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MAR 0 5 2020

ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Serial No. 20-074
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Docket No.: 50-305
License No.: DPR-43

**DOMINION ENERGY KEWAUNEE, INC.**
**KEWAUNEE POWER STATION**
**2019 ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT**

Enclosed is the Kewaunee Power Station (KPS) 2019 Annual Radioactive Effluent Release Report for January through December 2019. This report is submitted to meet the requirements of KPS Technical Requirements Manual (TRM) Section 10.3. Also included is Revision 22 of the Radiological Environmental Monitoring Manual, submitted to meet the requirements of KPS TRM Section 10.1.1.

If you have questions or require additional information, please feel free to contact Mr. William Zipp at 920-304-9729.

Sincerely,

Bradly J McMahon

Bradly J. McMahon
Director Kewaunee Site

Commitments made by this letter: NONE

IE48
IE25
NRR

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Dominion Energy®

# 2019 Annual Radioactive Effluent Release Report

*Kewaunee Power Station*

Dominion Energy Kewaunee, Inc.

DOCKET 50-305

# KEWAUNEE POWER STATION

## ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

January 1 - December 31, 2019

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## 0.0 SUMMARY

On October 22, 2012, Dominion made known the decision to permanently shut down the Kewaunee Power Station (KPS). On February 25, 2013, Dominion Energy Kewaunee (DEK) submitted a certification of permanent cessation of power operations pursuant to 10 CFR 50.82(a)(1)(i), stating that DEK has decided to permanently cease power operation of KPS on May 7, 2013. On May 15, 2013 the NRC docketed the certification for permanent removal of fuel from the reactor vessel pursuant to 10 CFR 50.82(a)(1)(ii). Therefore the 10 CFR Part 50 license no longer authorizes KPS to operate the reactor or emplace or retain fuel in the reactor vessel, as specified in 10 CFR 50.82(a)(2).

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 2017.

All radioactive liquid was drained from systems in the Auxiliary Building by the end of the first week of August 2018.

The remaining effluent release paths are continuous gaseous radioactive releases from the Auxiliary Building Vent and batch liquid radioactive waste releases to Lake Michigan. Batch gaseous radioactive releases and continuous liquid radioactive releases are no longer performed.

In 2019 there were no identified gaseous radionuclides released from the Auxiliary Building Vent, and no batch liquid radioactive waste releases to Lake Michigan.

In 2019 there was one solid waste shipment off site totaling 1.42E+01 $m^3$ (5.00E+2 $ft^3$) containing 1.18E-01 Curies.

## 1.0 INTRODUCTION

This report is being submitted in accordance with the requirements of Kewaunee Technical Requirements Manual, Section 10.3.2 and the Offsite Dose Calculation Manual, Section 15.2. It includes data from all effluent releases made from January 1 - December 31, 2019. The report contains summaries of the gaseous and liquid releases made to the environment including the quantity, characterization, time duration and calculated radiation dose at the site boundary resulting from these releases. The report also includes a summation of solid radioactive waste disposal, revisions to the Process Control Program and the Offsite Dose Calculation Manual, and major changes to the radioactive liquid and gaseous waste systems. Values indicated as 0 (zero) in this report refer to actual values less than the detection limits. A table of these less than detectable (LLD) values is identified in sections 2.1 and 3.1.

### 1.1 Effluent Dose Limits

Specifications are set to ensure that offsite doses are maintained as low as reasonably achievable while still allowing for practical and dependable evolutions at the Kewaunee Power Station.

The Kewaunee Offsite Dose Calculation Manual (ODCM) describes the methodology and parameters used in:

1. The calculation of radioactive liquid effluent monitoring instrumentation alarm/trip set points.

2. The calculation of radioactive liquid and gaseous concentrations, dose rates and cumulative quarterly and annual doses. The ODCM methodology is acceptable for use in demonstrating compliance with 10 CFR 20.1301/1302; 10 CFR 50, Appendix I; and 40 CFR 190.

## 2.0 GASEOUS EFFLUENTS

### 2.1 Lower Limits of Detection (LLD) for Gaseous Effluents

Gaseous radioactive effluents are released in the continuous mode. Batch gaseous radioactive releases are no longer performed. The Auxiliary Building ventilation stack was sampled continuously for Particulates, Gross Alpha, and Strontium 90, by an "off-line" sample train. This stack was also grab-sampled monthly for Tritium.

The LLD's for gaseous radio-analyses, as listed in Table 13.2.1-1 of the Kewaunee ODCM are:

| Analysis | LLD (μCi/ml) |
|---|---|
| Particulate Gamma Emitters | 1.00E-11 |
| Particulate Gross Alpha | 1.00E-11 |
| Strontium 90 | 1.00E-11 |
| Tritium (H-3) | 1.00E-06 |

The nominal "a priori" LLD values are shown below.

| Isotope | a priori LLD (μCi/ml) |
|---|---|
| a. Particulate emissions: | |
| Mn-54 | 1.11E-13 |
| Co-60 | 3.57E-13 |
| Zn-65 | 1.68E-13 |
| Cs-134 | 4.69E-13 |
| Cs-137 | 1.68E-13 |
| Ce-144 | 1.24E-12 |
| b. Composite particulate samples: | |
| Sr-90 | 1.00E-14 |
| Gross Alpha | 1.00E-14 |

These "a priori" LLDs represent the capabilities of the counting systems in use, not an after the fact "a posteriori" limit for a particular measurement.

## 2.2 Gaseous Effluent Data

Table 2.1 presents a quarterly summation of the total activity released and average release rates of gaseous effluents (continuous mode). Table 2.2 presents the dose limits for gaseous effluents, and the calculated doses this year from gaseous effluents.

**Table 2.1**
**Gaseous Effluents - Summation of all Releases (Continuous Mode)**

| | 1st Quarter | 2nd Quarter | 3rd Quarter | 4th Quarter | Total |
|---|---|---|---|---|---|
| Particulates | | | | | |
| Total Activity Released (Ci) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Average Release Rate (μCi/sec) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Tritium | | | | | |
| Total Activity Released (Ci) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Average Release Rate (μCi/sec) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Gross Alpha Released (Ci) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

**Table 2.2**
**Dose from Gaseous Effluents**

The offsite dose limits from radioactive materials in gaseous effluents are specified in Section 13.2.3 of the Kewaunee ODCM and can be summarized as follows:

| | Organ |
|---|---|
| Quarterly Limit | 7.5 mrem |
| Annual Limit | 15.0 mrem |

The following offsite doses were calculated using equation 2.2 from the Kewaunee ODCM. Calculated offsite doses versus quarterly and annual limits are shown below.

In 2019 there were no identified gaseous radionuclides released from the Auxiliary Building Vent.

| | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr | Annual |
|---|---|---|---|---|---|
| 1. Organ Dose | | | | | |
| Specification (mrem) | 7.50E+00 | 7.50E+00 | 7.50E+00 | 7.50E+00 | 1.50E+01 |
| Total Body | | | | | |
| Actual Dose (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| % of Specification | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Bone | | | | | |
| Actual Dose (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| % of Specification | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Liver | | | | | |
| Actual Dose (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| % of Specification | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

**Table 2.2 (continued)**
**Dose from Gaseous Effluents**

| | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr | Annual |
|---|---|---|---|---|---|
| Thyroid | | | | | |
| Actual Dose (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| % of Specification | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Kidney | | | | | |
| Actual Dose (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| % of Specification | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Lung | | | | | |
| Actual Dose (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| % of Specification | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| GI-LLI | | | | | |
| Actual Dose (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| % of Specification | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

## 3.0 LIQUID EFFLUENTS

### 3.1 Lower Limits of Detection (LLD) for Liquid Effluents

Liquid radioactive effluents are released as batch releases. Continuous liquid radioactive releases are no longer performed. Each batch is sampled prior to release and analyzed for gamma emitters and tritium. A fraction of each sample is retained for a proportional composite which is then analyzed for Gross Alpha, Strontium 90, Iron 55 and Nickel 63.

The LLD's for liquid batch release radio-analyses, as listed in Table 13.1.1-1 of the Kewaunee ODCM are:

| Analysis | LLD (μCi/ml) |
|---|---|
| Principal Gamma Emitters | 1.00 E-06 |
| Tritium (H-3) | 1.00 E-05 |
| Gross Alpha | 5.00 E-07 |
| Strontium 90 | 5.00 E-08 |
| Iron 55 | 1.00 E-06 |
| Nickel 63 | 1.00 E-04 |

The actual obtained "a priori" LLD values for batch releases are shown below.

There were no batch liquid radioactive waste releases to Lake Michigan in 2019.

### 3.2 Liquid Batch Release Statistics

The following is a summation of all liquid batch releases during 2019.

Number of batch releases.....0

Total time for all batch releases (min).....0

Maximum time for a batch release (min).....0

Minimum time for a batch release (min).....0

Average time for a batch release (min).....0

### 3.3 Liquid Effluent Data

The following Table 3.1 presents a quarterly summation of the total activity released (batch mode) and average concentration for all liquid effluents. It also presents the gross alpha activity released, volume of waste released, and volume of dilution water used. Table 3.2 presents the doses from liquid effluents for each quarter and the calculated doses this year from liquid effluents.

**Table 3.1**
**Liquid Effluents - Summation of all Releases (Batch Mode)**

| | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr | Total |
|---|---|---|---|---|---|
| Fission and Activation Products | | | | | |
| Total Release (Ci) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Average Concentration (μCi/ml) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Tritium | | | | | |
| Total Release (Ci) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Average Concentration (μCi/ml) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| % of Specification Limit(3.0E-3 μCi/ml) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Gross Alpha Activity | | | | | |
| Total Release (Ci) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Volume of Waste Released | | | | | |
| Total (liters) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Volume of Dilution Water | | | | | |
| Total (liters) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

There were no batch liquid radioactive waste releases to Lake Michigan in 2019.

**Table 3.2**
**Dose from Liquid Effluents**

There were no batch liquid radioactive releases to Lake Michigan in 2019.

| | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr | Annual |
|---|---|---|---|---|---|
| Total Body | | | | | |
| Specification (mrem) | 1.50E+00 | 1.50E+00 | 1.50E+00 | 1.50E+00 | 3.00E+00 |
| Actual Dose (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| % of Specification | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Organs | | | | | |
| Specification (mrem) | 5.00E+00 | 5.00E+00 | 5.00E+00 | 5.00E+00 | 1.00E+01 |
| Bone | | | | | |
| Actual Dose (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| % of Specification | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Liver | | | | | |
| Actual Dose (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| % of Specification | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Thyroid | | | | | |
| Actual Dose (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| % of Specification | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Kidney | | | | | |
| Actual Dose (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| % of Specification | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Lung | | | | | |
| Actual Dose (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| % of Specification | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| GI-LLI | | | | | |
| Actual Dose (mrem) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| % of Specification | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

### 3.4 Ground Water Monitoring

The Kewaunee Power Station has 14 wells used to sample for groundwater contamination. Eight of the wells are located to monitor for leakage from the Auxiliary Building (AB). The other six wells are designated as Monitoring Wells (MW) and sample areas outside the industrial security area to identify any spread of contamination. As the data below indicates there was no gamma activity identified and the tritium in all the AB wells is below Minimum Detectable Concentrations (MDC). The tritium levels have decreased to below MDC in the AB wells since the plant was permanently shut down in 2013. All but one of the MW wells indicates no radionuclide contamination. MW-704 indicated tritium levels above MDC. The positive result for this well was first reported in 2018 and was documented in CR1783. The tritium in MW-704 has trended down since late third quarter 2018. There were no voluntary ground water communications, no spills, and no leaks in 2019.

| Sample Point<br>Sample Date | Tritium<br>pCi/L | Total Gamma Activity<br>µCi/ml |
|---|---|---|
| **AB-707** | | |
| 04/24/19 | <273 | None Detected |
| | | |
| | | |
| **AB-708** | | |
| 4/24/19 | <273 | None Detected |
| | | |
| | | |
| **AB-709** | | |
| 5/15/19 | <253 | None Detected |
| | | |
| | | |
| **AB-710** | | |
| 5/15/19 | <253 | None Detected |
| | | |
| | | |
| **AB-711** | | |
| 6/13/19 | <270 | None Detected |
| | | |
| | | |
| **AB-712** | | |
| 6/13/19 | <270 | None Detected |
| | | |
| | | |

| Sample Point<br>Sample Date | Tritium<br>pCi/L | Total Gamma Activity<br>µCi/ml |
|---|---|---|
| **AB-715** | | |
| 7/8/19 | <268 | None Detected |
| | | |
| | | |
| **AB-717** | | |
| 7/8/19 | <268 | None Detected |
| | | |
| | | |
| **MW-701** | | |
| 8/14/19 | <275 | None Detected |
| | | |
| | | |
| **MW-702** | | |
| 8/14/19 | <275 | None Detected |
| | | |
| | | |
| **MW-703** | | |
| 9/9/19 | <282 | None Detected |
| | | |
| | | |
| **MW-704** | | |
| 4/24/19 | 618 | None Detected |
| 7/8/19 | 483 | None Detected |
| 9/9/19 | 335 | None Detected |
| **MW-705** | | |
| 10/7/19 | <278 | None Detected |
| | | |
| | | |
| **MW-706** | | |
| 10/7/19 | <278 | None Detected |
| | | |
| | | |

## 4.0 METEOROLOGICAL DATA

Meteorological data is no longer required to be reported in accordance with the Kewaunee ODCM Rev. 18, Section 15.2.

## 5.0 SOLID WASTE DISPOSAL

Table 5.1 is a summation of solid radioactive waste shipped during 2019. Presented are the types of waste streams, waste classification, and major nuclides.

**Table 5.1**
**Solid Waste and Irradiated Fuel Shipments**

A. Solid Radioactive Waste Shipped Off-Site for Burial or Disposal

1. Type of Waste with Estimate of Major Nuclide Composition

| Resins, Filters, and Evaporator Bottoms | Volume | | Curies Shipped |
|---|---|---|---|
| Waste Class | $ft^3$ | $m^3$ | Curies |
| A | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| B | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| C | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Unclassified | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| All | 0.00E+00 | 0.00E+00 | 0.00E+00 |

Major nuclides for the above table: NA

| Dry Active Waste | Volume | | Curies Shipped |
|---|---|---|---|
| Waste Class | $ft^3$ | $m^3$ | Curies |
| A | 5.00E+02 | 1.42E+01 | 1.18E-01 |
| B | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| C | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Unclassified | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| All | 5.00E+02 | 1.42E+01 | 1.18E-01 |

Major nuclides for the above table: H-3, C-14, Fe-55, Co-60, Ni-59, Ni-63, Nb-94, Tc-99, I-129, Cs-137, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Cm-243, Cm-244

**Table 5.1 (continued)**
**Solid Waste and Irradiated Fuel Shipments**

| Irradiated Components | Volume | | Curies Shipped |
|---|---|---|---|
| Waste Class | $ft^3$ | $m^3$ | Curies |
| A | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| B | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| C | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Unclassified | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| All | 0.00E+00 | 0.00E+00 | 0.00E+00 |

Major nuclides for the above table: NA

| Other Waste – Metals: SFP racks. | Volume | | Curies Shipped |
|---|---|---|---|
| Waste Class | $ft^3$ | $m^3$ | Curies |
| A | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| B | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| C | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Unclassified | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| All | 0.00E+00 | 0.00E+00 | 0.00E+00 |

Major nuclides for the above table: NA

| Sum of All Low-Level Waste | Volume | | Curies Shipped |
|---|---|---|---|
| Waste Class | $ft^3$ | $m^3$ | Curies |
| A | 5.00E+02 | 1.42E+01 | 1.18E-01 |
| B | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| C | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Unclassified | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| All | 5.00E+02 | 1.42E+01 | 1.18E-01 |

Major nuclides for the above table: H-3, C-14, Fe-55, Co-60, Ni-59, Ni-63, Nb-94, Tc-99, I-129, Cs-137, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Cm-243, Cm-244

**Table 5.1 (continued)**
**Solid Waste and Irradiated Fuel Shipments**

B. Irradiated Fuel Shipments

| Number of Shipments | Mode of Transportation | Destination |
|---|---|---|
| None | NA | NA |

No irradiated fuel shipments were made from the Kewaunee Power Station during 2019.

## 6.0 SUPPLEMENTAL INFORMATION

### 6.1 Abnormal Releases or Abnormal Discharges

No abnormal releases or abnormal discharges were made from the Kewaunee Power Station during the report period.

### 6.2 Non-routine Planned Discharges

No non-routine planned discharges were made from the Kewaunee Power Station during the reporting period.

### 6.3 Program Revisions

In accordance with Technical Requirements Manual Section 10.1.1.c.3 and the Offsite Dose Calculation Manual Section 15.2.f, revisions to the Process Control Program, Offsite Dose Calculation Manual, or the Radiological Environmental Monitoring Program for the report period are listed below.

6.3.1 Process Control Program

There were no revisions to the Process Control Program during the report period.

6.3.2 Offsite Dose Calculation Manual

There were no revisions to the Offsite Dose Calculation Manual during the report period.

6.3.3 Radiological Environmental Monitoring Manual

Revision 22 of the Kewaunee Power Station Radiological Environmental Monitoring Manual (REMM) was issued on April 1, 2019. See Appendix A.

### 6.4 Major Changes to the Radioactive Liquid, Gaseous and Solid Waste Systems

There were no changes to the radioactive liquid, gaseous, or solid waste systems during the reporting period.

### 6.5 Effluent Monitoring System Inoperability

There were no effluent radiation monitors inoperable for the consecutive time period listed in the ODCM for this report period.

**6.6 Corrections to Previous Reports**

None.

**6.7 Other**

6.7.1 Condition Report CR1848 was submitted on January 23, 2019.

R-13 Sample Flow Rate Monitor Calibration Frequency Issue.

On 1/23/2019 it was identified that the 18-month calibration frequency for the R-13 Sample Flow Rate Monitor (DVR 13.3.2.4), including the 1.25 times extension, woud be exceeded on 1/27/2019.

At the time of discovery R-13 Sample Flow Rate Monitor was FUNCTIONAL and would remain as such until 1/27/2019. Radiation Protection swapped sampling to R-14 to allow R-13 to be declared NON-FUNCTIONAL on 1/26/2019. The calibration of the flow monitor was scheduled for the week of 1/27/2019.

The calibration of the R-13 Sample Flow Rate Monitor was completed on 2/15/2019 using procedure SP-45.050.13. R-13 was declared FUNCTIONAL on 2/25/2019.

6.7.2 Condition Report CR1857 was submitted on February 16, 2019.

R-18 Liquid Effluent Monitor is NON-FUNCTIONAL.

R-18 was declared NON-FUNCTIONAL due to exceeding the frequency, and allowable extension, of DVR 13.3.1.4, Perform CHANNEL CALIBRATION. There was no impact to plant safety as DNC 13.3.1.B, CONTINGENCY MEASURES, can be implemented if a discharge is required. No discharges were allowed at the time.

Closed CR to R-18 PM(RE306694) scheduled for 2/27/2019. Administrative controls were in place to prevent discharges until R-18 was declared back in service.

The calibration of the R-18 Effluent Monitor was completed on 2/27/2019.

# Appendix A

# Kewaunee Power Station

# Radiological Environmental Monitoring Manual (REMM)

Revision 22
April 1, 2019

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# Dominion Energy Kewaunee, Inc.

# Kewaunee Power Station

# RADIOLOGICAL ENVIRONMENTAL MONITORING MANUAL (REMM)

Revision 22

DATE: April 1, 2019

Approved By: DJ Shannon / _____ Date: 3/19/19
Manager – Radiological Protection and Chemistry

Approved By: WF Zipp / _____ Date: 3/20/19
Manager – Nuclear Engineering and Tech Support

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## Tables & Figures

# *1.0 Introduction*

## *1.1 Purpose*

The purpose of this document is to define the Radiological Environmental Monitoring Program (REMP) for the Kewaunee Power Station (KPS). The REMP is required by ODCM 13.5.

This document is known as the Radiological Environmental Monitoring Manual (REMM) and is intended to serve as a tool for program administration and as a guidance document for contractors which implement the monitoring program.

## *1.2 Scope*

This program defines the sampling and analysis schedule which was developed to provide representative measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides that lead to the highest potential radiation exposures of MEMBERS OF THE PUBLIC resulting from plant decommissioning activities. This monitoring program implements Section IV.B.2 of Appendix I to 10CFR Part 50 and thereby verifies that the measurable concentrations of radioactivity and levels of radiation are not higher than expected on the basis of the effluent measurements and the modeling of the environmental exposure pathways. Guidance for the development of this monitoring program is provided by the Radiological Assessment Branch Technical Position on Environmental Monitoring. This program has been developed in accordance with NUREG 0472.

On October 22, 2012, Dominion made known the decision to permanently shut down the Kewaunee Power Station (KPS). On February 25, 2013, Dominion Energy Kewaunee (DEK) submitted a certification of permanent cessation of power operations pursuant to 10 CFR 50.82(a)(1)(i), stating that DEK has decided to permanently cease power operation of KPS on May 7, 2013. On May 15, 2013 the NRC docketed the certification for permanent removal of fuel from the reactor vessel pursuant to 10 CFR 50.82(a)(1)(ii). Therefore, the 10 CFR Part 50 license no longer authorizes KPS to operate the reactor or emplace or retain fuel in the reactor vessel, as specified in 10 CFR 50.82(a)(2). On June 15$^{th}$, 2017 transfer of all spent nuclear fuel into dry cask storage was completed.

On April 24, 2017 Radiation Safety and Control Services, Inc. (RSCS) submitted Technical Support Document No. 16-086 Rev. 2, Kewaunee Shut-Down Environmental Radionuclides of Concern and Radiological Environmental Monitoring Manual Changes, to KPS. This document evaluated the radionuclides of concern for environmental releases after permanent shutdown of KPS. The result of the evaluation was the optimization of the environmental program due to radioactive decay and reduced source terms during the decommissioning phase of the plant.

The program will provide field and analytical data on the air, aquatic, and terrestrial radioecology of the area near the Kewaunee Power Station so as to:

1. Determine the effects of the decommissioning activities of the Kewaunee Power Station on the environment;
2. Serve as a gauge of the operating effectiveness of in-plant control of waste discharges; and
3. Provide data on the radiation dose to the public by direct or indirect pathways of exposure.

### *1.3 Implementation*

This document is considered, by reference, to be part of the Offsite Dose Calculation Manual. This is as required by KPS Technical Requirements Manual (TRM) 10.1.1. The REMM is controlled as a separate document for ease of revision, use in the field and use by contractors. This format was approved by the NRC as part of TS Amendment No. 64, which provided Radiological Effluent Technical Specifications (RETS) for KPS.

The REMP is set up to be implemented by a vendor and controlled by KPS in accordance with Nuclear Administrative Directive NAD-01.20, "Radiological Environmental Monitoring Program." Monthly reviews of the vendor's progress report are performed by KPS in accordance with this manual in section 3.4. Annual reviews and submittals of the vendor's report and monitoring data are checked and approved by KPS in accordance with procedure RP-KW-HSP-HPE-280. All sample collection, preparation, and analysis are performed by the vendor except where noted. Procedure RP-KW-HSP-HPE-164 outlines the environmental sample collection performed by KPS.

Periodic reviews of monitoring data and an annual land use census will be used to develop modifications to the existing monitoring program. Upon approval, these modifications will be incorporated into this document per RP-KW-280, so that it will accurately reflect the current radiological environmental monitoring program in effect for KPS.

The remainder of this document is divided into two sections. The first section, 2.0 REMP Requirements, describes the different TRM and REMM requirements associated with the REMP. The second section, 3.0 REMP Implementation, describes the specific requirements used to implement the REMP.

## *2.0 REMP Requirements*

KPS TS Amendment No. 104 implemented the guidance provided in Generic Letter 89-01, "Implementation of Programmatic Controls for Radiological Effluent Technical Specifications (RETS)." These changes included:

1. Incorporation of *programmatic controls* in the Administrative Controls section of the TS to satisfy existing regulatory requirements for RETS, and

2. Relocation of the *procedural details* on radioactive effluents monitoring, radiological environmental monitoring, reporting details, and other related specifications from the TS to the ODCM.

Relocating the procedural details to the ODCM allows for revising these requirements using the 10CFR50.59 process instead of requiring prior NRC approval using the TS Amendment process.

The RETS requirements were incorporated verbatim into the ODCM, Revision 6. Several of these requirements pertain only to the environmental monitoring program and therefore have been relocated into this document (REMM, Revision 3 and 4) and are identified as REMM requirements.

All KPS TS related REMM requirements were removed from KPS TS and placed in the Technical Requirements Manual as part of TRM Revision 0 on 4/26/2016.

### *2.1 ODCM 13.5 Requirements*

ODCM 13.5 provides the programmatic control, which requires a program to monitor for radiation and radionuclides in the environs of the plant. This is the reason for the existence of the REMP. ODCM 13.5 also provides the programmatic control which requires:

a. The program to perform the monitoring, sampling, analysis, and reporting in accordance with the methodology and parameters in the ODCM,

b. A land use census to be performed, and

c. Participation in an Interlaboratory Comparison Program.

The details of each requirement are described in the REMM requirements stated below.

TRM 10.3.1 requires an "Annual Radiological Environmental Operating Report," be submitted to the NRC each year. The specific contents of this report are detailed in REMM 2.4.1. Additional specific reporting requirements are listed in the other REMM requirements.

## *2.2 REMM Requirements*

The following REMM requirements include the procedural details that were originally located in the KPS RETS section and then relocated into Revision 6 of the ODCM, as discussed above. These requirements are specific to the radiological environmental monitoring program and have been relocated into this document for ease of use and completeness.

The REMM requirements for the Monitoring Program, Land Use Census, and the Interlaboratory Comparison Program include a detailed operating requirement (numbered 2.2.1, 2.2.2, and 2.2.3 respectively) and an associated verification requirement (numbered 2.3.1, 2.3.2, and 2.3.3 respectively), along with the basis for the requirement. Reporting requirements are listed in requirement REMM 2.4.1.

ODCM 13.0, USE AND APPLICATION, apply to both the ODCM and REMM.

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

REMM 2.2.1 The radiological environmental monitoring program shall be conducted as specified in Table 2.2.1-A.

APPLICABILITY: At all times.

ACTIONS

| NON-CONFORMANCE | CONTINGENCY MEASURES | RESTORATION TIME |
|---|---|---|
| A. Radiological Environmental Monitoring Program not conducted as specified in REMM Table 2.2.1-A. | A.1 Prepare and submit to the NRC in the Annual Radiological Environmental Operating Report, a description of the reasons for not conducting the program as required and the plans for preventing a recurrence. | In accordance with the Annual Radiological Environmental Operating Report frequency. |
| B. Level of radioactivity in an environmental sampling medium at a specified location exceeds the reporting levels of REMM Table 2.2.1-D when averaged over any calendar quarter.<br><br>OR | B.1 ----------NOTES----------<br>1. Only applicable if the radioactivity/radionuclides are the result of plant effluents.<br>2. For radionuclides other than those in REMM Table 2.2.1-D, this report shall indicate the methodology and parameters used to estimate the potential annual dose to a MEMBER OF THE PUBLIC.<br>---------- | |

ACTIONS (continued)

| NON-CONFORMANCE | CONTINGENCY MEASURES | RESTORATION TIME |
|---|---|---|
| More than one of the radionuclides in REMM Table 2.2.1-D are detected in the environmental sampling medium and<br><br>Concentration 1 / Reporting level 1 +<br><br>Concentration 2 / Reporting level 2 + ...≥ 1.0.<br><br>OR<br><br>Radionuclides other than those in REMM Table 2.2.1-D are detected in an environmental sampling medium at a specified location which are the result of plant effluents and the potential annual dose to a MEMBER OF THE PUBLIC from all radionuclides is ≥ the calendar year limits of DNC 13.1.2, DNC 13.2.2, DNC 13.2.3 | Prepare and submit to the NRC, a Special Report, pursuant to DNC 15.3, that<br>(1) Identifies the cause(s) for exceeding the limit(s) and<br>(2) Defines the corrective actions to be taken to reduce radioactive effluents so that the potential annual dose to a MEMBER OF THE PUBLIC is less than the calendar year limits of DNC 13.1.2, DNC 13.2.2, DNC 13.2.3<br><br>OR<br><br>B.2 ----------NOTES----------<br>1. Only applicable if the radioactivity/radionuclides are not the result of plant effluents.<br>2. For radionuclides other than those in REMM Table 2.2.1-D, this report shall indicate the methodology and parameters used to estimate the potential annual dose to a MEMBER OF THE PUBLIC.<br>----------<br>Report and describe the condition in the Annual Radiological Environmental Operating Report. | 30 days<br><br>In accordance with the Annual Radiological Environmental Operating Report frequency. |

ACTIONS (continued)

| NON-CONFORMANCE | CONTINGENCY MEASURES | RESTORATION TIME |
|---|---|---|
| C. Broad leaf vegetation samples unavailable from one or more of the sample locations required by REMM Table 2.2.1-A. | C.1 Identify specific alternative locations for obtaining replacement samples and add them to the Radiological Environmental Operating Program.<br><br>AND<br><br>C.2 When changes in sampling locations are permanent, then the sampling schedule in the REMM will be updated to reflect the new routine and alternative sampling locations. This revision will be submitted in the next Annual Radiological Environmental Operating Report. | 30 days |

VERIFICATION REQUIREMENTS

| | VERIFICATION | FREQUENCY |
|---|---|---|
| REMM 2.3.1 | Collect and analyze radiological environmental monitoring samples pursuant to the requirements of REMM Table 2.2.1-A and the detection capabilities required by Table 2.2.1-A. | In accordance with REMM Table 2.2.1-A |

## BASES

The radiological environmental monitoring program provides representative measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides that lead to the highest potential radiation exposures of MEMBERS OF THE PUBLIC resulting from the station decommissioning activities. This monitoring program implements Section IV.B.2 of Appendix I to 10CFR Part 50 and thereby supplements the radiological effluent monitoring program by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and the modeling of the environmental exposure pathways. Guidance for this monitoring program is provided by the Radiological Assessment Branch Technical Position on Environmental Monitoring. Program changes may be initiated based on operational experience.

The required detection capabilities for environmental sample analyses are tabulated in terms of the lower limits of detection (LLDs). The LLDs required by Table 2.3.1-A are considered optimum for routine environmental measurements in industrial laboratories. It should be recognized that the LLD is defined as a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

Detailed discussion of the LLD, and other detection limits, can be found in HASL Procedures Manual, HASL-300 (revised annually), Currie, L.A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry," Anal. Chem. 40, 586-93 (1968), and Hartwell, J.K., "Detection Limits for Radioanalytical Counting Techniques," Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975).

## RADIOLOGICAL ENVIRONMENTAL MONITORING LAND USE CENSUS

REMM 2.2.2 A land use census shall:

a. Be conducted,

b. Identify within a distance of 8 km (5 miles) the location, in each of the 10 meteorological sectors, of the nearest residence, and the nearest garden > 50 $m^2$ (500 $ft^2$) producing broad leaf vegetation. Sampling of broad leaf vegetation may be performed at the site boundary in each of two different direction sectors with the highest predicted D/Qs in lieu of the garden census. Requirements for broad leaf vegetation sampling in REMM Table 2.2.1-A item 4b shall be followed, including analysis of control samples.

APPLICABILITY: At all times.

ACTIONS

| NON-CONFORMANCE | CONTINGENCY MEASURES | RESTORATION TIME |
|---|---|---|
| A. Land use census identifies location(s) that yields a calculated dose, dose commitment greater than the values currently being calculated in ODCM 13.2.3.1. | A.1 Identify the new location(s) in the next Radiological Environmental Operating Program. | In accordance with the Radiological Environmental Operating Report. |

| NON-CONFORMANCE | CONTINGENCY MEASURES | RESTORATION TIME |
|---|---|---|
| B. Land use census identifies location(s) that yields a calculated dose, or dose commitment (via the same exposure pathway) greater than 20% at a location from which samples are currently being obtained in accordance with REMM 2.2.1. | B.1 Add the new location(s) to the Radiological Environmental Operating Program.<br><br>AND<br><br>B.2 Delete the sampling locations(s), excluding the control station location, having the lowest calculated dose, dose commitment(s) or D/Q value, via the same exposure pathway, from the Radiological Environmental Operating Program.<br><br>AND<br><br>B.3 Submit in the next Radiological Environmental Operating Report documentation for a change which includes revised figures(s) and table(s) reflecting the new location(s) with information supporting the change in sampling locations. | 30 days<br><br>In accordance with Radiological Environmental Operating Report. |

VERIFICATION REQUIREMENTS

| VERIFICATION | | FREQUENCY |
|---|---|---|
| REMM 2.3.2 | Conduct the land use census during the growing season using that information that will provide the best results, such as by a door-to-door survey, aerial survey, reporting the results of the land use census in the Annual Radiological Environmental Operating Report, or by consulting local agriculture authorities. | 12 months |

BASES

This requirement is provided to ensure that changes in the use of areas at and beyond the SITE BOUNDARY are identified and that modifications to the radiological environmental monitoring program are made if required by the door-to-door survey, from aerial survey or from consulting with local agricultural authorities. This census satisfies the requirements of Section IV.B.3 of Appendix I to 10CFR Part 50. Restricting the census to gardens of greater than 50 $m^2$ provides assurance that significant exposure pathways via broad leaf vegetation will be identified and monitored since a garden of this size is the minimum required to produce the quantity (26 kg/yr) of broad leaf vegetation assumed in Regulatory Guide 1.109 for consumption by a child. To determine this minimum garden size, the following assumptions were made:

1. 20% of the garden was used for growing broad leaf vegetation (e.g., similar to lettuce and cabbage), and
2. A broad leaf vegetation yield of 2 $kg/m^2$.

## RADIOLOGICAL ENVIRONMENTAL MONITORING INTERLABORATORY COMPARISON PROGRAM

REMM 2.2.3 Analyses shall be performed on all radioactive materials, supplied as part of an Interlaboratory Comparison Program that has been approved by the Commission.

APPLICABILITY: At all times.

ACTIONS

| NON-CONFORMANCE | CONTINGENCY MEASURES | RESTORATION TIME |
|---|---|---|
| A. Analyses not performed as required. | A.1 Report the corrective actions taken to prevent a recurrence to the NRC in the Annual Radiological Environmental Operating Report. | In accordance with the Annual Radiological Environmental Operating Report. |

VERIFICATION REQUIREMENTS

| VERIFICATION | | FREQUENCY |
|---|---|---|
| REMM 2.3.3 | Report a summary of the results obtained as part of the Interlaboratory Comparison Program in the Annual Radiological Environmental Operating Report. | In accordance with the Annual Radiological Environmental Operating Report. |

BASES

The requirement for participation in an approved Interlaboratory Comparison Program is provided to ensure that independent checks on the precision and accuracy of measurements of radioactive material in environmental sample matrices are performed as part of the quality assurance program for environmental monitoring in order to demonstrate that the results are valid for the purposes of Section IV.B.2 of Appendix I to 10CFR Part 50.

***REMM 2.4.1 Reporting Requirements***

2.4.1 The Annual Radiological Environmental Operating Report shall include:

a. Summaries, interpretations, and an analysis of trends of the results of the radiological environmental surveillance activities for the report period, including a comparison with pre-operational studies, with operational controls as appropriate, and with previous environmental surveillance reports, and an assessment of the observed impacts of the plant decommissioning activities on the environment. The reports shall also include the results of land use censuses required by REMM 2.2.2.

b. The results of analyses of radiological environmental samples and of environmental radiation measurements taken during the period pursuant to the locations specified in the table and figures in the Radiological Environmental Monitoring Manual (REMM), as well as summarized and tabulated results of these analyses and measurements in the format of the table in the Radiological Assessment Branch Technical Position, Revision 1, November 1979. In the event that some individual results are not available for inclusion with the report, the report shall be submitted noting and explaining the reasons for the missing results. The missing data shall be submitted as soon as possible in a supplementary report when applicable.

c. A summary description of the radiological environmental monitoring program; legible maps covering all sampling locations keyed to a table giving distances and directions from the centerline of one reactor; the results of licensee participation in the Interlaboratory Comparison Program, required by REMM 2.2.3; discussion of all deviations from the sampling schedule of Table 2.2.1-A; and discussion of all analyses in which the LLD required by Table 2.3.1-A was not achievable.

Discussion

KPS TRM 10.3.1 provides the programmatic control, which requires that an Annual Radiological Environmental Operating Report be submitted to the NRC. It also states that this report shall include summaries, interpretations, and analysis of trends of the results of the REMP for the reporting period.

The procedural details of this report are included in this requirement. REMM 2.2.1/2.3.1, 2.2.2/2.3.2, and 2.2.3/2.3.3 also include specific reporting requirements. These requirements reference this REMM, along with TRM 10.3.1, as the method for reporting deviations from the current program during the reporting period, and require that this information be included in the Annual Radiological Environmental Operating Report.

## *3.0 REMP Implementation*

The Radiological Environmental Monitoring Program for KPS is under the direction of a Contracted Vendor (CV). This section describes this program, as required by REMM 2.2.1 and the process the CV uses to perform it.

### *3.1 Sampling Requirements*

Table 2.2.1-A identifies the various samples required by the REMP. Identified in the "available sample locations" column in Table 2.2.1-A are the sample locations selected, in conjunction with the vendor, to meet or exceed the REMP requirements. Table 2.2.1-B includes the same requirements as in Table 2.2.1-A, but presents the information in a different format by identifying the type of samples required at each location and the collection frequency. Table 2.2.1-C identifies the location and description of each sample location. Figure 1 shows the physical location of each sample point on an area map.

### *3.2 Analysis Methodology*

Analytical procedures and counting methods employed by the CV will follow those recommended by the U.S. Public Health Service publication, Radioassay Procedures for Environmental Samples, January 1967; and the U.S. Atomic Energy Commission Health and Safety Laboratory, HASL Procedures Manual (HASL-300), 1972. The manual is also available on-line at www.eml.st.dhs.gov/publications/procman.

Updated copies shall be kept on file at KPS or can be obtained from the CV with sufficient notification.

### *3.3 Detection Capability (LLD) Requirements*

The required detection capabilities for environmental sample and analysis are tabulated in terms of lower limits of detection (LLDs) in Table 2.3.1-A. The LLDs required by Table 2.3.1-A are considered optimum for routine environmental measurements in industrial laboratories. It should be recognized that the LLD is defined as a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

Detailed discussion of the LLD, and other detection limits, can be found in HASL Procedures Manual, HASL-300 (revised annually), Currie, L.A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry," Anal. Chem. 40, 586-93 (1968), and Hartwell, J.K., "Detection Limits for Radioanalytical Counting Techniques," Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975).

### *3.4 Contracted Vendor Reporting Requirements*

*Monthly Progress Reports*

Monthly progress reports will include a tabulation of completed analytical data on samples obtained during the previous 30 day period. Included in the report are the status of field collections and graphic representations indicating possible trends. One copy of the reports will be submitted within 30 to 60 days of the reporting month. Monthly progress reports are reviewed for:

- Reasonableness
- Consistency
- Accuracy
- Completeness
- Recognition of deficiencies
- Examination of any past deficiencies and corrective actions taken
- Recommendations for any modifications or improvements to the REMM

Notify the vendor of any unusual or abnormal data noted during the review, including an evaluation of the applicability of REMM Specification 2.2.1.b.

The review shall include determination of the need to make notifications to State and Local Agencies due to levels of radioactive materials in water samples.

*Annual Reports*

Annual reports will be submitted in two parts. Part I, to be submitted to the NRC, will be prepared in accordance with NRC Regulatory Guide 4.8. It will contain an introductory statement, a summary of results, description of the program, discussion of the results, and summary table. Part II of the annual report will include tables of analytical data for all samples collected during the reporting period, together with graphic presentation where trends are evident and statistical evaluation of the results. Gamma scan data will be complemented by figures of representative spectra if requested by KPS.

*Non-Routine Reports*

If analyses of any samples collected show abnormally high levels of radioactivity, KPS will be notified by telephone immediately after data becomes available.

*Action Limits*

The CV will report any radioactive concentrations found in the environmental samples which exceed the reporting levels shown in Table 2.2.1-D, CV to KPS column. These levels are set below the NRC required reporting levels (KPS to NRC column) so actions can be initiated to prevent exceeding the NRC concentration limits.

### *3.5 Quality Assurance Program*

To ensure the validity of the data, the CV maintains a Quality Assurance (QA) Program, which employs quality control checks, with documentation of the analytical phase of its environmental monitoring studies. The program and procedures are defined in the CV's Quality Manual. The program shall be reviewed and meet the requirements of Regulatory Guide 4.15 and 10CFR21. All data related to quality control will be available for review by Dominion Energy Kewaunee upon reasonable prior notification. Proprietary information will be identified so that it may be treated accordingly.

Updated copies of the Quality Manual shall be kept on file at KPS or can be obtained from the CV with sufficient notification.

### *3.6 Sample Descriptions*

A description of each of the samples required by this program follows:

*Ambient Radiation*

Two packets of thermo-luminescent dosimeters ($CaSO_4$: Dy cards) are placed at fifteen locations as follows:

- Four at the ISFSI fence as part of inner ring locations (K-1m, K-1o, K-1q, K-1r)
- Four inner ring locations (K-1f, K-25, K-27, K-30)
- Six outer ring locations (K-3, K-5, K-8, K-17, K-39, K-43)
- One control location (K-2)

One packet is changed quarterly and one annually. Annual TLDs will serve as an emergency set to be read when needed. They will be exchanged annually (without reading) if not read during the year. To insure the precision of the measurement, each packet will contain two cards with four dosimeters each (four sensitive areas each for a total of eight). For protection against moisture each set of cards is sealed in a plastic bag and placed in a plastic container.

Each card is individually calibrated for self-irradiation and light response. Fading is guaranteed by the TLD vendor not to exceed 20% in one year. Minimum sensitivity for the multi-area dosimeter is 0.5 mR defined as 3 times the standard deviation of the background. Maximum Error (1 standard deviation) - $^{60}Co$ Gamma +/-0.2 mR or +/-3%, whichever is greater. The maximum spread between areas on the same dosimeter is 3.5% at 1 standard deviation.

Reporting units for TLDs are mR/91 days for quarterly TLDs and mR/exposure period for annual TLDs.

Tests for uniformity and reproducibility of TLDs as specified in NRC Regulatory Guide 4.13 are performed annually.

*Airborne Particulates*

Airborne particulates are collected at four locations (K-1f, K-2(control), K-8, and K-43) on a continuous basis on a 47 mm diameter filter at a volumetric rate of approximately one cubic foot per minute (CFM). The filters are changed weekly, placed in protective envelopes, and delivered to the CV for Gamma Isotopic Analysis. Filter samples are analyzed weekly for gross beta activity after sufficient time (usually 3 to 5 days) has elapsed to allow decay of Radon and Thoron daughters. If gross beta concentrations in air particulate samples are greater than ten (10) times the yearly mean of the control samples, gamma isotopic analysis shall be performed on the individual samples. Quarterly composites from each location receive Gamma Isotopic Analysis using a Germanium detector. All identifiable gamma-emitters are quantified. Reporting units are $pCi/m^3$.

*Surface Water*

Surface water is sampled quarterly from Lake Michigan at the KPS discharge (K-1d).

Samples are collected quarterly at the Green Bay Municipal Pumping station between Kewaunee and Green Bay (K-9) – both raw and treated water is collected.

Quarterly samples are also taken, when available, from creek locations (K-1b, K-1e) that pass through the reactor site. The samples are taken at a point near the mouth of each creek and at the shore of the drainage pond. The water is analyzed for gross beta activity in:

a. The total residue,
b. The dissolved solids, and
c. The suspended solids.

The samples are also analyzed for K-40, Gamma Isotopic Analysis, tritium, and Sr-90. Reporting units are pCi/l.

*Well Water*

One gallon of drinking water samples are taken once every three months from one off-site well, (K-13) and three on-site wells (K-1h, K-1t, and K-1u). All samples are analyzed for gross beta in the total residue, K-40, tritium, and by Gamma Isotopic Analysis. Samples from one on-site well are analyzed for Sr-90. Samples from K-1h, K-1t, and K-1u are also analyzed for gross alpha. Reporting units are pCi/l.

*Shoreline Sediment*

Shoreline sediment samples are taken semi-annually from three locations (K-1c, K-1j, K-9) in areas with potential for recreational value.

*Fish*

Fish are collected once per year (third quarter) near the discharge area (K-1d). An alternate source for fish is a local fish market (e.g., LaFond's in Kewaunee). Flesh is separated from the bones and analyzed for gross beta activity and by Gamma Isotopic Analysis. The bones are analyzed for gross beta activity and Sr-90. Reporting units are pCi/g wet weight.

*Vegetation*

Annually, during the 3rd quarter, samples of broad leaf vegetation grown and marketed for human consumption are collected from K-26 (control), depending upon the availability of samples. If samples are not available from this location, samples may be obtained from any local source so there is some sample of record. The location will be documented. In addition, two samples of broad leaf vegetation from the highest predicted X/Q and D/Q, if available, are collected annually from the farmland owned by Dominion Energy Kewaunee (K-23 a and b) and rented to a private individual for growing crops. Reporting units are pCi/g wet weight.

*Soil*

Twice during the growing season samples of the top two inches of soil are collected from five locations (K-1f, K-3(control), K-34, K-35 (control), K-38). The soil is analyzed for gross alpha and gross beta activities, for Sr-90, and Gamma Isotopic Analysis to identify and quantify gamma-emitting manmade radionuclides. Reporting units are pCi/g dry weight.

*Cattle feed*

Once per year, during the first quarter when grass is not available, cattle feed (such as hay or silage) is collected from the six dairy farms (K-3(control), K-5, K-34, K-35 (control), K-38, K-39). The analyses performed are the same as for grass. Reporting units are pCi/g wet weight.

*Grass*

Grass is collected three times per year (2nd, 3rd, and 4th quarters) from the six dairy farms (K-3(control), K-5, K-35 (control), K-34, K-38, and K-39) and from two on-site locations (K-1b and K-1f). The samples are analyzed for gross beta activity, for Sr-90, and Gamma Isotopic Analysis to identify and quantify gamma-emitting radionuclides. Reporting units are pCi/g wet weight.

*Groundwater Monitoring Wells*

The Groundwater Protection Program (RP-KW-001-028, Groundwater Protection Program) consists of 14 wells. Figure 2 shows the locations of the 14 installed groundwater monitoring wells. The wells and locations are identified with a diamond shape in Figure 2. The wells are labeled MW (Monitoring Well) and AB (Auxiliary Building).

Results of analyses and a description of any event above Reporting Levels will be included in the Annual Radioactive Effluent Release Report for the 14 wells.

Any results exceeding the limits of Table 2.2.1-D shall be reported in accordance with section 2.2.1-B of the REMM, as well as:

- Informal notification to the State and Local Agencies before the end of the next business day.
- Providing a copy of the written 30 day NRC report to State and Local Agencies.

## *Table 2.2.1-A*

## *Radiological Environmental Monitoring Program*

| Exposure Pathway And/Or Sample | Minimum Required Samples [a] | Available Sample Locations [b] | Sampling, Collection and Analysis Frequency | Type of Analysis |
|---|---|---|---|---|
| 1. Ambient Radiation[c] | 8 Inner Ring locations | **K-1f, K-1m, K-1o, K-1q, K-1r, K-25, K-27, K-30,** | See Table 2.2.1-B | Gamma dose |
| | 6 Outer Ring locations | **K-3, K-5, K-8, K-17, K-39, K-43** | | |
| | 1 Control location | **K-2** | | |
| | 1 Population center | **K-43** | | |
| | 1 Special interest location | **K-8** | | |
| | 1 Nearby resident | **K-27** | | |
| 2. Airborne Particulates | 3 samples close to the site boundary in highest average X/Q | **K-1f, K-8, K-43** | See Table 2.2.1.B Continuous sampler operation | Particulates; gross beta analysis[e] Gamma isotopic[f] of composite (by location) |
| | 1 sample from the closest community having the highest X/Q | **K-43** | Particulates See Table 2.2.1-B | |
| | 1 sample from a control location | **K-2[d]** | See Table 2.2.1-B | |
| 3. Waterborne<br>a. Surface[g] | 1 Upstream sample<br>1 Downstream sample | **K-1b, K-1d**<br>**K-1e, K-9[J]** | Grab sample<br>See Table 2.2.1-B | Gross Beta, Gamma isotopic[f] K-40 tritium, and Sr-90[i] |
| b. Well | 1-2 locations likely to be affected [d]<br>1 off-site location | **K-1h, K-1t[h], K-1u[h]**<br>**K-13** | Grab sample<br>See Table 2.2.1-B | Gamma isotopic[f], tritium and K-40 analysis<br>Gross Beta, one well for Sr-90 |
| c. Shoreline Sediment | 1 sample from downstream area with potential for recreational value | **K-1c, K-1j, K-9** | Grab sample<br>See Table 2.2.1-B | Gamma isotopic [f] analysis<br>Gross Beta, Sr-90 |

| *Table 2.2.1-A*<br>*Radiological Environmental Monitoring Program* | | | | |
|---|---|---|---|---|
| Exposure Pathway And/Or Sample | Minimum Required Samples [a] | Available Sample Locations [b] | Sampling, Collection and Analysis Frequency | Type of Analysis |
| 4. Ingestion | | | | |
| a. Fish | 1 random sample of commercially and recreationally important species in the vicinity of the plant. | **K-1d** | See Table 2.2.1-B | Gamma Isotopic[f] and Gross Beta on edible portions, Gross Beta and Sr-90 on bones |
| b. Food Products | Two samples of broad leaf vegetation grown nearest each of two different offsite locations within 5 miles of the plant since milk sampling is no longer performed.[k] | **K-23a, K-23b** | See Table 2.2.1-B | Gamma Isotopic[f] Analysis. |
| | 1 sample 15-30 km distant since milk sampling is no longer performed. | **K-26** (control) | | |
| 5. Miscellaneous samples not identified in NUREG-0472[k] | | | | |
| a. Soil | None required | **K-1f, K-34, K-35 (control)**<br>**K-38**<br>**K-3** (control) | See Table 2.2.1-B | Gross Alpha/Beta<br>Sr-90<br>Gamma Isotopic[f] |
| b. Cattle feed | None required | **K-5, K-35 (control)**<br>**K-34, K-38, K-39**<br>**K-3** (control) | See Table 2.2.1-B | Gross Beta<br>Sr-90<br>Gamma Isotopic[f] |
| c. Grass | None required | **K-1b, K-1f, K-35 (control), K-39**<br>**K-5, K-34, K-38**<br>**K-3** (control) | See Table 2.2.1-B | Gross Beta<br>Sr-90<br>Gamma Isotopic[f] |

| *Table Notations for Table 2.2.1-A* | |
|---|---|
| a. | The samples listed in this column describe the minimum sampling required to meet REMP requirements. |
| b. | Additional details of sample locations are provided in Table 2.2.1-C and Figure 1. The REMP requires that samples be taken from each of the "available sample locations" listed (see section 3.1). Deviations from the required sampling schedule will occur if specimens are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of automatic sampling equipment and other legitimate reasons. If specimens are unobtainable due to sampling equipment malfunction, reasonable efforts shall be made to complete corrective actions prior to the end of the next sampling period. All deviations from the sampling schedule shall be documented, as required by REMM 2.4.1.c, in the Annual Radiological Environmental Operating Report. It is recognized that, at times, it may not be possible or practicable to continue to obtain samples of the media of choice at the most desired location or time. In these instances suitable alternative media and locations may be chosen for the particular pathway in question and appropriate substitutions made within 30 days in the REMM. The cause of the unavailability of samples for that pathway and the new location(s) for obtaining replacement samples will be identified in the Annual Radiological Environmental Operating Report. |
| c. | For the purposes of this table, each location will have 2 packets of thermoluminescent dosimeters (TLDs). The TLDs are CaSO4: Dy cards with 2 cards/packet and 4 dosimeters/card (four sensitive areas each for a total of eight dosimeters/packet). The NRC guidance of 40 stations is not an absolute number. The number of direct radiation monitoring stations has been reduced according to geographical limitations; e.g., Lake Michigan. The frequency of analysis or readout for TLD systems depends upon the characteristics of the specific system used and selection is made to obtain optimum dose information with minimal fading. |
| d. | The purpose of this sample is to obtain background information. If it is not practical to establish control locations in accordance with the distance and wind direction criteria, other sites that provide valid background data may be substituted. |
| e. | Airborne particulate sample filters shall be analyzed for gross beta radioactivity 24 hours or more after sampling to allow for radon and thoron daughter decay. If gross beta activity in air particulate samples is greater than ten times the yearly mean of control samples, gamma isotopic analysis shall be performed on the individual samples. |
| f. | Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility. |
| g. | The "upstream sample" shall be taken at a distance beyond significant influence of the discharge. The "downstream" sample shall be taken in an area near the mixing zone. |
| h. | Well water samples 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. |
| i. | In the event elevated analyses are reported by CV for gamma isotopic or tritium, a review will be conducted with the option to retest additional analysis for hard to detect isotopes or alpha emitters. The additional test may include Fe-55, Ni-63, or alpha emitters anticipated on current plant conditions. |
| j. | Two samples to be collected, Raw and Treated |
| k. | See Regulatory Guide 4.1, Revision 2. Broad leaf vegetation, as well as grass, soil, and cattle feed, are a sufficient substitute if milk samples are not performed. |

## *Table 2.2.1-B*
## *Type and Frequency of Collection*

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

### *Table Notations for Table 2.2.1-B*

a. Three times a year, second (April, May, June), third (July, August, September), and fourth (October, November, December) quarters
b. To be collected in May and November
c. Annually in third quarter (July, August, or September)
d. First (January, February, March) quarter only
e. Alternate since milk sampling is no longer performed
f. Two samples, raw and treated
g. The frequency may be increased dependent on the dust loading.

| Code | Description | Code | Description | Code | Description |
|---|---|---|---|---|---|
| AP | Airborne Particulate | GR | Grass | SW | Surface Water |
| CF | Cattle feed | SO | Soil | WW | Well Water |
| FI | Fish | SS | Shoreline Sediment | | |
| BLV | Broad Leaf Vegetation | TLD | Thermo-luminescent Dosimeter | | |

| *Table 2.2.1-C*<br>*Sampling Locations, Kewaunee Power Station* | | | |
|---|---|---|---|
| **Code** | **Type[a]** | **Distance (Miles)[b] and Sector** | **Location** |
| K-1 | | | Onsite – generic code |
| K-1b | I | 0.12 N | Middle Creek<br>87°32'8.62"W 44°20'44.80"N |
| K-1c | I | 0.10 N | 500' North of Condenser Discharge<br>87°32'4.21"W 44°20'39.76"N |
| K-1d | I | 0.10 E | Condenser Discharge<br>87°32'1.87"W 44°20'32.71"N |
| K-1e | I | 0.12 S | South Creek<br>87°32'5.03"W 44°20'25.04"N |
| K-1f | I | 0.12 S | Maintenance Waste Oil and Material Storage Building<br>87°32'14"W 44°21'26"N |
| K-1h | I | 0.12 NW | North Well<br>87°32'18.05"W 44°20'39.15"N |
| K-1j | I | 0.10 S | 500' south of Condenser Discharge<br>87°31'58.75"W 44°20'29.33"N |
| K-1m | I | 0.15 N | ISFSI East<br>87°32'8.78"W 44°20'37.13"N |
| K-1o | I | 0.16 N | ISFSI North<br>87°32'9.19"W 44°20'40.11"N |
| K-1q | I | 0.16 N | ISFSI West<br>87°32'13.41"W 44°20'39.86"N |
| K-1r | I | 0.13 N | ISFSI West<br>87°32'14.25"W 44°20'39.09"N |
| K-1t | I | 0.10 ESE | Gatehouse<br>87°32'4.47"W 44°20'30.79"N |
| K-1u | I | 0.05 SSW | Maintenance Building<br>87°33'21"W 44°21'19"N |
| K-2 | C | 8.91 NNE | WPS Operations Building in Kewaunee<br>87°29'59.62"W 44°28'25.49"N |
| K-3[f] | I/C | 5.9 N | Lyle and John Siegmund Farm, N2815 Hwy 42, Kewaunee<br>87°32'35.98"W 44°25'39.21"N |
| K-5 | I | 3.2 NNW | Ed Paplham Farm, E4160 Old Settlers Rd, Kewaunee<br>87°33'47.10"W 44°23'2.83"N |

| *Table 2.2.1-C* *Sampling Locations, Kewaunee Power Station* | | | |
|---|---|---|---|
| **Code** | **Type[a]** | **Distance (Miles)[b] and Sector** | **Location** |
| K-8 | I | 4.85 WSW | Saint Isadore the Farmer Church, 18424 Tisch Mills Rd, Tisch Mills<br>87°37'50.85"W 44°19'18.48"N |
| 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 2 miles north of Kewaunee)<br>87°46'16.94"W 44°29'16.55" |
| K-13 | C | 3.0 SSW | Rand's General Store, Two Creeks<br>87°33'48.23"W 44°18'8.69"N |
| K-17 | I | 4.0 W | Jansky's Farm, N885 Cty Tk B, Kewaunee<br>87°36'47.52"W 44°21'21.62"N |
| K-23a | I | 0.5 W | 0.5 miles west of plant, Kewaunee site<br>87°32'3.38"W 44°21'12.12"N |
| K-23b | I | 0.6N | 0.6 miles north of plant, Kewaunee site<br>87°32'43.93"W 44°20'32.36"N |
| K-25 | I | 1.9 SW | Wotachek Farm, E3968 Cty Tk BB, Two Rivers<br>87°34'10.67"W 44°19'38.81"N |
| K-26[c] | C | 9.1 SSW | Wilfert's Vegetable Stand 7528 Manitou Dr., Two Rivers<br>87°39'3.75"W 44°11'21.60"N |
| K-27 | I | 1.53 NW | Schleis Farm, E4298 Sandy Bay Rd<br>87°33'6.93"W 44°21'22.96"N |
| K-30 | I | 0.8 N | End of site boundary<br>87°32'2.61"W 44°21'12.86"N |
| K-34 | I | 2.7 N | Leon & Vicky Struck Farm, N1549 Lakeshore Dr, Kewaunee<br>87°31'14.33"W 44°22'48.13"N |
| K-35[d] | C | 6.71 WNW | Duane Ducat Farm, N1215 Sleepy Hollow, Kewaunee<br>87°40'1.53"W 44°22'10.90"N |
| K-38 | I | 2.45 WNW | Dave Sinkula Farm, N890 Town Hall Road, Kewaunee<br>87°34'56.92"W 44°21'22.64"N |
| K-39 | I | 3.46 N | Francis Wotja Farm, N1859 Lakeshore Road, Kewaunee<br>87°31'14.28"W 44°23'28.25"N |
| K-43[e] | I | 2.71 SSW | Gary Maigatter Property, 17333 Highway 42, Two Rivers<br>87°33'42.99"W 44°18'26.63"N |

### *Table Notations for Table 2.2.1-C*

a. I = indicator; C = control.
b. Distances are measured from reactor stack.
c. Location K-18 was changed because Schmidt's Food Stand went out of business. It was replaced by Bertler's Fruit Stand (K-26). It was replaced with Sandy's Vegetable in 2007. The location as of 2009 is Wilfert's Vegetable Stand.
d. Removed from the program in fall of 2001, back to program in August 2008.
e. K-7 moved to a nearby location and relabeled K-43, within 0.2 miles of original, August/September 2010.
f. Location K-3 is an indicator for ambient radiation and a control for soil, cattle feed, and grass.

| *Table 2.2.1-D*<br>*Reporting Levels for Radioactivity Concentrations in Environmental Samples* | | | |
|---|---|---|---|
| **Medium** | **Radionuclide** | **Reporting Levels** | |
| | | **CV to KPS[a]** | **KPS to NRC[b]** |
| Airborne Particulate (pCi/m3) | Gross Beta | 1 | -- |
| | Cs-134 | 1 | 10 |
| | Cs-137 | 1 | 20 |
| Water (pCi/l) | Gross Alpha | 10 | -- |
| | Gross Beta | 30 | -- |
| | H-3 | 10,000 | 20,000[c] |
| | Mn-54 | 100 | 1,000 |
| | Co-60 | 30 | 300 |
| | Cs-134 | 10 | 30 |
| | Cs-137 | 20 | 50 |
| | Sr-90 | 8[d] | -- |
| Grass, Cattle Feed, and Broad Leaf Vegetation (pCi/g wet) | Gross Beta | 30 | -- |
| | Cs-134 | 0.2 | 1 |
| | Cs-137 | 0.2 | 2 |
| | Sr-90 | 1 | -- |
| Soil, Shoreline Sediments (pCi/g) | Gross Beta | 50 | -- |
| | Cs-134 | 5 | -- |
| | Cs-137 | 5 | -- |
| | Sr-90 | 5 | -- |
| Fish (pCi/g wet) | Gross Beta (Flesh, Bones) | 10 | -- |
| | Mn-54 | -- | 30.0 |
| | Co-60 | -- | 10.0 |
| | Cs-134 (Flesh) | 1 | 1.0 |
| | Cs-137 (Flesh) | 2 | 2.0 |
| | Sr-90 (Bones) | 2 | -- |

a. Radionuclides will be monitored by the CV and concentrations above the listed limits will be reported to KPS.
b. Concentrations above the listed limits will be reported to NRC as required by REMM 2.2.1.b.
c. For drinking water samples, this is 40CFR Part 141 value. If no drinking water pathway exists, then a value of 30,000 pCi/l may be used.
d. The Sr-90 values are based on the EPA drinking water standards. See note "e" of Table 2.3.1-A for further information

*Table 2.3.1-A*
*Detection Capabilities for Environmental Sample Analysis[a]*
*Lower Limit of Detection (LLD)[b,c]*

| Analysis | Water (pCi/l) | Airborne Particulate ($pCi/m^3$) | Fish (pCi/kg, wet) | Food Products (pCi/kg, wet) | Sediment (pCi/kg, dry) |
|---|---|---|---|---|---|
| Gross Beta | 4 | 0.01 | | | |
| H-3 | 2000[d] | | | | |
| Mn-54 | 15 | | 130 | | |
| Co-60 | 15 | | 130 | | |
| Cs-134 | 15 | 0.05 | 130 | 60 | 150 |
| Cs-137 | 18 | 0.06 | 150 | 80 | 180 |
| Sr-90[e] | 5 | | | | |

## *Table Notations for Table 2.3.1-A*

a. This list does not mean that only these nuclides are to be considered. Other peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Annual Radiological Environment Operating Report.

b. Required detection capabilities for thermoluminescent dosimeters used for environmental measurements are given in Regulatory Guide 4.13.

c. The LLD is defined, for purposes of these requirements, as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system, which may include radiochemical separation:

$$LLD = \frac{4.66 s_b}{E \times V \times 2.22 \times Y \times e^{-\lambda \Delta t}}$$

Where:

LLD is the a priori lower limit of detection as defined above, as picocuries per unit mass or volume,

$S_b$ is the standard deviation of the background counting rate or of the counting rate of blank sample as appropriate, as counts per minute,

E is the counting efficiency, as counts per disintegration,

V is the sample size in units of mass or volume,

2.22 is the number of disintegrations per minute per picocurie,

Y is the fractional radiochemical yield, when applicable,

$\lambda$ is the radioactive decay constant for the particular radionuclide, and

$\Delta t$ for environmental samples is the elapsed time between sample collection, or end of the sample collection period, and time of counting,

Typical values of E, V, Y, and $\Delta t$ should be used in calculation.

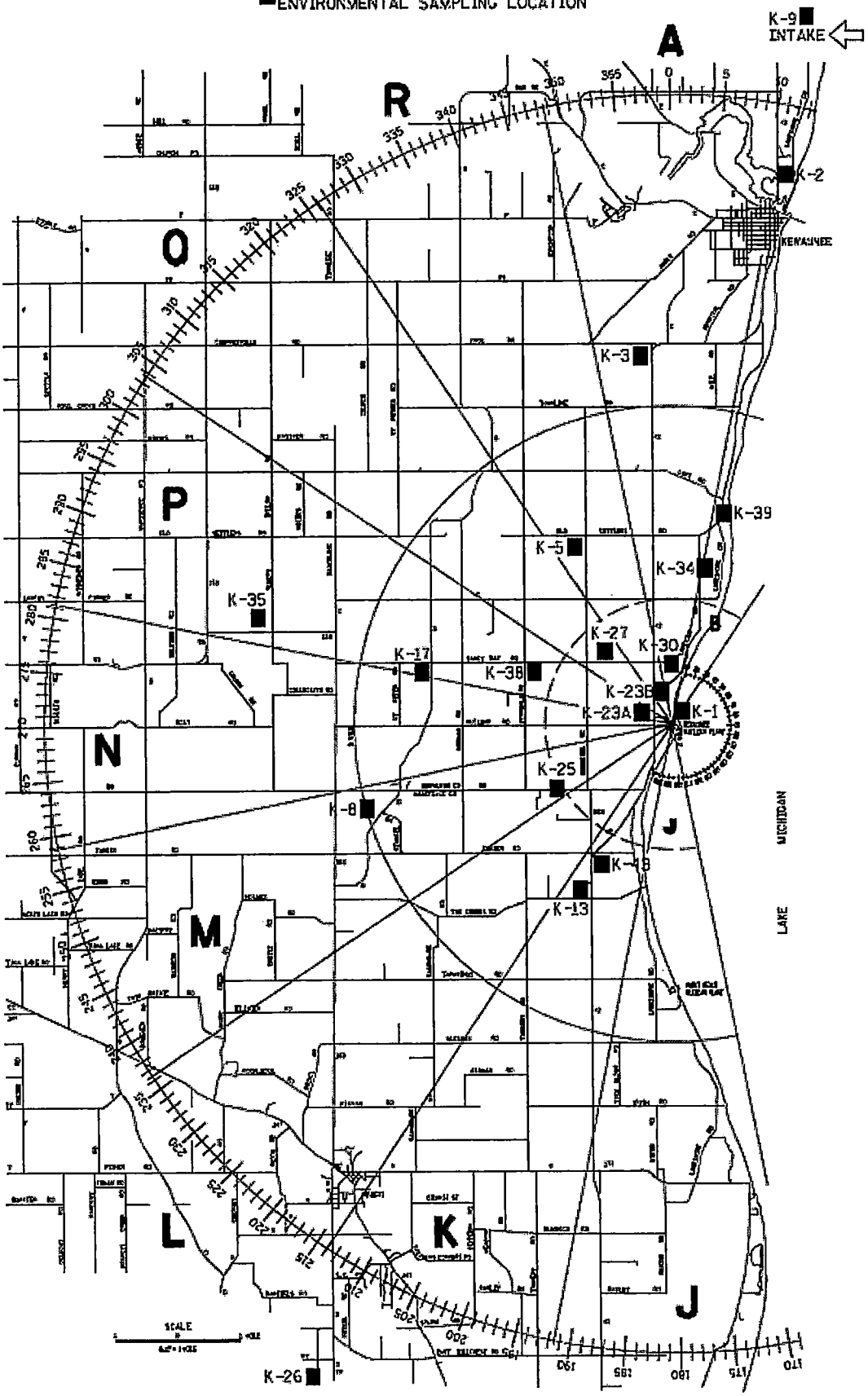
*Table Notations for Table 2.3.1-A (con't)*

It should be recognized that the LLD is defined as a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement. Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidable small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDs unachievable. In such cases, the contributing factors shall be identified and described in the Annual Radiological Environmental Operating Report.

d. If no drinking water pathway exists, a value of 3,000 pCi/l may be used.

e. This is NOT a NUREG-0472 required value. It is based on EPA drinking water standards, which tie into the NEI Groundwater Protection Initiative that was implemented at KPS on August 4, 2006.

FIGURE 1
ENVIRONMENTAL SAMPLING LOCATION



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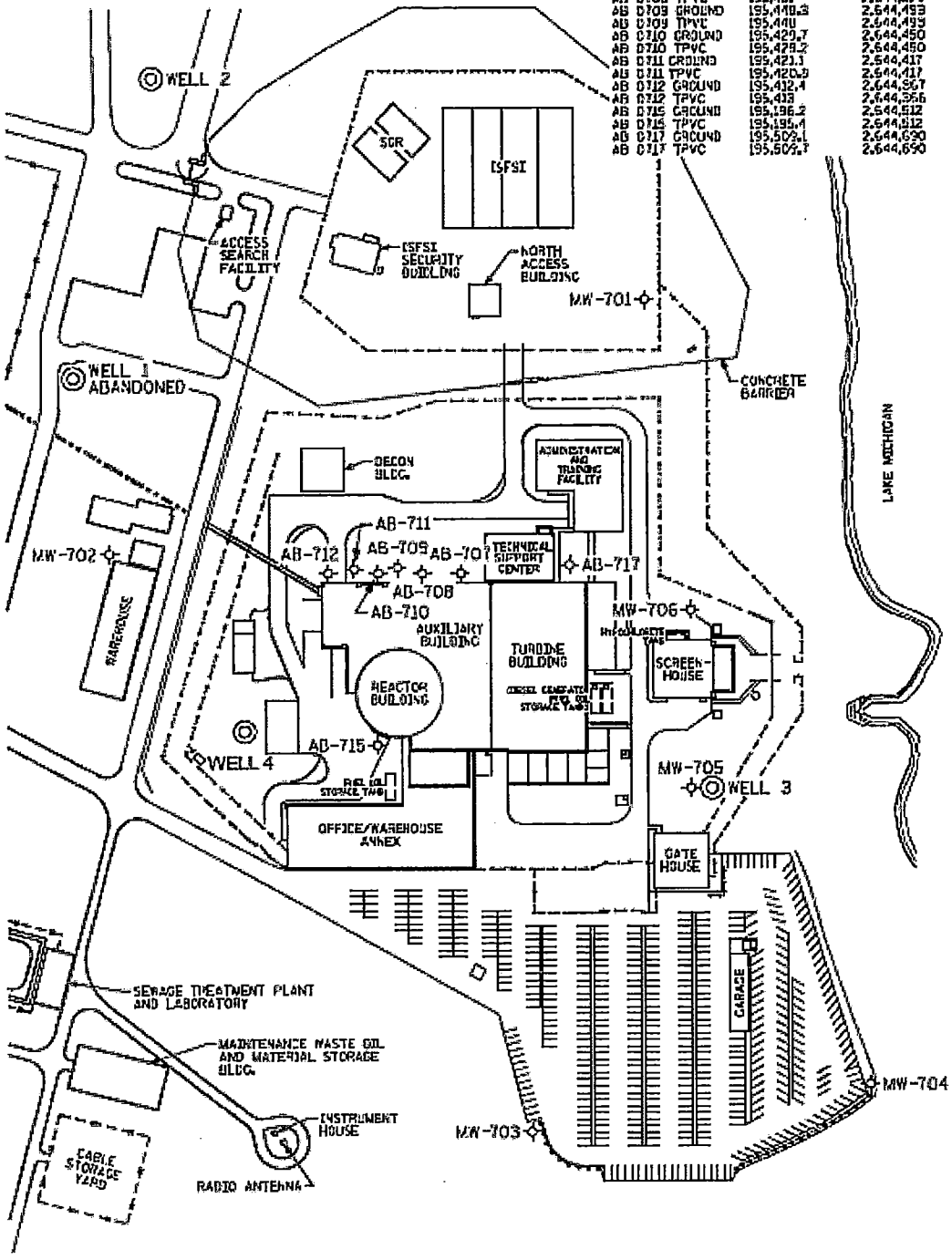
# FIGURE 2
WELL LOCATIONS

NOTES:
1. LOCATIONS OF MONITORING WELLS SURVEYED BY STS ON JUNE 21, 2007.
2. LOCATIONS OF WATER SUPPLY WELLS ARE ESTIMATED.
3. COORDINATES ARE IN NAD 1927 WISCONSIN STATE PLANE CENTRAL.

LEGEND:
- 6' HIGH FENCE
- SUPPLY WELL
- MONITORING WELL

| LOCATION | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| MW-0701 GROUND | 195,059.5 | 2,644,681 | 605.326 |
| MW-0701 TPVC | 195,059 | 2,644,681 | 606.622 |
| MW-0702 GROUND | 195,372.1 | 2,644,086 | 607.287 |
| MW-0702 TPVC | 195,371.5 | 2,644,091 | 607.305 |
| MW-0703 GROUND | 194,761.4 | 2,644,833 | 603.112 |
| MW-0703 TPVC | 194,762.3 | 2,644,835 | 602.685 |
| MW-0704 GROUND | 194,938.2 | 2,644,268 | 608.915 |
| MW-0704 TPVC | 194,938.7 | 2,644,268 | 608.502 |
| MW-0705 GROUND | 195,264.4 | 2,644,927 | 609.339 |
| MW-0705 TPVC | 195,264.4 | 2,644,927 | 604.912 |
| MW-0706 GROUND | 195,491.2 | 2,644,365 | 605.407 |
| MW-0706 TPVC | 195,491.2 | 2,644,365 | 605.987 |
| AB 0707 GROUND | 195,461 | 2,644,463 | 606.0152 |
| AB 0707 TPVC | 195,460.4 | 2,644,463 | 605.4723 |
| AB 0708 GROUND | 195,451.3 | 2,644,550 | 606.0315 |
| AB 0708 TPVC | 195,451 | 2,644,575 | 605.5155 |
| AB 0709 GROUND | 195,440.3 | 2,644,493 | 606.1195 |
| AB 0709 TPVC | 195,440 | 2,644,493 | 605.8593 |
| AB 0710 GROUND | 195,429.7 | 2,644,450 | 606.1403 |
| AB 0710 TPVC | 195,429.2 | 2,644,450 | 605.8672 |
| AB 0711 GROUND | 195,421.1 | 2,644,417 | 605.8648 |
| AB 0711 TPVC | 195,420.9 | 2,644,417 | 605.4903 |
| AB 0712 GROUND | 195,412.4 | 2,644,367 | 605.5062 |
| AB 0712 TPVC | 195,413 | 2,644,366 | 605.1851 |
| AB 0715 GROUND | 195,196.2 | 2,644,512 | 605.1383 |
| AB 0716 TPVC | 195,195.4 | 2,644,512 | 605.4798 |
| AB 0717 GROUND | 195,509.1 | 2,644,690 | 605.4198 |
| AB 0717 TPVC | 195,509.7 | 2,644,690 | 605.2917 |

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