11
SPDW-30287	12/9/2021	Ra-228	12.3 ± 1.7	15.3	10.7 - 19.9	Pass	0.80
SPDW-30295	12/16/2021	H-3	2,265 ± 163	2,110	1,688 - 2,532	Pass	1.07
SPDW-30301	12/30/2021	H-3	2,055 ± 163	2,110	1,688 - 2,532	Pass	0.97
SPDW-30307	12/13/2021	Ra-226	11.7 ± 0.4	12.3	8.6 - 16.0	Pass	0.95

<sup>a</sup> Liquid sample results are reported in pCi/Liter, air filters (pCi/m<sup>3</sup>), charcoal (pCi/charcoal canister), and solid samples (pCi/kg).

<sup>b</sup> Laboratory codes : W & SPW (Water), MI (milk), AP (air filter), SO (soil), VE (vegetation), CH (charcoal canister), F (fish), U (urine).

<sup>c</sup> Results are based on single determinations.

<sup>d</sup> Acceptance criteria are listed in Attachment A of this report.

TABLE A-4. Intralaboratory "Blank" Samples

Lab Code <sup>b</sup>	Sample Type	Date	Analysis <sup>c</sup>	Concentration <sup>a</sup>		Acceptance Criteria (4.66 $\sigma$ )
				Laboratory results (4.66 $\sigma$ )		
				LLD	Activity <sup>d</sup>	
SPW-54	Water	1/8/2021	H-3	153	24 ± 77	200
SPDW-61	Water	1/11/2021	Gr. Alpha	0.56	-0.32 ± 0.37	2
SPDW-61	Water	1/11/2021	Gr. Beta	0.73	-0.11 ± 0.49	4
SPW-130	Water	1/19/2021	Sr-89	0.66	-0.12 ± 0.49	5
SPW-130	Water	1/19/2021	Sr-90	0.68	-0.02 ± 0.31	1
SPW-132	Water	1/19/2021	H-3	165	38 ± 79	200
SPW-4923	Water	1/26/2021	I-131	0.28	0.26 ± 0.16	1
SPW-187	Water	1/18/2021	Ra-228	1.44	0.81 ± 0.76	2
SPW-235	Water	1/26/2021	Ra-228	1.54	0.94 ± 0.82	2
SPW-254	Water	2/2/2021	I-131	0.29	-0.06 ± 0.13	1
SPW-304	Water	2/5/2021	H-3	159	6 ± 74	200
SPW-371	Water	2/12/2021	H-3	154	-37 ± 70	200
SPW-525	Water	3/5/2021	H-3	160	97 ± 80	200
SPW-691	Water	3/19/2021	H-3	158	-38 ± 71	200
SPW-693	Water	1/4/2021	Ra-226	0.03	-0.01 ± 0.01	2
SPW-799	Water	3/30/2021	Ra-228	1.03	0.06 ± 0.48	2
SPW-809	Water	3/19/2021	Ra-226	0.04	0.01 ± 0.03	2
SPDW-30102	Water	3/31/2021	Ra-226	0.03	0.00 ± 0.03	2
SPW-811	Water	4/1/2021	H-3	158	-29 ± 77	200
SPW-918	Water	4/7/2021	H-3	156	93 ± 79	200
SPW-943	Water	4/9/2021	Gr. Alpha	0.39	-0.08 ± 0.27	2
SPW-943	Water	4/9/2021	Gr. Beta	0.73	0.04 ± 0.51	4
SPW-1047	Water	4/15/2021	H-3	160	-51 ± 74	200
SPW-1249	Water	4/30/2021	H-3	158	109 ± 81	200
SPW-1372	Water	5/11/2021	Gr. Alpha	0.35	0.27 ± 0.27	2
SPW-1372	Water	5/11/2021	Gr. Beta	0.68	0.27 ± 0.49	4
SPW-1376	Water	5/11/2021	Sr-89	0.52	0.23 ± 0.39	5
SPW-1376	Water	5/11/2021	Sr-90	0.51	-0.06 ± 0.23	1
SPDW-30124	Water	5/13/2021	Ra-226	0.03	-0.02 ± 0.03	2
SPDW-30104	Water	5/26/2021	Ra-228	1.30	-0.04 ± 0.60	2
SPDW-30107	Water	5/28/2021	H-3	157	33 ± 76	200
SPDW-30117	Water	6/4/2021	H-3	165	67 ± 81	200
SPMI-1671	Milk	6/8/2021	Sr-89	0.46	0.23 ± 0.42	5
SPMI-1671	Milk	6/8/2021	Sr-90	0.45	0.23 ± 0.24	1
SPDW-30159	Water	6/11/2021	Ra-226	0.04	-0.02 ± 0.04	2
SPDW-30128	Water	6/15/2021	H-3	161	17 ± 76	200
SPDW-30133	Water	6/17/2021	I-131	0.20	0.06 ± 0.12	1
SPDW-30134	Water	6/18/2021	Gr. Alpha	0.46	-0.11 ± 0.32	2
SPDW-30134	Water	6/18/2021	Gr. Beta	0.70	-0.10 ± 0.49	4
SPDW-30147	Water	6/25/2021	Ra-228	1.76	-0.15 ± 0.80	2

<sup>a</sup> Liquid sample results are reported in pCi/Liter, air filters ( pCi/m<sup>3</sup>), charcoal (pCi/charcoal canister), and solid samples (pCi/g).

<sup>b</sup> Laboratory codes : W & SPW (Water), MI (milk), AP (air filter), SO (soil), VE (vegetation), CH (charcoal canister), F (fish), U (urine).

<sup>c</sup> I-131(G); iodine-131 as analyzed by gamma spectroscopy.

<sup>d</sup> Activity reported is a net activity result.

TABLE A-4. Intralaboratory "Blank" Samples

Lab Code <sup>b</sup>	Sample Type	Date	Analysis <sup>c</sup>	Concentration <sup>a</sup>		Acceptance Criteria (4.66 $\sigma$ )
				Laboratory results (4.66 $\sigma$ )		
				LLD	Activity <sup>d</sup>	
SPDW-30205	Water	7/8/2021	Ra-226	0.03	0.02 $\pm$ 0.03	2
SPDW-3000	Water	7/29/2021	Ra-226	0.03	0.03 $\pm$ 0.03	2
SPDW-30223	Water	8/2/2021	Gr. Alpha	0.46	-0.13 $\pm$ 0.31	2
SPDW-30223	Water	8/2/2021	Gr. Beta	0.70	0.16 $\pm$ 0.49	4
SPDW-30225	Water	8/13/2021	H-3	161	-2 $\pm$ 75	200
SPDW-30230	Water	8/18/2021	Ra-228	1.02	0.47 $\pm$ 0.53	2
SPW-2782	Water	9/3/2021	Sr-89	0.60	-0.16 $\pm$ 0.48	5
SPW-2782	Water	9/3/2021	Sr-90	0.63	0.20 $\pm$ 0.32	1
SPDW-2784	Water	9/3/2021	H-3	157	-50 $\pm$ 69	200
SPDW-2890	Water	9/10/2021	H-3	163	-59 $\pm$ 72	200
SPDW-2981	Water	9/17/2021	H-3	162	11 $\pm$ 78	200
SPDW-3114	Water	9/17/2021	Ra-226	0.03	0.04 $\pm$ 0.03	2
SPDW-3035	Water	9/23/2021	Ra-228	1.15	0.10 $\pm$ 0.55	2
SPDW-3222	Water	9/28/2021	Ra-228	1.37	-0.30 $\pm$ 0.60	2
SPDW-3287	Water	9/29/2021	U-234	0.22	0.19 $\pm$ 0.23	1
SPDW-3287	Water	9/29/2021	U-238	0.38	-0.05 $\pm$ 0.21	1
SPDW-30275	Water	9/29/2021	Ra-226	0.05	0.03 $\pm$ 0.04	2
SPDW-3156	Water	10/1/2021	H-3	161	-11 $\pm$ 75	200
SPDW-3289	Water	10/12/2021	Gr. Alpha	0.40	0.21 $\pm$ 0.30	2
SPDW-3289	Water	10/12/2021	Gr. Beta	0.72	0.31 $\pm$ 0.52	4
SPDW-3392	Water	10/15/2021	H-3	158	58 $\pm$ 79	200
SPDW-3603	Water	10/28/2021	H-3	163	26 $\pm$ 77	200
SPDW-30282	Water	11/4/2021	Ra-226	0.04	0.04 $\pm$ 0.03	2
SPDW-3768	Water	11/10/2021	H-3	162	31 $\pm$ 77	200
SPDW-3859	Water	11/18/2021	H-3	162	45 $\pm$ 78	200
SPDW-30289	Water	11/22/2021	Ra-226	0.03	0.19 $\pm$ 0.03	2
SPDW-3957	Water	12/3/2021	H-3	161	118 $\pm$ 84	200
SPW-3970	Water	12/7/2021	Sr-89	0.54	-0.12 $\pm$ 0.43	5
SPW-3970	Water	12/7/2021	Sr-90	0.54	0.08 $\pm$ 0.26	1
SPDW-30286	Water	12/9/2021	Ra-228	0.91	-0.26 $\pm$ 0.39	2
SPDW-30288	Water	12/10/2021	I-131	0.22	0.00 $\pm$ 0.12	1
SPDW-30306	Water	12/13/2021	Ra-226	0.05	-0.05 $\pm$ 0.04	2
SPDW-30294	Water	12/16/2021	H-3	162	-33 $\pm$ 73	200
SPDW-30300	Water	12/30/2021	H-3	166	68 $\pm$ 91	200

<sup>a</sup> Liquid sample results are reported in pCi/Liter, air filters ( pCi/m<sup>3</sup>), charcoal (pCi/charcoal canister), and solid samples (pCi/g).

<sup>b</sup> Laboratory codes : W & SPW (Water), MI (milk), AP (air filter), SO (soil), VE (vegetation), CH (charcoal canister), F (fish), U (urine).

<sup>c</sup> I-131(G); iodine-131 as analyzed by gamma spectroscopy.

<sup>d</sup> Activity reported is a net activity result.

TABLE A-5. Intralaboratory "Duplicate" Samples

Lab Code <sup>b</sup>	Date	Analysis	Concentration <sup>a</sup>		Averaged Result	Acceptance
			First Result	Second Result		
S-20,21	1/5/2021	K-40	23.3 ± 0.6	22.6 ± 1.6	23.0 ± 0.9	Pass
XW-295,296	1/13/2021	H-3	245 ± 87	288 ± 89	267 ± 62	Pass
S-143,144	1/14/2021	K-40	7.47 ± 0.76	8.38 ± 0.22	7.93 ± 0.40	Pass
S-360,361	2/10/2021	K-40	9.23 ± 0.54	9.00 ± 0.68	9.12 ± 0.43	Pass
S-406,407	2/15/2021	K-40	2.92 ± 0.28	2.94 ± 0.94	2.93 ± 0.49	Pass
W-469,470	2/22/2021	Ra-226	0.75 ± 0.21	0.87 ± 0.22	0.81 ± 0.15	Pass
W-448,449	2/25/2021	Gr. Alpha	3.52 ± 1.84	3.72 ± 1.87	3.62 ± 1.31	Pass
W-448,449	2/25/2021	Gr. Beta	8.71 ± 1.36	8.91 ± 1.40	8.81 ± 0.98	Pass
W-448,449	2/25/2021	Ra-226	1.87 ± 0.25	1.82 ± 0.28	1.85 ± 0.19	Pass
W-448,449	2/25/2021	Ra-228	2.65 ± 1.26	2.53 ± 1.35	2.59 ± 0.92	Pass
P-511,512	3/2/2021	H-3	198 ± 85	202 ± 86	200 ± 60	Pass
WW-630,631	3/10/2021	H-3	144 ± 82	148 ± 82	146 ± 58	Pass
WW-743,744	3/16/2021	H-3	183 ± 85	167 ± 84	175 ± 60	Pass
S-785,786	3/25/2021	Pb-214	0.59 ± 0.08	0.34 ± 0.05	0.47 ± 0.05	Pass
S-785,786	3/25/2021	Ac-228	0.61 ± 0.12	0.58 ± 0.13	0.60 ± 0.09	Pass
AP-1052,1053	3/30/2021	Be-7	0.081 ± 0.010	0.075 ± 0.011	0.078 ± 0.007	Pass
AP-966,967	3/30/2021	Be-7	0.080 ± 0.010	0.085 ± 0.009	0.083 ± 0.007	Pass
SWU-835,836	3/30/2021	Gr. Beta	1.22 ± 0.56	1.27 ± 0.55	1.24 ± 0.39	Pass
AP-1204,1205	3/30/2021	Be-7	0.187 ± 0.102	0.160 ± 0.088	0.173 ± 0.067	Pass
AP-1029,1030	4/2/2021	Be-7	0.067 ± 0.012	0.079 ± 0.012	0.073 ± 0.009	Pass
SW-922,923	4/7/2021	H-3	440 ± 99	307 ± 93	373 ± 68	Pass
WW-987,988	4/12/2021	H-3	190 ± 87	284 ± 92	237 ± 63	Pass
F-1246,1247	4/22/2021	K-40	3.26 ± 0.66	2.83 ± 0.46	3.04 ± 0.40	Pass
SWT-1311,1312	4/27/2021	Gr. Beta	1.05 ± 0.52	1.16 ± 0.55	1.10 ± 0.38	Pass
WW-1401,1402	5/5/2021	Gr. Alpha	1.10 ± 1.00	2.50 ± 1.20	1.80 ± 0.78	Pass
WW-1401,1402	5/5/2021	K-40	126 ± 15	105 ± 30	115 ± 17	Pass
DW-30071,30072	5/6/2021	Ra-226	0.98 ± 0.15	0.67 ± 0.13	0.83 ± 0.10	Pass
DW-30071,30072	5/6/2021	Ra-228	0.83 ± 0.51	1.21 ± 0.54	1.02 ± 0.37	Pass
DW-30078,30079	5/10/2021	Gr. Alpha	4.90 ± 0.92	5.92 ± 0.99	5.41 ± 0.68	Pass
AP-051120A,B	5/11/2021	Gr. Beta	0.006 ± 0.002	0.005 ± 0.002	0.005 ± 0.002	Pass
DW-30083,30084	5/11/2021	Ra-226	0.34 ± 0.13	0.19 ± 0.20	0.27 ± 0.12	Pass
DW-30083,30084	5/11/2021	Ra-228	0.98 ± 0.60	0.15 ± 0.56	0.57 ± 0.41	Pass
S-1506,1507	5/18/2021	K-40	10.1 ± 0.8	14.9 ± 1.2	12.5 ± 0.7	Pass
DW-30092,30093	5/20/2021	Gr. Alpha	2.86 ± 0.85	2.40 ± 0.90	2.63 ± 0.62	Pass
DW-30095,30096	5/21/2021	Ra-226	1.18 ± 0.16	0.73 ± 0.15	0.96 ± 0.11	Pass
DW-30095,30096	5/21/2021	Ra-228	1.44 ± 0.63	0.61 ± 0.59	1.03 ± 0.43	Pass
AP-052521A,B	5/25/2021	Gr. Beta	0.021 ± 0.003	0.022 ± 0.003	0.021 ± 0.002	Pass
S-1589,1590	5/28/2021	Pb-214	1.16 ± 0.08	1.06 ± 0.09	1.11 ± 0.06	Pass
S-1589,1590	5/28/2021	Ac-228	1.17 ± 0.18	1.08 ± 0.14	1.13 ± 0.11	Pass

TABLE A-5. Intralaboratory "Duplicate" Samples

Lab Code <sup>b</sup>	Date	Analysis	Concentration <sup>a</sup>		Averaged Result	Acceptance
			First Result	Second Result		
AP-060121A,B	6/1/2021	Gr. Beta	0.015 ± 0.003	0.013 ± 0.003	0.014 ± 0.002	Pass
DW-30113,30114	6/1/2021	Ra-226	2.00 ± 0.34	2.64 ± 0.26	2.32 ± 0.21	Pass
DW-30113,30114	6/1/2021	Ra-228	2.50 ± 0.78	3.13 ± 0.82	2.82 ± 0.57	Pass
PS-1631,1632	6/2/2021	K-40	21.1 ± 0.8	20.4 ± 0.8	20.7 ± 0.6	Pass
DW-30119,30120	6/3/2021	Gr. Alpha	1.18 ± 0.75	0.66 ± 0.64	0.92 ± 0.49	Pass
WW-1908,1909	6/4/2021	H-3	150 ± 85	176 ± 87	163 ± 61	Pass
VE-1717,1718	6/7/2021	Be-7	0.50 ± 0.19	0.38 ± 0.14	0.44 ± 0.12	Pass
VE-1717,1718	6/7/2021	K-40	5.26 ± 0.47	5.45 ± 0.44	5.35 ± 0.32	Pass
AP-060821A,B	6/8/2021	Gr. Beta	0.030 ± 0.004	0.028 ± 0.004	0.029 ± 0.003	Pass
AP-1822,1823	6/10/2021	Be-7	0.23 ± 0.12	0.22 ± 0.12	0.22 ± 0.08	Pass
CF-1844,1845	6/14/2021	K-40	8.37 ± 0.44	8.33 ± 0.35	8.35 ± 0.28	Pass
AP-061521A,B	6/15/2021	Gr. Beta	0.020 ± 0.004	0.017 ± 0.003	0.019 ± 0.002	Pass
DW-30131,30132	6/17/2021	Ra-226	0.41 ± 0.21	0.34 ± 0.23	0.38 ± 0.16	Pass
DW-30131,30132	6/17/2021	Ra-228	0.42 ± 0.85	0.52 ± 0.74	0.47 ± 0.56	Pass
DW-30138,30139	6/17/2021	Gr. Alpha	1.59 ± 0.84	2.21 ± 0.95	1.90 ± 0.63	Pass
S-1929,1930	6/22/2021	K-40	19.4 ± 1.0	19.2 ± 1.1	19.3 ± 0.7	Pass
AP-062221A,B	6/22/2021	Gr. Beta	0.014 ± 0.003	0.012 ± 0.028	0.013 ± 0.014	Pass
DW-30150,30151	6/28/2021	Ra-226	0.53 ± 0.15	0.55 ± 0.19	0.54 ± 0.12	Pass
DW-30150,30151	6/28/2021	Ra-228	0.76 ± 0.54	0.52 ± 0.52	0.64 ± 0.37	Pass
AP-2160,2161	6/28/2021	Be-7	0.11 ± 0.01	0.11 ± 0.01	0.11 ± 0.01	Pass
DW-30150,30151	6/28/2021	Ra-226	0.53 ± 0.15	0.55 ± 0.19	0.54 ± 0.12	Pass
DW-30150,30151	6/28/2021	Ra-228	0.76 ± 0.54	0.52 ± 0.52	0.64 ± 0.37	Pass
AP-2218,2119	6/29/2021	Be-7	0.11 ± 0.01	0.12 ± 0.01	0.11 ± 0.01	Pass
AP-2235,2236	6/30/2021	Be-7	0.10 ± 0.01	0.11 ± 0.01	0.10 ± 0.01	Pass
CF-2139,2140	7/12/2021	Be-7	0.49 ± 0.12	0.65 ± 0.20	0.57 ± 0.12	Pass
CF-2139,2140	7/12/2021	K-40	8.25 ± 0.41	7.94 ± 0.46	8.10 ± 0.31	Pass
VE-2214,2215	7/12/2021	K-40	3.26 ± 0.11	3.41 ± 0.25	3.34 ± 0.14	Pass
DW-30169,30170	7/12/2021	Gr. Alpha	2.61 ± 0.87	2.09 ± 0.84	2.35 ± 0.60	Pass
DW-30169,30170	7/12/2021	Gr. Beta	2.09 ± 0.67	2.52 ± 0.60	2.31 ± 0.45	Pass
DW-30169,30170	7/12/2021	Ra-226	0.84 ± 0.24	0.82 ± 0.20	0.83 ± 0.16	Pass
DW-30169,30170	7/12/2021	Ra-228	0.80 ± 0.54	0.84 ± 0.50	0.82 ± 0.37	Pass
AP-71320,71321	7/13/2021	Gr. Beta	0.015 ± 0.003	0.010 ± 0.003	0.013 ± 0.002	Pass
XW-2424,2425	7/16/2021	H-3	193 ± 86	104 ± 81	149 ± 59	Pass
DW-30183,30184	7/19/2021	Ra-226	1.37 ± 0.18	1.21 ± 0.27	1.29 ± 0.16	Pass
DW-30183,30185	7/19/2021	Ra-228	1.51 ± 0.69	1.52 ± 0.68	1.52 ± 0.48	Pass
AP-71920,71921	7/19/2021	Gr. Beta	0.021 ± 0.004	0.020 ± 0.003	0.021 ± 0.002	Pass
S-2277,2278	7/20/2021	K-40	13.6 ± 0.9	12.3 ± 0.9	12.9 ± 0.6	Pass
DW-30191,30192	7/20/2021	Gr. Alpha	3.88 ± 0.94	3.66 ± 94.00	3.77 ± 47.00	Pass
SG-2382,2383	7/23/2021	Pb-214	1.88 ± 0.21	1.94 ± 0.21	1.91 ± 0.15	Pass
SG-2382,2383	7/23/2021	Ac-228	1.69 ± 0.28	1.96 ± 0.33	1.83 ± 0.22	Pass
DW-30207,30208	7/26/2021	Gr. Alpha	5.47 ± 1.29	5.20 ± 1.24	5.34 ± 0.89	Pass
DW-30207,30208	7/26/2021	Gr. Beta	5.89 ± 0.77	6.11 ± 0.73	6.00 ± 0.53	Pass

TABLE A-5. Intralaboratory "Duplicate" Samples

Lab Code <sup>b</sup>	Date	Analysis	Concentration <sup>a</sup>		Averaged Result	Acceptance
			First Result	Second Result		
DW-30210,30211	7/28/2021	Ra-226	0.48 ± 0.13	0.62 ± 0.11	0.55 ± 0.09	Pass
DW-30210,30211	7/28/2021	Ra-228	0.45 ± 0.53	0.73 ± 0.65	0.59 ± 0.42	Pass
S-2509,2510	8/1/2021	K-40	14.2 ± 0.5	13.7 ± 1.0	14.0 ± 0.6	Pass
S-2509,2510	8/1/2021	Be-7	7.27 ± 0.29	7.97 ± 0.69	7.62 ± 0.37	Pass
DW-30221,30222	8/6/2021	Gr. Alpha	2.19 ± 1.55	2.08 ± 1.54	2.14 ± 1.09	Pass
DW-30221,30222	8/6/2021	Gr. Beta	1.19 ± 1.04	2.76 ± 1.08	1.98 ± 0.75	Pass
DW-30221,30222	8/6/2021	Ra-226	2.00 ± 0.22	1.58 ± 0.26	1.79 ± 0.17	Pass
DW-30221,30222	8/6/2021	Ra-228	1.69 ± 0.56	1.75 ± 0.54	1.72 ± 0.39	Pass
VE-2551,2552	8/11/2021	K-40	2.68 ± 0.20	2.61 ± 0.27	2.64 ± 0.17	Pass
VE-2551,2552	8/11/2021	Be-7	0.16 ± 0.08	0.18 ± 0.08	0.17 ± 0.05	Pass
AP-2578,2579	8/12/2021	Be-7	0.18 ± 0.09	0.20 ± 0.11	0.19 ± 0.07	Pass
AP-082421A,B	8/24/2021	Gr. Beta	0.032 ± 0.004	0.028 ± 0.004	0.030 ± 0.003	Pass
AP-083121A,B	8/24/2021	Gr. Beta	0.027 ± 0.004	0.029 ± 0.004	0.028 ± 0.003	Pass
VE-2684,2685	8/25/2021	K-40	2.15 ± 0.26	1.92 ± 0.27	2.03 ± 0.19	Pass
VE-2684,2685	8/25/2021	Be-7	0.20 ± 0.10	0.26 ± 0.11	0.23 ± 0.07	Pass
VE-2728,2729	8/25/2021	K-40	2.34 ± 0.41	2.27 ± 0.40	2.31 ± 0.29	Pass
DW-30238,30239	8/25/2021	Gr. Alpha	3.94 ± 0.91	2.43 ± 0.86	3.185 ± 0.63	Pass
DW-30238,30239	8/25/2021	Ra-226	2.57 ± 0.24	1.83 ± 0.24	2.20 ± 0.17	Pass
DW-30238,30239	8/25/2021	Ra-228	2.86 ± 0.83	2.52 ± 0.66	2.69 ± 0.53	Pass
SW-2641,2642	8/31/2021	H-3	289 ± 92	310 ± 93	300 ± 65	Pass
VE-2858,2859	9/2/2021	K-40	8.36 ± 0.41	8.02 ± 0.47	8.19 ± 0.31	Pass
SG-2934,2935	9/13/2021	Pb-214	2.72 ± 0.22	2.54 ± 0.27	2.63 ± 0.17	Pass
SG-2934,2935	9/13/2021	Ac-228	3.16 ± 0.39	3.22 ± 0.58	3.19 ± 0.35	Pass
DW-30249,30250	9/17/2021	Ra-226	0.70 ± 0.18	1.00 ± 0.17	0.85 ± 0.12	Pass
S-3042,3043	9/22/2021	K-40	7.55 ± 0.80	7.57 ± 0.81	7.56 ± 0.57	Pass
DW-30249,30250	9/17/2021	Ra-226	0.70 ± 0.18	1.00 ± 0.17	0.85 ± 0.12	Pass
S-3042,3043	9/22/2021	K-40	7.55 ± 0.80	7.57 ± 0.81	7.56 ± 0.57	Pass
DW-30256,30257	10/8/2021	Gr. Alpha	2.35 ± 0.79	2.71 ± 0.92	2.53 ± 0.61	Pass
S-3279,3280	10/11/2021	K-40	10.08 ± 0.58	9.18 ± 0.53	9.63 ± 0.39	Pass
DW-30262,30263	10/14/2021	Ra-226	1.49 ± 0.30	1.51 ± 0.17	1.50 ± 0.17	Pass
DW-30262,30263	10/14/2021	Ra-228	1.16 ± 0.79	2.08 ± 0.82	1.62 ± 0.57	Pass
AP-102521A,B	10/25/2021	Gr. Beta	0.026 ± 0.005	0.030 ± 0.010	0.028 ± 0.010	Pass
XWW-3707,3708	10/27/2021	H-3	206 ± 87	268 ± 90	237 ± 63	Pass
AP-110121A,B	11/1/2021	Gr. Beta	0.017 ± 0.004	0.016 ± 0.00	0.016 ± 0.003	Pass
DW-30277,30278	11/5/2021	Gr. Alpha	10.11 ± 1.19	9.72 ± 1.11	9.92 ± 0.81	Pass
DW-30277,30278	11/5/2021	Gr. Beta	5.53 ± 0.72	4.22 ± 0.69	4.88 ± 0.50	Pass
DW-30277,30278	11/5/2021	Ra-226	6.27 ± 0.32	6.34 ± 0.37	6.31 ± 0.25	Pass
DW-30277,30278	11/5/2021	Ra-228	3.10 ± 0.86	3.76 ± 0.90	3.43 ± 0.62	Pass
AP-111521A,B	11/15/2021	Gr. Beta	0.022 ± 0.004	0.026 ± 0.005	0.024 ± 0.003	Pass
AP-112221A,B	11/22/2021	Gr. Beta	0.023 ± 0.004	0.025 ± 0.005	0.024 ± 0.003	Pass
AP-112921A,B	11/29/2021	Gr. Beta	0.038 ± 0.005	0.035 ± 0.005	0.037 ± 0.004	Pass

TABLE A-5. Intralaboratory "Duplicate" Samples

Lab Code <sup>b</sup>	Date	Analysis	Concentration <sup>a</sup>		Averaged Result	Acceptance
			First Result	Second Result		
DW-30297,8	12/15/2021	Ra-226	1.71 ± 0.15	1.21 ± 0.13	1.46 ± 0.10	Pass
DW-30297,8	12/15/2021	Ra-228	2.44 ± 0.98	1.96 ± 0.97	2.20 ± 0.69	Pass
S-4182,4183	12/19/2021	Pb-214	1.19 ± 0.06	1.07 ± 0.08	1.13 ± 0.05	Pass
S-4182,4183	12/19/2021	Ac-228	1.08 ± 0.11	1.15 ± 0.14	1.12 ± 0.09	Pass
S-4182,4183	12/19/2021	K-40	1.75 ± 0.74	1.80 ± 0.84	1.78 ± 0.56	Pass
AP-122721A,B	12/27/2021	Gr. Beta	0.063 ± 0.006	0.060 ± 0.006	0.062 ± 0.004	Pass
AP-4350,4351	12/28/2021	Be-7	0.06 ± 0.02	0.06 ± 0.02	0.06 ± 0.01	Pass
AP-4845,4846	12/31/2021	Be-7	0.07 ± 0.01	0.06 ± 0.02	0.06 ± 0.01	Pass

Note: Duplicate analyses are performed on every twentieth sample received. Results are not listed for those analyses with activities that measure below the LLD.

<sup>a</sup> Results are reported in units of pCi/L, except for air filters (pCi/Filter or pCi/m3), food products, vegetation, soil and sediment (pCi/g).

<sup>b</sup> AP (Air Particulate), AV (Aquatic Vegetation), BS (Bottom Sediment), CF (Cattle Feed), CH (Charcoal Canister), DW (Drinking Water), E (Egg), F (Fish), G (Grass), LW (Lake Water), MI (Milk), P (Precipitation), PM (Powdered Milk), S (Solid), SG (Sludge), SO (Soil), SS (Shoreline Sediment), SW (Surface Water), SWT (Surface Water Treated), SWU (Surface Water Untreated), VE (Vegetation), W (Water), WW (Well Water).

TABLE A-6. Department of Energy's Mixed Analyte Performance Evaluation Program (MAPEP).

Lab Code <sup>b</sup>	Reference Date	Analysis	Laboratory result	Concentration <sup>a</sup>		Acceptance
				Known Activity	Control Limits <sup>c</sup>	
MAAP-594	2/1/2021	Gross Alpha	1.30 ± 0.08	1.77	0.53 - 3.01	Pass
MAAP-594	2/1/2021	Gross Beta	0.81 ± 0.04	0.649	0.325 - 0.974	Pass
MADW-571	2/1/2021	Gross Alpha	0.73 ± 0.06	0.87	0.26 - 1.48	Pass
MADW-572	2/1/2021	Gross Beta	2.38 ± 0.06	2.50	1.25 - 3.75	Pass
MASO-591	2/1/2021	Cs-134	-2.57 ± 2.21	0	NA <sup>c</sup>	Pass
MASO-591	2/1/2021	Cs-137	1700 ± 20	1550	1085 - 2015	Pass
MASO-591	2/1/2021	Co-57	977 ± 7	920	644 - 1196	Pass
MASO-591	2/1/2021	Co-60	1360 ± 10	1370	959 - 1781	Pass
MASO-591	2/1/2021	Mn-54	0.91 ± 2.85	0	NA <sup>c</sup>	Pass
MASO-591	2/1/2021	Zn-65	687 - 17	604	423 - 785	Pass
MASO-591	2/1/2021	K-40	682 ± 53	618	433 - 803	Pass
MAW-569	2/1/2021	Cs-134	10.5 ± 0.3	11.5	8.1 - 15.0	Pass
MAW-569	2/1/2021	Cs-137	8.53 ± 0.32	7.9	5.5 - 10.3	Pass
MAW-569	2/1/2021	Co-57	12.2 ± 0.3	11.4	8.0 - 14.8	Pass
MAW-569	2/1/2021	Co-60	0.03 ± 0.05	0	NA <sup>c</sup>	Pass
MAW-569	2/1/2021	Mn-54	16.5 ± 0.4	15.5	10.9 - 20.2	Pass
MAW-569	2/1/2021	Zn-65	11.5 ± 0.5	10.5	7.40 - 13.7	Pass
MAW-569	2/1/2021	K-40	9.93 ± 1.42	0	NA <sup>c</sup>	Fail <sup>d</sup>
MAAP-592	2/1/2021	Cs-134	1.54 ± 0.06	2.14	1.50 - 2.78	Pass
MAAP-592	2/1/2021	Cs-137	-0.011 ± 0.020	0	NA <sup>c</sup>	Pass
MAAP-592	2/1/2021	Co-57	0.636 ± 0.042	0.69	0.480 - 0.892	Pass
MAAP-592	2/1/2021	Co-60	-0.64 ± 0.02	0	NA <sup>c</sup>	Fail <sup>e</sup>
MAAP-592	2/1/2021	Mn-54	0.312 ± 0.058	0.312	0.218 - 0.406	Pass
MAAP-592	2/1/2021	Zn-65	0.41 ± 0.07	0.352	0.246 - 0.458	Pass
MAVE-588	2/1/2021	Cs-134	3.73 ± 0.09	3.60	2.50 - 4.70	Pass
MAVE-588	2/1/2021	Cs-137	5.69 ± 0.10	4.69	3.28 - 6.10	Pass
MAVE-588	2/1/2021	Co-57	6.23 ± 0.07	5.05	3.54 - 6.57	Pass
MAVE-588	2/1/2021	Co-60	3.29 ± 0.06	2.99	2.09 - 3.89	Pass
MAVE-588	2/1/2021	Mn-54	6.17 ± 0.16	5.25	3.68 - 6.83	Pass
MAVE-588	2/1/2021	Zn-65	-0.04 ± 0.08	0	NA <sup>c</sup>	Pass
MAAP-3007	8/1/2021	Gross Alpha	0.45 ± 0.04	0.960	0.288 - 1.632	Pass
MAAP-3007	8/1/2021	Gross Beta	0.71 ± 0.04	0.553	0.277 - 0.830	Pass
MADW-2688	8/1/2021	Gross Alpha	0.19 ± 0.03	0.232	0.070 - 0.394	Pass
MADW-2688	8/1/2021	Gross Beta	2.60 ± 0.06	2.807	1.404 - 4.211	Pass

TABLE A-6. Department of Energy's Mixed Analyte Performance Evaluation Program (MAPEP).

Lab Code <sup>b</sup>	Reference Date	Analysis	Concentration <sup>a</sup>			Acceptance
			Laboratory result	Known Activity	Control Limits <sup>c</sup>	
MASO-3004	8/1/2021	Cs-134	1035 ± 10	1170	819 - 1521	Pass
MASO-3004	8/1/2021	Cs-137	628 ± 11	572	400 - 744	Pass
MASO-3004	8/1/2021	Co-57	-0.11 ± 1.26	0	NA <sup>c</sup>	Pass
MASO-3004	8/1/2021	Co-60	720 ± 7	722	714 - 1326	Pass
MASO-3004	8/1/2021	Mn-54	456 ± 11	410	287 - 533	Pass
MASO-3004	8/1/2021	Zn-65	1002 ± 22	907	635 - 1179	Pass
MASO-3004	8/1/2021	K-40	663 ± 50	607	425 - 789	Pass
MADW-3003	8/1/2021	Ra-226	0.32 ± 0.06	0.226	0.158 - 0.294	Fail <sup>f</sup>
MADW-3003	8/1/2021	Sr-90	3.63 ± 0.16	3.9	2.70 - 5.02	Pass
MADW-3003	8/1/2021	U-234	0.02 - 0.01	0.02	NA <sup>g</sup>	Pass
MADW-3003	8/1/2021	U-238	0.02 - 0.01	0.01	NA <sup>g</sup>	Pass

<sup>a</sup> Results are reported in units of Bq/kg (soil), Bq/L (water) or Bq/total sample (filters, vegetation).

<sup>b</sup> Laboratory codes as follows: MAW (water), MADW (water), MAAP (air filter), MASO (soil) and MAVE (vegetation).

<sup>c</sup> MAPEP results are presented as the known values and expected laboratory precision (1 sigma, 1 determination) and control limits as defined by the MAPEP. A known value of "zero" indicates an analysis was included in the testing series as a "false positive". MAPEP does not provide control limits.

<sup>d</sup> The sample spectrum was reanalyzed utilizing the minimum data point background width method. The result was 1.59 ± 1.77 Bq/L which satisfies MAPEP criteria for a false positive test.

<sup>e</sup> A decimal was misplaced in one of two cobalt-60 results while calculating a mean result causing MAPEP to fail the result as a statistically significant negative value at 3 standard deviations. The correct mean result (-0.0004 ± 0.0186) is not a statistically significant negative value and would not have failed.

<sup>f</sup> Radium result did not meet MAPEP acceptance criteria.

<sup>g</sup> Provided in the series for "sensitivity evaluation". MAPEP does not provide control limits.

TABLE A-7. Interlaboratory Comparison Crosscheck Program, Environmental Resource Associates (ERA)<sup>a</sup>.  
MRAD-30 Study

Lab Code <sup>b</sup>	Date	Analysis	Concentration <sup>a</sup>		Control Limits <sup>d</sup>	Acceptance
			Laboratory Result	ERA Value <sup>c</sup>		
ERAP-722	3/22/2021	Cs-134	898	1030	668 - 1260	Pass
ERAP-722	3/22/2021	Cs-137	181	163	134 - 214	Pass
ERAP-722	3/22/2021	Co-60	1270	1220	1040 - 1550	Pass
ERAP-722	3/22/2021	Mn-54	< 4.3	< 50.0	0.00 - 50.0	Pass
ERAP-722	3/22/2021	Zn-65	908	771	632 - 1180	Pass
ERAP-722	3/22/2021	Sr-90	184	189	120 - 257	Pass
ERAP-724	3/22/2021	Gross Alpha	88.4	96.1	50.2 - 158	Pass
ERAP-724	3/22/2021	Gross Beta	74.1	62.6	38.0 - 94.6	Pass

<sup>a</sup> Results obtained by Environmental, Inc., Midwest Laboratory (EIML) as a participant in the crosscheck program for proficiency testing administered by Environmental Resource Associates, serving as a replacement for studies conducted previously by the Environmental Measurements Laboratory Quality Assessment Program (EML).

<sup>b</sup> Laboratory code ERAP (air filter). Results are reported in units of (pCi/Filter).

<sup>c</sup> The ERA Assigned values for the air filter standards are equal to 100% of the parameter present in the standard as determined by the gravimetric and/or volumetric measurements made during standard preparation as applicable.

<sup>d</sup> The acceptance limits are established per the guidelines contained in the Department of Energy (DOE) report EML-564, Analysis of Environmental Measurements Laboratory (EML) Quality Assessment Program (QAP) Data Determination of Operational Criteria and Control Limits for Performance Evaluation Purposes or ERA's SOP for the generation of Performance Acceptance Limits.



## Appendix B

### Data Reporting Conventions

## APPENDIX B. DATA REPORTING CONVENTIONS

---

### Data Reporting Conventions

1.0. All activities, except gross alpha and gross beta, are decay corrected to collection time or the end of the collection period.

### 2.0. Single Measurements

Each single measurement is reported as follows:  $x \pm s$   
where:  $x$  = value of the measurement;  
 $s = 2\sigma$  counting uncertainty (corresponding to the 95% confidence level).

In cases where the activity is less than the lower limit of detection  $L$ , it is reported as:  $< L$ , where  $L$  = the lower limit of detection based on  $4.66\sigma$  uncertainty for a background sample.

### 3.0. Duplicate analyses

If duplicate analyses are reported, the convention is as follows. :

3.1. Individual results: For two analysis results;  $x_1 \pm s_1$  and  $x_2 \pm s_2$

Reported result:  $x \pm s$ ; where  $x = (1/2)(x_1 + x_2)$  and  $s = (1/2)\sqrt{s_1^2 + s_2^2}$

3.2. Individual results:  $< L_1$ ,  $< L_2$  Reported result:  $< L$ , where  $L$  = lower of  $L_1$  and  $L_2$

3.3. Individual results:  $x \pm s$ ,  $< L$  Reported result:  $x \pm s$  if  $x \geq L$ ;  $< L$  otherwise.

### 4.0. Computation of Averages and Standard Deviations

4.1 Averages and standard deviations listed in the tables are computed from all of the individual measurements over the period averaged; for example, an annual standard deviation would not be the average of quarterly standard deviations. The average  $\bar{x}$  and standard deviation "s" of a set of  $n$  numbers  $x_1, x_2 \dots x_n$  are defined as follows:

$$\bar{x} = \frac{1}{n} \sum x \qquad s = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$$

4.2 Values below the highest lower limit of detection are not included in the average.

4.3 If all values in the averaging group are less than the highest LLD, the highest LLD is reported.

4.4 If all but one of the values are less than the highest LLD, the single value  $x$  and associated two sigma error is reported.

4.5 In rounding off, the following rules are followed:

4.5.1. If the number following those to be retained is less than 5, the number is dropped, and the retained numbers are kept unchanged. As an example, 11.443 is rounded off to 11.44.

4.5.2. If the number following those to be retained is equal to or greater than 5, the number is dropped and the last retained number is raised by 1. As an example, 11.445 is rounded off to 11.45.



## Appendix C

Maximum permissible concentrations of radioactivity  
in air and water above natural background in unrestricted areas

APPENDIX C

Table C-1. Maximum permissible concentrations of radioactivity in air and water above natural background in unrestricted areas<sup>a</sup>.

Air (pCi/m <sup>3</sup> )		Water (pCi/L)	
Gross alpha	1 x 10 <sup>-3</sup>	Strontium-89	8,000
Gross beta	1	Strontium-90	500
Iodine-131 <sup>b</sup>	2.8 x 10 <sup>-1</sup>	Cesium-137	1,000
		Barium-140	8,000
		Iodine-131	1,000
		Potassium-40 <sup>c</sup>	4,000
		Gross alpha	2
		Gross beta	10
		Tritium	1 x 10 <sup>6</sup>

<sup>a</sup> Taken from Table 2 of Appendix B to Code of Federal Regulations Title 10, Part 20, and appropriate footnotes. Concentrations may be averaged over a period not greater than one year.

<sup>b</sup> Value adjusted by a factor of 700 to reduce the dose resulting from the air-grass-cow-milk-child pathway.

<sup>c</sup> A natural radionuclide.



**Dominion  
Energy®**

**2021  
Annual  
Radiological  
Environmental  
Operating  
Report**

*Kewaunee Power Station  
Part II, Data  
Tabulations, Graphs  
and Analyses*

**Dominion Energy Kewaunee, Inc.**



REPORT TO  
DOMINION NUCLEAR  
RADIOLOGICAL MONITORING PROGRAM FOR  
THE KEWAUNEE POWER STATION  
KEWAUNEE, WISCONSIN

ANNUAL REPORT - PART II  
DATA TABULATIONS AND ANALYSES

January 1 to December 31, 2021

Prepared and submitted by

ATI ENVIRONMENTAL, Inc.  
Midwest Laboratory  
Project No. 8002

Approved:

Ashok Banavali, Ph.D.  
Laboratory Manager

Daniel J. Shannon  
Manager - Radiological Protection  
and Chemistry, KPS

## PREFACE

Staff members of ATI Environmental, Inc., Midwest Laboratory were responsible for the acquisition of data presented in this report. Samples were collected by personnel of ATI Environmental, Inc., Midwest Laboratory and the Kewaunee Power Station.

## TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
Preface.....	ii
List of Figures.....	iv
List of Tables.....	v
1.0 INTRODUCTION.....	1
2.0 GRAPHS OF DATA TRENDS.....	6
3.0 DATA TABULATIONS.....	15

LIST OF FIGURES

No.	Caption	Page
1	Sampling locations, Kewaunee Power Station	2
2	Airborne particulates, weekly averages; gross beta, Location K-1f	7
3	Location K-2	7
4	Location K-8	7
5	Location K-43	8
6	Airborne particulates, gross beta, monthly averages, Location K-1f	9
7	Location K-2	9
8	Location K-8	9
9	Location K-43	10
10	Well water, gross alpha in total residue, Location K-1h	11
11	Location K-1t	11
12	Location K-1u	11
13	Well water, gross beta in total residue, Location K-1h	12
14	Location K-1t	12
15	Location K-1u	12
16	Location K-13	12
17	Surface water, gross beta (total residue), Location K-1b	13
18	Location K-1d	13
19	Location K-1e	13
20	Location K-9	13
21	Surface water, tritium activity, Location K-1d	14
22	Location K-9	14

LIST OF TABLES

No.	Title	Page
1	Sampling locations, Kewaunee Power Station	3
2	Type and frequency of collection	4
3	Sample codes used in Table 2	5
	Airborne particulates analysis for gross beta	
4	Location K-1f	16
5	Location K-2	17
6	Location K-8	18
7	Location K-43	19
8	Airborne particulates, gross beta, monthly averages, minima and maxima	20
9	Airborne particulates, quarterly composites of weekly samples, analysis for gamma-emitting isotopes	22
10	Ambient gamma radiation (TLD), quarterly exposure	24
11	Well water, analysis for gross alpha, gross beta, tritium, potassium-40, strontium-90 and gamma-emitting isotopes.	25
12	Broad leaf Vegetation samples for gamma-emitting isotopes.	27
13	Cattle feed, analysis for gross beta, strontium-90, and gamma-emitting isotopes	28
14	Grass, analysis for gross beta, strontium-90, and gamma-emitting isotopes	30
15	Soil, analysis for gross alpha, gross beta, strontium-90 and gamma-emitting isotopes	33
16	Surface water, analysis for gross beta, potassium-40, and gamma-emitting isotopes	35
17	Surface water, analysis for tritium and strontium-90	40
18	Fish samples, analysis for gross beta, strontium-90, and gamma-emitting isotopes	41
19	Shoreline sediments, analysis for gross beta, strontium-90 and gamma-emitting isotopes	42

## 1.0 INTRODUCTION

The following constitutes Part II of the final report for the 2021 Radiological Monitoring Program conducted at the Kewaunee Power Station (KPS), Kewaunee, Wisconsin.

Included are tabulations of data for all samples collected in 2021 along with graphs of data trends. A summary and interpretation of the data presented here are published in Part I of the 2021 Annual Report on the Radiological Monitoring Program for the Kewaunee Power Station.

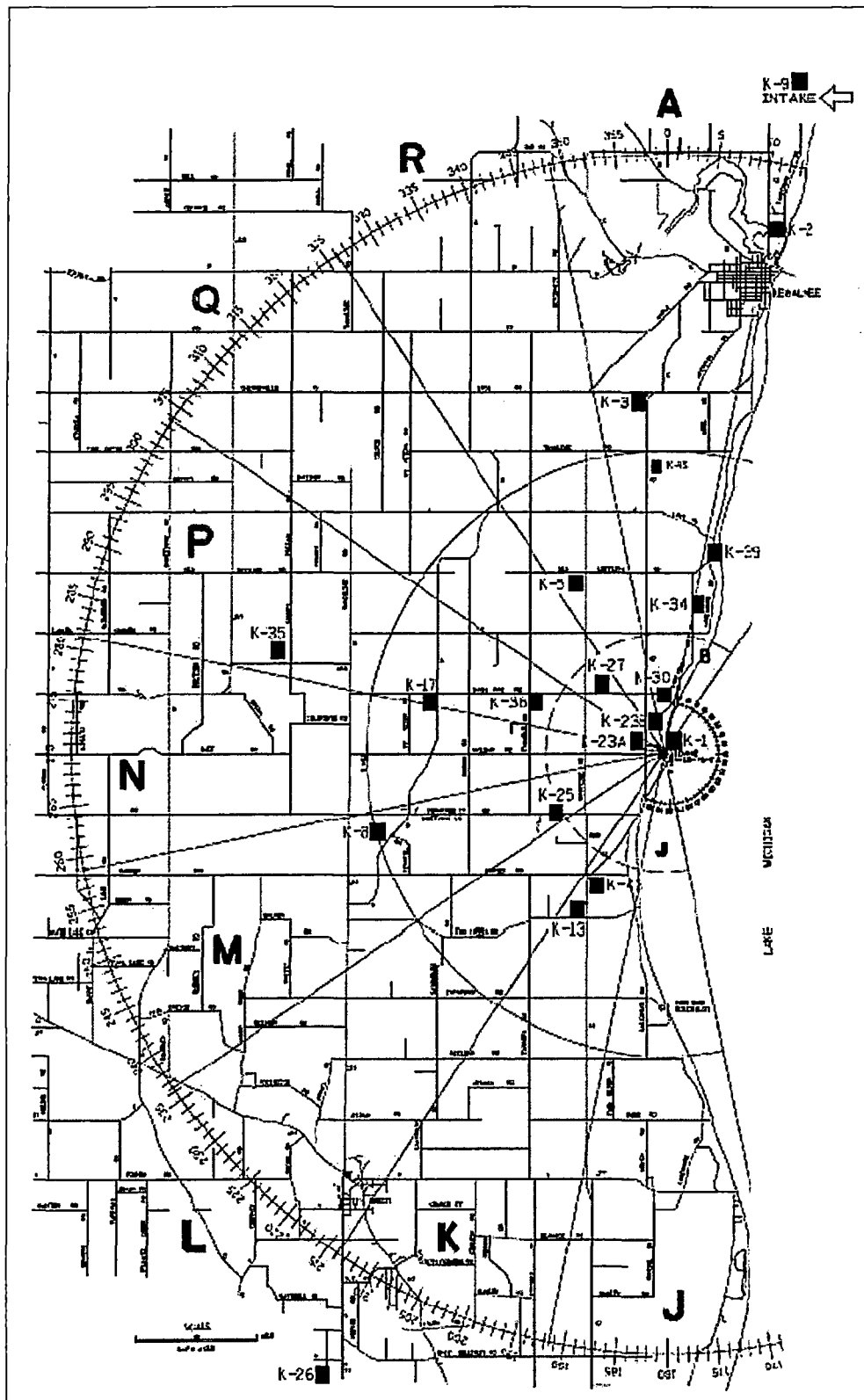


Figure 1. Environmental Sampling Locations

Table 1. Sampling locations, Kewaunee Power Station.

Code	Type <sup>a</sup>	Distance (miles) <sup>b</sup> and Sector	Location
K-1	I		Onsite
K-1b	I	0.12 N	Middle Creek
K-1c	I	0.10 N	500' north of condenser discharge
K-1d	I	0.10 E	Condenser discharge
K-1e	I	0.12 S	South Creek
K-1f	I	0.12 S	Maintenance Waste Oil and Material Storage Building
K-1h	I	0.12 NW	North Well
K-1j	I	0.10 S	500' south of condenser discharge
K-1m	I	0.15 N	ISFSI East
K-1o	I	0.16 N	ISFSI North
K-1q	I	0.16 N	ISFSI West
K-1r	I	0.13 N	ISFSI West
K-1t	I	0.10 ESE	Gatehouse
K-1u	I	0.05 SSW	Maintenance Building
K-2	C	8.91 NNE	WPS Operations Building in Kewaunee
K-3 <sup>c</sup>	I/C	5.9 N	Lyle and John Siegmund Farm, N2815 Hwy 42, Kewaunee
K-5	I	3.2 NNW	Ed Papham Farm, E4160 Old Settlers Rd, Kewaunee
K-8	I	4.85 WSW	St. Isadore the Farmer Church, 18424 Tisch Mills Rd, Tisch Mills
K-9	C	11.5 NNE	Green Bay Municipal Pumping Station, six miles east of Green Bay (sample source is Lake Michigan water from Rostok Intake, two miles north of Kewaunee).
K-13	C	3.0 SSW	Rand's General Store, Two Creeks
K-17	I	4.0 W	Klimesh's Farm, N885 Tk B, Kewaunee
K-23a	I	0.5 W	0.5 miles west of plant, Kewaunee site
K-23b	I	0.6 N	0.6 miles north of plant, Kewaunee site
K-25	I	1.9 SW	Wotachek Farm, 3968 E. Cty Tk BB, Two Rivers
K-26	C	9.1 SSW	Wilfert Farms Vegetable Stand (9.1 miles south of "BB")
K-27	I	1.53 NW	Schleis Farm, E4298 Sandy Bay Rd, Kewaunee
K-30	I	0.8 N	End of site boundary
K-34	I	2.7 N	Leon and Vicki Struck, N1549 Lakeshore Dr., Kewaunee
K-35	C	6.71 WNW	Duane Ducat, N1215 Sleepy Hollow Rd., Kewaunee
K-38	I	2.45 WNW	Dave Sinkula Farm, N890 Town Hall Road, Kewaunee
K-39	I	3.46 N	Francis Wojta, N1859 Lakeshore Dr., Kewaunee
K-43	I	2.71 SSW	Gary Maigatter Property, 17333 Hwy 42, Two Rivers
K-45	I	5.1 N	Wakker's Dairy, N2348 Highway 42, Kewaunee

<sup>a</sup> I = indicator; C = control.

<sup>b</sup> Distances are measured from reactor stack.

<sup>c</sup> Location K-3 is an indicator for ambient radiation and a control for soil, cattle feed and grass.

Table 2. Type and frequency of collection.

Location	Weekly	Quarterly		Semiannually	Annually
K-1b		SW	GR <sup>a</sup>		
K-1c				SS <sup>b</sup>	
K-1d		SW			FI <sup>c</sup>
K-1e		SW			
K-1f	AP <sup>g</sup>	GR <sup>a</sup>	TLD	SO	
K-1h		WW			
K-1j				SS <sup>b</sup>	
K-1m		TLD			
K-1o		TLD			
K-1q		TLD			
K-1r		TLD			
K-1t		WW <sup>h</sup>			
K-1u		WW <sup>h</sup>			
K-2	AP <sup>g</sup>	TLD			
K-3		GR <sup>a</sup>	TLD	SO	CF <sup>d</sup>
K-5		GR <sup>a</sup>	TLD		
K-8	AP <sup>g</sup>	TLD			
K-9		SW <sup>f</sup>		SS <sup>b</sup>	
K-13		WW			
K-17		TLD			
K-23a					BLV <sup>e</sup>
K-23b					BLV <sup>e</sup>
K-25		TLD			
K-26					BLV <sup>e</sup>
K-27		TLD			
K-30		TLD			
K-34		GR <sup>a</sup>		SO	CF <sup>d</sup>
K-35		GR <sup>a</sup>		SO	CF <sup>d</sup>
K-38		GR <sup>a</sup>		SO	CF <sup>d</sup>
K-39		GR <sup>a</sup>	TLD		
K-43	AP <sup>g</sup>	TLD			
K-45					CF <sup>d</sup>

<sup>a</sup> Three times a year, second third and fourth quarters.

<sup>b</sup> Collected in May and November.

<sup>c</sup> Collected in the third quarter.

<sup>d</sup> First quarter (January, February, March) only.

<sup>e</sup> Alternate since milk sampling is no longer performed.

<sup>f</sup> Two samples, raw and treated.

<sup>g</sup> Frequency may be increased dependent on dust loading.

<sup>h</sup> Well water shall be taken when this source is tapped for drinking or irrigation purposes in areas where the hydraulic gradient or recharge properties are suitable for contamination.

Table 3. Sample Codes:

<u>Code</u>	<u>Description</u>
AP	Airborne particulates
BLV	Broad leaf vegetation
CF	Cattle feed
FI	Fish
GR	Grass
SO	Soil
SW	Surface water
SS	Shoreline Sediment
TLD	Thermoluminescent dosimeter
WW	Well water

## 2.0 GRAPHS OF DATA TRENDS

Note: Conventions used in trending data.

The following conventions should be used in the interpretation of the graphs of data trends:

1. Both solid and open data points may be used in the graphs. A solid point indicates an activity, an open point, a lower limit of detection (LLD) value.
2. Data points are connected by a solid line. A break in the plot indicates missing data.

# KPS

## Air Particulates – Gross Beta

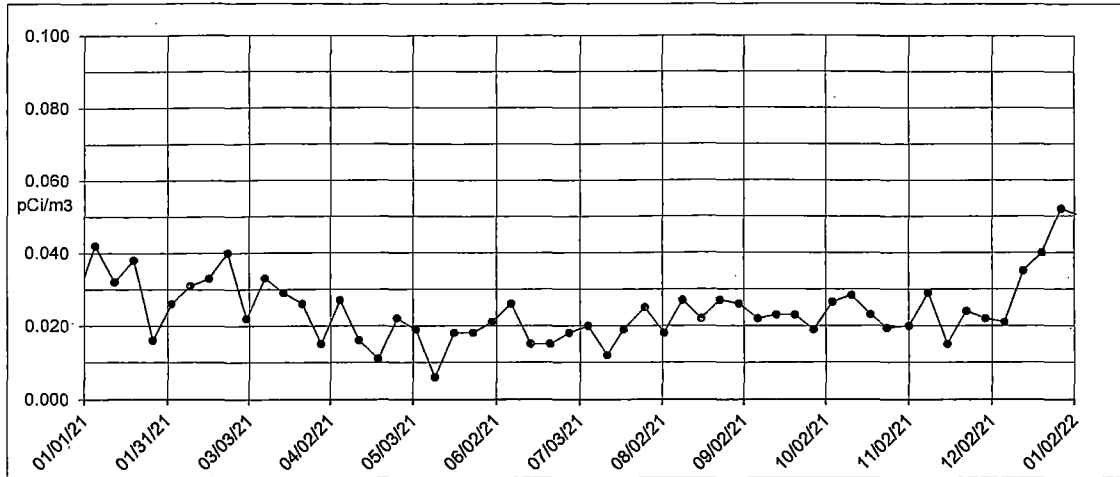


Figure 2. Location K-1f (weekly samples, 2021).

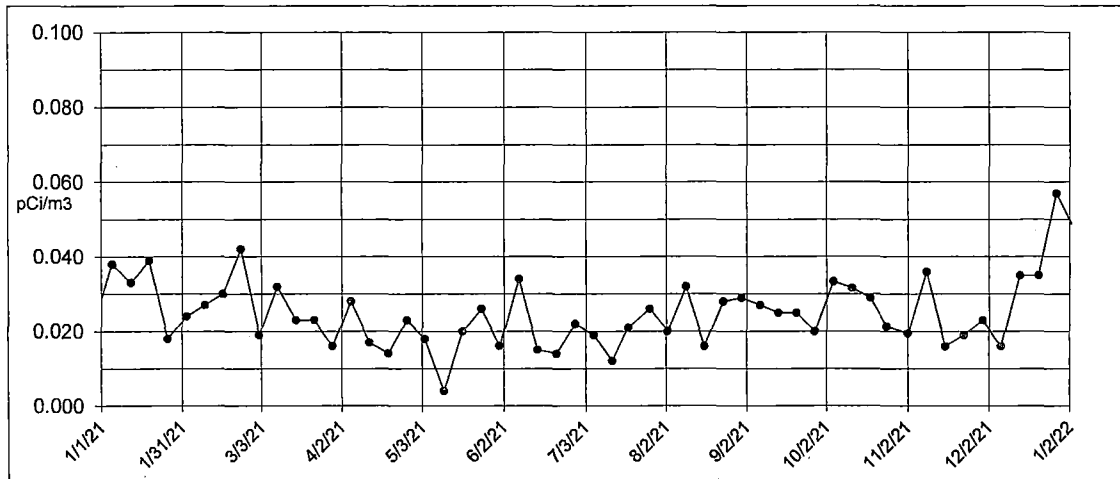


Figure 3. Location K-2 (weekly samples, 2021).

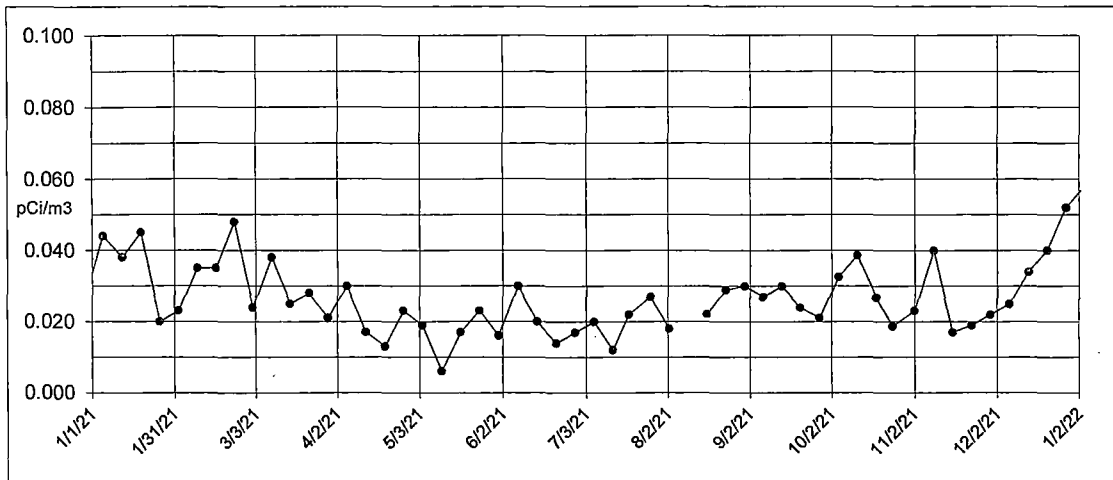


Figure 4. Location K-8 (weekly samples, 2021).

KPS

Air Particulates – Gross Beta

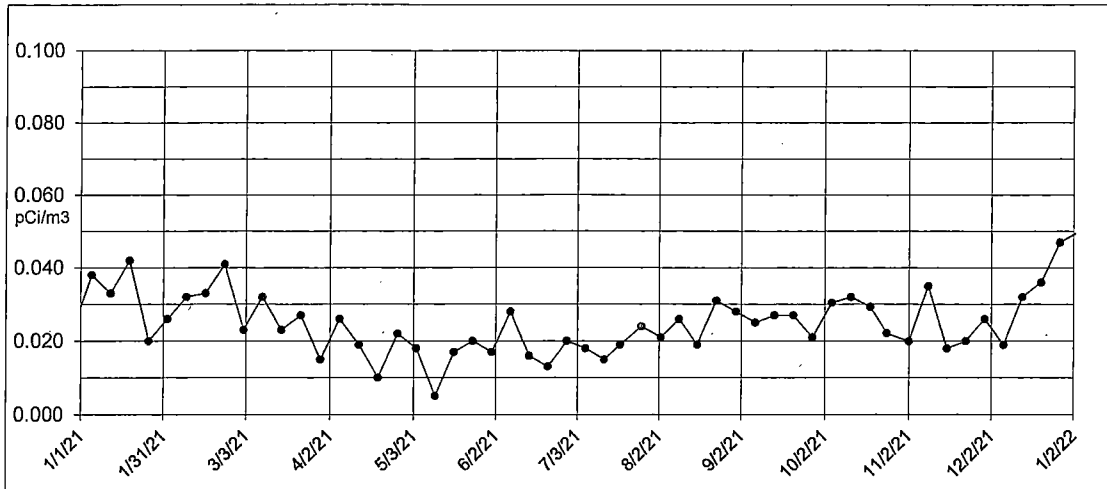


Figure 5. Location K-43 (weekly samples, 2021).

KPS

Air Particulates – Gross Beta

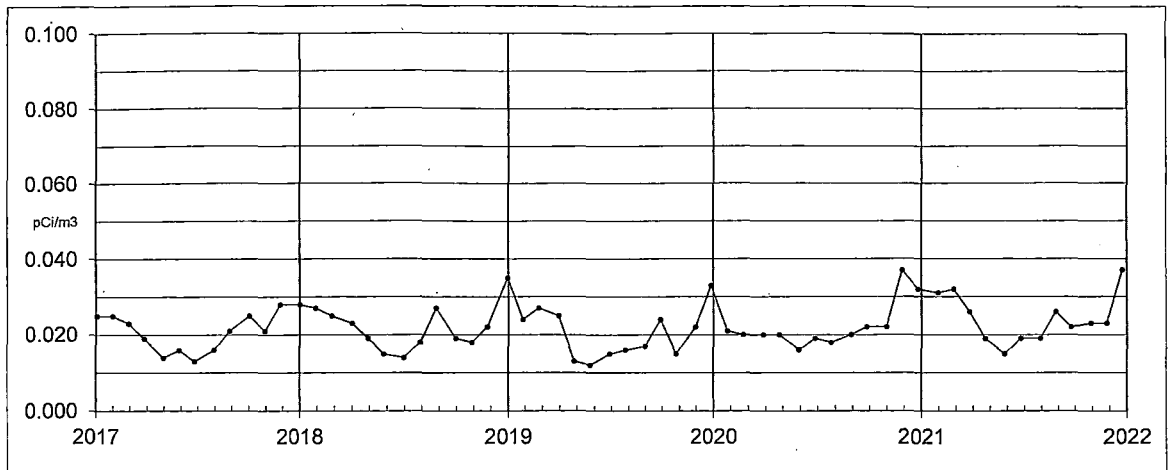


Figure 6. Location K-1f (monthly averages, 2017-2021).

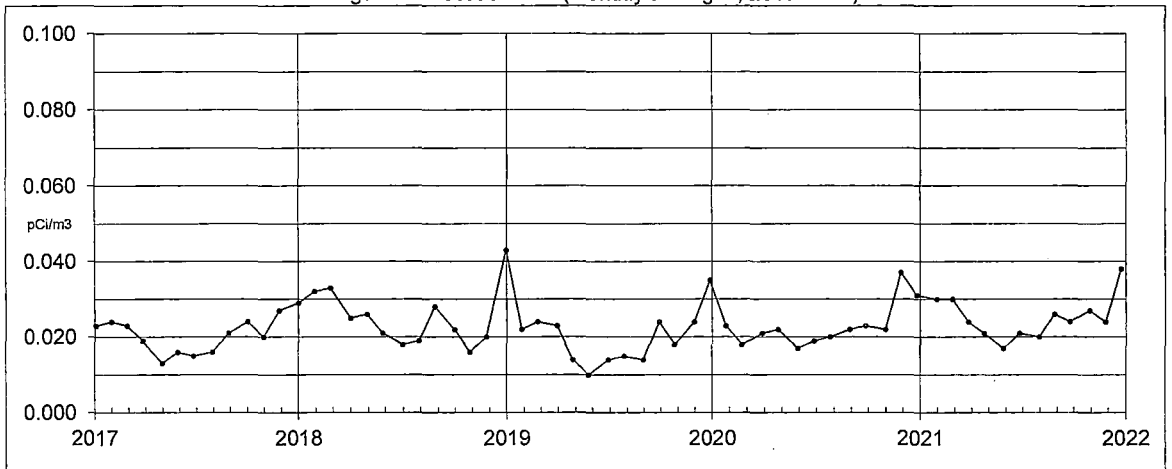


Figure 7. Location K-2 (monthly averages, 2017-2021).

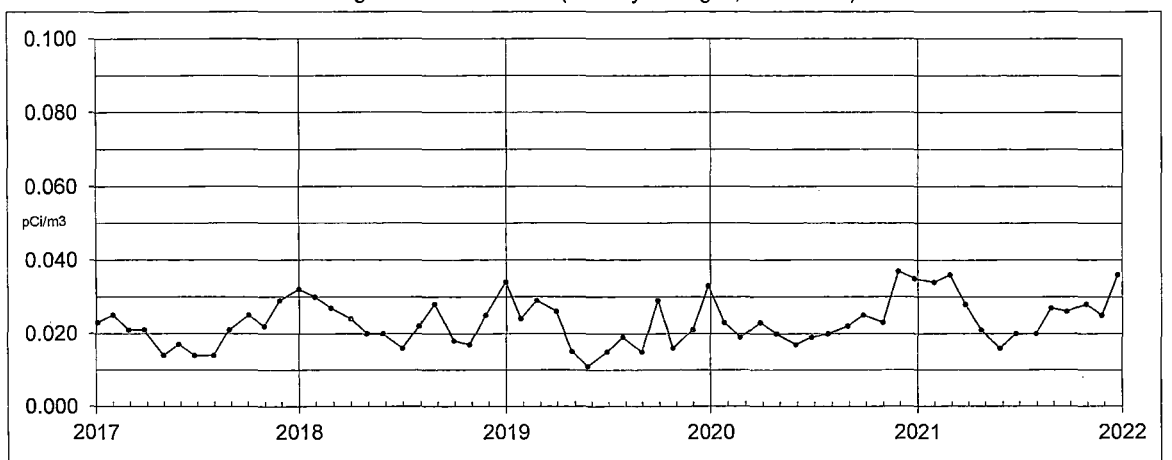


Figure 8. Location K-8 (monthly averages, 2017-2021).

KPS

Air Particulates – Gross Beta

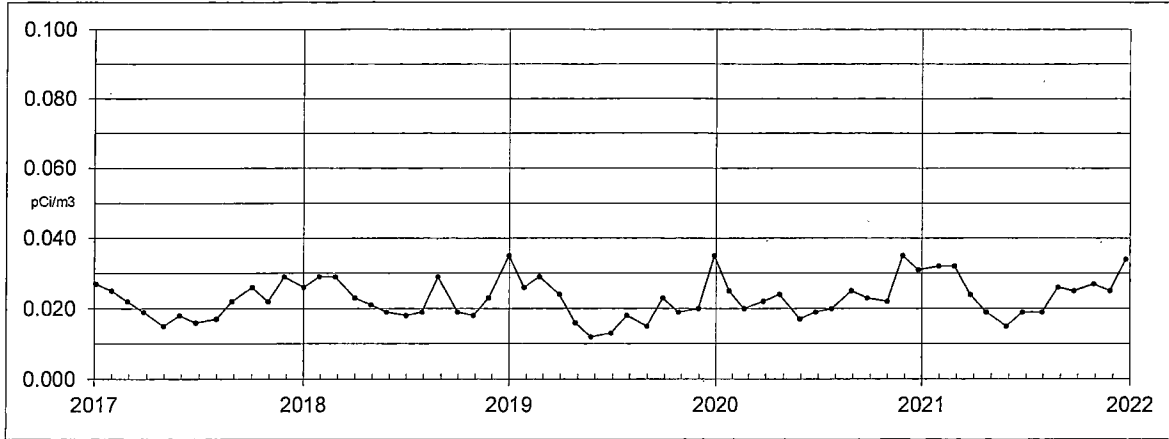


Figure 9. Location K-43 (monthly averages, 2017-2021).

# KPS

## Well Water – Gross Alpha

Note: An open data point indicates activity less than the lower limit of detection (LLD).

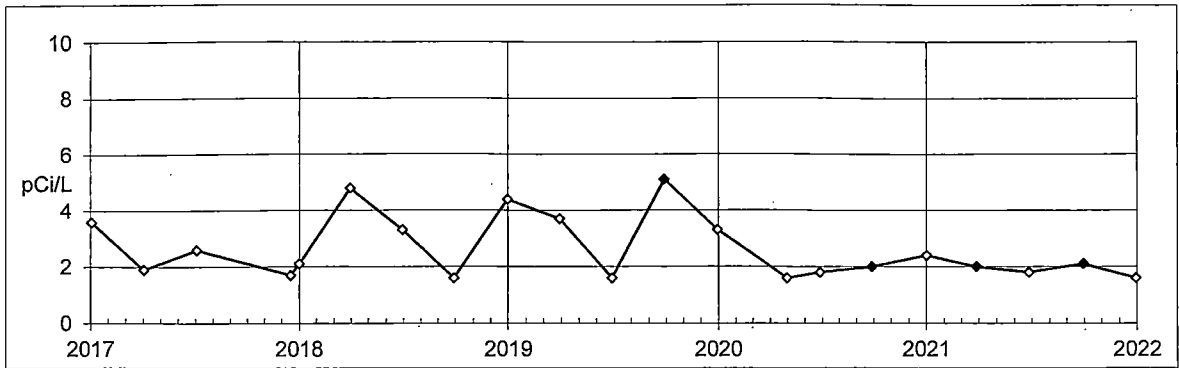


Figure 10. Location K-1h. Total Residue. Quarterly collection.

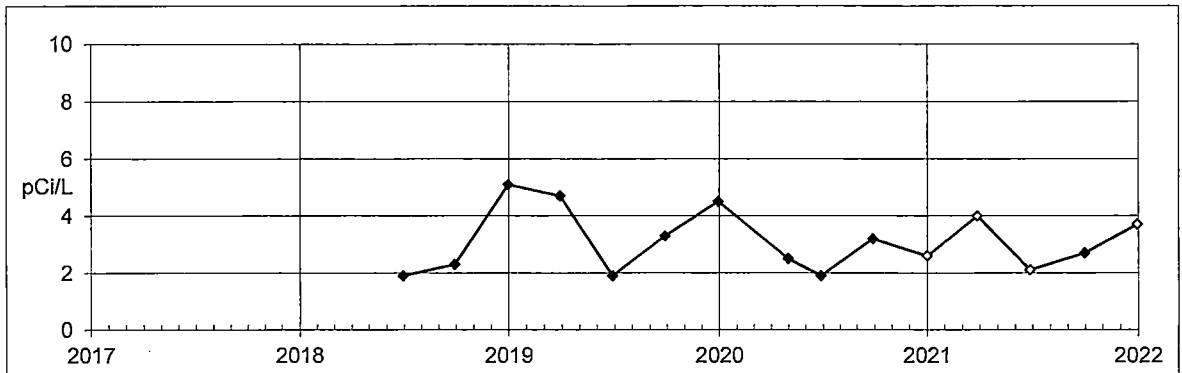


Figure 11. Location K-1t. Total Residue. Quarterly collection. (Initiated 1/1/18; sample taken only when source has been tapped for drinking or irrigation purposes.)

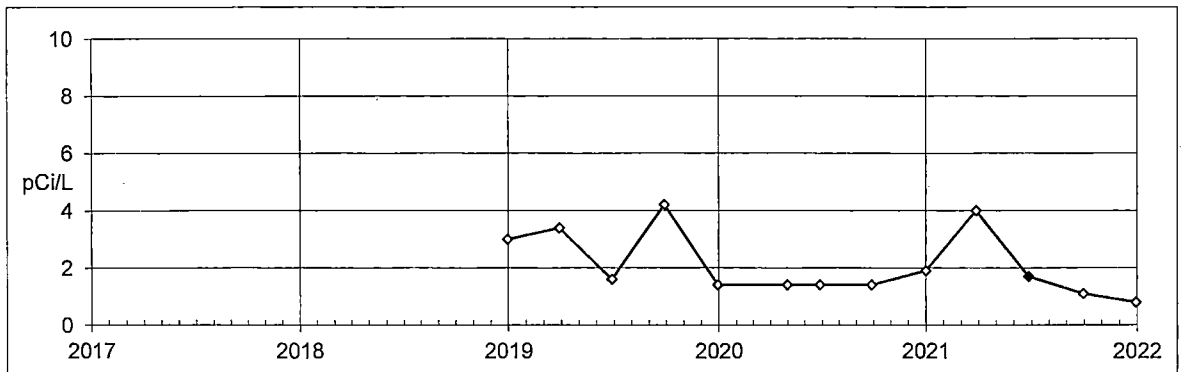


Figure 12. Location K-1u. Total Residue. Quarterly collection. (Initiated 1/2/18; sample taken only when source has been tapped for drinking or irrigation purposes.)

KPS

Well Water – Gross Beta

Note: An open data point indicates activity less than the lower limit of detection (LLD).

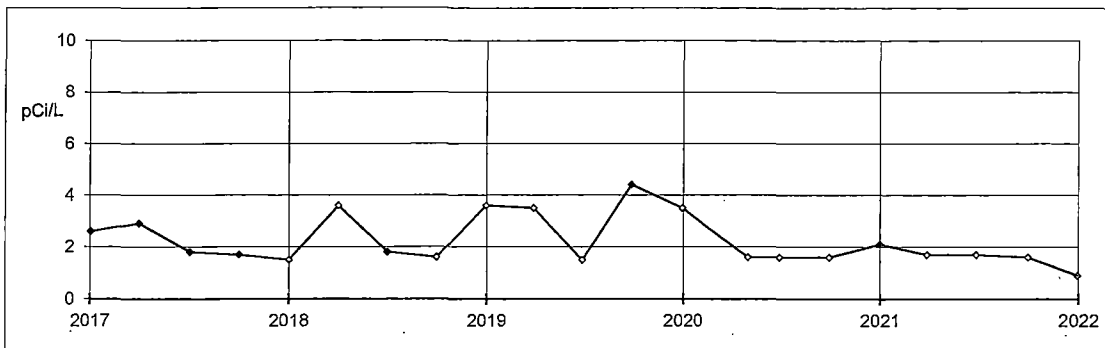


Figure 13. Location K-1h. Total Residue. Quarterly collection.

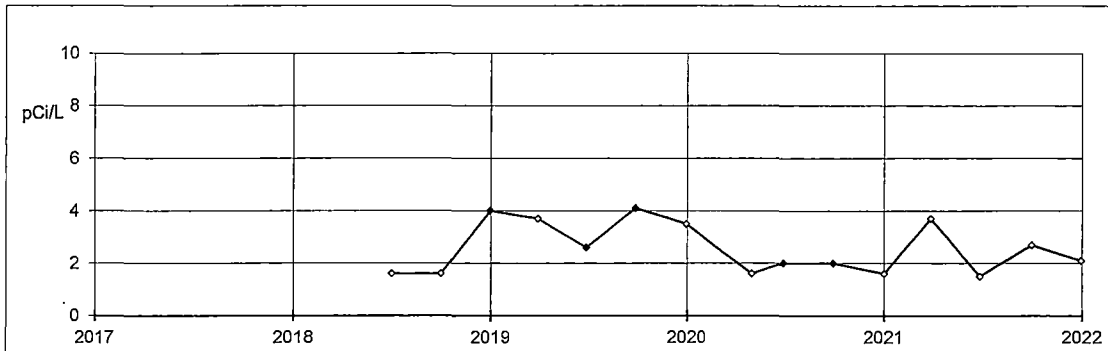


Figure 14. Location K-1t. Total Residue. Quarterly collection. (Initiated 1/1/18; sample taken only when source has been tapped for drinking or irrigation purposes.)

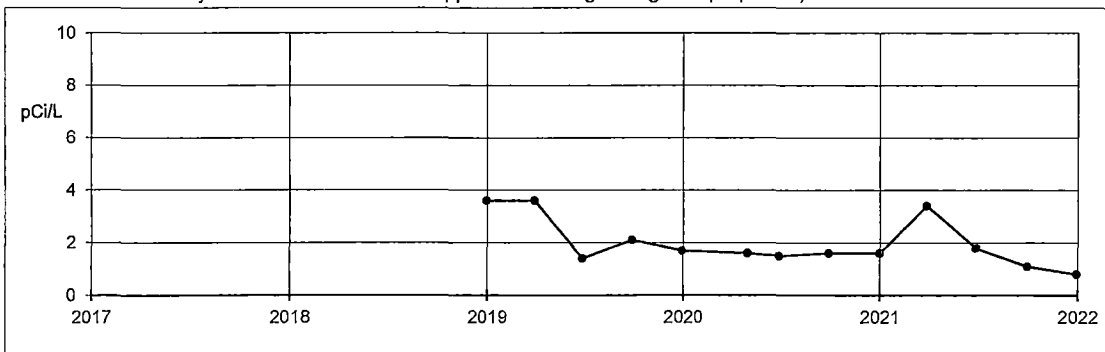


Figure 15. Location K-1u. Total Residue. Quarterly collection. (Initiated 1/2/18; sample taken only when source has been tapped for drinking or irrigation purposes.)

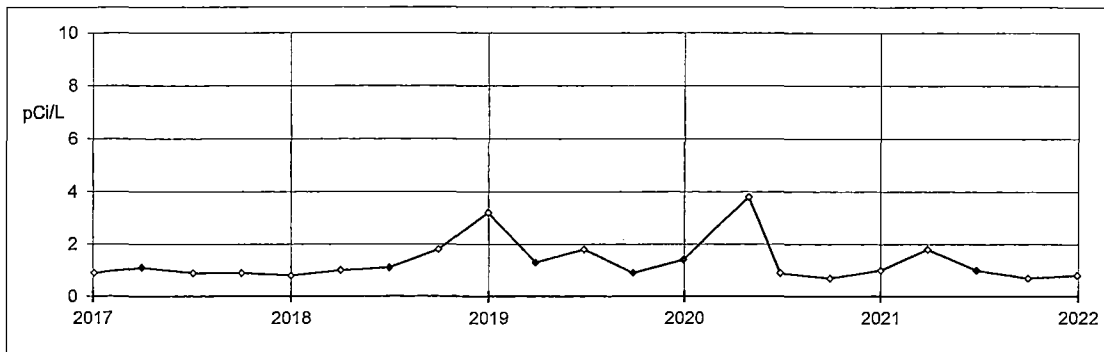


Figure 16. Location K-13. Total Residue. Quarterly collection.

KPS

Surface Water - Gross Beta

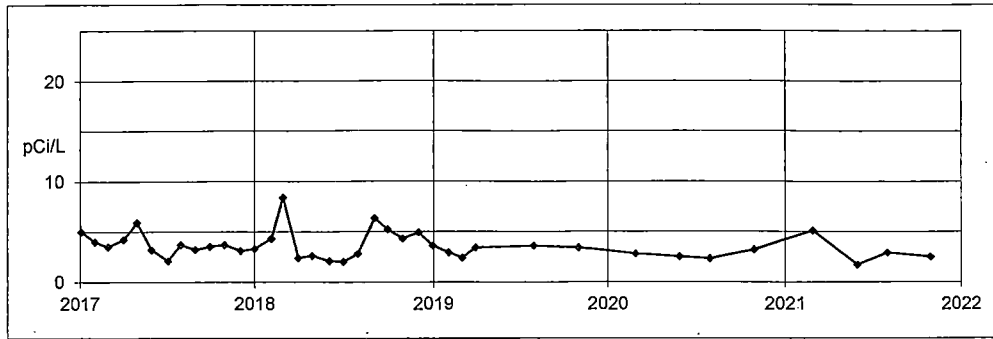


Figure 17. Surface water . Middle Creek, Onsite K-1b.

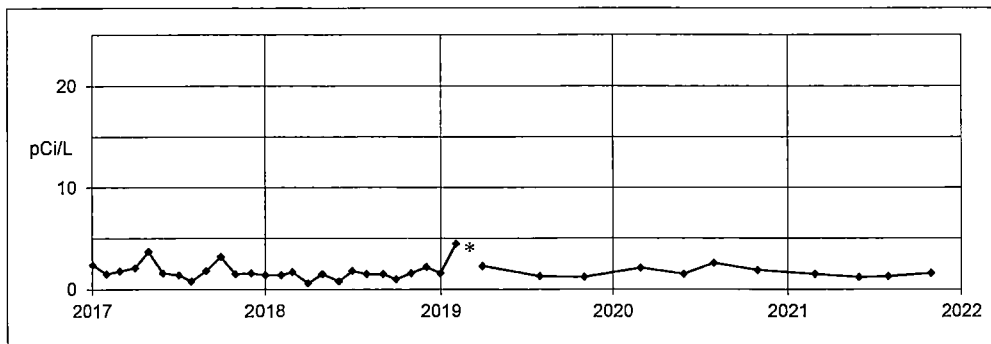


Figure 18. Surface water. Lake Michigan, condenser discharge, Onsite K-1d.

\* Sample not available 3/4/19 due to frozen conditions. (CR#1890)

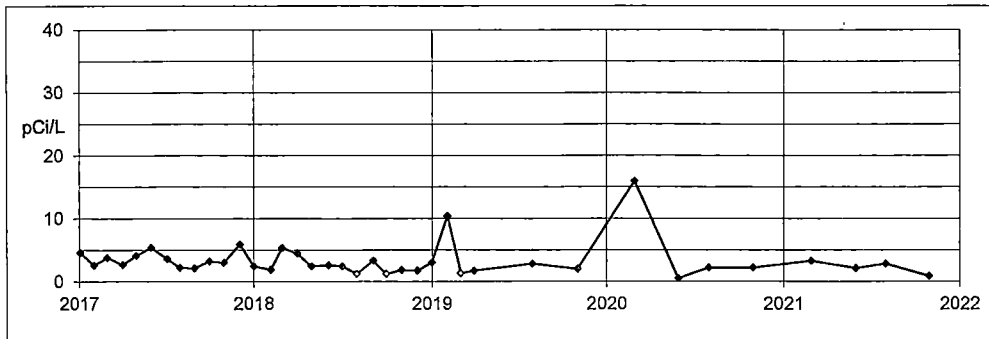


Figure 19. Surface water. South Creek, Onsite K-1e.

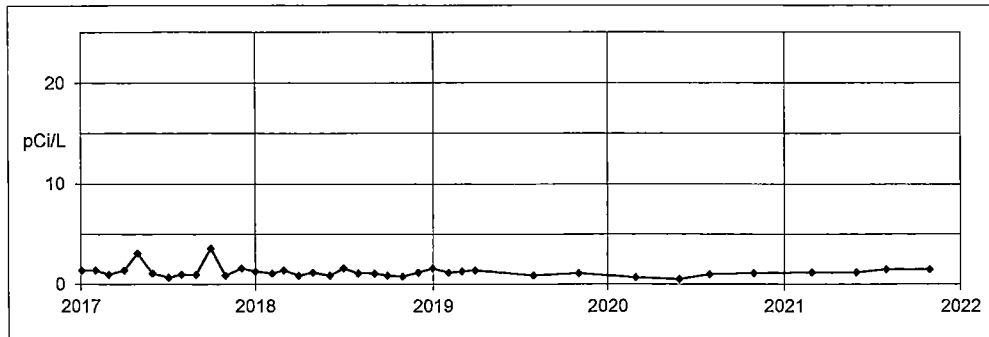


Figure 20. Surface water (raw). Lake Michigan, Rostok Intake K-9.

KPS

Surface Water – Tritium

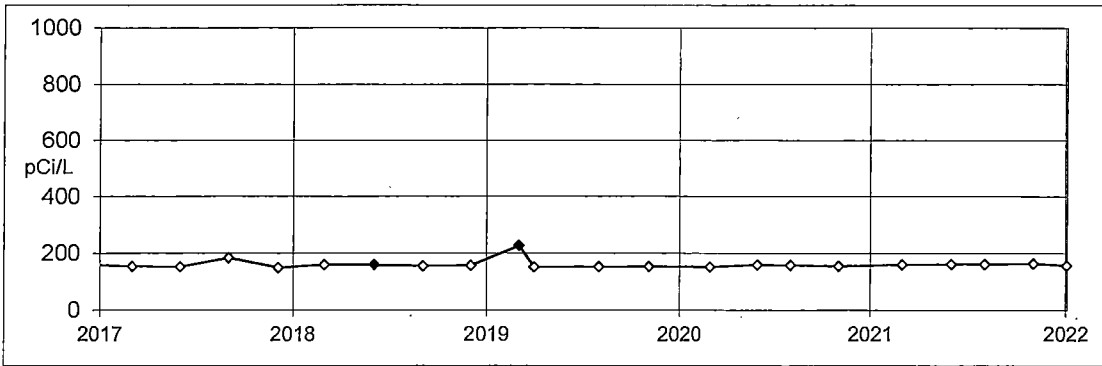


Figure 21. Surface water. Lake Michigan, condenser discharge, K-1d. Quarterly collection.

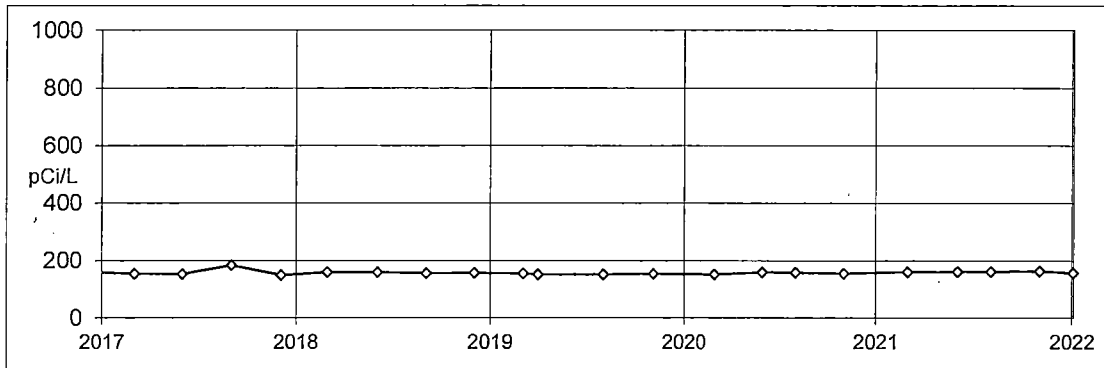


Figure 22. Surface water. Lake Michigan, Rostok Intake, K-9. Quarterly collection.

KPS

Table 4. Airborne particulates, analyses for gross beta.

Location: K-1f

Units: pCi/m<sup>3</sup>

Collection: Continuous, weekly exchange.

Date Collected	Volume (m <sup>3</sup> )	Gross Beta	Date Collected	Volume (m <sup>3</sup> )	Gross Beta
<u>Required LLD</u>		<u>0.010</u>	<u>Required LLD</u>		<u>0.010</u>
01-05-21	299	0.042 ± 0.004	07-06-21	303	0.020 ± 0.003
01-12-21	304	0.032 ± 0.004	07-13-21	302	0.012 ± 0.003
01-19-21	301	0.038 ± 0.004	07-19-21	267	0.019 ± 0.003
01-26-21	303	0.016 ± 0.003	07-27-21	339	0.025 ± 0.003
02-02-21	303	0.026 ± 0.004	08-03-21	302	0.018 ± 0.003
02-09-21	301	0.031 ± 0.004	08-10-21	308	0.027 ± 0.004
02-16-21	305	0.033 ± 0.004	08-17-21	302	0.022 ± 0.003
02-23-21	301	0.040 ± 0.004	08-24-21	297	0.027 ± 0.004
03-02-21	300	0.022 ± 0.003	08-31-21	303	0.026 ± 0.004
03-09-21	303	0.033 ± 0.004	09-07-21	303	0.022 ± 0.003
03-16-21	302	0.029 ± 0.003	09-14-21	305	0.023 ± 0.003
03-23-21	302	0.026 ± 0.004	09-21-21	299	0.023 ± 0.003
03-30-21	303	0.015 ± 0.003	09-28-21	302	0.019 ± 0.003
1st Quarter Mean ± s.d.		0.029 ± 0.008	3rd Quarter Mean ± s.d.		0.022 ± 0.004
04-06-21	301	0.027 ± 0.003	10-05-21	304	0.026 ± 0.004
04-13-21	307	0.016 ± 0.003	10-12-21	301	0.028 ± 0.004
04-20-21	300	0.011 ± 0.003	10-19-21	312	0.023 ± 0.003
04-27-21	301	0.022 ± 0.003	10-25-21	262	0.019 ± 0.004
05-04-21	303	0.019 ± 0.003	11-02-21	337	0.020 ± 0.003
05-11-21	309	0.006 ± 0.002	11-09-21	301	0.029 ± 0.004
05-18-21	298	0.018 ± 0.003	11-16-21	304	0.015 ± 0.003
05-25-21	301	0.021 ± 0.003	11-23-21	305	0.024 ± 0.004
06-01-21	301	0.013 ± 0.003	11-30-21	308	0.022 ± 0.004
06-08-21	303	0.026 ± 0.004	12-07-21	297	0.021 ± 0.003
06-15-21	302	0.015 ± 0.003	12-14-21	298	0.035 ± 0.004
06-22-21	302	0.015 ± 0.003	12-21-21	303	0.040 ± 0.004
06-29-21	303	0.018 ± 0.003	12-28-21	306	0.052 ± 0.005
2nd Quarter Mean ± s.d.		0.017 ± 0.006	4th Quarter Mean ± s.d.		0.027 ± 0.010
Cumulative Average					0.024

## KPS

Table 5. Airborne particulates, analyses for gross beta.

Location: K-2

Units: pCi/m<sup>3</sup>

Collection: Continuous, weekly exchange.

Date Collected	Volume (m <sup>3</sup> )	Gross Beta	Date Collected	Volume (m <sup>3</sup> )	Gross Beta
<u>Required LLD</u>		<u>0.010</u>	<u>Required LLD</u>		<u>0.010</u>
01-05-21	299	0.038 ± 0.004	07-06-21	302	0.019 ± 0.003
01-12-21	303	0.033 ± 0.004	07-13-21	302	0.012 ± 0.003
01-19-21	301	0.039 ± 0.004	07-19-21	266	0.021 ± 0.004
01-26-21	303	0.018 ± 0.003	07-27-21	339	0.026 ± 0.003
02-02-21	303	0.024 ± 0.003	08-03-21	302	0.020 ± 0.003
02-09-21	301	0.027 ± 0.004	08-10-21	309	0.032 ± 0.004
02-16-21	305	0.030 ± 0.004	08-17-21	301	0.016 ± 0.003
02-23-21	300	0.042 ± 0.004	08-24-21	297	0.028 ± 0.004
03-02-21	300	0.019 ± 0.003	08-31-21	303	0.029 ± 0.004
03-09-21	303	0.032 ± 0.004	09-07-21	303	0.027 ± 0.004
03-16-21	302	0.023 ± 0.003	09-14-21	305	0.025 ± 0.003
03-23-21	302	0.023 ± 0.003	09-21-21	299	0.025 ± 0.004
03-30-21	303	0.016 ± 0.003	09-28-21	302	0.020 ± 0.003
1st Quarter Mean ± s.d.		<u>0.028 ± 0.008</u>	3rd Quarter Mean ± s.d.		<u>0.023 ± 0.006</u>
04-06-21	301	0.028 ± 0.003	10-05-21	304	0.033 ± 0.004
04-13-21	307	0.017 ± 0.003	10-12-21	301	0.032 ± 0.004
04-20-21	300	0.014 ± 0.003	10-19-21	312	0.029 ± 0.004
04-27-21	301	0.023 ± 0.003	10-25-21	262	0.021 ± 0.004
05-04-21	303	0.018 ± 0.003	11-02-21	337	0.019 ± 0.003
05-11-21	309	0.004 ± 0.002	11-09-21	301	0.036 ± 0.004
05-18-21	298	0.020 ± 0.003	11-16-21	304	0.016 ± 0.003
05-25-21	301	0.026 ± 0.004	11-23-21	306	0.019 ± 0.003
06-01-21	301	0.016 ± 0.003	11-30-21	308	0.023 ± 0.004
06-08-21	302	0.034 ± 0.004	12-07-21	297	0.016 ± 0.003
06-15-21	302	0.015 ± 0.003	12-14-21	299	0.035 ± 0.004
06-22-21	302	0.014 ± 0.003	12-21-21	303	0.035 ± 0.004
06-29-21	303	0.022 ± 0.003	12-28-21	307	0.057 ± 0.005
2nd Quarter Mean ± s.d.		<u>0.019 ± 0.008</u>	4th Quarter Mean ± s.d.		<u>0.029 ± 0.011</u>
Cumulative Average					0.025

## KPS

Table 6. Airborne particulates, analyses for gross beta.

Location: K-8

Units: pCi/m<sup>3</sup>

Collection: Continuous, weekly exchange.

Date Collected	Volume (m <sup>3</sup> )	Gross Beta	Date Collected	Volume (m <sup>3</sup> )	Gross Beta
<u>Required LLD</u>		<u>0.010</u>	<u>Required LLD</u>		<u>0.010</u>
01-05-21	299	0.044 ± 0.004	07-06-21	302	0.020 ± 0.003
01-12-21	304	0.038 ± 0.004	07-13-21	302	0.012 ± 0.003
01-19-21	301	0.045 ± 0.004	07-19-21	267	0.022 ± 0.004
01-26-21	303	0.020 ± 0.003	07-27-21	339	0.027 ± 0.003
02-02-21	303	0.023 ± 0.003	08-03-21	302	0.018 ± 0.003
02-09-21	301	0.035 ± 0.004	08-10-21		ND <sup>a</sup>
02-16-21	305	0.035 ± 0.004	08-17-21	302	0.022 ± 0.003
02-23-21	300	0.048 ± 0.005	08-24-21	297	0.029 ± 0.004
03-02-21	300	0.024 ± 0.003	08-31-21	299	0.030 ± 0.004
03-09-21	303	0.038 ± 0.004	09-07-21	303	0.027 ± 0.004
03-16-21	302	0.025 ± 0.003	09-14-21	304	0.030 ± 0.004
03-23-21	302	0.028 ± 0.004	09-21-21	299	0.024 ± 0.004
03-30-21	303	0.021 ± 0.003	09-28-21	302	0.021 ± 0.003
1st Quarter Mean ± s.d.		<u>0.033 ± 0.010</u>	3rd Quarter Mean ± s.d.		<u>0.024 ± 0.005</u>
04-06-21	301	0.030 ± 0.003	10-05-21	304	0.033 ± 0.004
04-13-21	307	0.017 ± 0.003	10-12-21	301	0.039 ± 0.004
04-20-21	300	0.013 ± 0.003	10-19-21	312	0.027 ± 0.004
04-27-21	301	0.023 ± 0.003	10-25-21	262	0.019 ± 0.004
05-04-21	303	0.019 ± 0.003	11-02-21	337	0.023 ± 0.003
05-11-21	309	0.006 ± 0.002	11-09-21	301	0.040 ± 0.004
05-18-21	299	0.017 ± 0.003	11-16-21	304	0.017 ± 0.003
05-25-21	301	0.023 ± 0.003	11-23-21	306	0.019 ± 0.003
06-01-21	301	0.016 ± 0.003	11-30-21	308	0.022 ± 0.004
06-08-21	303	0.030 ± 0.004	12-07-21	297	0.025 ± 0.004
06-15-21	302	0.020 ± 0.004	12-14-21	298	0.034 ± 0.004
06-22-21	302	0.014 ± 0.003	12-21-21	302	0.040 ± 0.004
06-29-21	303	0.017 ± 0.003	12-28-21	306	0.052 ± 0.005
2nd Quarter Mean ± s.d.		<u>0.019 ± 0.007</u>	4th Quarter Mean ± s.d.		<u>0.030 ± 0.011</u>
Cumulative Average					0.026

<sup>a</sup> ND - No data. Breaker found open. (CR# 2217)

KPS

Table 7. Airborne particulates, analyses for gross beta.

Location: K-43

Units: pCi/m<sup>3</sup>

Collection: Continuous, weekly exchange.

Date Collected	Volume (m <sup>3</sup> )	Gross Beta	Date Collected	Volume (m <sup>3</sup> )	Gross Beta
<u>Required LLD</u>		<u>0.010</u>	<u>Required LLD</u>		<u>0.010</u>
01-05-21	299	0.038 ± 0.004	07-06-21	303	0.018 ± 0.003
01-12-21	304	0.033 ± 0.004	07-13-21	302	0.015 ± 0.003
01-19-21	301	0.042 ± 0.004	07-19-21	267	0.019 ± 0.003
01-26-21	303	0.020 ± 0.003	07-27-21	339	0.024 ± 0.003
02-02-21	303	0.026 ± 0.004	08-03-21	302	0.021 ± 0.003
02-09-21	301	0.032 ± 0.004	08-10-21	308	0.026 ± 0.004
02-16-21	305	0.033 ± 0.004	08-17-21	302	0.019 ± 0.003
02-23-21	301	0.041 ± 0.004	08-24-21	297	0.031 ± 0.004
03-02-21	300	0.023 ± 0.003	08-31-21	303	0.028 ± 0.004
03-09-21	303	0.032 ± 0.004	09-07-21	303	0.025 ± 0.003
03-16-21	302	0.023 ± 0.003	09-14-21	304	0.027 ± 0.004
03-23-21	302	0.027 ± 0.004	09-21-21	299	0.027 ± 0.004
03-30-21	303	0.015 ± 0.003	09-28-21	302	0.021 ± 0.003
1st Quarter Mean ± s.d.		<u>0.030 ± 0.008</u>	3rd Quarter Mean ± s.d.		<u>0.023 ± 0.005</u>
04-06-21	301	0.026 ± 0.003	10-05-21	304	0.030 ± 0.004
04-13-21	307	0.019 ± 0.003	10-12-21	301	0.032 ± 0.004
04-20-21	300	0.010 ± 0.003	10-19-21	312	0.029 ± 0.004
04-27-21	301	0.022 ± 0.003	10-25-21	262	0.022 ± 0.004
05-04-21	303	0.018 ± 0.003	11-02-21	337	0.020 ± 0.003
05-11-21	309	0.005 ± 0.002	11-09-21	301	0.035 ± 0.004
05-18-21	298	0.017 ± 0.003	11-16-21	304	0.018 ± 0.003
05-25-21	301	0.020 ± 0.003	11-23-21	306	0.020 ± 0.003
06-01-21	301	0.017 ± 0.003	11-30-21	308	0.026 ± 0.004
06-08-21	303	0.028 ± 0.004	12-07-21	297	0.019 ± 0.003
06-15-21	302	0.016 ± 0.003	12-14-21	298	0.032 ± 0.004
06-22-21	302	0.013 ± 0.003	12-21-21	303	0.036 ± 0.004
06-29-21	304	0.020 ± 0.003	12-28-21	306	0.047 ± 0.005
2nd Quarter Mean ± s.d.		<u>0.018 ± 0.006</u>	4th Quarter Mean ± s.d.		<u>0.028 ± 0.008</u>
Cumulative Average					0.025

KPS

Table 8. Airborne particulate data, gross beta analyses, monthly averages, minima and maxima.

January			
Location	Average	Minima	Maxima
Indicators	0.032	0.016	0.045
K-1f	0.031	0.016	0.042
K-8	0.034	0.020	0.045
K-43	0.032	0.020	0.042
Controls	0.030	0.018	0.039
K-2	0.030	0.018	0.039

April			
Location	Average	Minima	Maxima
Indicators	0.020	0.010	0.027
K-1f	0.019	0.011	0.027
K-8	0.021	0.011	0.027
K-43	0.019	0.010	0.026
Controls	0.021	0.014	0.028
K-2	0.021	0.014	0.028

February			
Location	Average	Minima	Maxima
Indicators	0.033	0.022	0.048
K-1f	0.032	0.022	0.040
K-8	0.036	0.024	0.048
K-43	0.032	0.023	0.041
Controls	0.030	0.019	0.042
K-2	0.030	0.019	0.042

May			
Location	Average	Minima	Maxima
Indicators	0.015	0.005	0.023
K-1f	0.015	0.006	0.021
K-8	0.016	0.006	0.023
K-43	0.015	0.005	0.020
Controls	0.017	0.004	0.026
K-2	0.017	0.004	0.026

March			
Location	Average	Minima	Maxima
Indicators	0.026	0.015	0.038
K-1f	0.026	0.015	0.033
K-8	0.028	0.021	0.038
K-43	0.024	0.015	0.032
Controls			
K-2	0.024	0.016	0.032

June			
Location	Average	Minima	Maxima
Indicators	0.019	0.013	0.030
K-1f	0.019	0.015	0.026
K-8	0.020	0.014	0.030
K-43	0.019	0.013	0.028
Controls	0.021	0.014	0.034
K-2	0.021	0.014	0.034

Note: Samples collected on the first, second or third day of the month are grouped with data of the previous month.

KPS

Table 8. Airborne particulate data, gross beta analyses, monthly averages, minima and maxima, (continued)

July			
Location	Average	Minima	Maxima
Indicators	0.019	0.012	0.027
K-1f	0.019	0.012	0.025
K-8	0.020	0.012	0.027
K-43	0.019	0.015	0.024
Controls	0.020	0.012	0.026
K-2	0.020	0.012	0.026

October			
Location	Average	Minima	Maxima
Indicators	0.026	0.019	0.039
K-1f	0.023	0.019	0.028
K-8	0.028	0.019	0.039
K-43	0.027	0.020	0.032
Controls	0.027	0.019	0.033
K-2	0.027	0.019	0.033

August			
Location	Average	Minima	Maxima
Indicators	0.026	0.019	0.031
K-1f	0.026	0.022	0.027
K-8	0.027	0.022	0.030
K-43	0.026	0.019	0.031
Controls	0.026	0.016	0.032
K-2	0.026	0.016	0.032

November			
Location	Average	Minima	Maxima
Indicators	0.024	0.015	0.040
K-1f	0.023	0.015	0.029
K-8	0.025	0.017	0.040
K-43	0.025	0.018	0.035
Controls	0.024	0.016	0.036
K-2	0.024	0.016	0.036

September			
Location	Average	Minima	Maxima
Indicators	0.024	0.019	0.030
K-1f	0.022	0.019	0.023
K-8	0.026	0.021	0.030
K-43	0.025	0.021	0.027
Controls	0.024	0.020	0.027
K-2	0.024	0.020	0.027

December			
Location	Average	Minima	Maxima
Indicators	0.036	0.019	0.052
K-1f	0.037	0.021	0.052
K-8	0.038	0.025	0.052
K-43	0.034	0.019	0.047
Controls	0.036	0.016	0.057
K-2	0.036	0.016	0.057

Note: Samples collected on the first, second or third day of the month are grouped with data of the previous month.

## KPS

Table 9. Airborne particulate samples, quarterly composites of weekly samples, analysis for gamma-emitting isotopes.

	Sample Description and Concentration (pCi/m <sup>3</sup> )			
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
<u>Indicator</u>				
<u>K-1f</u>				
Lab Code	KAP- 1007	KAP- 2164	KAP- 3376	KAP- 4350
Volume (m <sup>3</sup> )	3927	3931	3932	3938
Be-7	0.082 ± 0.014	0.096 ± 0.013	0.081 ± 0.015	0.057 ± 0.018
Nb-95	< 0.0010	< 0.0009	< 0.0010	< 0.0016
Zr-95	< 0.0020	< 0.0014	< 0.0021	< 0.0014
Ru-103	< 0.0013	< 0.0010	< 0.0011	< 0.0015
Ru-106	< 0.0087	< 0.0077	< 0.0070	< 0.0060
Cs-134	< 0.0009	< 0.0008	< 0.0010	< 0.0009
Cs-137	< 0.0010	< 0.0009	< 0.0007	< 0.0005
Ce-141	< 0.0019	< 0.0018	< 0.0014	< 0.0032
Ce-144	< 0.0043	< 0.0034	< 0.0047	< 0.0037
<u>K-8</u>				
Lab Code	KAP- 1010	KAP- 2166	KAP- 3378	KAP- 4353
Volume (m <sup>3</sup> )	3926	3932	3618	3938
Be-7	0.089 ± 0.019	0.097 ± 0.019	0.091 ± 0.017	0.072 ± 0.019
Nb-95	< 0.0021	< 0.0005	< 0.0011	< 0.0009
Zr-95	< 0.0023	< 0.0017	< 0.0025	< 0.0022
Ru-103	< 0.0017	< 0.0012	< 0.0015	< 0.0015
Ru-106	< 0.0089	< 0.0079	< 0.0085	< 0.0081
Cs-134	< 0.0007	< 0.0009	< 0.0009	< 0.0009
Cs-137	< 0.0010	< 0.0009	< 0.0008	< 0.0007
Ce-141	< 0.0031	< 0.0019	< 0.0021	< 0.0033
Ce-144	< 0.0049	< 0.0048	< 0.0044	< 0.0055

## KPS

Table 9. Airborne particulate samples, quarterly composites of weekly samples, analysis for gamma-emitting isotopes, (continued).

Indicator	Sample Description and Concentration (pCi/m <sup>3</sup> )			
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
<u>K-43</u>				
Lab Code	KAP- 1011	KAP- 2167	KAP- 3379	KAP- 4353
Volume (m <sup>3</sup> )	3927	3932	3931	3939
Be-7	0.086 ± 0.016	0.105 ± 0.017	0.107 ± 0.018	0.072 ± 0.019
Nb-95	< 0.0010	< 0.0010	< 0.0008	< 0.0009
Zr-95	< 0.0025	< 0.0016	< 0.0020	< 0.0022
Ru-103	< 0.0017	< 0.0010	< 0.0009	< 0.0015
Ru-106	< 0.0043	< 0.0076	< 0.0067	< 0.0081
Cs-134	< 0.0008	< 0.0008	< 0.0008	< 0.0009
Cs-137	< 0.0004	< 0.0008	< 0.0006	< 0.0007
Ce-141	< 0.0030	< 0.0014	< 0.0018	< 0.0033
Ce-144	< 0.0053	< 0.0052	< 0.0033	< 0.0055
<u>Control</u>				
<u>K-2</u>				
Lab Code	KAP- 1008	KAP- 2165	KAP- 3377	KAP- 4352
Volume (m <sup>3</sup> )	3925	3930	3930	3941
Be-7	0.073 ± 0.016	0.102 ± 0.018	0.097 ± 0.018	0.074 ± 0.016
Nb-95	< 0.0007	< 0.0007	< 0.0016	< 0.0019
Zr-95	< 0.0013	< 0.0016	< 0.0015	< 0.0018
Ru-103	< 0.0007	< 0.0009	< 0.0009	< 0.0012
Ru-106	< 0.0085	< 0.0063	< 0.0078	< 0.0081
Cs-134	< 0.0010	< 0.0011	< 0.0009	< 0.0009
Cs-137	< 0.0006	< 0.0006	< 0.0010	< 0.0008
Ce-141	< 0.0016	< 0.0009	< 0.0017	< 0.0026
Ce-144	< 0.0030	< 0.0028	< 0.0042	< 0.0047

## KPS

Table 10. Ambient gamma radiation (TLD), quarterly exposure.

	<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	
Date Placed	01-04-21	04-01-21	07-01-21	10-04-21	
Date Removed	04-01-21	07-01-21	10-04-21	01-03-22	
	mR/91 days				
<u>Indicator</u>					<u>Mean±s.d.</u>
K-1f	14.2 ± 0.6	14.4 ± 0.7	13.7 ± 0.7	15.0 ± 0.8	14.3 ± 0.5
K-3	16.1 ± 0.7	15.3 ± 0.6	16.2 ± 0.7	17.6 ± 0.7	16.3 ± 1.0
K-5	15.7 ± 0.7	16.9 ± 0.7	15.5 ± 0.6	15.6 ± 0.6	15.9 ± 0.7
K-8	15.4 ± 0.8	16.6 ± 0.7	16.3 ± 0.9	18.5 ± 0.8	16.7 ± 1.3
K-17	17.6 ± 1.0	18.4 ± 1.0	17.6 ± 0.5	18.2 ± 1.1	18.0 ± 0.4
K-25	16.7 ± 0.8	18.6 ± 0.7	18.4 ± 0.7	20.6 ± 1.1	18.6 ± 1.6
K-27	16.3 ± 0.4	16.8 ± 0.6	17.2 ± 0.3	18.7 ± 0.7	17.3 ± 1.0
K-30	16.2 ± 0.9	15.5 ± 0.8	15.4 ± 0.8	16.2 ± 1.0	15.8 ± 0.4
K-39	16.1 ± 0.8	17.2 ± 0.6	16.8 ± 0.7	19.4 ± 1.0	17.4 ± 1.4
K-43	13.8 ± 0.8	13.4 ± 0.7	14.2 ± 1.0	15.3 ± 0.8	14.2 ± 0.8
Mean ± s.d.	15.8 ± 1.1	16.3 ± 1.7	16.1 ± 1.5	17.5 ± 1.9	16.4 ± 0.7
<u>Control</u>					
K-2	15.9 ± 0.6	15.9 ± 0.5	16.0 ± 0.6	18.1 ± 0.7	16.5 ± 1.1
Mean ± s.d.	15.9 ± 0.6	15.9 ± 0.5	16.0 ± 0.6	18.1 ± 0.7	16.5 ± 1.1
<u>Inside the Protected Area</u>					
Date Placed	01-04-21	04-01-21	07-01-21	09-29-21	
Date Removed	04-01-21	07-01-21	09-29-21	12-29-21	<u>Mean±s.d.</u>
K-1m	136.2 ± 6.4	155.4 ± 8.3	138.0 ± 7.1	160.9 ± 9.5	147.6 ± 12.4
K-1o	121.9 ± 1.3	137.0 ± 5.2	136.2 ± 3.0	140.3 ± 3.4	133.9 ± 8.2
K-1q	19.2 ± 1.3	21.7 ± 0.5	21.8 ± 1.7	24.2 ± 0.4	21.7 ± 2.0
K-1r	15.2 ± 1.0	18.5 ± 0.6	16.7 ± 0.6	20.5 ± 1.3	17.7 ± 2.3
Mean ± s.d.	73.1 ± 64.9	83.2 ± 73.2	78.2 ± 68.1	86.5 ± 74.5	80.3 ± 5.9

## KPS

Table 11. Well water, analyses for gross alpha, gross beta, tritium, strontium-90, potassium-40 and gamma-emitting isotopes.  
Collection: Quarterly.

Sample Description and Concentration (pCi/L)				
<u>Indicator</u>				
<u>K-1h</u>				
Date Collected	01-04-21	04-01-21	07-01-21	10-04-21
Lab Code	KWW- 1	KWW- 826	KWW- 2017	KWW- 3188
Gross alpha	< 2.4	2.0 ± 1.4	< 1.8	2.1 ± 1.2
Gross beta	2.1 ± 1.2	< 1.7	< 1.7	< 1.6
H-3	< 153	< 156	< 159	< 159
Sr-90	< 0.5	< 0.4	< 0.5	< 0.5
K-40 (ICP)	1.80	1.48	1.48	1.64
Mn-54	< 1.8	< 2.2	< 2.3	< 3.1
Fe-59	< 3.1	< 3.0	< 7.2	< 7.1
Co-58	< 2.9	< 1.7	< 3.7	< 3.7
Co-60	< 1.7	< 2.1	< 2.8	< 4.1
Zn-65	< 6.6	< 3.5	< 4.6	< 5.9
Zr-Nb-95	< 4.0	< 3.1	< 3.4	< 5.9
Cs-134	< 3.9	< 3.5	< 3.8	< 4.6
Cs-137	< 2.3	< 3.0	< 1.3	< 4.6
Ba-La-140	< 3.9	< 5.4	< 3.3	< 3.1
<u>K-1t</u>				
Date Collected	01-04-21	04-01-21	07-01-21	10-04-21
Lab Code	KWW- 2	KWW- 827	KWW- 2018	KWW- 3189
Gross alpha	< 2.6	< 4.0	< 2.1	2.7 ± 1.7
Gross beta	< 1.6	< 3.7	< 1.5	2.1 ± 1.2
H-3	< 158	< 156	< 159	< 159
K-40 (ICP)	3.12	2.79	3.03	2.87
Mn-54	< 2.5	< 2.6	< 2.9	< 1.5
Fe-59	< 4.7	< 6.4	< 5.5	< 4.6
Co-58	< 2.2	< 3.3	< 2.8	< 2.2
Co-60	< 4.0	< 1.8	< 2.1	< 2.4
Zn-65	< 9.7	< 4.1	< 2.5	< 1.9
Zr-Nb-95	< 4.2	< 2.4	< 2.4	< 3.0
Cs-134	< 4.2	< 4.6	< 2.6	< 2.2
Cs-137	< 2.3	< 3.7	< 3.0	< 2.5
Ba-La-140	< 4.9	< 7.4	< 1.6	< 11.7

KPS

Table 11. Well water, analyses for gross alpha, gross beta, tritium, strontium-90, potassium-40 and gamma-emitting isotopes (continued).  
Collection: Quarterly.

Sample Description and Concentration (pCi/L)				
Indicator				
<u>K-1u</u>				
Date Collected	01-04-21	04-01-21	07-01-21	10-04-21
Lab Code	KWW- 3	KWW- 828	KWW- 2019	KWW- 3190
Gross alpha	< 1.9	< 4.0	1.7 ± 0.9	< 1.1
Gross beta	< 1.6	< 3.4	1.8 ± 0.6	1.4 ± 0.6
H-3	< 153	< 156	< 159	< 159
K-40 (ICP)	1.39	1.48	1.31	1.39
Mn-54	< 2.3	< 1.7	< 2.9	< 2.4
Fe-59	< 3.3	< 3.5	< 3.8	< 7.3
Co-58	< 1.7	< 4.2	< 2.4	< 2.6
Co-60	< 2.3	< 4.4	< 2.0	< 2.6
Zn-65	< 5.8	< 3.2	< 3.8	< 2.2
Zr-Nb-95	< 3.0	< 1.9	< 3.0	< 3.7
Cs-134	< 2.9	< 3.6	< 3.1	< 2.6
Cs-137	< 3.1	< 3.6	< 3.8	< 3.0
Ba-La-140	< 2.8	< 7.3	< 7.4	< 15.5
<u>Control</u>				
<u>K-13</u>				
Date Collected	01-04-21	04-01-21	07-01-21	10-04-21
Lab Code	KWW- 4	KWW- 829	KWW- 2020	KWW- 3191 <sup>a</sup>
Gross beta	< 1.0	< 1.8	1.0 ± 0.5	< 0.7
H-3	< 153	< 156	< 159	< 159
K-40 (ICP)	1.15	1.07	0.98	1.07
Mn-54	< 5.5	< 3.6	< 4.0	< 1.5
Fe-59	< 5.4	< 6.4	< 9.0	< 6.0
Co-58	< 4.2	< 4.7	< 4.3	< 2.5
Co-60	< 6.2	< 3.9	< 2.3	< 1.7
Zn-65	< 14.2	< 9.6	< 6.4	< 1.8
Zr-Nb-95	< 7.6	< 8.3	< 3.7	< 3.0
Cs-134	< 5.8	< 4.5	< 4.5	< 2.3
Cs-137	< 6.4	< 4.3	< 4.1	< 2.4
Ba-La-140	< 6.1	< 7.8	< 11.4	< 12.4

<sup>a</sup> Location K-43 substituted for this collection due to the sickness of the owner of location K-13

## KPS

Table 12. Broadleaf vegetation samples, analyses for gamma-emitting isotopes.  
Annual collection.

Sample Description and Concentration (pCi/g wet)		
Location	Indicator	
	K-23a	K-23b
Date Collected	08-02-21	08-02-21
Lab Code	KVE- 2454	KVE- 2455
Type	Broadleaf Veg.	Broadleaf Veg.
Be-7	2.43 ± 0.36	1.57 ± 0.27
K-40	3.98 ± 0.47	10.11 ± 0.59
Nb-95	< 0.023	< 0.027
Zr-95	< 0.026	< 0.033
Ru-103	< 0.021	< 0.023
Ru-106	< 0.143	< 0.207
Cs-134	< 0.023	< 0.022
Cs-137	< 0.025	< 0.017
Ce-141	< 0.037	< 0.040
Ce-144	< 0.166	< 0.140
Control		
Location	K-26	
Date Collected	09-01-21	
Lab Code	KVE- 2808	
Type	Cabbage	
Be-7	< 0.08	
K-40	2.39 ± 0.22	
Nb-95	< 0.006	
Zr-95	< 0.013	
Ru-103	< 0.007	
Ru-106	< 0.078	
Cs-134	< 0.009	
Cs-137	< 0.005	
Ce-141	< 0.022	
Ce-144	< 0.048	

## KPS

Table 13. Cattlefeed, analyses for gross beta, strontium-90, and gamma-emitting isotopes.  
Collection: First Quarter

Sample Description and Concentration (pCi/g wet)				
Control				
Location	K-3	K-35	K-3	K-35
Date Collected	01-04-21	01-04-21	01-04-21	01-04-21
Lab Code	KCF- 5	KCF- 7	KCF- 9	KCF- 11
Type	Hay	Hay	Silage	Silage
Gross beta	18.20 ± 0.53	5.67 ± 0.50	2.43 ± 0.07	16.08 ± 0.44
Sr-90	< 0.003	< 0.011	< 0.001	0.004 ± 0.002
Be-7	0.64 ± 0.124	1.98 ± 0.456	0.27 ± 0.104	< 0.112
K-40	13.43 ± 0.52	5.87 ± 0.77	3.05 ± 0.25	10.76 ± 0.52
Nb-95	< 0.012	< 0.034	< 0.012	< 0.013
Zr-95	< 0.020	< 0.042	< 0.015	< 0.027
Ru-103	< 0.007	< 0.028	< 0.006	< 0.011
Ru-106	< 0.092	< 0.226	< 0.075	< 0.117
Cs-134	< 0.010	< 0.032	< 0.010	< 0.014
Cs-137	< 0.011	< 0.030	< 0.006	< 0.011
Ce-141	< 0.018	< 0.038	< 0.020	< 0.021
Ce-144	< 0.084	< 0.251	< 0.066	< 0.083
Indicator				
Location	K-34	K-34	K-38	K-38
Date Collected	01-04-21	01-04-21	01-04-21	01-04-21
Lab Code	KCF- 6	KCF- 10	KCF- 8	KCF- 12
Type	Hay	Silage	Hay	Silage
Gross beta	25.15 ± 0.71	2.39 ± 0.10	15.96 ± 0.60	8.14 ± 0.29
Sr-90	0.003 ± 0.001	0.001 ± 0.001	< 0.007	0.004 ± 0.002
Be-7	1.21 ± 0.175	0.53 ± 0.112	< 0.223	< 0.182
K-40	6.08 ± 0.39	2.42 ± 0.25	11.80 ± 1.13	6.83 ± 0.49
Nb-95	< 0.016	< 0.009	< 0.040	< 0.014
Zr-95	< 0.012	< 0.017	< 0.048	< 0.026
Ru-103	< 0.009	< 0.009	< 0.037	< 0.011
Ru-106	< 0.097	< 0.082	< 0.316	< 0.086
Cs-134	< 0.012	< 0.011	< 0.042	< 0.015
Cs-137	< 0.014	< 0.008	< 0.036	< 0.014
Ce-141	< 0.025	< 0.021	< 0.066	< 0.025
Ce-144	< 0.081	< 0.057	< 0.313	< 0.063

## KPS

Table 13. Cattlefeed, analyses for gross beta, strontium-90, and gamma-emitting isotopes (continued).  
Collection: First Quarter

Location	Sample Description and Concentration (pCi/g wet)	
	Indicator	
Location	K-45	K-45
Date Collected	08-02-21	08-02-21
Lab Code	KCF- 2452 <sup>a</sup>	KCF- 2453 <sup>a</sup>
Type	Hay	Silage
Gross beta	18.74 ± 0.86	11.84 ± 0.33
Sr-90	< 0.025	< 0.003
Be-7	< 0.278	0.43 ± 0.120
K-40	14.91 ± 0.83	9.65 ± 0.47
Nb-95	< 0.018	< 0.019
Zr-95	< 0.033	< 0.018
Ru-103	< 0.024	< 0.011
Ru-106	< 0.251	< 0.134
Cs-134	< 0.024	< 0.014
Cs-137	< 0.023	< 0.012
Ce-141	< 0.042	< 0.025
Ce-144	< 0.194	< 0.103

<sup>a</sup> Collection was delayed due to a suspension of dairy activities at both locations K-5 and K-39.  
Samples were collected at new location, K-45, close to locations K-5 and K-39 (CR#2182).

## KPS

Table 14. Grass, analyses for gross beta, strontium-90, and gamma-emitting isotopes.  
 Collection: Quarterly, April through December  
 Units: pCi/g wet

Sample Description and Concentration (pCi/g wet)				
Location	Indicator			
	K-1b	K-1f	K-5	K-34
Date Collected	06-01-21	06-01-21	06-01-21	06-01-21
Lab Code	KG- 1597	KG- 1598	KG- 1600	KG- 1601
Gross beta	7.26 ± 0.21	8.02 ± 0.23	8.76 ± 0.24	7.93 ± 0.22
Sr-90	< 0.002	< 0.002	< 0.002	0.001 ± 0.001
Be-7	0.90 ± 0.27	0.91 ± 0.31	1.54 ± 0.25	0.80 ± 0.21
K-40	8.28 ± 0.67	9.62 ± 0.85	10.74 ± 0.67	8.90 ± 0.71
Mn-54	< 0.016	< 0.025	< 0.015	< 0.019
Co-58	< 0.016	< 0.020	< 0.018	< 0.014
Co-60	< 0.020	< 0.024	< 0.014	< 0.010
Nb-95	< 0.016	< 0.031	< 0.023	< 0.019
Zr-95	< 0.027	< 0.032	< 0.019	< 0.038
Ru-103	< 0.019	< 0.028	< 0.016	< 0.021
Ru-106	< 0.141	< 0.302	< 0.114	< 0.139
Cs-134	< 0.024	< 0.034	< 0.018	< 0.020
Cs-137	< 0.022	< 0.029	< 0.021	< 0.024
Ce-141	< 0.050	< 0.060	< 0.042	< 0.049
Ce-144	< 0.134	< 0.267	< 0.103	< 0.144
Location	Indicator		Control	
	K-38	K-39	K-3	K-35
Date Collected	06-01-21	06-01-21	06-01-21	06-01-21
Lab Code	KG- 1603	KG- 1604	KG- 1599	KG- 1602
Gross beta	9.88 ± 0.27	4.21 ± 0.18	9.02 ± 0.24	8.12 ± 0.23
Sr-90	< 0.002	< 0.002	< 0.003	< 0.002
Be-7	1.38 ± 0.42	2.00 ± 0.42	0.52 ± 0.17	0.83 ± 0.22
K-40	9.53 ± 0.79	9.25 ± 0.89	6.08 ± 0.47	7.32 ± 0.62
Mn-54	< 0.035	< 0.033	< 0.016	< 0.015
Co-58	< 0.032	< 0.042	< 0.018	< 0.009
Co-60	< 0.027	< 0.015	< 0.016	< 0.019
Nb-95	< 0.029	< 0.033	< 0.019	< 0.014
Zr-95	< 0.050	< 0.040	< 0.027	< 0.037
Ru-103	< 0.032	< 0.045	< 0.016	< 0.021
Ru-106	< 0.323	< 0.278	< 0.194	< 0.155
Cs-134	< 0.028	< 0.033	< 0.016	< 0.020
Cs-137	< 0.035	< 0.049	< 0.010	< 0.015
Ce-141	< 0.043	< 0.075	< 0.037	< 0.032
Ce-144	< 0.194	< 0.253	< 0.121	< 0.124

## KPS

Table 14. Grass, analyses for gross beta, strontium-90, and gamma-emitting isotopes (continued).  
 Collection: Quarterly, April through December  
 Units: pCi/g wet

Sample Description and Concentration (pCi/g wet)				
Location	Indicator			
	K-1b	K-1f	K-5	K-34
Date Collected	08-02-21	08-02-21	08-02-21	08-02-21
Lab Code	KG- 2443	KG- 2444	KG- 2447	KG- 2448
Gross beta	5.40 ± 0.17	5.07 ± 0.20	8.62 ± 0.24	8.29 ± 0.33
Sr-90	< 0.002	< 0.002	< 0.002	< 0.003
Be-7	2.51 ± 0.24	2.46 ± 0.24	1.03 ± 0.23	7.89 ± 0.30
K-40	4.29 ± 0.40	4.29 ± 0.38	6.74 ± 0.48	6.53 ± 0.36
Mn-54	< 0.011	< 0.010	< 0.017	< 0.019
Co-58	< 0.012	< 0.010	< 0.015	< 0.012
Co-60	< 0.015	< 0.013	< 0.013	< 0.015
Nb-95	< 0.022	< 0.013	< 0.018	< 0.021
Zr-95	< 0.020	< 0.022	< 0.017	< 0.029
Ru-103	< 0.020	< 0.020	< 0.016	< 0.018
Ru-106	< 0.138	< 0.088	< 0.120	< 0.160
Cs-134	< 0.017	< 0.016	< 0.017	< 0.017
Cs-137	< 0.018	< 0.013	< 0.016	< 0.021
Ce-141	< 0.022	< 0.034	< 0.036	< 0.025
Ce-144	< 0.140	< 0.085	< 0.136	< 0.094

Location	Indicator		Control	
	K-38	K-39	K-3	K-35
Date Collected	08-02-21	08-02-21	08-02-21	08-02-21
Lab Code	KG- 2450	KG- 2451	KG- 2445	KG- 2449
Gross beta	9.42 ± 0.28	5.11 ± 0.20	8.40 ± 0.25	8.72 ± 0.24
Sr-90	< 0.002	< 0.002	< 0.003	< 0.003
Be-7	2.92 ± 0.35	5.64 ± 0.24	1.91 ± 0.24	1.12 ± 0.29
K-40	7.74 ± 0.59	6.42 ± 0.30	7.06 ± 0.50	8.43 ± 0.70
Mn-54	< 0.023	< 0.014	< 0.010	< 0.021
Co-58	< 0.017	< 0.011	< 0.012	< 0.028
Co-60	< 0.011	< 0.013	< 0.018	< 0.023
Nb-95	< 0.015	< 0.014	< 0.020	< 0.018
Zr-95	< 0.030	< 0.021	< 0.021	< 0.028
Ru-103	< 0.023	< 0.016	< 0.018	< 0.021
Ru-106	< 0.202	< 0.088	< 0.114	< 0.221
Cs-134	< 0.024	< 0.015	< 0.017	< 0.031
Cs-137	< 0.020	< 0.013	< 0.020	< 0.017
Ce-141	< 0.054	< 0.023	< 0.023	< 0.037
Ce-144	< 0.167	< 0.128	< 0.107	< 0.186

KPS

Table 14. Grass, analyses for gross beta, strontium-90, and gamma-emitting isotopes (continued).  
 Collection: Quarterly, April through December  
 Units: pCi/g wet

Sample Description and Concentration (pCi/g wet)				
Location	Indicator			
	K-1b	K-1f	K-5	K-34
Date Collected	10-04-21	10-04-21	10-04-21	10-04-21
Lab Code	KG- 3198	KG- 3199	KG- 3201	KG- 3202
Gross beta	6.69 ± 0.21	5.32 ± 0.27	3.85 ± 0.15	3.72 ± 0.15
Sr-90	< 0.004	< 0.005	< 0.001	0.003 ± 0.001
Be-7	3.76 ± 0.37	7.53 ± 0.55	4.78 ± 0.14	3.02 ± 0.28
K-40	5.49 ± 0.62	3.66 ± 0.52	5.49 ± 0.18	2.82 ± 0.31
Mn-54	< 0.015	< 0.015	< 0.006	< 0.013
Co-58	< 0.029	< 0.016	< 0.007	< 0.012
Co-60	< 0.014	< 0.015	< 0.007	< 0.012
Nb-95	< 0.026	< 0.026	< 0.011	< 0.021
Zr-95	< 0.038	< 0.031	< 0.014	< 0.019
Ru-103	< 0.022	< 0.021	< 0.011	< 0.012
Ru-106	< 0.138	< 0.229	< 0.059	< 0.125
Cs-134	< 0.024	< 0.024	< 0.007	< 0.015
Cs-137	< 0.022	< 0.020	< 0.008	< 0.015
Ce-141	< 0.026	< 0.035	< 0.016	< 0.033
Ce-144	< 0.100	< 0.187	< 0.071	< 0.086

Location	Indicator		Control	
	K-38	K-39	K-3	K-35
Date Collected	10-04-21	10-04-21	10-04-21	10-04-21
Lab Code	KG- 3204	KG- 3205	KG- 3200	KG- 3203
Gross beta	3.37 ± 0.14	9.99 ± 0.67	4.08 ± 0.15	5.74 ± 0.19
Sr-90	< 0.003	< 0.006	< 0.002	< 0.003
Be-7	4.16 ± 0.14	4.86 ± 0.29	3.32 ± 0.12	3.71 ± 0.32
K-40	4.03 ± 0.17	4.44 ± 0.39	4.65 ± 0.17	4.77 ± 0.46
Mn-54	< 0.007	< 0.013	< 0.006	< 0.020
Co-58	< 0.006	< 0.013	< 0.006	< 0.016
Co-60	< 0.006	< 0.012	< 0.006	< 0.016
Nb-95	< 0.009	< 0.017	< 0.007	< 0.025
Zr-95	< 0.009	< 0.020	< 0.013	< 0.042
Ru-103	< 0.009	< 0.011	< 0.007	< 0.020
Ru-106	< 0.059	< 0.111	< 0.042	< 0.136
Cs-134	< 0.006	< 0.013	< 0.005	< 0.018
Cs-137	< 0.007	< 0.020	< 0.006	< 0.015
Ce-141	< 0.014	< 0.031	< 0.012	< 0.030
Ce-144	< 0.053	< 0.121	< 0.048	< 0.087

## KPS

Table 15. Soil samples, analyses for gross alpha, gross beta, strontium-90, and gamma-emitting isotopes.  
Collection: Semiannually

Sample Description and Concentration (pCi/g dry)			
Location	Indicator		
	K-1f	K-34	K-38
Date Collected	05-03-21	05-03-21	05-03-21
Lab Code	KSO- 1325	KSO- 1327	KSO- 1329
Gross alpha	6.01 ± 1.49	7.06 ± 1.63	6.68 ± 2.25
Gross beta	15.63 ± 1.03	26.00 ± 1.66	30.85 ± 1.72
Sr-90	< 0.052	< 0.045	< 0.041
Be-7	< 0.46	< 0.38	< 0.34
K-40	20.15 ± 0.83	18.77 ± 1.15	22.72 ± 1.37
Nb-95	< 0.088	< 0.062	< 0.063
Zr-95	< 0.070	< 0.086	< 0.094
Ru-103	< 0.067	< 0.048	< 0.065
Ru-106	< 0.178	< 0.255	< 0.323
Cs-134	< 0.018	< 0.025	< 0.036
Cs-137	0.05 ± 0.02	0.10 ± 0.05	0.14 ± 0.06
Ce-141	< 0.128	< 0.075	< 0.097
Ce-144	< 0.172	< 0.194	< 0.178
Date Collected	10-04-21	10-04-21	10-04-21
Lab Code	KSO- 3192	KSO- 3195	KSO- 3197
Gross alpha	6.87 ± 1.92	6.87 ± 1.96	6.60 ± 1.63
Gross beta	24.32 ± 1.60	23.39 ± 1.72	28.12 ± 1.60
Sr-90	< 0.043	< 0.028	0.029 ± 0.017
Be-7	< 0.39	< 0.42	< 0.41
K-40	19.12 ± 0.99	17.93 ± 0.96	23.10 ± 1.12
Nb-95	< 0.040	< 0.053	< 0.084
Zr-95	< 0.074	< 0.056	< 0.102
Ru-103	< 0.046	< 0.031	< 0.047
Ru-106	< 0.248	< 0.205	< 0.276
Cs-134	< 0.025	< 0.034	< 0.031
Cs-137	0.10 ± 0.04	0.12 ± 0.03	0.10 ± 0.04
Ce-141	< 0.099	< 0.085	< 0.123
Ce-144	< 0.217	< 0.168	< 0.257

## KPS

Table 15. Soil samples, analyses for gross alpha, gross beta, strontium-90, and gamma-emitting isotopes (continued).  
Collection: Semiannually

Sample Description and Concentration (pCi/g dry)		
Location	Control	
	K-3	K-35
Date Collected	05-03-21	05-03-21
Lab Code	KSO- 1326	KSO- 1328
Gross alpha	8.13 ± 1.85	7.55 ± 1.96
Gross beta	30.13 ± 1.77	21.11 ± 1.68
Sr-90	< 0.056	< 0.045
Be-7	< 0.43	< 0.46
K-40	20.16 ± 1.30	16.16 ± 1.19
Nb-95	< 0.045	< 0.046
Zr-95	< 0.109	< 0.075
Ru-103	< 0.050	< 0.049
Ru-106	< 0.325	< 0.377
Cs-134	< 0.029	< 0.026
Cs-137	0.11 ± 0.04	0.06 ± 0.03
Ce-141	< 0.088	< 0.078
Ce-144	< 0.173	< 0.178
Date Collected	10-04-21	10-04-21
Lab Code	KSO- 3193	KSO- 3196
Gross alpha	7.52 ± 1.91	5.78 ± 2.20
Gross beta	28.03 ± 1.73	17.77 ± 1.53
Sr-90	< 0.046	< 0.028
Be-7	< 0.38	< 0.48
K-40	21.65 ± 1.04	13.73 ± 0.95
Nb-95	< 0.037	< 0.076
Zr-95	< 0.041	< 0.095
Ru-103	< 0.031	< 0.035
Ru-106	< 0.288	< 0.178
Cs-134	< 0.030	< 0.035
Cs-137	0.13 ± 0.05	0.12 ± 0.043
Ce-141	< 0.073	< 0.103
Ce-144	< 0.127	< 0.150

## KPS

Table 16. Surface water samples, analyses for gross beta, potassium-40 and gamma-emitting isotopes.

Collection: Quarterly

Sample Description and Concentration (pCi/L)			
Indicator			
<u>K-1b</u>			
Date Collected	03-01-21	06-01-21	08-02-21
Lab Code	KSW- 480	KSW- 1592	KSW- 2438
Gross beta			
Suspended Solids	< 0.7	< 0.7	< 0.7
Dissolved Solids	5.1 ± 1.0	1.7 ± 0.8	2.9 ± 0.8
Total Residue	5.1 ± 1.0	1.7 ± 0.8	2.9 ± 0.8
K-40 (ICP)	5.00	< 2.30	3.77
Mn-54	< 2.8	< 1.8	< 3.0
Fe-59	< 4.9	< 3.6	< 4.0
Co-58	< 3.2	< 2.7	< 4.2
Co-60	< 2.8	< 1.9	< 3.7
Zn-65	< 3.8	< 4.9	< 2.6
Zr-Nb-95	< 2.8	< 2.6	< 2.9
Cs-134	< 3.7	< 3.3	< 3.4
Cs-137	< 2.8	< 2.8	< 2.5
Ba-La-140	< 2.3	< 4.4	< 4.0
<u>K-1d</u>			
Date Collected	03-01-21	06-01-21	08-02-21
Lab Code	KSW- 481	KSW- 1593	KSW- 2439
Gross beta			
Suspended Solids	< 0.8	< 0.8	< 0.8
Dissolved Solids	1.5 ± 0.4	1.2 ± 0.4	1.3 ± 0.4
Total Residue	1.5 ± 0.4	1.2 ± 0.4	1.3 ± 0.4
K-40 (ICP)	1.80	1.23	1.39
Mn-54	< 4.1	< 3.3	< 3.0
Fe-59	< 4.9	< 7.3	< 8.0
Co-58	< 2.6	< 2.7	< 3.5
Co-60	< 2.1	< 2.7	< 3.0
Zn-65	< 8.0	< 4.3	< 5.6
Zr-Nb-95	< 2.6	< 2.3	< 4.2
Cs-134	< 4.3	< 4.2	< 4.6
Cs-137	< 4.2	< 4.2	< 5.9
Ba-La-140	< 5.2	< 3.3	< 4.7

## KPS

Table 16. Surface water samples, analyses for gross beta, potassium-40, and gamma-emitting isotopes (continued).

Collection: Quarterly

Sample Description and Concentration (pCi/L)	
<u>Indicator</u>	
<u>K-1b</u>	
Date Collected	11-01-21
Lab Code	KSW- 3661
Gross beta	
Suspended Solids	< 0.7
Dissolved Solids	2.5 ± 0.7
Total Residue	2.5 ± 0.7
K-40 (ICP)	3.36
Mn-54	< 2.8
Fe-59	< 3.9
Co-58	< 1.7
Co-60	< 1.7
Zn-65	< 4.3
Zr-Nb-95	< 2.1
Cs-134	< 3.7
Cs-137	< 2.4
Ba-La-140	< 3.5
<u>K-1d</u>	
Date Collected	11-01-21
Lab Code	KSW- 3662
Gross beta	
Suspended Solids	< 0.8
Dissolved Solids	1.6 ± 0.8
Total Residue	1.6 ± 0.8
K-40 (ICP)	1.39
Mn-54	< 2.0
Fe-59	< 3.9
Co-58	< 2.1
Co-60	< 1.9
Zn-65	< 5.8
Zr-Nb-95	< 2.4
Cs-134	< 3.3
Cs-137	< 3.7
Ba-La-140	< 3.3

## KPS

Table 16. Surface water samples, analyses for gross beta, potassium-40 and gamma-emitting isotopes (continued).  
Collection: Quarterly

Sample Description and Concentration (pCi/L)			
<u>Indicator</u>			
<u>K-1e</u>			
Date Collected	03-01-21	06-01-21	08-02-21
Lab Code	KSW- 482	KSW- 1594	KSW- 2440
Gross beta			
Suspended Solids	< 0.7	< 0.7	< 0.7
Dissolved Solids	3.3 ± 0.9	2.1 ± 0.8	2.8 ± 0.9
Total Residue	3.3 ± 0.9	2.1 ± 0.8	2.8 ± 0.9
K-40 (ICP)	4.43	2.05	3.44
Mn-54	< 2.9	< 1.8	< 1.5
Fe-59	< 2.9	< 4.5	< 4.8
Co-58	< 1.6	< 2.2	< 2.0
Co-60	< 3.1	< 2.4	< 2.0
Zn-65	< 4.5	< 4.1	< 2.9
Zr-Nb-95	< 3.0	< 2.4	< 2.8
Cs-134	< 2.8	< 3.0	< 2.8
Cs-137	< 3.2	< 2.8	< 1.8
Ba-La-140	< 2.7	< 1.8	< 6.5
Date Collected	11-01-21		
Lab Code	KSW- 3663		
Gross beta			
Suspended Solids	< 0.7		
Dissolved Solids	0.9 ± 0.4		
Total Residue	0.9 ± 0.4		
K-40 (ICP)	3.12		
Mn-54	< 4.8		
Fe-59	< 9.0		
Co-58	< 5.5		
Co-60	< 3.8		
Zn-65	< 3.9		
Zr-Nb-95	< 5.5		
Cs-134	< 4.8		
Cs-137	< 4.4		
Ba-La-140	< 2.7		

## KPS

Table 16. Surface water samples, analyses for gross beta, potassium-40 and gamma-emitting isotopes (continued).

Collection: Quarterly

Sample Description and Concentration (pCi/L)			
<u>Control</u>			
<u>K-9 (Raw)</u>			
Date Collected	03-01-21	06-01-21	08-02-21
Lab Code	KSW- 483	KSW- 1595	KSW- 2441
Gross beta			
Suspended Solids	< 0.8	< 0.8	< 0.8
Dissolved Solids	1.2 ± 0.4	1.2 ± 0.4	1.5 ± 0.4
Total Residue	1.2 ± 0.4	1.2 ± 0.4	1.5 ± 0.4
K-40 (ICP)	1.31	1.15	1.23
Mn-54	< 2.2	< 3.8	< 1.8
Fe-59	< 3.4	< 4.4	< 6.2
Co-58	< 3.3	< 2.8	< 2.3
Co-60	< 3.5	< 2.1	< 2.1
Zn-65	< 7.5	< 3.5	< 1.3
Zr-Nb-95	< 4.7	< 2.8	< 3.2
Cs-134	< 4.2	< 4.3	< 2.6
Cs-137	< 3.2	< 2.3	< 2.9
Ba-La-140	< 4.6	< 2.4	< 5.7
<u>K-9 (Tap)</u>			
Date Collected	03-01-21	06-01-21	08-02-21
Lab Code	KSW- 484	KSW- 1596	KSW- 2442
Gross beta			
Suspended Solids	< 0.7	< 0.7	< 0.7
Dissolved Solids	1.1 ± 0.4	0.9 ± 0.4	1.0 ± 0.4
Total Residue	1.1 ± 0.4	0.9 ± 0.4	1.0 ± 0.4
K-40 (ICP)	1.31	1.15	1.48
Mn-54	< 1.9	< 1.9	< 2.6
Fe-59	< 5.9	< 6.5	< 5.3
Co-58	< 1.6	< 2.2	< 2.6
Co-60	< 3.9	< 2.1	< 2.5
Zn-65	< 7.8	< 1.8	< 4.4
Zr-Nb-95	< 5.8	< 3.4	< 3.6
Cs-134	< 4.4	< 3.5	< 2.8
Cs-137	< 2.6	< 3.1	< 1.9
Ba-La-140	< 4.6	< 4.2	< 6.5

## KPS

Table 16. Surface water samples, analyses for gross beta, potassium-40, and gamma-emitting isotopes (continued).

Collection: Quarterly

---

Sample Description and Concentration (pCi/L)	
<u>Control</u>	
<u>K-9 (Raw)</u>	
Date Collected	11-01-21
Lab Code	KSW- 3664
Gross beta	
Suspended Solids	< 0.8
Dissolved Solids	1.0 ± 0.4
Total Residue	1.0 ± 0.4
K-40 (ICP)	1.23
Mn-54	< 3.0
Fe-59	< 5.6
Co-58	< 2.1
Co-60	< 2.3
Zn-65	< 4.1
Zr-Nb-95	< 3.9
Cs-134	< 2.7
Cs-137	< 2.7
Ba-La-140	< 4.4
<u>K-9 (Tap)</u>	
Date Collected	11-01-21
Lab Code	KSW- 3665
Gross beta	
Suspended Solids	< 0.7
Dissolved Solids	0.7 ± 0.4
Total Residue	0.7 ± 0.4
K-40 (ICP)	1.23
Mn-54	< 3.4
Fe-59	< 4.8
Co-58	< 2.9
Co-60	< 2.1
Zn-65	< 6.2
Zr-Nb-95	< 5.4
Cs-134	< 4.3
Cs-137	< 2.9
Ba-La-140	< 3.5

---

KPS

Table 17. Surface water, analyses for tritium and strontium-90.

Location and Collection Period		Concentration pCi/L	
		H-3	Sr-90
<u>Indicator</u>			
<u>K-1b</u>			
1st Quarter	KSW -480	< 160	< 0.7
2nd Quarter	KSW -1592	< 161	< 0.4
3rd Quarter	KSW -2438	< 161	< 0.6
4th Quarter	KSW -3661	< 163	< 0.5
<u>K-1d</u>			
1st Quarter	KSW -481	< 160	< 0.6
2nd Quarter	KSW -1593	< 161	< 0.4
3rd Quarter	KSW -2439	< 161	< 0.5
4th Quarter	KSW -3662	< 163	< 0.6
<u>K-1e</u>			
1st Quarter	KSW -482	< 160	< 0.8
2nd Quarter	KSW -1594	< 161	< 0.4
3rd Quarter	KSW -2440	< 161	< 0.6
4th Quarter	KSW -3663	< 163	< 0.5
<u>Control</u>			
<u>K-9</u>			
1st Quarter	KSW -483 (Raw)	< 160	< 0.7
	KSW -484 (Tap)	< 160	< 0.6
2nd Quarter	KSW -1595 (Raw)	< 161	< 0.5
	KSW -1596 (Tap)	< 161	< 0.4
3rd Quarter	KSW -2441 (Raw)	< 161	< 0.5
	KSW -2442 (Tap)	< 161	< 0.5
4th Quarter	KSW -3664 (Raw)	< 163	< 0.5
	KSW -3665 (Tap)	< 163	< 0.5

KPS

Table 18. Fish, collected at K-1d, analyses for gross beta, strontium-90 and gamma-emitting isotopes.  
Collection: Annually

Sample Description and Concentration (pCi/g wet)		
Collected	08-25-21	
Lab Code	KF- 3186	
Type	Chinook Salmon	
Portion	<u>Flesh</u>	<u>Bones</u>
Gross beta	5.29 ± 0.29	4.52 ± 0.78
Sr-90	NA <sup>a</sup>	< 0.07
K-40	3.71 ± 0.46	NA <sup>a</sup>
Mn-54	< 0.020	NA <sup>a</sup>
Fe-59	< 0.046	NA <sup>a</sup>
Co-58	< 0.022	NA <sup>a</sup>
Co-60	< 0.018	NA <sup>a</sup>
Cs-134	< 0.017	NA <sup>a</sup>
Cs-137	< 0.018	NA <sup>a</sup>

<sup>a</sup> NA = Not analyzed; analyses not required.

## KPS

Table 19. Shoreline sediment samples, analyses for gross beta and strontium-90, and gamma-emitting isotopes.  
Collection: May and November

Sample Description and Concentration (pCi/g dry)			
Location	Indicator		Control
	K-1c	K-1j	K-9
Collection Date	05-03-21	05-03-21	05-03-21
Lab Code	KSS- 1322	KSS- 1323	KSS- 1324
Gross beta	8.11 ± 0.89	8.20 ± 0.93	9.50 ± 0.90
Sr-90	< 0.039	< 0.037	< 0.042
K-40	3.91 ± 0.49	5.31 ± 0.51	7.70 ± 0.64
Co-58	< 0.023	< 0.014	< 0.023
Co-60	< 0.016	< 0.017	< 0.017
Cs-134	< 0.019	< 0.021	< 0.017
Cs-137	< 0.030	< 0.019	< 0.020
Location			
Collection Date	11-01-21	11-01-21	11-01-21
Lab Code	KSS- 3666	KSS- 3668	KSS- 3669
Gross beta	9.12 ± 0.92	12.12 ± 0.98	13.59 ± 1.05
Sr-90	< 0.067	< 0.062	< 0.052
K-40	6.28 ± 0.44	8.44 ± 0.55	9.78 ± 0.55
Co-58	< 0.012	< 0.017	< 0.019
Co-60	< 0.011	< 0.009	< 0.011
Cs-134	< 0.014	< 0.014	< 0.013
Cs-137	< 0.017	< 0.019	< 0.015

**This page intentionally left blank**



**Dominion  
Energy®**

**2021  
Annual  
Radiological  
Environmental  
Operating  
Report**

*Kewaunee Power Station  
Part III, Corrective  
Actions written during  
reporting period*

**Dominion Energy Kewaunee, Inc.**

**This page intentionally left blank**

CA842 (Peroutka/Shannon) to evaluate the changes at sampling locations K-5 and K-39 and initiate actions needed to revise the REMM in accordance with RP-KW-280

CA843 (Peroutka/Shannon) to include the revision of the REMM in the Annual Effluent Release Report

Work Order #

Comments

Status

Pending

Attachments

2020-Kewaunee-Land-Use-Census.pdf

Content Type: Item

Version: 6.0

Created at 3/25/2021 2:01 PM by  Dan J Shannon (Dom Nuclear Projects, Inc - 4)

Last modified at 6/16/2021 7:16 AM by  Timothy P Olson (Dom Nuclear Projects, Inc - 4)

Close

locations were collected and analyzed in 2020.

ATI-Environmental, the vendor who is also contracted to perform sampling and analysis for the REMM, stated that the quarterly Grass sampling and TLD monitoring could still be performed, but that there is no Cattle feed available for sampling at these locations.

Initial Actions

Initiated CR to evaluate the changes to sampling locations K-5 and K-39 and revise the REMM per RP-KW-280

Recom Actions:

Assign action to RP (Peroutka/Shannon) to evaluate the changes at sampling locations K-5 and K-39 and initiate actions needed to revise the REMM in accordance with RP-KW-280 (5/27/21)

Assign action to RP (Peroutka/Shannon) to include the revision of the REMM in the Annual Effluent Release Report (5/12/22)

additional Contacts

Tag #:

Equipment Location

Equipment Description

Plant System

OP-AA-102 Review Reqd?

No

Operability Assesment

N/A

Operability Comments

Functionality Assessment

N/A

Reportable Condition

No

Reportability Comments

Is Equipment Important to Emergency Response WM-KW-100 values No

O/R Comments

Significance (screening)

3

Potential Repeat (screening)

No

Previous Issue

No history identified

CRT Comments

Print

CR\_ID 2182  
Short description REMM Revision Required Due to Changes Identified by 2020 Annual Land Use Census  
Site Kewaunee  
Discovery Date/Time 3/25/2021 12:00 PM  
Submitter  Dan J Shannon (Dom Nuclear Projects, Inc - 4)  
Submitters Dept 2. Radiation Protection  
Supervisor  Bradly J McMahon (Dom Nuclear Projects, Inc - 4)  
Unit 1 Mode  
Unit ISFSI? No  
Revision #

Long Description  
The 2020 annual Land Use Census performed by the contracted vendor ATI-Environmental, as required by the Radiological Environmental Monitoring Manual and RP-KW-001-014, identified changes at two indicator sampling locations, K-5 and K-39:  
  
K-5 – Paplham Farm located 3.2 miles from KPS in sector NNW. Samples required at this indicator location include Grass and TLD (quarterly), and Cattle feed (annually) per REMM Table 2.2.1-B. As of November 2020, this farm has been foreclosed and all farming operations have ceased.  
  
K-39, Wotja Farm located 3.46 miles from KPS in sector N. Samples required at this indicator location include Grass and TLD (quarterly), and Cattle feed (annually) per REMM Table 2.2.1-B. All the cows at this location have been sold and the owner is no longer in the milk production business.  
  
All required REMM samples at these two

Print

CR_ID	2217
Short description	K-8 Environmental air sampler found off due to an open breaker. Most likely the breaker opened due to recent lighting storms.
Site	Kewaunee
Discovery Date/Time	8/10/2021 11:20 AM
Submitter	<input type="checkbox"/> Mark A Peroutka (Dom Nuclear Projects, Inc - 4)
Submitters Dept	2. Radiation Protection
Supervisor	<input type="checkbox"/> Dan J Shannon (Dom Nuclear Projects, Inc - 4)
Unit 1 Mode	
Unit ISFSI?	No
Revision #	0
Long Description	K-8 Environmental air sampler found off due to an open breaker. Most likely the breaker opened due to recent lighting storms earlier this week. Breaker located on the pole was reset/closed and sampler started running. The air sampler had operated for 117.49 hours. The air sample filter was changed out and sent to vendor for analysis with reduce volume.
Initial Actions	Reset Breaker on pole. Verified Sampler was working properly. Collected reduced volume sample and sent to vendor.
Recom Actions:	None
additional Contacts	
Tag #:	
Equipment Location	
Equipment Description	
Plant System	
OP-AA-102 Review Req'd?	No
Operability Assesment	N/A
Operability Comments	None
Functionality Assessment	N/A
Reportable Condition	No

Reportability Comments

Is Equipment Important to Emergency Response WM-KW-100 values

O/R Comments

None

Significance (screening)

3

Potential Repeat (screening)

Yes

Previous Issue

CR784 K-8 REMP ENVIRONMENTAL AIR SAMPLERS  
FOUND NOT RUNNING

CR1285 K-8 ENVIROMENTAL AIR SAMPLER FOUND  
NOT RUNNING

CR1940 Environmental air sample pump found off at  
location K-8

CR1974 K-8 Location environmental air sample pump  
found not running due to breaker being open

CR2025 K-8 Environmental air sampler found off with  
blown fuse

CRT Comments

CA847 (Peroutka/Shannon) to include this CR in the  
2021 Annual Radiological Environmental Operation  
Report.

Work Order #

Comments

Status

Pending

Content Type: Item

Version: 5.0

Created at 8/10/2021 4:17 PM by  Mark A Peroutka (Dom Nuclear Projects, Inc - 4)

Last modified at 8/12/2021 1:00 PM by  Timothy P Olson (Dom Nuclear Projects, Inc - 4)

Close