APPENDIX F

ANNUAL RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM REPORT (ARGPPR)

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DRESDEN NUCLEAR POWER STATION
UNITS 1, 2 and 3

Annual Radiological Groundwater Protection Program Report

1 January through 31 December 2016

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I. Summary and Conclusions

Dresden Station is situated on approximately 600 acres of land that borders the Illinois River to the north and the Kankakee River to the east. This land is referred to as the owner-controlled area. The Dresden power plant itself takes up a small parcel of the owner-controlled area and is surrounded by a security fence. The security fence defines what is known as the Protected Area (PA).

The Dresden power plant has experienced leaks from underground lines and spills from systems containing radioactive water over its 50 year history. These incidents have created a number of areas of localized contamination within the PA. The liquid scintillation analyses of groundwater in many of these areas show measurable concentrations of tritium (H-3).

Dresden participated in a fleetwide hydrogeologic investigation in during the summer of 2006 in an effort to characterize groundwater movement at each site. This investigation also compiled a list of the historic spills and leaks as well as a detailed analysis on groundwater hydrology for Dresden Nuclear Generation Station. Combining the tritium concentration in a locally contaminated area with the speed and direction of groundwater in the vicinity can produce a contaminated groundwater plume projection. If the plume of contaminated groundwater passes through the path of a groundwater monitoring well, it can be anticipated that the tritium concentration in this well will increase to some maximum concentration, then decrease over time.

The fleetwide Hydrogeologic Investigation Report (HIR) shows that groundwater movement on the Dresden site is very slow. In addition, there is a confining rock layer, the Maquoketa Shale layer, about 55 feet below the surface that impedes groundwater movement below this depth.

Dresden has a domestic water system that is supplied by two deep wells (1500 feet deep) that were installed about 50 years ago south of the PA. Samples taken from domestic water supply have never shown any detectable tritium concentration.

Tritium has a half-life of 12.3 years. This means that 40 years from now 90% of the tritium on site today will have decayed away to more stable elements. Given the limited volume of contaminated groundwater on site, radioactive decay, slow groundwater movement, and dilution effects, the conclusion of the HIR is that the operation of Dresden Nuclear Power Station has no adverse radiological impact on the environment. As a result there is little potential for contaminated groundwater on site to affect off-site drinking water.

II. Introduction

Radiological Groundwater Monitoring Program (RGPP):

Dresden has a Radiological Groundwater Monitoring Program (RGPP) that provides long-term monitoring intended to verify the fleet-wide hydrogeologic study conclusions. Dresden uses developed groundwater wells and surface water sample points in the RGPP.

The Dresden RGPP was established in 2006 and there have been no significant changes to this program. This program does not impact the operation of the plant and is independent of the REMP.

Developed groundwater wells are wells that were installed specifically for monitoring groundwater. These wells are equipped with screens and are properly sealed near the surface to avoid surface water intrusion. The wells were designed in accordance with appropriate codes and developed in accordance with appropriate standards and procedures. Dresden has groundwater monitoring wells identified as "shallow" (depths from 15 to 35 feet), "Intermediate" (depths from 35 to 55 feet) and "deep" (depths beyond 100 feet). All wells installed to a depth greater than 100 feet ("deep" wells) were found to be dry and removed from the RGPP. Surface water sample points are identified sample locations in the station's canals and cooling pond.

There are 96 sampling points in the RGPP:

Dresden has 47 developed groundwater monitoring wells within the Protected Area (PA). Some of these wells form a ring just inside the security fence and the remaining wells were installed near underground plant system piping that contains radioactive water.

Dresden has 30 developed groundwater monitoring wells outside the PA the majority of which form a ring just within the perimeter of the property.

Dresden has 12 surface water monitoring locations on the owner-controlled area sampled as part of the Dresden RGPP. Three of these locations are monitored for level only and have no analyses in the accompanying tables.

Dresden has 4 precipitation water monitoring locations sampled as part of the Dresden RGPP. An additional 8 locations were studied in 2011 through 2012, but only 4 locations are currently permanently a part of the RGPP program.

Dresden has 1 sentinel well and 2 CST leak detection valves. These 3 sampling points are not constructed to code or developed to a standard. These sampling points are idle and only used for qualitative troubleshooting.

The Dresden site-specific RGPP procedure identifies the historic 'events' that would affect the individual RGPP sample results. This procedure identifies threshold values for each sample point, which if exceeded, could be an indication of a new spill from an above ground system or a new leak in an underground pipe containing tritiated water.
The RGPP sample points are currently sampled on a frequency determined by the well detection category in accordance with site document EN-DR-408-4160, Dresden RGPP Reference Material. During 2016, there were 580 analyses that were performed on 270 samples from 80 sampling points.

Sentinel Wells, sometimes referred to as "baby wells" are wells that were installed to monitor local shallow groundwater; typically in associated with a historic underground pipe leak. These wells are not constructed to code or developed to a standard. Most sentinel wells are from 6 to 12 feet deep and consist of 2" PVC pipe without screens. These wells are categorized as idle wells and are used only for troubleshooting purposes.

Dresden has two basic storm water runoff sewer systems within the P.A: one storm-system routes to the east, then north and discharges into the Unit 1 intake canal, the second storm-system routes to the west, then north, through a large Oil/Water Separator and discharges to the hot canal. Both the Unit 1 intake canal and the hot canal eventually route to the cooling pond. The Dresden Station RGPP has twelve RGPP surface water sampling points to monitor these systems.

A. Objectives of the RGPP

The Objective of the RGPP is to provide long-term monitoring intended to verify the fleet-wide hydrogeologic study conclusions. The objective of the site-specific RGPP is to provide indication of short-term changes to groundwater tritium concentrations within the PA.

If isotopic results of groundwater samples exceed the thresholds specified in this procedure it could be an indication of a new spill from an above ground system or a new leak in an underground pipe containing tritiated water.

Specific Objectives include:

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

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

3. Regularly assess analytical results to identify adverse trends.

4. Take necessary corrective actions to protect groundwater resources.

B. Implementation of the Objectives

1. Dresden Nuclear Power Station will continue to perform routine sampling and radiological analysis of water from selected locations.

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

3. Dresden Nuclear Power Station staff and consulting hydrogeologist assess analytical results on an ongoing basis to identify adverse trends.

4. If an adverse trend in groundwater monitoring analytical results is identified, further investigation will be undertaken. If the investigation identifies a leak or unidentified spill, corrective actions will be implemented.

C. Program Description

Dresden has a Radiological Groundwater Monitoring Program (RGPP) that provides long-term monitoring intended to verify the fleet-wide hydrogeologic study conclusions. Dresden uses 89 developed groundwater wells and surface water sample points in the RGPP.

1. Sample Collection

Sample locations can be found in Table A–1, Appendix A.

<u>Groundwater and Surface Water</u>

Water samples are collected in accordance with the schedule delineated in the Dresden site-specific RGPP procedures. Analytical laboratories are subject to internal quality assurance programs, industry crosscheck programs, as well as nuclear industry audits. Station personnel review and evaluate the analytical results.

D. Characteristics of Tritium (H-3)

Tritium (chemical symbol H-3) is a radioactive isotope of hydrogen. The most common form of tritium is tritium oxide, which is also called "tritiated water." The chemical properties of tritium are essentially those of ordinary hydrogen.

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

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

Tritium has a half-life of approximately 12.3 years. It decays spontaneously to helium-3 (3He). This radioactive decay releases a beta particle (low-energy electron). The radioactive decay of tritium is the source of the health risk from exposure to tritium. Tritium emits very weak radiation and leaves the body relatively quickly. Since tritium is almost always found as water it goes directly into soft tissues and organs. The associated dose to these tissues is generally uniform and is dependent on the water content of the specific tissue.

III. Program Description

A. Sample Analysis

This section describes the general analytical methodologies used by Teledyne Brown Engineers (TBE) to analyze the environmental samples for radioactivity for the Dresden Nuclear Power Station RGPP in 2016.

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

1. Concentrations of gamma emitters in groundwater and surface water
2. Concentrations of strontium in groundwater
3. Concentrations of tritium in groundwater, surface water and precipitation water
4. Concentrations of gross alpha and gross beta in groundwater
5. Concentrations of Am-241 in groundwater
6. Concentrations of Cm-242 and Cm-243/244 in groundwater
7. Concentrations of Pu-238 and Pu-239/240 in groundwater
8. Concentrations of U-233/234, U-235 and U-238 in groundwater
9. Concentrations of Fe-55 in groundwater
10. Concentrations of Ni-63 in groundwater

B. Data Interpretation

The radiological data collected prior to Dresden Nuclear Power Station becoming operational were used as a baseline with which these operational data were compared. For the purpose of this report, Dresden Nuclear Power Station was considered operational at initial criticality. Several factors were important in the interpretation of the data:

1. <u>Lower Limit of Detection and Minimum Detectable Concentration</u>

   The Lower Limit of Detection (LLD) is the minimum sensitivity value that must be achieved routinely by the analytical parameter.

2. <u>Laboratory Measurements Uncertainty</u>

   The estimated uncertainty in measurement of tritium in environmental samples is frequently on the order of 50% of the measurement value.

   Statistically, the exact value of a measurement is expressed as a range with a stated level of confidence. The convention is to report results with a 95% level of confidence. The uncertainty comes from calibration standards, sample volume or weight measurements, sampling uncertainty and other factors. Exelon reports the uncertainty of a measurement created by statistical process (counting error) as well as all sources of error (Total Propagated Uncertainty or TPU). Each result has two values calculated. Exelon reports the TPU by following the result with plus or minus ± the estimated sample standard deviation as TPU that is obtained by propagating all sources of analytical uncertainty in measurements.

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

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

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

C. Background Analysis

A pre-operational radiological environmental monitoring program (pre-operational REMP) was conducted to establish background radioactivity levels prior to operation of the Station. The environmental media sampled and analyzed during the pre-operational REMP were atmospheric radiation, fall-out, domestic water, surface water, marine life, and food stuffs. The results of the monitoring were detailed in the report entitled, Environmental Radiological Monitoring for Dresden Nuclear Power Nuclear Power Station, Commonwealth Edison Company, Annual Report 1986, May 1987.

1. Background Concentrations of Tritium

The purpose of the following discussion is to summarize background measurements of tritium in various media performed by others. Additional detail may be found by consulting references (CRA 2006).

a. Tritium Production

Tritium is created in the environment from naturally-occurring processes both cosmic and subterranean, as well as from anthropogenic (i.e., man-made) sources. In the upper atmosphere, "Cosmogenic" tritium is produced from the bombardment of stable nuclides and combines with oxygen to form tritiated water, which will then enter the hydrologic cycle. Below ground, "lithogenic" tritium is produced by the bombardment of natural lithium present in crystalline rocks by neutrons produced by the radioactive decay of naturally abundant uranium and thorium. Lithogenic production of tritium is usually negligible compared to other sources due to the limited abundance of lithium in rock. The lithogenic tritium is introduced directly to groundwater.

A major anthropogenic source of tritium and strontium-90 comes from the former atmospheric testing of thermonuclear weapons. Levels of tritium in precipitation increased significantly during the 1950s and early 1960s, and later with additional testing, resulting in the release of significant amounts of tritium to the atmosphere. The Canadian heavy water nuclear power reactors, other commercial power reactors, nuclear research, and weapons production continue to influence tritium concentrations in the environment.

b. Precipitation Data

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

Tritium concentrations in surface water showed a sharp decline up until 1975 followed by a gradual decline since that time. Tritium concentrations in Midwest precipitation have typically been below 100 pCi/L since around 1980. Tritium concentrations in wells may still be above the 200-

pCi/L detection limit from the external causes described above. Water from previous years and decades is naturally captured in groundwater, so some well water sources today are affected by the surface water from the 1960s that was elevated in tritium.

c. Surface Water Data

Tritium concentrations are routinely measured in large surface water bodies, including Lake Michigan and the Mississippi River. Illinois surface water data were typically less than 100 pCi/L.

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

IV. Results and Discussion

Dresden Station initiated a Radiological Groundwater Protection Program (RGPP) in 2006.

A. Groundwater Results

Groundwater

Samples were collected from on-site wells throughout the year in accordance with Dresden's RGPP. Analytical results and anomalies are discussed below:

Tritium

Following historic ground tritium-contamination events at Dresden Station (EN-DR-408-4160, Revision 4, Attachment 3), routine sampling and analyses continue, both inside and outside the protected areas.

Low level tritium was detected from January through December 2016 in several sampling and testing locations (Table B-I.1, Appendix B); however, overall tritium concentrations have been trending down.

The vast majority of these locations showed a range of tritium contamination from LLD to values less than 20,000 pCi/L.

MD-11 and MW-DN-124-I were the only 2 locations with tritium concentrations above 20,000 pCi/L. The highest level ever reached during calendar year 2016 was 419,000 pCi/L by MD-11 (sample collected on 5/23/2016).

It is important to note that wells that exceed the United States Environmental Agency (USEPA) drinking water standard (and the Nuclear Regulatory Commission Reporting Limit) of 20,000 pCi/L were due to the 2014 2/3B CST Leak. The exceedances are located within Station property, and do not serve as a drinking water source.

Strontium

Samples were collected and analyzed for Sr-89 and Sr-90 activity (Table B-I.1, Appendix B). Sr-89 was not detected in any of the samples. Sr-90 was detected in 4 samples at location MW-DN-105S. The concentrations ranged from 0.7 to 2.5 pCi/L.

Gross Alpha and Gross Beta (dissolved and suspended)

Gross Alpha and Gross Beta analyses in the dissolved and suspended fractions were performed on groundwater samples during the second quarter of 2016 (Table B-I.1, Appendix B). Gross Alpha (dissolved) was not detected at any groundwater locations. Gross Alpha (suspended) was detected in 7 groundwater locations with concentrations ranging from 1.3 to 10.5 pCi/L. Gross Beta (dissolved) was detected at 30 of the groundwater locations. The concentrations ranged from 2.4 to 33.9 pCi/L. Gross Beta (suspended) was detected in 8 groundwater locations with concentrations ranging from 2.3 to 15.8 pCi/L. The concentrations of Gross Alpha and Gross Beta, which are slightly above detectable levels, are considered to be background and are not the result of plant effluents.

Gamma Emitters

Only naturally-occurring nuclides were detected in 3 samples. No other gamma-emitting nuclides were detected (Table B-I.2, Appendix B).

Hard-To-Detects

Hard-To-Detect analyses were performed on 3 groundwater locations to establish background levels. The analyses included Fe-55, Ni-63, Am-241, Cm-242, Cm-243/244, Pu-238, Pu-239/240, U-233/234, U-235 and U-238. U-238 was detected at 1 of the 3 groundwater monitoring locations. The concentration of U-238 was 0.24 pCi/L (Table B-I.3, Appendix B). The concentrations detected are considered background.

All other hard-to-detect nuclides were not detected at concentrations greater than their respective MDCs.

B. Surface Water Results

Surface Water

Samples were collected from 9 surface water locations throughout the year in accordance with the station radiological groundwater protection program. Analytical results and anomalies are discussed below:

Tritium

Samples from all locations were analyzed for tritium activity (Table B-II.1, Appendix B). Tritium values ranged from the detection limit to 5,760 pCi/l. The measurable concentrations of tritium are from an upstream source.

Strontium

Samples were not analyzed for strontium activity on 2016 (Table B-II.1. Appendix B).

Gross Alpha and Gross Beta (dissolved and suspended)

Samples were not analyzed for Gross Alpha and Gross Beta in 2016.

Gamma Emitters

No gamma-emitting nuclides were detected (Table B-II.2, Appendix B).

Hard-To-Detects

Samples were not analyzed for Hard-To-Detect analyses in 2016.

C. Precipitation Water Results

Precipitation Water

Samples were collected from 4 precipitation water locations throughout the year in accordance with the station radiological groundwater protection program. Analytical results and anomalies are discussed below.

Tritium

Samples from 4 locations were analyzed for tritium activity (Table B-III.1,

Appendix B). Tritium was not detected in any samples.

D. Drinking Water Well Survey

No drinking water well surveys were conducted in 2016.

E. Summary of Results – Inter-Laboratory Comparison Program

Inter-Laboratory Comparison Program results for TBE are presented in the AREOR.

F. Leaks, Spills, and Releases

No leaks, spills, and releases occurred in 2016.

G. Trends

Overall, tritium concentrations are decreasing across the Station. The Station continued to implement the tritium monitoring plan with monthly/quarterly sampling of a subset of shallow and intermediate aquifer wells, sewage treatment plant water, and storm sewer water.

An elevated concentration persists in the area of the Condensate Storage Tanks (Event 20 in EN-DR-408-4160, Revision 4, Attachment 3). Two remediation wells were installed in August 2015 to pump tritiated water out of the ground, and active remediation started in December 2015.

H. Investigations

No investigations performed in 2016.

I. Actions Taken

1. Compensatory Actions

None.

2. Actions to Recover/Reverse Plumes

In August 2015, two remediation wells were installed by the CSTs. The intent is to pump tritiated water out of the ground. The water is processed through the liquid radwaste system. Active remediation was initiated in December 2015. Remediation continued through 2016.

TABLE A-1: Radiological Groundwater Protection Program - Sampling Locations, Dresden Nuclear Power Station, 2016

Site	Site Type	Location
CBG	Storm Sewer	10 feel west of RP Office
DSP-105	Monitoring Well	30 feet east of the east wall of the EM Shop
DSP-106	Monitoring Well	65 feet east of east wall of EM Shop
DSP-107	Monitoring Well	9 feet east of the east Unit 1 Fuel Pool wall
DSP-108	Monitoring Well	40 ft east of the Unit 1 Sphere
DSP-117	Monitoring Well	Northeast of Unit 1 Sphere; 825 feet west of Ross Bridge
DSP-121	Monitoring Well	72 feet north of 2/3 Intake Canal fence
DSP-122	Monitoring Well	50 feet north of the Radwaste Tank Farm
DSP-123	Monitoring Well	Northeast corner of the Unit 1 Off-gas Building
DSP-124	Monitoring Well	9 feet south of Floor Drain Collector Tank
DSP-125	Monitoring Well	Northeast corner of the Unit 2/3A CST
DSP-126	Monitoring Well	21 feet northwest of the northwest bend in road behind Training Building
DSP-147	Monitoring Well	325 feet west of Telemetry Bridge
DSP-148	Monitoring Well	130 feet southeast of the Flow Regulating Station building
DSP-149R	Monitoring Well	35 feet south by southwest of the 138 KV yard fence
DSP-150	Monitoring Well	85 feet east of the northeast corner of the Unit 1 Spent Fuel Pool pad
DSP-151	Monitoring Well	65 feet north of the northeast corner of the Storeroom
DSP-152	Monitoring Well	210 feet south by southeast of the southeast corner of Maintenance Garage
DSP-153	Monitoring Well	150 feet east of the southeast corner of liquid hydrogen tank farm fence
DSP-154	Monitoring Well	33 feet west of the track; 165 feet east of the Security Checkpoint
DSP-156	Monitoring Well	70 feet east by northeast of the northwest corner of 138 KV yard fence
DSP-157-I	Monitoring Well	25 feet south of the south edge of the Employee Parking lot
DSP-157-M	Monitoring Well	25 feet south of the south edge of the Employee Parking lot
DSP-157-S	Monitoring Well	25 feet south of the south edge of the Employee Parking lot
DSP-158-I	Monitoring Well	53 feet west of the Kankakee River; 33 feet west of the cinder track
DSP-158-M	Monitoring Well	53 feet west of the Kankakee River; 33 feet west of the cinder track
DSP-158-S	Monitoring Well	50 feet west of the Kankakee River; 33 feet west of the cinder track
DSP-159-I	Monitoring Well	250 feet west of the Thorsen house; 450 ft south of the plant access gate
DSP-159-M	Monitoring Well	250 feet west of the Thorsen house; 450 ft south of the plant access gate
DSP-159-S	Monitoring Well	251 feet west of the Thorsen house; 450 ft south of the plant access gate
MW-DN-101-I	Monitoring Well	60 feet north of the Unit 1 Diesel Fuel Storage
MW-DN-101-S	Monitoring Well	60 feet north of the Unit 1 Diesel Fuel Storage
MW-DN-102-I	Monitoring Well	12 feet south of the southeast corner of the MUDS Building
MW-DN-102-S	Monitoring Well	13 feet south of the southeast corner of the MUDS Building
MW-DN-103-I	Monitoring Well	280 feet west of the northwest corner of N-GET Building
MW-DN-103-S	Monitoring Well	281 feet west of the northwest corner of N-GET Building
MW-DN-104-S	Monitoring Well	50 feet north of Radwaste Tank Farm
MW-DN-105-S	Monitoring Well	65 feet north of the northeast corner of the Storeroom
MW-DN-106-S	Monitoring Well	75 feet north of the 2/3 Intake Canal fence; east of the Unit 1 Intake Canal
MW-DN-107-S	Monitoring Well	15 feet west by southwest of the Unit 1 CST
MW-DN-108-I	Monitoring Well	7 feet southwest of the southwest corner of the Unit 1 Cribhouse
MW-DN-109-I	Monitoring Well	8 feet north of Chemistry Building
MW-DN-109-S	Monitoring Well	8 feet north of Chemistry Building
MW-DN-110-I	Monitoring Well	25 feet west of the Waste Water Treatment (WWT) Building
MW-DN-110-S	Monitoring Well	25 feet west of the Waste Water Treatment (WWT) Building
MW-DN-111-S	Monitoring Well	9 feet east of the Floor Drain Collector Tank
MW-DN-112-I	Monitoring Well	100 feet south of the Chemistry Building
MW-DN-112-S	Monitoring Well	100 feet south of the Chemistry Building
MW-DN-113-I	Monitoring Well	90 feet west of the southwest corner of the Administration Building
MW-DN-113-S	Monitoring Well	91 feet west of the southwest corner of the Administration Building
MW-DN-114-I	Monitoring Well	50 feet east of the Unit 1 Clean Demineralized Water Tank
MW-DN-114-S	Monitoring Well	8 feet southwest of the Radiation protection Dept west access doors
MW-DN-115-I	Monitoring Well	11 feet south of Instrument Maintenance Shop
MW-DN-115-S	Monitoring Well	12 feet south of Instrument Maintenance Shop
MW-DN-116-I	Monitoring Well	75 feet south of the Calgon Building roll-up door
MW-DN-116-S	Monitoring Well	75 feet south of the Calgon Building roll-up door
MW-DN-117-I	Monitoring Well	35 feet east by northeast of the Unit 1 Stack
MW-DN-118-S	Monitoring Well	Southeast corner of the Unit 1 Fuel Pool
MW-DN-119-I	Monitoring Well	20 feet east by northeast of the Unit 1 Sewage Ejector Building
MW-DN-119-S	Monitoring Well	21 feet east by northeast of the Unit 1 Sewage Ejector Building
MW-DN-120-I	Monitoring Well	45 feet north by northeast of the Ross Bridge railing
MW-DN-120-S	Monitoring Well	46 feet north by northeast of the Ross Bridge railing

TABLE A-1: Radiological Groundwater Protection Program - Sampling Locations, Dresden Nuclear Power Station, 2016

Site	Site Type	Location
MW-DN-121-S	Monitoring Well	7 feet west of the dirt road; 42 feet east of the 345KV yard fence
MW-DN-122-I	Monitoring Well	150 feet north of Collins Road; northeast of the G.E. Fuel Storage Facility
MW-DN-122-S	Monitoring Well	150 feet north of Collins Road; northeast of the G.E. Fuel Storage Facility
MW-DN-123-I	Monitoring Well	400 feet west of the Thorsen house; west of the Cold Canal
MW-DN-123-S	Monitoring Well	400 feet west of the Thorsen house; west of the Cold Canal
MW-DN-124-I	Monitoring Well	10 feet south of the liquid nitrogen inerting tanks
MW-DN-124-S	Monitoring Well	10 feet south of the liquid nitrogen inerting tanks
MW-DN-125-S	Monitoring Well	40 feet east of 2/3 B CST
MW-DN-126-S	Monitoring Well	15 feet south of fence around Unit 2/3 A CST and B CST (outside of fence)
MW-DN-127-S	Monitoring Well	20 feet south of Unit 3 HRSS
MW-DN-134-S	Monitoring Well	20-ft North of Mausoleum Building
MW-DN-135-S	Monitoring Well	20-ft East of Mausoleum Building
MW-DN-136-S	Monitoring Well	14.5-ft South of Mausoleum Building
MW-DN-137-S	Monitoring Well	20-ft West of Mausoleum Building
MW-DN-140-S	Monitoring Well	East of MW-DN-104S at SW corner outside of 2/3 crib house
MW-DN-141-S	Monitoring Well	North of 'A' Waste Tank next to 2/3 main chimney
MD-11	Sample Location	Piping located between Condensate Storage Tanks.
DSP-131	Surface Water	Storm water – 35 ft NE of the Unit 2/3 heating boiler 150,000 gallon diesel fuel storage tank 15 ft W of the hot canal fence – underneath Security Block
DSP-132	Surface Water	Storm water – 150 ft NE of the Unit 1 Sphere. The sewer is in the middle of the road with a solid cover (no slots). There are two other sewers in the vicinity with solid covers on them, but both have the word "SANITARY" on the cover. The sewer is 66 ft SE of the Unit 1 diesel fuel transfer shed.
DSP-133	Surface Water	Storm water ditch north of Pre-Access Facility
SW-DN-101	Surface Water	Unit 2/3 Intake (DSP50) at the Ross Bridge
SW-DN-102	Surface Water	Unit 2/3 Discharge (DSP20) at the Telemetry Bridge
SW-DN-103	Surface Water	Unit 2/3 Return Canal at the Discharge to the Intake Canal
SW-DN-104	Surface Water	Cold Canal (DSP34A) at the Cooling Tower walkway bridge
SW-DN-105	Surface Water	Hot Canal (DSP34B) at the Cooling Tower walkway bridge
SW-DN-106	Surface Water	Cooling Pond - Pool II at the east side of the Covered Bridge
2/3 Discharge Hot Canal Level	Surface Water	2/3 Discharge Hot Canal Headworks
2/3 Cribhouse Cold Canal Level	Surface Water	2/3 Cribhouse
Unit 1 Cribhouse Intake Level	Surface Water	Unit 1 Cribhouse
FW-1	Precipitation	40 feet southwest of Unit 2/3 Off-gas Filter Building access door; north end of guardrail
FW-2	Precipitation	50 feet East of Chem Feed Trailer
FW-3	Precipitation	South of Stock Truck Bay rollup door
FW-4	Precipitation	Southeast corner of Unit 3 RB Interlock
FW-5	Precipitation	East of Unit 2/3 Intake Ross barrier
FW-6	Precipitation	North of Unit 1 Chimney
FW-7	Precipitation	Southeast of Unit 2 TB Trackway
FW-8	Precipitation	Southwest corner of 2/3 CST on fence
FW-9	Precipitation	South of MUDS Building on Security fence
FW-10	Precipitation	At the fence at the northwest corner of the SBO Building
FW-11	Precipitation	30 feet east of the east wall of the EM shop; at the stanchion for RGPP well DSP-105
FW-12	Precipitation	60 feet southeast of the southwest corner of the Admin Building; on the security fence

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APPENDIX B

DATA TABLES

TABLE B-I.1 CONCENTRATIONS OF TRITIUM, STRONTIUM, GROSS ALPHA, AND GROSS BETA IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF DRESDEN NUCLEAR POWER STATION, 2016

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE		H-3	Sr-89	Sr-90	Gr-A (Dis)	Gr-A (Sus)	Gr-B (Dis)	Gr-B (Sus)
CBG	05/23/16		13200 ± 1370						
DSP-105	02/12/16		212 ± 124						
DSP-105	02/12/16	*Original*	194 ± 125						
DSP-105	02/12/16	*Reanalysis*	229 ± 121						
DSP-105	06/01/16		< 176	< 8.3	< 0.6	< 2.5	< 0.6	7.5 ± 1.5	< 1.4
DSP-105	08/22/16		< 181						
DSP-105	10/12/16		< 194						
DSP-106	02/12/16		1900 ± 254						
DSP-106	06/01/16		1750 ± 236	< 8.8	< 0.7	< 1.8	< 0.6	5.6 ± 1.2	< 1.4
DSP-106	08/22/16		1820 ± 244						
DSP-106	10/12/16		1650 ± 224						
DSP-107	02/12/16		2670 ± 328						
DSP-107	05/31/16	*Original*	1980 ± 258	< 6.4	< 0.7	< 2.7	1.9 ± 0.9	3.8 ± 1.4	< 2.8
DSP-107	05/31/16	*Recount*					2.8 ± 1.6		
DSP-107	08/22/16		2020 ± 265						
DSP-107	10/12/16		1930 ± 260						
DSP-108	02/11/16		711 ± 147						
DSP-108	06/01/16		567 ± 135	< 6.4	< 0.7	< 3.0	< 0.6	15.7 ± 2.0	< 1.4
DSP-108	08/22/16		481 ± 131						
DSP-108	10/12/16		524 ± 145						
DSP-122	02/09/16		1230 ± 192						
DSP-122	05/27/16		668 ± 140						
DSP-122	08/18/16		526 ± 136						
DSP-122	10/10/16		666 ± 152						
DSP-123	02/11/16		1310 ± 201						
DSP-123	05/31/16		1180 ± 182	< 4.6	< 0.8	< 2.6	< 0.6	16.9 ± 2.0	< 1.4
DSP-123	08/18/16		959 ± 165						
DSP-123	10/11/16		1130 ± 185						
DSP-124	02/15/16		1800 ± 246						
DSP-124	05/26/16		1610 ± 224						
DSP-124	08/16/16		1990 ± 260						
DSP-124	10/18/16		1910 ± 258						
DSP-125	02/15/16		1060 ± 175						
DSP-125	05/23/16		798 ± 166						
DSP-125	06/17/16		520 ± 140	< 7.8	< 0.6	< 12.6	2.9 ± 1.1	25.9 ± 4.5	< 3.8
DSP-125	08/15/16		562 ± 136						
DSP-125	10/13/16		493 ± 145						
DSP-126	05/31/16		< 179						
DSP-132	05/31/16		4700 ± 524						
DSP-147	05/30/16		< 180						
DSP-148	02/16/16		248 ± 132						
DSP-148	06/02/16		< 183						
DSP-148	08/23/16		< 180						
DSP-148	10/18/16		< 194						
DSP-149R	02/16/16		474 ± 145						
DSP-149R	06/02/16		394 ± 130						
DSP-149R	08/23/16		459 ± 131						
DSP-149R	10/18/16		439 ± 142						
DSP-150	02/12/16		< 200						
DSP-150	05/31/16		< 177						
DSP-150	08/22/16		< 175						
DSP-150	10/12/16		< 196						
DSP-151	02/08/16		< 192						
DSP-151	06/01/16		< 175						
DSP-151	08/18/16		< 180						
DSP-151	10/12/16		< 195						
DSP-154	05/30/16		< 185						
DSP-156	02/16/16		< 200						
DSP-156	06/02/16		< 182						
DSP-156	08/23/16		< 178						
DSP-156	10/18/16		< 195						
DSP-157-S	06/06/16		< 184						
DSP-157-M	06/06/16		< 183						
DSP-159-S	06/07/16		< 181						
DSP-159-M	06/07/16		193 ± 120						

TABLE B-I.1 CONCENTRATIONS OF TRITIUM, STRONTIUM, GROSS ALPHA, AND GROSS BETA IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF DRESDEN NUCLEAR POWER STATION, 2016

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE		H-3	Sr-89	Sr-90	Gr-A (Dis)	Gr-A (Sus)	Gr-B (Dis)	Gr-B (Sus)
MD-11	05/23/16		419000 ± 40700						
MD-11	10/13/16		287000 ± 28300	< 4.2	< 0.4	< 1.2	< 0.8	23.0 ± 1.5	< 1.6
MW-DN-101-I	02/11/16		583 ± 148						
MW-DN-101-I	05/31/16		584 ± 136	< 5.2	< 0.4	< 3.1	< 1.0	12.4 ± 1.9	< 2.6
MW-DN-101-I	08/18/16		577 ± 138						
MW-DN-101-I	10/11/16		594 ± 149						
MW-DN-101-S	02/11/16		< 197						
MW-DN-101-S	05/31/16		< 176	< 2.8	< 0.3	< 8.7	< 3.4	9.9 ± 5.7	5.5 ± 2.5
MW-DN-101-S	08/18/16		< 176						
MW-DN-101-S	10/11/16		< 194						
MW-DN-102-I	02/15/16		< 197						
MW-DN-102-I	05/24/16		< 181	< 5.3	< 0.5	< 2.6	< 0.4	2.4 ± 1.2	< 1.6
MW-DN-102-I	08/16/16		< 176						
MW-DN-102-I	10/17/16		< 197						
MW-DN-102-S	02/15/16		< 198						
MW-DN-102-S	05/24/16		< 183	< 3.6	< 0.4	< 51.8	< 5.0	30.6 ± 13.7	< 7.2
MW-DN-102-S	08/16/16		< 177						
MW-DN-102-S	10/17/16		< 194						
MW-DN-103-I	06/06/16		< 181						
MW-DN-103-S	06/06/16		< 183						
MW-DN-104-S	02/09/16		236 ± 131						
MW-DN-104-S	05/27/16		< 193						
MW-DN-104-S	08/18/16		< 181						
MW-DN-104-S	10/10/16		300 ± 133						
MW-DN-105-S	02/08/16	*Original*	< 197	< 7.7	1.9 ± 0.8				
MW-DN-105-S	02/08/16	*Recount*			2.5 ± 0.4				
MW-DN-105-S	06/01/16		< 190	< 3.6	< 0.4				
MW-DN-105-S	08/18/16		< 179	< 4.6	1.1 ± 0.4				
MW-DN-105-S	10/12/16		< 195	< 4.5	0.7 ± 0.3				
MW-DN-105-S	04/12/16				2.5 ± 0.7				
MW-DN-106-S	06/02/16		< 182						
MW-DN-107-S	02/12/16		< 199						
MW-DN-107-S	05/23/16		310 ± 127						
MW-DN-107-S	08/15/16		181 ± 119						
MW-DN-107-S	10/13/16		< 200						
MW-DN-108-I	02/11/16		< 197						
MW-DN-108-I	05/27/16	*Original*	< 184	< 6.0	< 0.6	< 2.2	3.9 ± 1.6	11.6 ± 1.6	15.8 ± 2.4
MW-DN-108-I	05/27/16	*Recount*					4.5 ± 2.6		15.0 ± 3.3
MW-DN-108-I	08/17/16		< 180						
MW-DN-108-I	10/10/16		< 193						
MW-DN-109-I	02/08/16		518 ± 144						
MW-DN-109-I	02/08/16	*Original*	422 ± 134						
MW-DN-109-I	02/08/16	*Reanalysis*	470 ± 134						
MW-DN-109-I	05/26/16		417 ± 129	< 5.0	< 0.5	< 4.3	< 0.4	10.9 ± 1.7	< 1.5
MW-DN-109-I	08/17/16		< 183						
MW-DN-109-I	10/10/16		504 ± 144						
MW-DN-109-S	02/08/16		< 196						
MW-DN-109-S	05/26/16		< 179	< 2.8	< 0.3	< 6.5	< 2.1	14.0 ± 4.7	< 3.7
MW-DN-109-S	08/17/16		< 177						
MW-DN-109-S	10/10/16		220 ± 129						
MW-DN-110-I	02/09/16		< 188						
MW-DN-110-I	05/26/16		< 183						
MW-DN-110-I	08/17/16		< 179						
MW-DN-110-I	10/10/16		218 ± 132						
MW-DN-110-I	10/10/16	*Original*	240 ± 127						
MW-DN-110-I	10/10/16	*Reanalysis*	231 ± 125						
MW-DN-110-S	02/09/16		< 193						
MW-DN-110-S	05/26/16		< 179						
MW-DN-110-S	08/17/16		< 180						
MW-DN-110-S	10/10/16		< 192						
MW-DN-111-S	02/15/16		472 ± 120						
MW-DN-111-S	02/15/16	*Original*	346 ± 135						
MW-DN-111-S	02/15/16	*Reanalysis*	316 ± 125						
MW-DN-111-S	05/26/16		599 ± 139						
MW-DN-111-S	08/16/16	*Original*	256 ± 122						

TABLE B-I.1 CONCENTRATIONS OF TRITIUM, STRONTIUM, GROSS ALPHA, AND GROSS BETA IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF DRESDEN NUCLEAR POWER STATION, 2016

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE		H-3	Sr-89	Sr-90	Gr-A (Dis)	Gr-A (Sus)	Gr-B (Dis)	Gr-B (Sus)
MW-DN-111-S	08/16/16	*Reanalysis*	381 ± 118						
MW-DN-111-S	10/18/16		323 ± 134						
MW-DN-112-I	02/08/16		< 193						
MW-DN-112-I	05/26/16		< 179						
MW-DN-112-I	08/16/16		< 181						
MW-DN-112-I	10/18/16		< 196						
MW-DN-112-S	02/08/16		< 191						
MW-DN-112-S	05/26/16		< 185						
MW-DN-112-S	08/16/16		< 180						
MW-DN-112-S	10/18/16		< 191						
MW-DN-113-I	02/12/16		820 ± 146						
MW-DN-113-I	02/12/16	*Original*	636 ± 209						
MW-DN-113-I	02/12/16	*Reanalysis*	537 ± 135						
MW-DN-113-I	05/24/16	*Original*	< 181	< 4.6	< 0.3	< 8.9	9.7 ± 2.5	18.3 ± 5.6	9.0 ± 2.6
MW-DN-113-I	05/24/16	*Recount*					10.5 ± 2.2		8.8 ± 2.7
MW-DN-113-I	08/16/16		< 182						
MW-DN-113-I	10/17/16		< 195						
MW-DN-113-S	02/12/16		< 186						
MW-DN-113-S	05/24/16	*Original*	< 184	< 5.6	< 0.5	< 3.0	6.7 ± 2.3	< 3.9	8.0 ± 2.6
MW-DN-113-S	05/24/16	*Recount*					9.0 ± 2.1		8.5 ± 2.5
MW-DN-113-S	08/16/16		< 183						
MW-DN-113-S	10/17/16		< 195						
MW-DN-114-I	02/08/16		11700 ± 1220						
MW-DN-114-I	02/08/16	*Original*	12000 ± 1250						
MW-DN-114-I	02/08/16	*Reanalysis*	12800 ± 1330						
MW-DN-114-I	06/01/16		10700 ± 1120						
MW-DN-114-I	08/19/16		6370 ± 688						
MW-DN-114-I	10/13/16		7350 ± 791						
MW-DN-114-S	02/08/16		2110 ± 269						
MW-DN-114-S	02/08/16	*Original*	2010 ± 259						
MW-DN-114-S	02/08/16	*Reanalysis*	2070 ± 265						
MW-DN-114-S	05/23/16		1670 ± 233						
MW-DN-114-S	08/19/16		< 185						
MW-DN-114-S	10/13/16		6500 ± 705						
MW-DN-115-I	02/12/16		426 ± 135						
MW-DN-115-I	05/24/16		460 ± 133						
MW-DN-115-I	08/22/16		219 ± 122						
MW-DN-115-I	10/13/16		439 ± 142						
MW-DN-115-S	02/12/16		< 192						
MW-DN-115-S	05/24/16		< 180						
MW-DN-115-S	08/22/16		< 170						
MW-DN-115-S	10/13/16		< 193						
MW-DN-116-I	02/09/16		281 ± 130						
MW-DN-116-I	05/31/16		756 ± 149	< 4.2	< 0.4	< 3.8	< 0.4	18.0 ± 2.0	< 1.5
MW-DN-116-I	08/17/16		237 ± 116						
MW-DN-116-I	10/11/16		230 ± 128						
MW-DN-116-S	02/09/16		195 ± 125						
MW-DN-116-S	05/31/16		< 180	< 3.9	< 0.4	< 4.8	< 0.7	18.3 ± 2.0	< 2.1
MW-DN-116-S	08/17/16		188 ± 114						
MW-DN-116-S	10/11/16		199 ± 128						
MW-DN-117-I	02/11/16		< 187						
MW-DN-117-I	10/11/16		< 196						
MW-DN-118-S	02/12/16		346 ± 133						
MW-DN-118-S	05/31/16		378 ± 129	< 2.5	< 0.3	< 4.8	< 0.9	13.2 ± 1.9	< 1.4
MW-DN-118-S	08/22/16		245 ± 113						
MW-DN-118-S	10/12/16		222 ± 131						
MW-DN-119-I	02/11/16		< 191						
MW-DN-119-I	06/01/16		< 180	< 2.2	< 0.3	< 4.4	< 0.9	21.6 ± 2.2	< 1.4
MW-DN-119-I	08/19/16		< 166						
MW-DN-119-I	10/11/16		193 ± 122						
MW-DN-119-S	02/11/16		< 193						
MW-DN-119-S	06/01/16		< 180	< 5.3	< 0.7	< 7.2	< 2.4	10.8 ± 4.6	< 3.9
MW-DN-119-S	08/19/16		< 171						
MW-DN-119-S	10/11/16		< 199						
MW-DN-122-I	05/30/16		< 181						

TABLE B-I.1 CONCENTRATIONS OF TRITIUM, STRONTIUM, GROSS ALPHA, AND GROSS BETA IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF DRESDEN NUCLEAR POWER STATION, 2016

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE		H-3	Sr-89	Sr-90	Gr-A (Dis)	Gr-A (Sus)	Gr-B (Dis)	Gr-B (Sus)
MW-DN-122-S	05/30/16		< 179						
MW-DN-124-I	02/15/16		32000 ± 3250						
MW-DN-124-I	05/26/16		30500 ± 3090	< 9.1	< 0.7	< 5.3	< 1.7	18.0 ± 4.9	< 3.8
MW-DN-124-I	08/19/16		25700 ± 2620						
MW-DN-124-I	10/17/16		29800 ± 3020						
MW-DN-124-S	02/15/16		4860 ± 540						
MW-DN-124-S	05/26/16		6040 ± 658	< 2.6	< 0.3	< 5.8	2.4 ± 1.4	16.6 ± 5.3	4.9 ± 2.6
MW-DN-124-S	08/19/16		3510 ± 408						
MW-DN-124-S	10/17/16		746 ± 158						
MW-DN-125-S	02/15/16		< 191						
MW-DN-125-S	06/07/16		< 180	< 2.7	< 0.2	< 3.6	< 0.7	< 2.2	< 1.7
MW-DN-125-S	08/19/16		< 167						
MW-DN-125-S	10/17/16		< 194						
MW-DN-126-S	02/15/16		4290 ± 491						
MW-DN-126-S	05/23/16		2600 ± 318	< 4.0	< 0.5	< 4.2	< 1.8	< 6.4	< 3.7
MW-DN-126-S	08/15/16		351 ± 119						
MW-DN-126-S	08/15/16	*Original*	352 ± 124						
MW-DN-126-S	08/15/16	*Reanalysis*	334 ± 114						
MW-DN-126-S	10/17/16		2590 ± 321						
MW-DN-127-S	02/15/16	*Original*	1550 ± 225						
MW-DN-127-S	02/15/16	*Reanalysis*	1250 ± 191						
MW-DN-127-S	05/24/16		348 ± 126	< 9.0	< 0.7	< 2.0	< 0.7	3.4 ± 1.2	< 1.6
MW-DN-127-S	08/19/16		880 ± 156						
MW-DN-127-S	10/13/16		587 ± 149						
MW-DN-134-S	02/10/16		< 192						
MW-DN-134-S	05/30/16		< 171	< 2.8	< 0.3	< 4.4	< 0.7	9.4 ± 1.7	< 1.6
MW-DN-134-S	08/23/16		< 168						
MW-DN-134-S	10/18/16		< 198						
MW-DN-135-S	02/10/16		< 190						
MW-DN-135-S	05/30/16		< 180	< 4.3	< 0.4	< 3.2	< 0.7	9.1 ± 1.6	< 1.6
MW-DN-135-S	08/23/16		< 169						
MW-DN-135-S	10/18/16		< 194						
MW-DN-136-S	02/10/16		< 195						
MW-DN-136-S	05/30/16		< 176	< 3.9	< 0.4	< 7.9	< 2.6	< 6.9	8.6 ± 2.7
MW-DN-136-S	08/23/16		< 171						
MW-DN-136-S	10/18/16		< 188						
MW-DN-137-S	02/10/16		< 193						
MW-DN-137-S	05/30/16		< 171	< 3.2	< 0.2	< 6.7	< 2.5	9.6 ± 4.0	< 3.9
MW-DN-137-S	08/23/16		< 167						
MW-DN-137-S	10/18/16		< 184						
MW-DN-140-S	02/09/16		713 ± 147						
MW-DN-140-S	05/27/16		492 ± 133						
MW-DN-140-S	08/18/16		346 ± 120						
MW-DN-140-S	10/10/16		399 ± 139						
MW-DN-141-S	02/09/16		961 ± 168						
MW-DN-141-S	02/09/16		870 ± 157						
MW-DN-141-S	05/27/16		1860 ± 249	< 3.7	< 1.0	< 1.1	< 0.9	13.9 ± 1.4	< 1.4
MW-DN-141-S	08/17/16		883 ± 161						
MW-DN-141-S	10/10/16		586 ± 145						
MW-DN-142-S	08/23/16		< 182	< 3.9	< 0.5	< 7.3	< 2.6	33.9 ± 3.6	5.0 ± 2.4
MW-DN-142-S	10/14/16		< 184						
MW-DN-143-S	08/23/16		< 183	< 4.8	< 0.9	< 2.2	< 0.8	7.4 ± 1.6	2.3 ± 0.8
MW-DN-143-S	10/14/16		< 196						
MW-DN-144-S	08/23/16	*Original*	< 180	< 4.2	< 0.5	< 4.2	1.3 ± 0.7	22.5 ± 2.1	7.7 ± 0.9
MW-DN-144-S	08/23/16	*Recount*					1.9 ± 1.0		6.3 ± 1.7
MW-DN-144-S	10/14/16		< 187						

TABLE B-I.2

CONCENTRATIONS OF GAMMA EMITTERS IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF DRESDEN NUCLEAR POWER STATION, 2016

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	Be-7	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140
DSP-105	02/12/16	< 63	< 70	< 7	< 6	< 15	< 5	< 13	< 5	< 8	< 15	< 5	< 6	< 35	< 13
DSP-105	06/01/16	< 25	< 19	< 2	< 3	< 6	< 2	< 5	< 2	< 4	< 12	< 2	< 2	< 21	< 7
DSP-105	08/22/16	< 47	< 35	< 5	< 6	< 14	< 5	< 11	< 4	< 9	< 14	< 6	< 6	< 29	< 10
DSP-105	10/12/16	< 22	< 14	< 2	< 2	< 4	< 2	< 4	< 2	< 4	< 15	< 2	< 2	< 23	< 6
DSP-106	02/12/16	< 43	< 117	< 7	< 7	< 14	< 6	< 13	< 6	< 11	< 15	< 5	< 6	< 32	< 10
DSP-106	06/01/16	< 31	< 67	< 3	< 3	< 7	< 3	< 6	< 3	< 5	< 13	< 3	< 3	< 25	< 9
DSP-106	08/22/16	< 39	< 92	< 4	< 5	< 9	< 5	< 10	< 5	< 8	< 12	< 4	< 5	< 24	< 9
DSP-106	10/12/16	< 16	< 26	< 1	< 2	< 3	< 1	< 3	< 2	< 3	< 15	< 1	< 1	< 20	< 6
DSP-107	02/12/16	< 63	< 58	< 6	< 7	< 16	< 7	< 13	< 7	< 10	< 15	< 8	< 9	< 44	< 13
DSP-107	05/31/16	< 28	< 63	< 3	< 4	< 8	< 3	< 6	< 4	< 6	< 14	< 3	< 3	< 27	< 10
DSP-107	08/22/16	< 60	< 137	< 6	< 8	< 16	< 7	< 12	< 7	< 12	< 15	< 6	< 6	< 40	< 12
DSP-107	10/12/16	< 17	< 12	< 1	< 2	< 4	< 1	< 3	< 2	< 3	< 15	< 1	< 1	< 20	< 7
DSP-108	02/11/16	< 40	< 41	< 5	< 5	< 10	< 5	< 8	< 6	< 8	< 10	< 5	< 5	< 24	< 8
DSP-108	06/01/16	< 25	< 49	< 2	< 3	< 6	< 2	< 5	< 3	< 5	< 11	< 2	< 3	< 22	< 7
DSP-108	08/22/16	< 44	< 42	< 4	< 5	< 11	< 5	< 10	< 5	< 9	< 11	< 4	< 5	< 25	< 9
DSP-108	10/12/16	< 16	< 13	< 1	< 2	< 3	< 1	< 3	< 2	< 3	< 14	< 1	< 1	< 20	< 6
DSP-123	02/11/16	< 57	< 122	< 7	< 5	< 11	< 7	< 12	< 4	< 14	< 14	< 6	< 7	< 36	< 11
DSP-123	05/31/16	< 23	< 24	< 2	< 2	< 6	< 2	< 5	< 3	< 5	< 11	< 2	< 2	< 23	< 8
DSP-123	08/18/16	< 15	< 29	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 8	< 1	< 2	< 15	< 4
DSP-123	10/11/16	< 16	< 14	< 1	< 2	< 4	< 1	< 3	< 2	< 3	< 14	< 1	< 1	< 21	< 7
DSP-125	06/17/16	< 63	< 151	< 7	< 9	< 22	< #	< 17	< 8	< 12	< 14	< 7	< 8	< 35	< 10
DSP-126	05/31/16	< 15	< 26	< 1	< 2	< 4	< 2	< 3	< 2	< 3	< 15	< 1	< 1	< 21	< 7
DSP-147	05/30/16	< 12	< 9	< 1	< 1	< 3	< 1	< 2	< 1	< 2	< 14	< 1	< 1	< 18	< 5
DSP-154	05/30/16	< 15	< 35	< 1	< 2	< 4	< 1	< 2	< 2	< 3	< 14	< 1	< 1	< 22	< 8
DSP-157-M	06/06/16	< 38	< 35	< 4	< 4	< 11	< 4	< 7	< 4	< 8	< 14	< 3	< 4	< 31	< 10
DSP 157-S	06/06/16	< 32	< 85	< 4	< 4	< 8	< 3	< 7	< 4	< 7	< 15	< 3	< 4	< 28	< 11
DSP 159-M	06/07/16	< 33	< 34	< 4	< 4	< 7	< 4	< 8	< 4	< 7	< 15	< 4	< 4	< 27	< 8
DSP 159-S	06/07/16	< 40	< 30	< 4	< 4	< 8	< 4	< 8	< 5	< 7	< 14	< 4	< 4	< 31	< 9
MD-11	10/13/16	< 17	44 ± 27	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 15	< 1	< 2	< 22	< 7
MW-DN-101-I	02/11/16	< 31	< 66	< 3	< 3	< 8	< 3	< 5	< 4	< 6	< 9	< 3	< 3	< 19	< 7
MW-DN-101-I	05/31/16	< 17	< 14	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 10	< 2	< 2	< 18	< 6
MW-DN-101-I	08/18/16	< 17	< 33	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 9	< 2	< 2	< 16	< 5
MW-DN-101-I	10/11/16	< 15	< 12	< 1	< 1	< 4	< 1	< 3	< 2	< 3	< 15	< 1	< 1	< 20	< 6
MW-DN-101-S	02/11/16	< 41	< 95	< 5	< 5	< 10	< 4	< 10	< 5	< 8	< 11	< 4	< 4	< 25	< 11
MW-DN-101-S	05/31/16	< 17	< 15	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 11	< 2	< 2	< 18	< 6
MW-DN-101-S	08/18/16	< 23	< 21	< 3	< 3	< 6	< 3	< 5	< 3	< 5	< 11	< 2	< 2	< 23	< 8
MW-DN-101-S	10/11/16	< 15	< 32	< 1	< 2	< 4	< 1	< 3	< 2	< 3	< 15	< 1	< 1	< 21	< 6
MW-DN-102-I	05/24/16	< 12	< 9	< 1	< 1	< 3	< 1	< 2	< 1	< 2	< 14	< 1	< 1	< 17	< 5
MW-DN-102-S	05/24/16	< 9	< 5	< 1	< 1	< 2	< 1	< 1	< 1	< 2	< 14	< 1	< 1	< 16	< 4
MW-DN-103-I	06/06/16	< 35	< 70	< 4	< 4	< 10	< 4	< 8	< 4	< 7	< 15	< 3	< 4	< 31	< 11
MW-DN-103-S	06/06/16	< 39	< 38	< 4	< 4	< 10	< 4	< 8	< 5	< 7	< 15	< 4	< 4	< 32	< 8
MW-DN-106-S	06/02/16	< 30	< 29	< 3	< 3	< 8	< 3	< 6	< 4	< 6	< 15	< 3	< 3	< 29	< 11
MW-DN-108-I	02/11/16	< 47	< 42	< 5	< 4	< 11	< 4	< 8	< 5	< 9	< 12	< 4	< 5	< 32	< 9

TABLE B-I.2

CONCENTRATIONS OF GAMMA EMITTERS IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF DRESDEN NUCLEAR POWER STATION, 2016

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	Be-7	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140
MW-DN-108-I	05/27/16	< 22	< 40	< 2	< 2	< 5	< 2	< 4	< 3	< 4	< 14	< 2	< 2	< 23	< 8
MW-DN-108-I	08/17/16	< 22	< 17	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 12	< 2	< 2	< 20	< 6
MW-DN-108-I	10/10/16	< 14	< 10	< 1	< 1	< 3	< 1	< 2	< 1	< 2	< 14	< 1	< 1	< 19	< 6
MW-DN-109-I	05/26/16	< 16	< 14	< 1	< 2	< 4	< 2	< 3	< 2	< 3	< 11	< 1	< 1	< 17	< 6
MW-DN-109-S	05/26/16	< 22	< 14	< 2	< 2	< 4	< 2	< 4	< 2	< 4	< 15	< 2	< 2	< 23	< 7
MW-DN-113-I	05/24/16	< 10	< 21	< 1	< 1	< 2	< 1	< 1	< 1	< 2	< 14	< 1	< 1	< 17	< 6
MW-DN-113-S	05/24/16	33 ± 12	< 9	< 0	< 0	< 1	< 0	< 1	< 1	< 1	< 15	< 0	< 0	< 14	< 4
MW-DN-116-I	02/09/16	< 33	< 30	< 4	< 4	< 8	< 4	< 7	< 4	< 8	< 11	< 3	< 4	< 26	< 9
MW-DN-116-I	05/31/16	< 17	< 15	< 2	< 2	< 4	< 2	< 3	< 2	< 4	< 12	< 2	< 2	< 19	< 6
MW-DN-116-I	08/17/16	< 22	< 20	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 12	< 2	< 2	< 21	< 7
MW-DN-116-I	10/11/16	< 14	< 11	< 1	< 1	< 3	< 1	< 2	< 2	< 2	< 14	< 1	< 1	< 21	< 6
MW-DN-116-S	02/09/16	< 34	< 63	< 3	< 3	< 8	< 4	< 6	< 4	< 7	< 11	< 4	< 4	< 23	< 8
MW-DN-116-S	05/31/16	< 15	< 13	< 1	< 2	< 4	< 1	< 3	< 2	< 3	< 10	< 1	< 1	< 16	< 5
MW-DN-116-S	08/17/16	< 20	< 18	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 11	< 2	< 2	< 19	< 6
MW-DN-116-S	10/11/16	< 14	< 31	< 1	< 1	< 3	< 1	< 2	< 1	< 3	< 14	< 1	< 1	< 19	< 5
MW-DN-117-I	02/11/16	< 34	< 31	< 3	< 4	< 8	< 3	< 7	< 3	< 6	< 9	< 4	< 4	< 22	< 6
MW-DN-117-I	10/11/16	< 15	< 11	< 1	< 2	< 4	< 1	< 3	< 2	< 3	< 15	< 1	< 1	< 21	< 7
MW-DN-118-S	02/12/16	< 46	< 123	< 5	< 5	< 10	< 5	< 8	< 6	< 8	< 14	< 5	< 5	< 30	< 11
MW-DN-118-S	05/31/16	< 23	< 20	< 2	< 3	< 6	< 2	< 5	< 3	< 5	< 15	< 2	< 2	< 24	< 9
MW-DN-118-S	08/22/16	< 40	< 70	< 4	< 4	< 9	< 4	< 8	< 5	< 7	< 15	< 4	< 4	< 29	< 11
MW-DN-118-S	10/12/16	< 16	< 13	< 1	< 2	< 4	< 1	< 3	< 2	< 3	< 15	< 1	< 1	< 22	< 7
MW-DN-119-I	06/01/16	< 19	< 17	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 12	< 2	< 2	< 21	< 6
MW-DN-119-S	06/01/16	< 13	< 30	< 1	< 1	< 3	< 1	< 3	< 2	< 3	< 9	< 1	< 1	< 16	< 6
MW-DN-122-I	05/30/16	< 15	< 37	< 1	< 2	< 4	< 1	< 3	< 2	< 3	< 14	< 1	< 1	< 21	< 7
MW-DN-122-S	05/30/16	< 16	< 41	< 1	< 2	< 4	< 1	< 3	< 2	< 3	< 15	< 1	< 1	< 20	< 8
MW-DN-124-I	05/26/16	< 11	< 10	< 1	< 1	< 3	< 1	< 2	< 1	< 2	< 15	< 1	< 1	< 19	< 5
MW-DN-124-I	10/17/16	< 20	< 18	< 2	< 2	< 6	< 2	< 4	< 3	< 4	< 14	< 2	< 2	< 24	< 8
MW-DN-124-S	05/26/16	< 12	< 20	< 1	< 1	< 2	< 1	< 2	< 1	< 2	< 15	< 1	< 1	< 19	< 4
MW-DN-124-S	10/17/16	< 20	79 ± 26	< 2	< 2	< 4	< 2	< 4	< 2	< 4	< 15	< 2	< 2	< 22	< 5
MW-DN-125-S	06/07/16	< 44	< 30	< 4	< 4	< 10	< 6	< 7	< 5	< 9	< 15	< 4	< 5	< 32	< 9
MW-DN-126-S	05/23/16	< 8	< 16	< 1	< 1	< 2	< 1	< 1	< 1	< 1	< 14	< 1	< 1	< 17	< 5
MW-DN-127-S	05/24/16	< 11	< 15	< 1	< 1	< 2	< 1	< 1	< 1	< 2	< 15	< 1	< 1	< 17	< 5
MW-DN-134-S	05/30/16	< 13	< 34	< 1	< 1	< 3	< 1	< 2	< 1	< 2	< 14	< 1	< 1	< 18	< 7
MW-DN-135-S	05/30/16	< 11	< 8	< 1	< 1	< 3	< 1	< 2	< 1	< 2	< 14	< 1	< 1	< 17	< 4
MW-DN-136-S	05/30/16	< 13	< 10	< 1	< 1	< 3	< 1	< 2	< 1	< 2	< 14	< 1	< 1	< 18	< 6
MW-DN-137-S	05/30/16	< 14	< 10	< 1	< 1	< 3	< 1	< 3	< 2	< 3	< 15	< 1	< 1	< 21	< 8
MW-DN-141-S	05/27/16	< 22	< 48	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 14	< 2	< 2	< 23	< 8
MW-DN-142-S	08/23/16	< 42	< 41	< 4	< 5	< 12	< 4	< 9	< 5	< 9	< 14	< 4	< 5	< 31	< 10
MW-DN-143-S	08/23/16	< 41	< 41	< 5	< 5	< 10	< 5	< 9	< 6	< 9	< 14	< 4	< 4	< 30	< 10
MW-DN-144-S	08/23/16	< 22	< 21	< 2	< 2	< 5	< 2	< 5	< 3	< 4	< 8	< 2	< 2	< 16	< 5

TABLE B-I.3

CONCENTRATIONS OF HARD TO DETECTS IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF DRESDEN NUCLEAR POWER STATION, 2016

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	Am-241	Cm-242	Cm-243/244	Pu-238	Pu-239/240	U-233/234	U-235	U-238	Fe-55	Ni-63
MD-11	10/13/16	< 0.04	< 0.06	< 0.06	< 0.04	< 0.11	< 0.10	< 0.06	< 0.10	< 134	< 3.1
MW-DN-124-I	05/26/16	< 0.17	< 0.12	< 0.07	< 0.08	< 0.04	< 0.13	< 0.08	0.24 ± 0.14	< 168	< 3.8
MW-DN-124-S	05/26/16	< 0.04	< 0.04	< 0.04	< 0.09	< 0.16	< 0.03	< 0.06	< 0.14	< 152	< 3.2

TABLE B-II.1 CONCENTRATIONS OF TRITIUM IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF DRESDEN NUCLEAR POWER STATION, 2016

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE		H-3
DSP-131	02/15/16		408 ± 134
DSP-131	05/27/16		298 ± 122
DSP-131	08/17/16		321 ± 126
DSP-131	10/10/16		427 ± 138
DSP-132	02/15/16		1870 ± 253
DSP-132	02/15/16	*Recount*	2020 ± 269
DSP-132	02/15/16	*Reanalysis*	1960 ± 250
DSP-132	05/31/16		4970 ± 550
DSP-132	08/22/16		5760 ± 630
DSP-132	10/17/16		1770 ± 245
DSP-133	02/10/16		< 189
DSP-133	05/30/16		< 180
DSP-133	08/23/16		< 178
DSP-133	10/18/16		< 197
SW-DN-101	02/10/16	*Original*	< 187
SW-DN-101	02/10/16	*Reanalysis*	< 185
SW-DN-101	06/02/16		882 ± 156
SW-DN-101	08/23/16		1430 ± 208
SW-DN-101	10/18/16		1210 ± 185
SW-DN-102	02/10/16		368 ± 132
SW-DN-102	06/02/16		573 ± 132
SW-DN-102	08/23/16		413 ± 130
SW-DN-102	10/18/16		1380 ± 200
SW-DN-103	02/10/16		351 ± 129
SW-DN-103	06/02/16		433 ± 123
SW-DN-103	08/23/16		716 ± 146
SW-DN-103	10/18/16		1380 ± 199
SW-DN-104	02/10/16		317 ± 130
SW-DN-104	05/30/16		390 ± 123
SW-DN-104	08/23/16		208 ± 122
SW-DN-104	10/18/16		1220 ± 187
SW-DN-105	02/10/16		255 ± 126
SW-DN-105	05/30/16		525 ± 127
SW-DN-105	08/23/16	*Original*	1510 ± 217
SW-DN-105	08/23/16	*Recount*	1460 ± 208
SW-DN-105	08/23/16	*Reanalysis*	1480 ± 207
SW-DN-105	10/18/16		1070 ± 171
SW-DN-106	02/10/16		380 ± 132
SW-DN-106	05/30/16		435 ± 123
SW-DN-106	08/23/16		< 179
SW-DN-106	10/17/16		1190 ± 182

TABLE B-II.2

CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF DRESDEN NUCLEAR POWER STATION, 2016

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	Be-7	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140
DSP-131	05/27/16	< 20	< 29	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 13	< 2	< 2	< 21	< 6
DSP-132	05/31/16	< 23	< 42	< 2	< 2	< 5	< 3	< 5	< 3	< 5	< 12	< 2	< 2	< 22	< 7
DSP-133	05/30/16	< 13	< 10	< 1	< 1	< 3	< 1	< 2	< 1	< 2	< 15	< 1	< 1	< 20	< 6
SW-DN-101	06/02/16	< 17	< 43	< 1	< 2	< 5	< 1	< 4	< 2	< 4	< 14	< 1	< 2	< 21	< 8
SW-DN-102	06/02/16	< 15	< 17	< 1	< 2	< 3	< 1	< 3	< 2	< 3	< 14	< 1	< 2	< 22	< 6
SW-DN-103	06/02/16	< 16	< 14	< 1	< 2	< 4	< 2	< 3	< 2	< 3	< 15	< 1	< 2	< 21	< 7
SW-DN-104	05/30/16	< 14	< 10	< 1	< 1	< 3	< 1	< 3	< 2	< 3	< 15	< 1	< 1	< 20	< 6
SW-DN-105	05/30/16	< 13	< 22	< 1	< 1	< 3	< 1	< 2	< 1	< 3	< 14	< 1	< 1	< 19	< 5
SW-DN-106	05/30/16	< 13	< 8	< 1	< 1	< 3	< 1	< 2	< 1	< 2	< 14	< 1	< 1	< 18	< 4

TABLE B-III.1 **CONCENTRATIONS OF TRITIUM IN PRECIPITATION WATER SAMPLES COLLECTED IN THE VICINITY OF DRESDEN NUCLEAR POWER STATION, 2016**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	H-3
FW-1	06/07/16	< 181
FW-10	06/01/16	< 183
FW-11	06/01/16	< 181
FW-12	06/01/16	< 182