PNNL-20436-10

PNNL Richland Campus Radionuclide Air Emissions Report for Calendar Year 2019

May 2020

SF Snyder
JM Barnett
LE Bisping

Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830

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Pacific Northwest National Laboratory
Richland, Washington 99352

Summary

The U.S. Department of Energy (DOE) Office of Science (SC) Pacific Northwest National Laboratory (PNNL) Richland Campus facilities with the largest potential for radioactive air emissions are those at the Physical Sciences Facility. Operations conform to the Washington State Department of Health-issued Radioactive Air Emissions License-005.

This report documents radionuclide air emissions that result in the 2019 highest effective dose equivalent (EDE) to an offsite member of the public, referred to as the maximally exposed individual (MEI). The report has been prepared in compliance with the Code of Federal Regulations (CFR), Title 40, Protection of the Environment, Part 61, National Emission Standards for Hazardous Air Pollutants (NESHAP), Subpart H, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities" and Washington Administrative Code (WAC) Chapter 246-247, "Radiation Protection–Air Emissions."

Federal regulations in 40 CFR 61, Subpart H, require the measurement and reporting of radionuclides emitted from DOE facilities and the resulting offsite dose from those emissions. While the regulations are intended for the measurement of point source emissions, they include fugitive emissions with regard to complying with the dose standard. The regulations impose a standard of 10 mrem/yr EDE, which is not to be exceeded. Washington State adopted the 40 CFR 61 standard of 10 mrem/yr EDE in its regulations and reporting of the EDE to the MEI from both point source emissions and any fugitive source emissions of radionuclides. WAC 246-247 further requires the reporting of radionuclide emissions, including radon, from all PNNL Richland Campus sources.

The PNNL Richland Campus MEI dose from routine major and minor point source emissions in 2019 is 1.4E-05 mrem (1.4E-07 millisievert [mSv]) EDE. The MEI dose from all PNNL Richland Campus fugitive sources is 1.3E-06 mrem (1.3E-08 mSv) EDE. The dose from radon emissions is 1.5E-10 mrem (1.5E-12 mSv) EDE. No nonroutine emissions from Campus facilities occurred in 2019. The total radiological dose to the MEI from all PNNL Richland Campus radionuclide emissions in 2019, including fugitive emissions and radon, is 1.5E-05 mrem (1.5E-07 mSv) EDE, or more than 10,000 times less than the federal and state standard of 10 mrem/yr, with which the PNNL Richland Campus is in compliance.

For further information concerning this report, contact Thomas M. McDermott, DOE Pacific Northwest Site Office, by telephone at (509) 372-4675 or by e-mail at tom.mcdermott@science.doe.gov.

CERTIFICATION of PNNL-20436-10

DOE-SC
Pacific Northwest National Laboratory Campus
Radionuclide Air Emissions Report
Calendar Year 2019

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. See 18 U.S.C. 1001. [verbatim from 40 CFR 61, Subpart H, 61.94(b)(9)]

Roger E. Snyder Digitally signed by Roger E. Snyder
Date: 2020.05.20 18:37:46 -05'00'

Roger E. Snyder, Manager
U.S. Department of Energy
Pacific Northwest Site Office

Date

Acronyms and Abbreviations

Bq	becquerel(s)
CAP88-PC	Clean Air Act Assessment Package 1988-Personal Computer
CFR	Code of Federal Regulations
Ci	curie(s)
CY	calendar year
DOE	U.S. Department of Energy
ED	effective dose
EDE	effective dose equivalent
GBq	gigabecquerel [1.0×10^9 Bq = 1 GBq]
HEPA	high-efficiency particulate air (filter)
LLS	low-level sources
LSLII	Life Sciences Laboratory-II
Major	a radionuclide emission point source having a radiological dose potential of greater than 0.1 mrem/yr EDE, based on emissions that would result if all pollution-control equipment did not exist but facility operations were otherwise normal
MEI	maximally exposed individual
Minor	a radionuclide emission point source having a radiological dose potential of less than or equal to 0.1 mrem/yr EDE, based on emissions that would result if all pollution-control equipment did not exist but facility operations were otherwise normal
mrem	millirem [i.e., 1.0×10^{-3} rem = 1.0E-03 rem]
mSv	millisievert
NA	not applicable
ND	not detected
NDRM	non-dispersible radioactive material
NESHAP	National Emission Standards for Hazardous Air Pollutants
PIC	Potential Impact Category
PNNL	Pacific Northwest National Laboratory
PSF	Physical Sciences Facility
QA	quality assurance
RAEL	radioactive air emissions license
rem	roentgen equivalent man
RTL	Research Technology Laboratory
SC	DOE Office of Science
VRRM	volumetrically released radioactive material
WAC	Washington Administrative Code
WDOH	Washington State Department of Health

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1.0 Introduction

This report documents calendar year (CY) 2019 radionuclide air emissions from the U.S. Department of Energy (DOE) Office of Science (SC) Pacific Northwest National Laboratory (PNNL) Richland Campus (hereafter, PNNL Richland Campus or Campus), and the resulting effective dose equivalent (EDE) to the maximally exposed individual (MEI) member of the public. This document complies with reporting requirements in the Code of Federal Regulations (CFR), Title 40, Protection of the Environment, Part 61, National Emission Standards for Hazardous Air Pollutants, Subpart H (2002), "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities," and in Washington Administrative Code (WAC) Chapter 246-247 (2019), "Radiation Protection—Air Emissions." This report satisfies the annual reporting requirements under the DOE PNNL Richland Campus license, Radioactive Air Emissions License (RAEL)-005, for CY2019 operations.

This report is available online at https://science.energy.gov/pnso/resources/.

Battelle Memorial Institute (Battelle) is contracted to operate PNNL for DOE-SC. Battelle manages operations at the PNNL Richland Campus and other leased/occupied research and office areas nearby. Activities at the Richland Campus include research and development in the physical, chemical, life, and environmental sciences, and relevant environmental monitoring.

1.1 PNNL Richland Campus Description

The PNNL Richland Campus (PNSO 2013) is located in southeastern Washington State and encompasses the DOE PNNL Site (Figure 1.1; orange boundary and yellow boundary, respectively). It is adjacent to the much larger DOE Hanford Site (Figure 1.2). The Richland Campus occupies 1.2 mi^2 (3.0 km^2) just south of the Hanford Site 300 Area, whereas the Hanford Site occupies about 580 mi^2 (1,500 km^2). The PNNL Site occupies an area of 0.86 mi^2 (2.2 km^2), an increase of about 20% over last year due to Campus land transfers between Battelle and DOE.

The Campus lies about 170 mi (275 km) east-northeast of Portland, Oregon; 170 mi (270 km) southeast of Seattle, Washington; and 125 mi (200 km) southwest of Spokane, Washington. Operations are permitted under RAEL-005 to perform radiological activities with potential air emissions.

The area south and east of the PNNL Richland Campus is developed with office, laboratory, residential, and retail space. The Columbia River borders the northern PNNL Richland Campus to the east. Environmental conditions of non-operational Hanford Site areas are also characteristic of the Campus. More in-depth discussions on the characteristics of the Hanford Site are available in the Hanford Site National Environmental Policy Act characterization (Duncan et al. 2007).

1.1.1 Historical Background

In December 2003, DOE assigned responsibility to the Pacific Northwest Site Office within DOE-SC to oversee the operation of PNNL, which was established in 1965. Battelle is contracted to DOE to operate PNNL (contract DE-AC06-76RL01830) and has operated PNNL since 1965. The PNNL Site, with boundaries, is identified in Figure 1.1 (yellow boundary). The PNNL Richland Campus (orange boundary) includes the Physical Sciences Facility (PSF) and Life Sciences Laboratory-II (LSLII) facilities, as identified in Figure 1.1. Other facilities on the PNNL Richland Campus have been owned or leased by Battelle since the mid-1960s.

Figure 1.1. DOE-SC PNNL Richland Campus Emission Units Locations

Figure 1.2. Location of the Hanford Site in Relation to the PNNL Richland Campus

The buildings or areas with emission units subject to 40 CFR 61, Subpart H, reporting are listed in Table 1.1. The four buildings of the PSF (3400 series buildings in Table 1.1) were constructed in 2009 and 2010 to replace aging laboratory infrastructure on the Hanford Site. The LSLII and former Research Technology Laboratory (RTL) Complex facilities had been regulated previously under a private Battelle license but were brought under the DOE RAEL-005 in October 2012; emission units from these facilities were administratively closed in 2019. Demolition of the RTL Complex, including RTL-520 and RTL-530, was completed in 2018.

As a group of research buildings, the PSF buildings host changing types of research. The LSLII facility had historically been used for radiological operations; work with dispersible radioactive material has ceased and no new or planned dispersible radiological operations occur at LSLII. Section 1.2.2 provides more detailed descriptions of the buildings with emission units subject to 40 CFR 61, Subpart H (2002), reporting.

The Hanford Site history is briefly described here because of its location adjacent to the PNNL Richland Campus and because it is a source of radiological airborne emissions that could affect the Campus. From the mid-1940s, facilities at the Hanford Site were dedicated to producing plutonium for national defense and to managing the radioactive and chemical wastes generated from those production processes. More recently, major efforts have been underway to clean up contamination in the environment and facilities resulting from past operational practices and the research and development of new and improved waste disposal technologies. The Hanford Site 300 Area, which is closest to the PNNL Richland Campus, contains research and development laboratories and ongoing remediation operations. The two principal DOE Offices that manage programs at the Hanford Site are the Richland Operations Office and the Office of River Protection.

Table 1.1. PNNL Richland Campus Licensed Buildings – 2019

Building	Start Date of DOE-SC Radiological Operations
3410 Building – Materials Sciences and Technology Laboratory	August 2010
3420 Building – Radiation Detection Laboratory	August 2010
3425 Building – Underground Laboratory	October 2010
3430 Building – Ultra-Trace Laboratory	July 2010
LSLII – Life Sciences Laboratory-II	October 2012[a,b]
RTL Complex – Demolition and Removal	August 2016[a,c]
RTL-520 – Research Technology Laboratory	October 2012[a,b]
RTL-530 – Research Technology Laboratory Radioactive Storage	October 2012[a,b]

(a) No active dispersible radiological operations in 2019. Facility emission units were administratively closed in 2019.
(b) Date of contractual transfer from Battelle private operations to DOE-SC.
(c) Date that permit was issued. Demolition was completed in 2018.

1.1.2 PNNL Richland Campus Facilities and 2019 Activities

Point source emission units are identified as major or minor. Other emissions are identified as a fugitive emission. The identifier for the emission unit considers whether radiological emissions are expected to expose a member of the public to a potential dose greater or less than 0.1 millirem per year (mrem/yr). A point source is designated *major* when hypothetically, in the absence of all abatement-control equipment,

its potential maximum emissions can cause a dose greater than 0.1 mrem/yr (0.001 mSv/yr) EDE[1] to the nearest member of the public not employed by DOE or its contractors associated with the PNNL Richland Campus and who lives near and/or has unrestricted access to a place of employment on the Campus. A point source is *minor* when under the same conditions its potential maximum emissions in the absence of all abatement-control equipment cannot cause a dose greater than 0.1 mrem/yr EDE. A source could be characterized as a fugitive emission if a potential source of radioactive material is not actively monitored or ventilated at the point of release.[2] Fugitive sources of radionuclide emissions are generally those that are not actively ventilated, not sealed to prevent the escape of volatile or resuspended radioactive material to the ambient air, and not as amenable to controlled routine sampling, as is done with stacks. Potential unabated emissions from Campus fugitive source locations would be expected to have an extremely small dose impact, even under worst-case release conditions.

Activity and dose information is generally reported to two significant digits. An annual dose rate of less than 1.0E-4 mrem/yr (1.0E-6 mSv/yr) is very low and may be rounded to one significant digit (e.g., 3.9E-5 mrem would be rounded to 4E-5 mrem [4E-7mSv]). More significant digits may be reported if they provide informative resolution or if the value is significantly larger than most of the other values reported with it (e.g., a 5.9723E+1 Ci K-40 emission from one source and 2.4E-3 Ci K-40 emission from another). Reported totals may be slightly different from the sum of individual values in the text because the individual text values are rounded whereas the reported total uses additional, unreported, significant digits in the summed individual value.

Types of emission units under the license include both major and minor emission units as well as fugitive emissions. Fugitive emissions also include Potential Impact Category (PIC)-5 permits for Campus-wide operations (Table 1.2; Figure 1.3 and Figure 1.1). PIC-5 emissions are very low potential-to-emit activities that are permitted under the license and conform to PNNL operational controls; emissions are conservatively reported as the permit maximum (Barnett 2018).

Table 1.2. Types of Emission Units under the DOE PNNL Richland Campus License – 2019

Facility/Building ID	Building Name or Campus-wide Permit Name	Emission Unit Type(s)
PSF/3410	Materials Sciences and Technology Laboratory	Major
PSF/3420	Radiation Detection Laboratory	Major and Minor
PSF/3425	Underground Laboratory	Fugitive
PSF/3430	Ultra-Trace Laboratory	Major and Minor
- /LSLII	Life Sciences Laboratory-II	Minor
RTL Complex	Demolition and Removal of the J-RTL Complex	Fugitive
	RTL-520 Research Technology Laboratory	Minor
	RTL-530 RTL Radioactive Material Storage	Fugitive
Campus	Volumetrically Released Radioactive Material (VRRM; PIC-5)	Fugitive
	Non-dispersible Radioactive Material (NDRM; PIC-5)	Fugitive
	Facilities Restoration (PIC-5)	Fugitive
	Low-level Sources (LLS; PIC-5)	Fugitive

[1] CAP88-PC Version 4.0, used for dose modeling, indicates dose as mrem/yr EDE in output files.
[2] Section 4.0 provides a more detailed discussion of fugitive emissions.

Figure 1.3. PNNL Richland Campus Physical Sciences Facility (PSF) with Buildings Identified

1.1.3 Facilities Adjacent to the PNNL Richland Campus

Land adjacent to the PNNL Richland Campus is occupied by the Hanford Site (Figure 1.2), office and research facilities, and a smaller number of local businesses (e.g., restaurants, offices). Just north of the Campus, the Hanford Site 300 Area hosts radiological operations. The current Hanford Site 300 Area activities include cleanup, research, and office support functions. Radiological emissions from the Hanford Site are described in the Hanford Site Radionuclide Air Emissions Report (Dyekman et al. 2020).

In addition to the Hanford Site, some privately and publicly owned facilities capable of generating airborne radionuclide emissions are located adjacent to or near the PNNL Richland Campus. These facilities include those that are on the Hanford Site but are not part of DOE operations: 1) a low-level waste burial site on the Hanford Site 200 Area plateau and 2) a commercial nuclear power reactor and associated buildings near the Columbia River, north of the Hanford Site 300 Area. In addition, nearby facilities include a radiological sample analysis laboratory and a tritium radiolabeling service south of the Campus, a commercial nuclear reactor fuel fabrication facility and a waste treatment business west of the Campus, and a nuclear power plant commercial laundry service southwest of the Campus. These facilities are discussed in this report to the extent necessary. Emissions from these facilities are not included in this report because they are regulated separately from the PNNL Richland Campus.

1.2 Point Source Descriptions

This section describes point sources that emit or have the potential to emit radionuclides at the Campus. A point source is reported in this document if it met the following two criteria during 2019:

- Required continuous sampling or periodic confirmatory measurements (including 40 CFR 61, Appendix D calculations) in accordance with 40 CFR 61, Subpart H (2002), and with WAC 246-247 (2019)
- Was described in the Washington State Department of Health (WDOH)-issued RAEL-005 and remained a registered emission unit during 2019.

Table 1.3 lists the PNNL Richland Campus emission units registered with the WDOH for radiological emissions. Potential Impact Categories for each emission unit are provided (Barnett 2018).

Table 1.3. PNNL Richland Campus Registered Radioactive Air Emissions Units

Building	Discharge Point ID	Discharge Point Description	Compliance Method[(a)]
3410	EP-3410-01-S	Major point source. Main stack. PIC-2.	Continuous sampling, Appendix D
3420	EP-3420-01-S	Major point source. Main stack. PIC-2.	Continuous sampling, Appendix D
	EP-3420-02-S	Minor point source. Areas not exhausted to main stack. Calculations used to determine radionuclide emissions in lieu of monitoring. PIC-4.	Appendix D
3425	J-3425	Fugitive emissions. Calculations used to determine radionuclide emissions in lieu of monitoring. PIC-4.	Appendix D
3430	EP-3430-01-S	Major point source. Main stack. PIC-2.	Continuous sampling, Appendix D
	EP-3430-02-S	Minor point source. Areas not exhausted to main stack. Calculations used to determine radionuclide emissions in lieu of monitoring. PIC-4.	Appendix D
LSLII[(b)]	EP-LSLII-01-V	Minor point source. Calculations used to determine radionuclide emissions in lieu of monitoring. PIC-4.	Appendix D
	EP-LSLII-02-V	Minor point source. Calculations used to determine radionuclide emissions in lieu of monitoring. PIC-4.	Appendix D
RTL-520[(c)]	EP-RTL-10-V	Minor point source. Calculations used to determine radionuclide emissions in lieu of monitoring. PIC-4.	Appendix D
	EP-RTL-11-V	Minor point source. Calculations used to determine radionuclide emissions in lieu of monitoring. PIC-4.	Appendix D
RTL-530[(c)]	J-RTL530	Fugitive emissions. Activities limited to waste management and storage. PIC-4.	Appendix D
J-RTL Complex[(c)]	J-RTL Complex	Fugitive emissions. Activities limited to demolition and removal. PIC-4.	Appendix D, radiological surveys
Campus	J-VRRM	Volumetrically released radioactive material	PIC-5
	J-NDRM	Non-dispersible radioactive material	PIC-5
	J-Facilities Restoration	Facilities restoration	PIC-5
	J-LLS	Low-level sources	PIC-5

(a) Appendix D means that values are calculated from in-facility material inventories and estimates and 40 CFR 61, Appendix D (1989). PIC-5 source compliance indicated per permit methods during years that the source is used.
(b) Closure of the LSLII emission units was effective August 19, 2019.
(c) Closure of RTL emission units (RTL-520, RTL-530, and J-RTL Complex) was effective January 31, 2019.

1.2.1 Emission Point Characteristics

In general, radionuclide air emissions from point sources are discharged from stacks and vents. Table 1.4 provides the emission point characteristics for the sampled emission units. The effective discharge height used in modeling was 107 ft (32.7 m) applied to all PSF major stack emissions, as a conservative assumption. Neither the J-Facilities Restoration nor J-LLS PIC-5 sources were implemented in 2019. All LSLII and RTL emission units ceased dispersible radiological operations prior to 2019 and, as indicated in Table 1.3, were administratively closed by the end of the year.

High-efficiency particulate air (HEPA) filters were the principal emission abatement method used at the major emission units to remove radioactive constituents from stack emissions during 2019. In general, one-stage of HEPA filtration was used as the final particulate-removal method before an air emission

stream was exhausted to the atmosphere. (Table 1.4 lists the emission abatement technologies at sampled stacks.) The single-stage HEPA filter abatement technology listed in the table has a minimum acceptable test criteria rating of 99% efficient.

Table 1.4. Characteristics of Sampled Emission Points

Unit Type/ Emission Point ID	Average Flow Rate	Total Flow	Temper-ature	Physical Discharge Height	Physical Discharge Diameter	Effective Discharge Height	Abatement Technology
Major EP-3410-01-S	20,962 ft^3/min (9.89 m^3/s)	1.10E+10 ft^3 (3.12E+08 m^3)	86º F (30.1º C)	44 ft (13.5 m)	3.3 ft (1.0 m)	107 ft (32.7 m)	Single-stage HEPA filter
Major EP-3420-01-S	50,126 ft^3/min (23.7 m^3/s)	2.63E+10 ft^3 (7.46E+08 m^3)	74º F (23.4º C)	51 ft (15.5 m)	4.3 ft (1.3 m)	145 ft (44.3 m)	Single-stage HEPA filter
Major EP-3430-01-S	35,476 ft^3/min (16.7 m^3/s)	1.86E+10 ft^3 (5.28E+08 m^3)	72º F (22.0º C)	44 ft (13.5 m)	3.7 ft (1.1 m)	118 ft (35.9 m)	Single-stage HEPA filter

1.2.2 PNNL Richland Campus Radiological Operations

This section describes the handling and processing of radioactive material in each facility on the PNNL Richland Campus.

Physical Sciences Facility Buildings

3410 Building – Materials Sciences and Technology Laboratory

The 3410 Building provides laboratory space and infrastructure for research associated with performance and life of materials in high-temperature, high-radiation, and corrosive environments found in next-generation technologies and applications for energy, construction, and transportation. Researchers work with metals, ceramics, polymeric materials, composites, and specialized coatings, and surface treatments to study these situations. Radioactive material emissions are discharged from this building through a major stack.

3420 Building – Radiation Detection Laboratory

The 3420 Building contains laboratories for a wide variety of radionuclide measurements. Projects support research in radionuclide measurement technologies, and capabilities used or under development include state-of-the-art analytical chemistry, radiation physics, light detection, particle detection, chromatography, scintillation materials, sorbents/“smart” materials, and field-deployable instrumentation. Applications for these capabilities range from fundamental science to applied systems. Radioactive material emissions are discharged from this building through either the major stack or the minor stack.

3425 Building – Underground Laboratory (Deep Lab)

The 3425 Building is an underground laboratory protected from background radiation to support the radiation detection capabilities in the 3420 Building. Research areas are located 40 ft (12 m) below ground. Projects support the development and advancement of radiation detection technologies. Additional activities include radiation physics experiments, development of ultra-low radioactivity materials, and other fundamental sciences studies. Radioactive material emissions from this building are fugitive emissions.

3430 Building – Ultra-Trace Laboratory

The 3430 Building provides ultra-trace radioanalytical capabilities for nuclear forensics. These capabilities include highly sensitive analytical systems such as mass spectrometers, optical microscopes, and electron microscopes to provide isotopic analyses and ultra-low-level radionuclide detection in a wide variety of sample matrices. Radioactive material emissions are discharged from this building through either the major stack or a minor stack.

Research Technology Laboratory Facilities

RTL-520

RTL-520 was demolished in 2018. The emission units in this building were administratively closed January 31, 2019.

RTL-530

RTL-530 was demolished in 2018. The emission unit was administratively closed January 31, 2019.

J-RTL Complex

J-RTL Complex was a fugitive emissions demolition and removal action; demolition and removal actions were completed in 2018. The action included removal of material from the RTL Complex such that the DOE unrestricted radiological release limits for the RTL Complex were met. Buildings in the Complex included historical emission units: EP-RTL-10-V, EP-RTL-11-V, and J-RTL530. This emission unit was administratively closed January 31, 2019.

Life Sciences Laboratory-II Facility

The LSLII building consists primarily of two laboratory floors with mechanical/electrical service rooms attached at the north and south ends of the building. Research in this facility includes applied research, prototype development and testing, and system validation for engineered structural materials. Mechanical design, automation, computational mechanics, and advanced materials characterization activities are also conducted in LSLII. Some electronic technology development and wet chemical work are performed as well. No new sources of radioactive material are planned for this facility. Radioactive material emissions had been discharged from this building through two minor stacks prior to 2019. Prior to 2019, these emission units ceased operations that had the potential for radioactive material emissions, and the units were administratively closed August 19, 2019.

2.0 Radionuclide Air Emissions

This section presents information on quantities of radionuclide emissions on the PNNL Richland Campus. The sampled point sources listed are actively ventilated stacks using electrically powered exhausters and from which emissions are discharged under controlled conditions. Also included are minor and fugitive emission units.

Table 2.1 indicates emissions from sampled point sources on the Campus in 2019. Table 2.2 shows the emissions that resulted in 99.95% of the dose impact from non-sampled PSF emission units, whereas Table 2.3 shows the remaining 0.05%. As indicated previously, LSLII and RTL Complex had no emissions in 2019. Table 2.4 summarizes the nuclide emissions from major sources and from minor, and fugitive sources that result in more than 99.95% of the total dose impact to the MEI. Appendix B lists the radioactive materials handled or potentially handled at the PNNL Richland Campus in 2019.

Table 2.1. Campus Radionuclide Emissions (Ci) from Sampled Point Sources in 2019

Nuclide	EP-3410-01-S 3410 Building	EP-3420-01-S 3420 Building	EP-3430-01-S 3430 Building	Total (Ci)
gross α[(a)]	1.92E-08	6.55E-08	2.79E-08	1.1E-07
gross β[(a)]	2.91E-07	6.31E-07	2.43E-07	1.2E-06
H-3[(b)]	1.20E-04	NA	NA	1.2E-04
Ar-37	NA	3.03E-07	NA	3.0E-07
Co-60	6.10E-09	2.96E-08	2.25E-08	5.8E-08
Kr-83m[(b)]	NA	4.39E-01	NA	4.4E-01
Kr-85[(b)]	NA	NA	4.50E-08	4.5E-08
Xe-127[(b)]	NA	8.00E-09	NA	8.0E-09
Xe-131m[(b)]	NA	NA	2.00E-08	2.0E-08
Cs-137	ND	1.28E-08	5.89E-09	1.9E-08
Rn-222[(b,d)]	NA	3.35E-07	3.00E-09	3.4E-07
U-233/234	NA	NA	ND	ND
Pu-238[(c)]	6.08E-13	9.75E-09	4.33E-10	1.0E-08[(c)]
Pu-239/240	1.06E-09	2.98E-09	2.31E-09	6.4E-09
Am-241	5.39E-10	3.08E-09[(c)]	8.64E-10[(c)]	4.5E-09[(c)]
Am-243	1.03E-08	3.54E-10[(c)]	2.27E-11[(c)]	1.1E-08[(c)]
Cm-243/244	1.52E-13[(c)]	ND	9.05E-10[(c)]	9.1E-10[(c)]

NA = not applicable; ND = not detected. To convert Ci to GBq, multiply Ci by 37.
(a) Maximum of the biweekly or composited average measurement.
(b) Value based on release records.
(c) Value based wholly or partially on calculated Appendix D methods of 40 CFR 61.
(d) Radon dose to MEI; see Sections 3.4 and 3.6.3.

Table 2.2. PNNL Richland Campus Appendix D Calculated and Release Record Radionuclide Emissions (Ci) from Minor Emissions Units and Fugitive Sources Resulting in 99.95% of the Offsite Dose – 2019[a,b]

Nuclide	EP-3420-02-S 3420 Building PSF	EP-3430-02-S 3430 Building PSF	J-3425 3425 Building PSF	Total[e] (Ci)
H-3[a]	7.19E-13	NA	NA	7.2E-13
Na-24	1.35E-08	1.30E-08	1.35E-08	4.0E-08
Co-60	3.32E-10	1.30E-10	1.62E-10	6.2E-10
Br-82	NA	1.30E-08	NA	1.3E-08
Rb-83	1.40E-06	NA	NA	1.4E-06
Kr-83m[a]	1.00E-06	NA	NA	1.0E-06
Sr-82	9.20E-10	NA	NA	9.2E-10
Sr-85	1.83E-08	1.14E-10	6.32E-11	1.8E-08
Y-88	4.42E-10	1.91E-10	1.03E-10	7.4E-10
Xe-133[a]	2.00E-05	NA	3.33E-11	2.0E-05
Cs-137	2.31E-10	9.63E-11	1.15E-10	4.4E-10
Pb-210	3.62E-09	1.38E-11	1.73E-10	3.8E-09
Pb-214	7.48E-09	NA	NA	7.5E-09
Bi-210	3.29E-09	NA	NA	3.3E-09
Bi-214	7.48E-09	NA	NA	7.5E-09
Po-210	3.22E-09	NA	1.12E-16	3.2E-09
Rn-222[a,c]	7.48E-09	NA	NA	7.5E-09
Ra-226	7.48E-09	1.19E-09	NA	8.7E-09
U-233	1.93E-08	NA	1.93E-08	3.9E-08
U-234	3.04E-16	2.25E-11	6.10E-14	2.3E-11
Pu-238[d]	NA	NA	NA	NA
Pu-239/240	NA	NA	1.61E-16	1.6E-16
Am-241[d]	2.74E-10	6.70E-11	1.91E-10	5.3E-10
Am-243[d]	NA	2.56E-15	NA	2.6E-15
Cm-244[b,d]	NA	NA	NA	NA

NA = not applicable for the indicated stack. To convert Ci to GBq, multiply Ci by 37.

(a) Values are not from actual measurements but are calculated from in-facility material inventories and estimates (Barnett et al. 2018; Snyder and Barnett 2016) and 40 CFR 61, Appendix D (1989). Values for gases are based on release records.

(b) Listed nuclides account for 99.95% of dose impact from release record and Appendix D calculated minor and fugitive sources in 2019. Isotopes sampled at major emission units also included.

(c) Radon dose to MEI; see Sections 3.4 and 3.6.3.

(d) Appendix D estimates were calculated in some cases and Pu-238, Am-241, Am-243, and Cm-244 for major emission units and are included with the Table 2.1 sampled emissions; listed for completeness.

(e) Totals reflect major and minor emission unit releases for both Appendix D estimates and gas emissions, used for dose contribution determinations.

Table 2.3. Nonsignificant (0.05% of Offsite Dose Contributors) PNNL Richland Campus Radionuclide Emissions (Ci) from Minor Emission Units and Fugitive Sources – 2019

Nuclide	Release[a] (Ci)	Nuclide	Release[a] (Ci)	Nuclide	Release[a] (Ci)	Nuclide	Release[a] (Ci)
Ag-109m	1.9E-14	Hg-203	1.7E-10	Os-191	7.4E-16	Sr-91	4.7E-10
Ag-112	2.2E-14	I-131	1.6E-11	P-32	4.3E-13	Tb-161	8.1E-13
Ar-37	3.0E-07[b]	I-132	2.1E-10	Pd-109	1.9E-14	Tc-99m	2.3E-10
Ar-39	3.9E-33	I-133	5.6E-10	Pm-149	2.5E-11	Te-123m	3.2E-11
Ba-133	9.9E-13	I-135	2.7E-10	Pm-151	1.1E-11	Te-129	1.1E-14
Ba-140	1.1E-10	Ir-192	7.8E-14	Po-214	7.5E-09	Te-131m	7.5E-11
Be-7	1.4E-14	Ir-194	2.5E-15	Po-218	7.5E-09	Te-132	2.3E-10
Be-10	4.9E-22	K-40	7.9E-19	Pr-143	3.4E-11	U-235	2.4E-14
C-14	2.7E-10	K-42	8.2E-09	Rb-82	9.2E-10	U-236	1.7E-16
Ca-47	2.7E-13	Kr-85	4.5E-08[b]	Rb-84	2.3E-09	U-238	4.8E-13
Cd-109	4.6E-10	La-140	3.3E-11	Rb-86	1.8E-11	Xe-127	8.0E-09
Ce-139	5.9E-11	La-141	1.0E-10	Rb-88	7.0E-36	Xe-131m	2.0E-08[b]
Ce-141	2.1E-11	Mn-54	5.2E-13	Re-188	1.5E-15	Xe-135	7.9E-10[b]
Ce-143	4.7E-10	Mn-56	1.8E-11	Rh-105	2.3E-11	Xe-135m	1.6E-11
Ce-144	1.5E-12	Mo-99	3.0E-10	Ru-103	5.6E-12	Y-90	3.7E-11
Cl-36	8.7E-14	Nb-95	1.3E-11	Ru-105	1.5E-14	Y-91	7.4E-12
Co-57	7.3E-11	Nb-95m	4.5E-13	S-35	1.2E-09	Y-91m	3.0E-10
Co-58	7.7E-14	Nb-97	5.5E-10	Sb-126	1.1E-12	Y-92	2.1E-10
Cr-51	5.1E-10	Nb-97m	4.9E-10	Sb-127	1.1E-14	Y-93	5.4E-10
Cu-64	7.0E-14	Nd-147	2.1E-11	Sm-153	7.6E-13	Zr-95	7.6E-12
Cu-67	7.6E-17	Np-236	7.0E-17	Sn-113	2.8E-10	Zr-97	5.2E-10
Fe-55	2.2E-13	Np-237	3.6E-19	Sn-121	1.3E-14	-	-
Fe-59	1.0E-12	Np-239	2.0E-10	Sr-89	6.9E-12	-	-
						Total (Ci)	**4.1E-07**

To convert Ci to GBq, multiply Ci by 37.

Values may not sum to the indicated total, due to rounding of tabulated emissions.

(a) Value based on release records for gases. Other emissions are calculated from in-facility material inventories and estimates (Barnett et al. 2018; Snyder and Barnett 2016) and 40 CFR 61, Appendix D (1989).

(b) Total also includes major and minor emission unit releases for these gases; used for dose contribution determinations.

Table 2.4. PNNL Richland Campus Radionuclide Emissions (Ci) in 2019

Nuclide	Major Emissions Units	Minor and Fugitive Emissions Units[a]	Total (Ci)
gross α	1.1E-07[b]	NA	1.1E-07
gross β	1.2E-06[b]	NA	1.2E-06
H-3	1.2E-04[c]	7.2E-13[c]	1.2E-04
Na-24	NA	4.0E-08	4.0E-08
Co-60	5.8E-08	6.2E-10	5.9E-08
Br-82	NA	1.3E-08	1.3E-08
Rb-83	NA	1.4E-06	1.4E-06
Kr-83m	4.4E-01[c]	1.0E-06[c]	4.4E-01
Sr-82	NA	9.2E-10	9.2E-10
Sr-85	NA	1.8E-08	1.8E-08
Y-88	NA	7.4E-10	7.4E-10
Xe-133	NA	2.0E-05[c]	2.0E-05
Cs-137	1.9E-08	4.4E-10	1.9E-08
Pb-210	NA	3.8E-09	3.8E-09
Pb-214	NA	7.5E-09	7.5E-09
Bi-210	NA	3.3E-09	3.3E-09
Bi-214	NA	7.5E-09	7.5E-09
Po-210	NA	3.2E-09	3.2E-09
Rn-222	3.4E-07[c]	7.5E-09[c]	3.5E-07
Ra-226	NA	8.7E-09	8.7E-09
U-233/234	ND	3.9E-08	3.9E-08
Pu-238	1.0E-08	NA	1.0E-08
Pu-239/240	6.4E-09	1.6E-16	6.4E-09
Am-241	4.5E-09	5.3E-10	5.0E-09
Am-243	1.1E-08	2.6E-15	1.1E-08
Cm-243/244	9.1E-10	NA	9.1E-10
TOTAL (Ci)	**4.4E-01**	**2.3E-05**	**4.4E-01**

NA = not applicable. To convert Ci to GBq, multiply Ci by 37.

(a) Nuclides that contribute 99.95% of the minor and fugitive dose to the MEI. See Table 2.3 for the nuclides that contribute the remaining 0.05% of dose impact.

(b) Maximum of the biweekly or semi-annual average measurement. Gross α is assumed to be Pu-239 and gross β is assumed to be Cs-137 for dose assessment.

(c) Value based on release records.

3.0 Dose Assessment

This section presents the method for determining the MEI dose from PNNL Richland Campus radiological emissions.

3.1 Description of Dose Model

The dose to the MEI was calculated using the dose-modeling program Clean Air Act Assessment Package 1988-Personal Computer (CAP88-PC) Version 4.0 (EPA 2015), approved by the U.S. Environmental Protection Agency. This dose value was used to determine compliance of the PNNL Richland Campus with the dose standard of 10 mrem/yr EDE to any member of the public as required by 40 CFR 61, Subpart H (2002), and WAC 246-247 (2019).

CAP88-PC Version 4.0 is an environmental dispersion model that allows user-entered emission point characteristics, annual emissions, site-specific meteorology, and public exposure characteristics to be used to calculate the dose to an exposed individual. This model is used to determine the dose to the MEI from Campus radionuclide emissions (Table 2.4).

The nearest location (e.g., dwelling, business, school, office) to the PNNL Richland Campus where a public receptor has the potential to receive the maximum exposure from RAEL-005 permitted emission units is determined. This may be a hypothetical person, but there must be some potential for continued occupancy at the location indicated. For example, the Campus northwest fence-line was not considered because no individual routinely occupies this location, which is in a shrub-steppe field. In addition to the nearest location, the location with the potential for the greatest impact from emissions is determined. Due to the proximity of offsite businesses and the annual variability of dispersion estimates at close distances, several options for businesses at boundary locations are the likely maximally impacted locations based on evaluations of average meteorology from 1983 through 2006, and individual year meteorology from 2006 through 2009. Table 3.1 provides information on these nearest receptors, including distances to the nearest farms that produce milk, meat, and vegetables.

The PNNL Richland Campus MEI is a member of the public who hypothetically receives the highest calculated radiological dose attributable to exposure to Campus emissions in one calendar year. Selection of the annual MEI is contingent on an individual’s place of residence or employment.

Potential MEI locations are evaluated with 1) the CAP88-PC Version 4.0 model, 2) PNNL Richland Campus facility emissions and release point characterization, and 3) CY2019 meteorological data (Appendix A) to determine the 2019 MEI receptor location from Campus emissions. The receptor is presumed to produce his or her own food supply at the MEI location.

Table 3.1. Receptor Locations for the PNNL Richland Campus

Locale	Distance Relative to PSF km (mi)
2019 PNNL Richland Campus MEI	
Business, 3190 George Washington Way	0.67 (0.42) SSE
Offsite nearest residence, business, school	
Residence[(a)]	0.97 (0.60) SE
School or preschool	1.6 (1.0) S
Business[(a)]	0.54 (0.33) SSE
Farm with potential for crops or livestock	
Nearest to PSF (east of Columbia River)	1.51 (0.93) E
Offsite maximum annual air concentration[(b)]	
Business, 3190 George Washington Way	0.67 (0.42) SSE
Richland Campus Historical MEIs[(c)]	
CY2018 / 1.8E-5 mrem	0.64 (0.40) SSE
CY2017 / 2.3E-5 mrem	0.70 (0.43) SSE
CY2016 / 5.8E-4 mrem	1.86 (1.16) S
CY2015 / 2.6E-4 mrem	1.86 (1.16) S
CY2014 / 2.9E-5 mrem	0.70 (0.43) SSE
CY2013 / 1.8E-5 mrem	0.75 (0.47) SSE
CY2012 / 9.2E-6 mrem	0.55 (0.34) SSE
CY2011 / 1.7E-5 mrem	0.55 (0.34) SSE
CY2010 / 0.8E-5 mrem	0.48 (0.30) SSE

(a) Residence and business may vary for each reference location. Locations with PNNL access control are considered part of the PNNL Richland Campus.
(b) This location is 2.47 km south of the Hanford Site 300 Area.
(c) To convert mrem to mSv, multiply mrem by 0.01. Dose includes point, non-point, and radon emissions.

3.2 Summary of Input Parameters

Radionuclide emissions data from the PNNL Richland Campus (Table 2.4) were used in the dose calculations. Emissions were modeled in CAP88-PC Version 4.0 with 2019 meteorology and applicable stack characteristics given in Section 1.2.1. The greatest dose impact from facility emissions is calculated for 3190 George Washington Way, SSE of the 3410 Building, where an office building is located; as a result, this is the 2019 MEI location. PSF emissions reported as gross alpha or gross beta were conservatively evaluated as Pu-239 or Cs-137, respectively. Appendix A provides additional data used for dose calculations; all other radionuclide-specific parameters used were default values in CAP88-PC Version 4.0 data libraries. The entire hypothetical MEI diet was constructed using the “local” food production option in CAP88-PC for ingestion-pathway parameters. This assumption overestimates the dose to the MEI because no food is produced at the 2019 MEI location.

Figure 3.1. Locations of PNNL Richland Campus Potential Receptors

3.3 Meteorological Data

Radionuclide air emissions disperse once they enter the atmosphere. Atmospheric dispersion models predict the degree of dilution and the magnitude of resulting air concentrations at downwind locations. Site-specific measurements of the occurrence frequencies for wind speed, wind direction, and atmospheric stability are used in the CAP88-PC model.

Radionuclide air concentrations at receptor locations are determined using the site-specific meteorological data. CAP88-PC Version 4.0 wind files were prepared from data collected at the Hanford Site 300 Area meteorological tower, just north of the PNNL Richland Campus (refer to Figure 5.1), and represent the average of hourly data recorded in 2019. Appendix A tables indicate meteorological data for 2019 as joint frequency of wind speed, wind direction, and stability category for the station located at the Hanford Site 300 Area. The proximity of the Hanford Site 300 Area meteorological station (less than 500 m from the Campus boundary) and lack of turbulent interference allows the Hanford Site 300 Area meteorological data to be used to represent the PNNL Richland Campus meteorology.

3.4 Compliance Assessment

Federal and state reporting requirements for doses (summarized in Table 3.2) vary. Section 3.4.1 and Section 3.4.2 give details on doses reported under 40 CFR 61, Subpart H, and the WAC, respectively.

Table 3.2. Summary of Reported Doses

	40 CFR 61, Subpart H Campus MEI (3190 GW Way)	**WAC 246-247 Campus MEI (3190 GW Way)**	**Offsite Maximum Air[(b)] for Campus Emissions (3190 GW Way)**
PNNL Richland Campus MEI Location			
Location relative to PSF	0.67 km (0.42 mi) SSE	0.67 km (0.42 mi) SSE	0.67 km (0.42 mi) SSE
Radon Emissions			
Rn-220	NA	0 Ci	0 Ci
Rn-222			
3420-01-S	NA	3.4E-07 Ci	3.4E-07 Ci
3420-02-S	NA	3.0E-09 Ci	3.0E-09 Ci
Receptor Dose			
Dose excluding radon emissions[(a)]	1.5E-05 mrem	1.5E-05 mrem	1.5E-05 mrem
Radon	NA	1.5E-10 mrem	1.5E-10 mrem
Total	**1.5E-05 mrem**	**1.5E-05 mrem**	**1.5E-05 mrem**

To convert Ci to GBq, multiply Ci by 37. To convert mrem to mSv, multiply mrem by 0.01.
(a) Dose from routine major and minor points' emissions, fugitive emissions, PIC-5, and nonroutine events.
(b) WAC 173-480.

3.4.1 40 CFR 61, Subpart H, Regulatory Standard

The regulatory standard for a maximum dose to any member of the public is 10 mrem/yr (0.10 mSv/yr) EDE. The standard is in 40 CFR 61, Subpart H (2002), and applies to radionuclide air emissions, other than radon, from DOE facilities. For CY2019, the PNNL Richland Campus MEI location was 0.67 km (0.42 mi) SSE of the PSF (3410 Building). The PNNL Richland Campus MEI dose is 1.5E-05 mrem (1.5E-07 mSv) (see Table 3.2, 40 CFR 61, Subpart H).

Table 3.3 indicates nuclide-specific doses to the CY2019 Campus MEI. The MEI dose includes routine and, as applicable, nonroutine point source emissions (see Section 3.5). The fugitive PIC-5 category doses are about 6% of the CY2019 PNNL Richland Campus MEI dose estimate.

Table 3.3. PNNL Richland Campus 2019 Combined Radionuclide Emissions and Dose Contributions by Nuclide from Major and Minor Emission Units and Fugitive Emissions

Radionuclide[(a)]	Releases (Ci)	Campus MEI Dose (mrem EDE)	% of Total EDE
H-3	1.2E-04	1.9E-08	<1%
Na-24	4.0E-08	5.1E-10	<1%
Co-60	5.9E-08	1.9E-07	1%
Br-82	1.3E-08	2.0E-10	<1%
Rb-83	1.4E-06	4.0E-07	3%
Kr-83m	4.4E-01	2.6E-09	<1%
Sr-82	9.2E-10	2.0E-10	<1%
Sr-85	1.8E-08	2.0E-09	<1%
Y-88	7.4E-10	5.6E-10	<1%
Xe-133	2.0E-05	6.6E-10	<1%
Cs-137[(b)]	1.2E-06	5.7E-06	37%
Pb-210	3.8E-09	8.6E-08	1%
Pb-214	7.5E-09	3.0E-10	<1%
Bi-210	3.3E-09	9.3E-10	<1%
Bi-214	7.5E-09	2.7E-10	<1%
Po-210	3.2E-09	5.6E-08	<1%
Rn-222	3.5E-07	1.5E-10	<1%
Ra-226[(c)]	8.7E-09	6.9E-07	5%
U-233/234	3.9E-08	4.7E-07	3%
Pu-238	1.0E-08	4.4E-07	3%
Pu-239/240[(d)]	1.2E-07	5.6E-06	36%
Am-241	5.0E-09	2.6E-07	2%
Am-243	1.1E-08	4.3E-07	3%
Cm-243/244	9.1E-10	2.7E-08	<1%
Table 2.3 nuclides	4.1E-07	9.0E-10	<1%
PIC-5 emissions – VRRM	NA	9.4E-07[(e)]	6%
PIC-5 emissions – NDRM	NA	6.6E-08[(e)]	<1%
PIC-5 emissions – Facilities Restoration[(e)]	-	0	0%
PIC-5 emissions – LLS[(e)]	-	0	0%
Total	**4.4E-01 Ci**	**1.5E-05 mrem EDE**	**100%**

To convert Ci to GBq, multiply Ci by 37. To convert mrem to mSv, multiply mrem by 0.01.

(a) Release based on 40 CFR 61, Appendix D (1989), release records, or measurements. See Table 2.1 and Table 2.2.

(b) Gross beta from PSF emission unit sampling assumed to be Cs-137. Also, calculated Cs-137 release based on 40 CFR 61, Appendix D (1989) methods.

(c) Dose includes progeny isotope Rn-222.

(d) Gross alpha from PSF emission unit sampling assumed to be Pu-239. Also includes Pu-239 and Pu-240 based on 40 CFR 61, Appendix D (1989) methods.

(e) The PIC-5 emission doses are assigned based on permit value. The LLS and Facilities Restoration emission sources were not implemented in 2019.

Table 3.4 provides the Campus MEI dose attributed to each emission point. The doses assigned to the fugitive VRRM and NDRM PIC-5 permitted emissions indicate a maximum dose impact. The PIC-5 permitted emissions for LLS and Facilities Restoration were not applicable for 2019 operations.

Table 3.4. Dose Contributions from Each Registered Emission Point

Facility/Building	Emission Unit	Emissions[(a)]	Campus MEI Dose (mrem EDE)	% of Total MEI Dose
PSF/3420 Building	3420-01-S	Sampled, Estimated	6.9E-06	45.3%
PSF/3410 Building	3410-01-S	Sampled, Estimated	2.8E-06	18.4%
PSF/3430 Building	3430-01-S	Sampled, Estimated	2.8E-06	18.0%
PSF/3420 Building	3420-02-S	Estimated	1.4E-06	9.3%
Campus	VRRM	PIC-5	9.4E-07[(b)]	6.1%
PSF/3425 Building	J-3425	Estimated	2.7E-07	1.8%
PSF/3430 Building	3430-02-S	Estimated	1.1E-07	0.7%
Campus	NDRM	PIC-5	6.6E-08[(b)]	<1%
LSLII	EP-LSLII-01-V	None	0	0%
LSLII	EP-LSLII-02-V	None	0	0%
RTL Complex	J-RTL	None	0	0%
RTL-520	EP-RTL-11-V	None	0	0%
RTL-520	EP-RTL-10-V	None	0	0%
RTL-530	J-RTL-530	None	0	0%
Campus	Facility Restoration	PIC-5	0[(b)]	0%
Campus	J-LLS	PIC-5	0[(b)]	0%

To convert mrem to mSv, multiply mrem by 0.01.
(a) Emissions "estimated" are determined by 40 CFR 61, Appendix D.
(b) Dose assigned by permit determination, or for J-LLS a dose estimate may be done.

For comparison, the Subpart H PNNL Richland Campus 2019 MEI dose and average U.S. background radiation (NCRP 2009) are shown below:

- Annual natural background radiation 310.0 mrem/yr
- Daily natural background radiation 0.85 mrem/d
- Hourly natural background radiation 0.035 mrem/hr
- Per minute natural background radiation 0.00059 mrem/min
- **PNNL Richland Campus 2019 MEI dose (40 CFR 61, Subpart H) 0.000015 mrem/yr**
- Per second natural background radiation 0.0000098 mrem/sec

Dose from anthropogenic sources, overwhelmingly a result of medical procedure exposures, adds another 310 mrem (3.1 mSv) to the annual average U.S. dose (HPS 2012). Last year, the PNNL Richland Campus MEI dose was 1.8E-5 mrem/yr (1.8E-7 mSv/yr).

3.4.2 Washington Administrative Code

For PNNL Richland Campus radionuclide air emissions, Washington State in WAC 246-247-040(1) (2019) has adopted the federal dose standard of 10 mrem/yr found in 40 CFR 61, Subpart H (2002). In addition to the maximum dose attributable to radionuclides emitted from point sources, WAC 246-247-040(6) requires that the dose to the MEI also include doses attributable to fugitive emissions, radon, and nonroutine events. Radon is exempt from consideration in determining compliance

with the dose standard of 40 CFR 61, Subpart H (2002), but it is encompassed by state regulations, as in WAC-246-247-040(6), which states that "[a]ll emissions of radionuclides . . . are subject to the standards of this section."

The WAC 246-247 receptor location considers whether an individual resides or abides at the evaluated location (see Table 3.2, WAC 246-247). For 2019, the WAC-246-247 dose is the 1.5E-5 mrem/yr (1.5E-7 mSv/yr). An additional assessment was performed for the location with maximum offsite nuclide air concentrations, whether the reside/abide criterion was met or not (see Table 3.2, WAC 173-480). For CY2019, the maximum modeled air concentration location is the same as the MEI location; the WAC 173-480 dose is also 1.5E-5 mrem/yr (1.5E-7 mSv/yr).

3.4.3 PNNL Richland Campus and Hanford Site Subpart H Doses

For information purposes only, the nearby Hanford Site, which is the adjacent DOE site with major emissions units, was considered for comparative evaluation. PNNL Richland Campus air compliance is a distinctly separate issue, but the dose from such nearby major radiological emitters is worth considering for total DOE-source impacts to the region. Hanford Site 300 Area emissions and the Hanford Site MEI for CY2019 were reviewed. Both the PNNL Richland Campus and the Hanford Site (Dyekman et al. 2020) are in compliance with the 10 mrem/yr regulatory standard for CY2019 radiological emissions.

The CY2019 Hanford Site MEI location is on the PNNL Richland Campus, directly south of the Hanford Site 300 Area. As a result, no dose to the Hanford Site MEI from Campus emissions was estimated for 2019. The dose to the PNNL Richland Campus MEI from the Hanford Site 300 Area emissions, excluding Rn-220 and Rn-222 (emissions listed in Table 3-1 of Dyekman et al. 2020), is indicated in Table 3.5. Essentially all of the dose from Hanford Site 300 Area emissions to the PNNL Richland Campus MEI is attributable to H-3 releases. The table also indicates the dose to the 2019 Hanford Site MEI for emissions from the Hanford Site 300 Area sources.

Table 3.5. Subpart H Doses to PNNL Richland Campus MEI and Hanford Site MEI

Receptor	Dose from 2019 PNNL Richland Campus Emissions	Dose from 2019 Hanford Site 300 Area Emissions
Hanford Site 2019 MEI	NA[(a)]	4.2E-02 mrem
PNNL Richland Campus 2019 MEI	1.5E-05 mrem	2.3E-02 mrem

To convert mrem to mSv, multiply mrem by 0.01.
(a) Hanford Site receptor located at the PNNL Richland Campus.

3.5 Nonroutine Releases of Radionuclides to the Atmosphere

No nonroutine emissions were reported in 2019.

3.6 Additional Compliance Information

3.6.1 Applicability of Stack Emissions Data to Air Emission Permits and Licenses

The WDOH license (RAEL-005) requires that an environmental monitoring program be established for the PNNL Richland Campus as a condition of operation. Environmental monitoring supplements the required stack sampling and provides additional assurance that airborne radiological releases comply with federal and state standards. The requirements for site selection and sampling program optimization are documented in Snyder et al. 2017. There are currently five particulate ambient air sampling stations. The Campus Environmental Monitoring Plan is documented in Snyder et al. 2020.

3.6.2 Construction Projects and Modifications Exempted from 40 CFR 61.96

No exemptions to the approval process under 40 CFR 61.96 were requested or granted in 2019.

3.6.3 Radon-220 and Radon-222 Emissions

Radon-220 was not emitted from PNNL Richland Campus operations in 2019. Some Rn-222 was emitted. See Section 3.4 for radon emissions and dose results.

4.0 Fugitive Sources of Emissions

The Clean Air Act (i.e., 40 CFR 61, Subpart H [2002]) governs emissions of radionuclides from DOE facilities and the resulting radiological doses to members of the public. A dose standard of 10 mrem/yr EDE was implemented, to which compliance is expected for radionuclide emissions emanating from both point and fugitive sources. Measuring and/or modeling these emissions are fundamental to demonstrating compliance with the standard.

In general, fugitive sources of radioactive emissions are radionuclide air emissions that do not and could not reasonably pass through a stack, vent, or other functionally equivalent structure and that are not feasible to measure directly or quantify (WAC 246-247-030 [2019]). Some fugitive sources can be classified as diffuse (i.e., area) sources (DOE 2015). The PNNL Richland Campus has no diffuse sources.

PNNL facility-specific fugitive sources include J-3425, J-RTL-530, and J-RTL Complex. J-RTL Complex and J-RTL-530 did not operate in 2019. In addition to facility-specific fugitive sources, Campus-wide permits for fugitive emissions are registered with WDOH. These include the following:

- J-VRRM — Volumetrically released radioactive material
- J-NDRM — Non-dispersible radioactive material
- J-Facilities Restoration — Facilities restoration
- J-LLS — Low-level sources

All four permitted emissions sources are managed such that the assigned dose (see Table 3.3) over-estimates the actual dose from respective applicable Campus-wide releases. These permits include PIC-5 (Barnett 2018) levels of radionuclide emissions and cover a broad range of the nuclides, as listed in Appendix B.

The 2019 PNNL Richland Campus emissions from facility fugitive sources were estimated (see Table 2.2 for a list of dose-significant emissions) and dose was determined (see Table 3.4). Table 3.4 also indicates the relative magnitudes and the permit-assigned doses from Campus-wide fugitive emission sources. Fugitive emissions from facility and permitted fugitive emissions account for 1.3E-06 mrem/yr (1.3E-08 mSv/yr) (8%) of the total 1.5E-5 mrem/yr (1.5E-07 mSv/yr) MEI dose for 2019.

Emissions from fugitive sources mix with ambient air, which may also include emissions from point sources. Emissions from all PNNL Richland Campus sources *and* non-PNNL and background sources are monitored by five particulate air sampling stations. The air surveillance program conducted in 2019 is described in Section 5.3.

Past operations at the nearby Hanford Site created a number of fugitive sources within the landscape, whose emissions could affect the PNNL Richland Campus. The Hanford Site fugitive emissions are evaluated in detail in their Radiological Air Emissions Report (e.g., Dyekman et al. 2020).

5.0 Supplemental Information

This section provides the following supplemental information related to PNNL Richland Campus radionuclide air emissions in 2019:

- Collective dose estimate (DOE 1995)
- Compliance status with 40 CFR 61, Subparts Q (2000) and T (2000)
- Radionuclide emission estimates and periodic confirmatory measurement information related to notices of construction
- Ambient air sampling measurements
- Quality assurance (QA) program status of compliance with 40 CFR 61, Appendix B (2011), Method 114

5.1 Collective Dose Estimate

The estimated regional collective dose from PNNL Richland Campus air emissions in 2019 was calculated using CAP88-PC Version 4.0. The population consists of approximately 432,700 residents within a 50-mi (80-km) radius of the Hanford Site 300 Area (Hamilton and Snyder 2011), with one adjustment to add 640 residents in the 1-2 mi S sector to account for the two phases of apartment units constructed and occupied, SW of RTL. The proximity of the Hanford Site 300 Area and relatively rural region within 50 mi of the Campus permits the Hanford Site 300 Area 50-mi population estimate to be applicable. Pathways evaluated for population exposure include inhalation, air submersion, ground-shine, and food consumption.

The 2019 total collective dose from radionuclide air emissions estimated from nuclides that originated from the PNNL Richland Campus was 8.4E-5 person-rem (8.4E-7 person-Sv). CAP88-PC Version 4.0 calculates the collective dose by considering site-specific meteorology and population distributions and subsequently summing the individual sector doses. This represents a slight increase from the 2018 estimate of 7.6E-5 person-rem (7.6E-7 person-Sv) (Snyder et al. 2019).

5.2 Compliance Status with 40 CFR, Subparts Q and T

In 40 CFR 61, Subpart Q (2000), “National Emission Standards for Radon Emissions From Department of Energy Facilities,” paragraph 61.190 states that the Subpart Q provisions apply to the design and operation of all storage and disposal facilities for radium-bearing material that emits Rn-222 to the air. Paragraph 61.191(b) states that a source means any building, structure, pile, impoundment, or area used for interim storage or disposal that is or contains waste material containing radium in sufficient concentration to emit Rn-222 in excess of a standard of 20 $pCi/m^2/s$. No operations from the storage and disposal of radium-bearing material resulting in radon emissions are conducted on the PNNL Richland Campus.

Activities at the PNNL Richland Campus were evaluated for compliance with 40 CFR 61, Subpart T (2000), “National Emissions Standards for Radon Emissions from the Disposal of Uranium Mill Tailings.” In paragraph 61.220, “Designation of Facilities,” owners and operators of such facilities are subject to the provisions in Subpart T: those whose sites were used for the disposal of tailings and that managed residual radioactive material or uranium byproduct materials during and following the

processing of uranium ores and that are listed in or designated by the Secretary of Energy under Title I of the Uranium Mill Tailings Control Act of 1978 or regulated under Title II of that act. No uranium milling and uranium ore processing activities are conducted on the PNNL Richland Campus.

Subparts Q and T do not apply to the PNNL Richland Campus for CY2019 operations.

5.3 Environmental Surveillance for the PNNL Richland Campus

Environmental surveillance activities for the PNNL Richland Campus radionuclide emissions sources include ambient particulate air sampling and ambient external dose monitoring.

5.3.1 Ambient Air Surveillance

A particulate air sampling network was established in 2010 to monitor radioactive particulates in ambient air near the PNNL Richland Campus. This sampling was initiated before starting radiological operations at the new PSF buildings. The first full calendar year of air surveillance was 2011. To satisfy air permit requirements, samples were collected in 2019 at four ambient air sampling stations within and along the perimeter of the PNNL Richland Campus and at a background monitoring station that was established in Benton City, Washington (Figure 5.1). In addition to Campus emissions, these samplers can collect radioactive particulates released from other nearby sources. During 2019, the Hanford Site 300 Area would have contributed most of the non-PNNL particulates detected from offsite facilities.

Routine surveillance activities at the PNNL Richland Campus include air sampling for particulate radionuclides. The air surveillance program is described in Snyder et al. 2020 and attachments (Meier 2011; Bisping 2011; Snyder 2019). During 2019, environmental air surveillance continued at PNL-1 (solar), PNL-2 (solar), PNL-3, PNL-4, and PNL-5 (background location) (Figure 5.1).

Particulate air samples are routinely analyzed for gross alpha activity and gross beta activity. Semi-annually, filters are composited for specific radionuclide analysis. The composite analyses reported for 2019 include gamma-emitting isotopes Co-60 and Cs-137, U-233/234,[3] Pu-238 and Pu-239/240, Am-241, Am-243, and Cm-243/244. Also, the Hanford Site has several nearby community sampling locations within a 30-mi (48-km) radius of the Campus as well as a background location in Yakima (MSA 2018).

The particulate ambient air sampling results are provided in Appendix C for the CY2019 PNNL Richland Campus sampling. Air sampling results are summarized in Table 5.1. The gross alpha and gross beta results were comparable to background levels. All nuclide-specific results shown in Table 5.1 were less than the values in Table 2 of 40 CFR 61, Appendix E (2011). There was no indication that levels of monitored particulate radionuclides near the PNNL Richland Campus were above standards.

[3] U-234 is a naturally occurring radionuclide. It is co-reported with U-233 by the analytical laboratory because the emission peaks overlap.

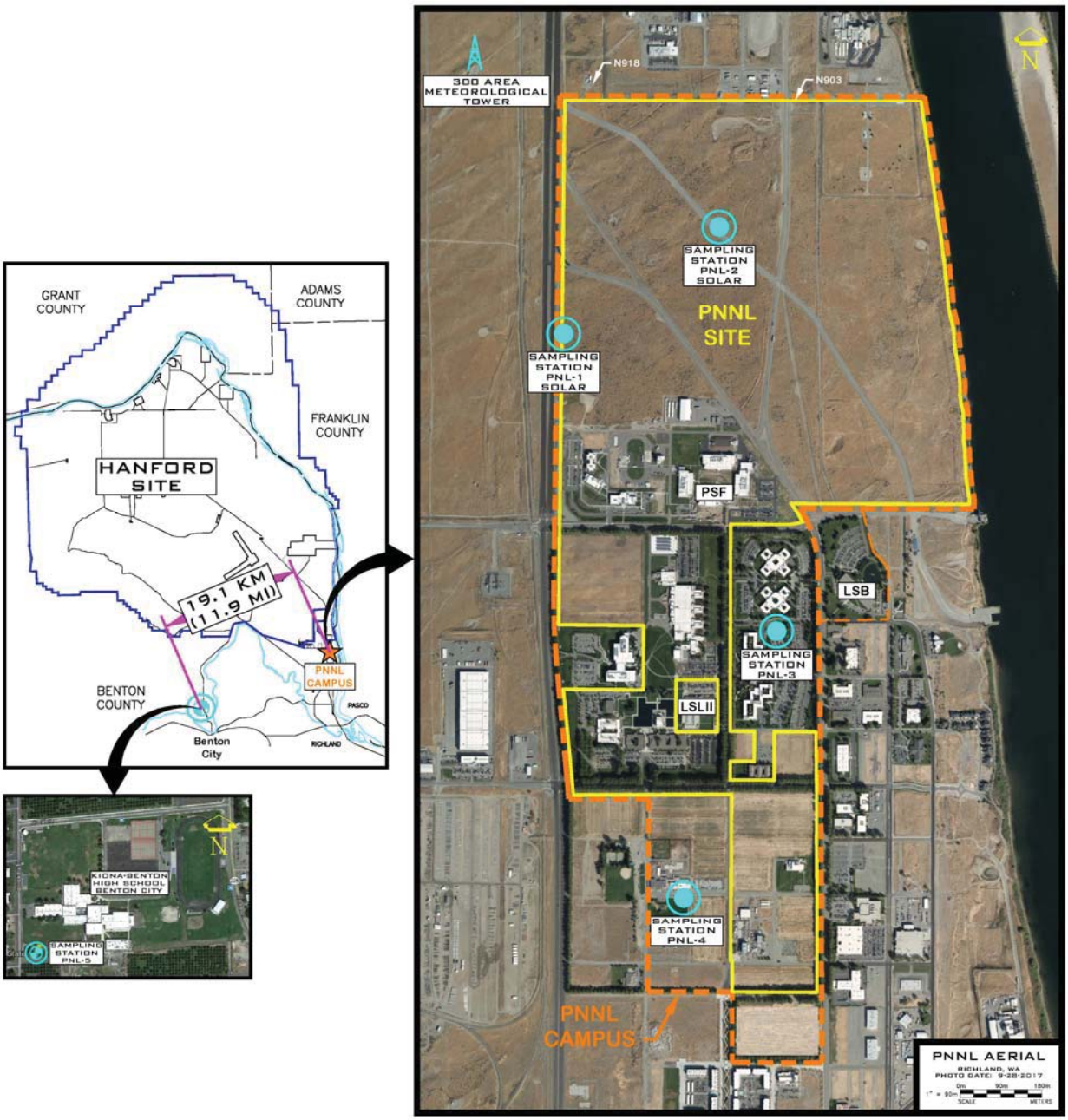

Figure 5.1. Air Surveillance Station Locations for the PNNL Richland Campus

Table 5.1. Summary of 2019 Air Sampling Results

Nuclide	Location[(a)]	No. of Samples Analyzed	No. of Detections	Value ± Error (pCi/m^3)[(b)]		
Gross Alpha	PNL-1	27	21	7.0E-04	±	1.9E-03
	PNL-2	27	20	7.2E-04	±	1.9E-03
	PNL-3	27	20	6.8E-04	±	1.9E-03
	PNL-4	26	23	7.9E-04	±	2.1E-03
	PNL-5	26	20	5.4E-04	±	1.5E-03
Gross Beta	PNL-1	27	27	1.9E-02	±	6.5E-03
	PNL-2	27	27	1.8E-02	±	6.5E-03
	PNL-3	27	27	1.9E-02	±	6.7E-03
	PNL-4	26	26	1.9E-02	±	6.5E-03
	PNL-5	26	26	1.5E-02	±	5.2E-03
Co-60	PNL-1	2	0	4.9E-05	±	1.3E-04
	PNL-2	2	0	2.1E-05	±	1.1E-04
	PNL-3	2	0	3.1E-05	±	1.1E-04
	PNL-4	2	0	8.5E-06	±	9.9E-05
	PNL-5	2	0	4.8E-05	±	1.2E-04
Cs-137	PNL-1	2	0	3.7E-05	±	1.1E-04
	PNL-2	2	0	9.6E-06	±	9.8E-05
	PNL-3	2	1	9.8E-05	±	2.1E-04
	PNL-4	2	0	4.2E-05	±	1.5E-04
	PNL-5	2	0	-1.4E-05	±	2.0E-04
U-233/234	PNL-1	2	1	3.3E-05	±	3.9E-05
	PNL-2	2	2	3.9E-05	±	2.7E-05
	PNL-3	2	2	4.5E-05	±	3.1E-05
	PNL-4	2	2	4.1E-05	±	3.1E-05
	PNL-5	2	2	4.1E-05	±	2.5E-05
Pu-238	PNL-1	2	0	3.2E-06	±	1.2E-05
	PNL-2	2	0	-2.1E-06	±	5.4E-06
	PNL-3	2	0	6.1E-07	±	6.5E-06
	PNL-4	2	0	5.5E-06	±	1.6E-05
	PNL-5	2	0	2.7E-07	±	4.3E-06
Pu-239/240	PNL-1	2	0	3.4E-06	±	1.2E-05
	PNL-2	2	0	2.3E-07	±	7.6E-06
	PNL-3	2	0	1.6E-06	±	9.2E-06
	PNL-4	2	0	6.9E-06	±	1.8E-05
	PNL-5	2	0	1.3E-06	±	8.6E-06
Am-241	PNL-1	2	0	5.5E-06	±	1.1E-05
	PNL-2	2	0	2.0E-06	±	6.5E-06
	PNL-3	2	0	8.9E-06	±	1.3E-05
	PNL-4	2	0	4.9E-06	±	8.2E-06
	PNL-5	2	0	3.7E-06	±	9.5E-06
Am-243	PNL-1	2	0	4.3E-06	±	1.4E-05
	PNL-2	2	0	9.7E-07	±	8.1E-06
	PNL-3	2	0	4.7E-06	±	7.7E-06
	PNL-4	2	0	-1.2E-06	±	7.7E-06
	PNL-5	2	0	1.1E-06	±	3.2E-06
Cm-243/244	PNL-1	2	0	6.2E-07	±	5.4E-06
	PNL-2	2	0	4.3E-07	±	2.4E-06
	PNL-3	2	0	2.7E-06	±	7.6E-06
	PNL-4	2	0	2.2E-07	±	4.0E-06
	PNL-5	2	0	9.4E-07	±	6.9E-06

To convert pCi/m^3 to Bq/m^3, multiply pCi/m^3 by 0.037.

(a) Refer to Figure 5.1 for PNL-1, PNL-2, PNL-3, PNL-4, and PNL-5 locations.

(b) The value is the average of samples collected throughout the year, with no background (PNL-5) results subtracted.

5.3.2 Ambient External Dose Monitoring

Ambient levels of external dose from beta, gamma, and X-ray sources were monitored quarterly at the five particulate air monitoring stations during 2019. No current PNNL Campus radioactive air emissions include significant quantities of external dose contributors. The program establishes baseline ambient external dose levels at the perimeter particulate sampling stations and the background (PNL-5) station. The 2019 ambient external dose monitoring results at Campus monitoring stations were all less than the background station; the background station indicated a local ambient external dose for 2019 of 40 mrem/yr (0.40 mSv/yr). Additional details regarding ambient external dose monitoring will be in the next PNNL Site Environmental Report of 2019 operations (e.g., Duncan et al. 2019).

5.4 Quality Assurance Program Compliance Status

Air emissions data reported in this document reflect the product of many QA activities concerned with the collecting, handling, analyzing, validating, and reporting of samples and the resultant analytical data. Those activities are identified in the QA plans (PNNL 2016) and in the PNNL Richland Campus Environmental Radiological Air Monitoring Plan (Snyder et al. 2020). The effluent monitoring QA elements described in PNNL 2016 were compatible with one or more of the documents shown in Table 5.2 during CY2019. QA requirements are implemented, as appropriate, at the Campus as new facilities become operational and programmatic plans are developed.

Table 5.2. Summary List of QA-Related Documents

10 CFR 830 (2001), *Nuclear Safety Management*
40 CFR 61, Appendix B (2011), “Method 114 – Test Methods for Measuring Radionuclide Emissions from Stationary Sources”
ANSI/ASME NQA-1-2000, *Quality Assurance Requirements for Nuclear Facilities*
DOE Order 414.1D (2011), *Quality Assurance*
ISO14001:2004 (ISO 2004), *International Organization for Standardization for Environmental Management Systems*
DOE Order 458.1 (2011), *Radiation Protection of the Public and the Environment*
DOE-HDBK-1216-2015, *Environmental Radiological Effluent Monitoring and Environmental Surveillance* (DOE 2015)
EPA QA/R-5, *EPA Requirements for Quality Assurance Project Plans* (EPA 2001)

6.0 References

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40 CFR 61, Appendix E. 2011. "Compliance Procedures Methods for Determining Compliance with Subpart I." Code of Federal Regulations, U.S. Government Printing Office, Washington, D.C.

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Appendix A

Dose Modeling and Meteorological Data

Appendix A

Dose Modeling and Meteorological Data

Wind rose for Hanford Site 300 Area, station #11, indicating from which direction that the wind blows.

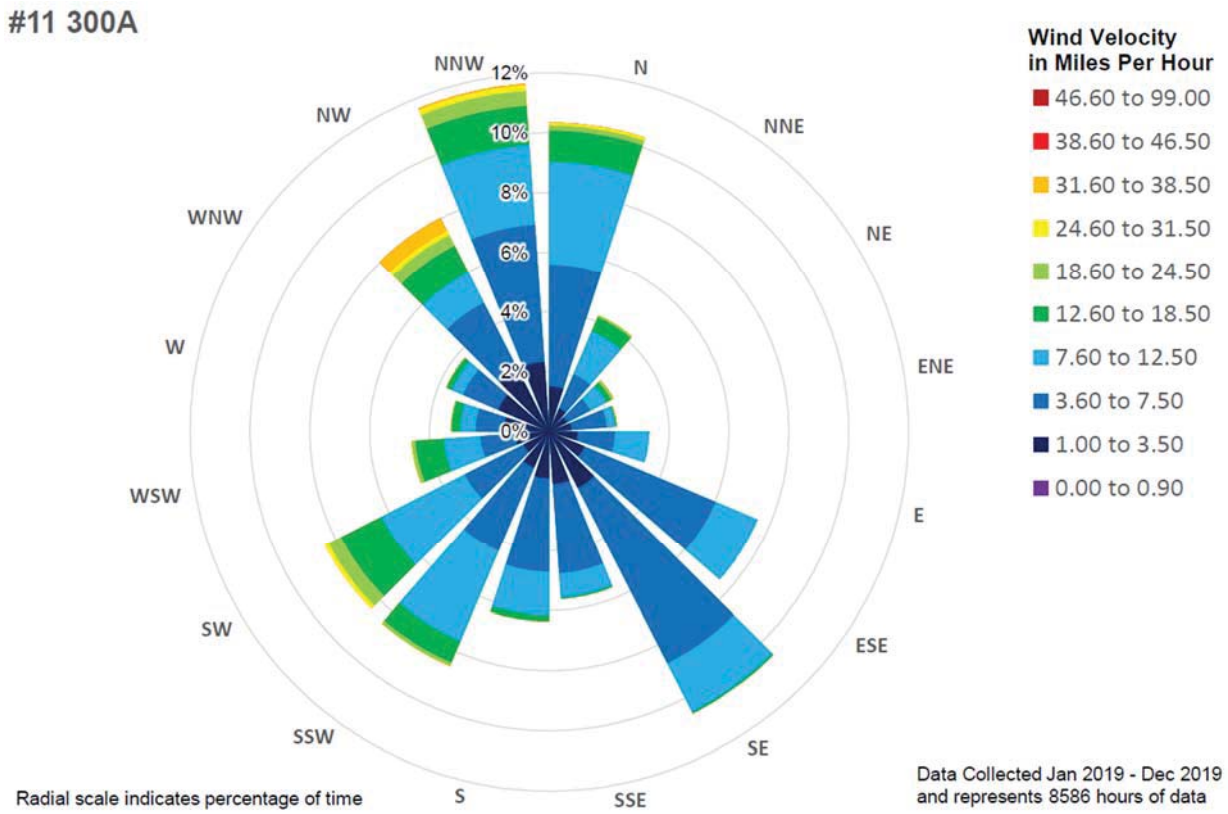

Figure A.1. Hanford Site 300 Area Meteorological Station Wind Rose and Histogram for 2019

Table A.1. Annual Average Joint Frequency during 2019 (as percent of time) of Wind Speed, Stability Class, and Direction for the Hanford Site 300 Area (Station 11) at the 10-Meter Level (3 sheets)

Wind Speed (m/sec)	Stability Class	Wind Direction Toward																**Total**
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	
0.89	A	0.07	0.02	0.00	0.01	0.03	0.04	0.00	0.03	0.01	0.00	0.00	0.02	0.03	0.04	0.00	0.05	**0.35**
	B	0.02	0.01	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.02	0.00	0.02	0.02	0.01	0.00	**0.15**
	C	0.00	0.02	0.08	0.08	0.07	0.08	0.03	0.04	0.02	0.05	0.02	0.03	0.02	0.03	0.01	0.00	**0.58**
	D	0.49	0.32	0.27	0.26	0.40	0.40	0.67	0.51	0.37	0.33	0.24	0.40	0.43	0.47	0.68	0.74	**6.98**
	E	0.46	0.21	0.15	0.21	0.20	0.44	0.70	0.47	0.64	0.49	0.35	0.34	0.47	0.61	0.66	0.72	**7.12**
	F	0.34	0.18	0.11	0.10	0.15	0.23	0.55	0.53	0.48	0.36	0.28	0.29	0.39	0.55	0.73	0.64	**5.91**
	G	0.15	0.08	0.06	0.08	0.10	0.10	0.19	0.21	0.06	0.10	0.07	0.10	0.19	0.17	0.26	0.22	**2.14**
	Total	**1.53**	**0.84**	**0.67**	**0.75**	**0.95**	**1.30**	**2.15**	**1.80**	**1.59**	**1.33**	**0.98**	**1.18**	**1.55**	**1.89**	**2.35**	**2.37**	**23.23**
2.65	A	0.02	0.06	0.05	0.03	0.04	0.02	0.05	0.03	0.04	0.14	0.04	0.05	0.01	0.00	0.02	0.02	**0.62**
	B	0.05	0.01	0.07	0.16	0.19	0.26	0.24	0.12	0.10	0.18	0.21	0.09	0.01	0.01	0.01	0.00	**1.71**
	C	0.07	0.09	0.24	0.32	0.36	0.56	0.42	0.17	0.26	0.33	0.24	0.12	0.03	0.03	0.02	0.08	**3.34**
	D	1.43	0.54	0.33	0.48	0.44	1.28	1.59	0.65	0.87	0.75	0.62	0.42	0.29	0.30	0.96	1.77	**12.72**
	E	1.47	0.39	0.10	0.17	0.15	1.13	1.96	0.88	0.95	0.99	0.74	0.33	0.44	0.54	0.73	1.50	**12.47**
	F	0.76	0.09	0.04	0.03	0.14	1.25	1.76	0.95	0.71	0.52	0.28	0.12	0.11	0.29	0.63	0.89	**8.57**
	G	0.29	0.06	0.04	0.02	0.02	0.27	0.57	0.22	0.20	0.11	0.07	0.03	0.05	0.12	0.12	0.35	**2.54**
	Total	**4.09**	**1.24**	**0.87**	**1.21**	**1.34**	**4.77**	**6.59**	**3.02**	**3.13**	**3.02**	**2.20**	**1.16**	**0.94**	**1.29**	**2.49**	**4.61**	**41.97**
4.70	A	0.06	0.24	0.12	0.01	0.00	0.04	0.03	0.04	0.03	0.21	0.22	0.06	0.02	0.04	0.03	0.04	**1.19**
	B	0.08	0.30	0.16	0.06	0.04	0.22	0.17	0.10	0.17	0.39	0.35	0.13	0.05	0.05	0.02	0.04	**2.33**
	C	0.14	0.27	0.15	0.07	0.04	0.10	0.28	0.12	0.08	0.54	0.50	0.17	0.01	0.00	0.03	0.14	**2.64**
	D	0.91	0.41	0.10	0.08	0.04	0.43	0.48	0.20	0.41	1.04	0.96	0.43	0.21	0.10	0.40	1.23	**7.43**
	E	1.22	0.20	0.03	0.05	0.01	0.20	0.31	0.19	0.47	0.64	0.77	0.34	0.22	0.19	0.51	0.80	**6.15**
	F	0.75	0.08	0.03	0.02	0.01	0.39	0.28	0.13	0.18	0.37	0.27	0.07	0.01	0.02	0.14	0.35	**3.10**
	G	0.28	0.04	0.00	0.00	0.00	0.13	0.25	0.02	0.11	0.10	0.07	0.02	0.00	0.01	0.02	0.06	**1.11**
	Total	**3.44**	**1.54**	**0.59**	**0.29**	**0.14**	**1.51**	**1.80**	**0.80**	**1.45**	**3.29**	**3.14**	**1.22**	**0.52**	**0.41**	**1.15**	**2.66**	**23.95**

Table A.1 (contd)

Wind Speed (m/sec)	Stability Class	Wind Direction Toward																**Total**
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	
7.15	A	0.00	0.11	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.29	0.22	0.02	0.05	0.09	0.02	**0.86**
	B	0.05	0.11	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.04	0.26	0.11	0.04	0.00	0.00	0.00	**0.63**
	C	0.09	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.13	0.17	0.05	0.02	0.03	0.05	**0.67**
	D	0.54	0.09	0.04	0.00	0.00	0.00	0.05	0.01	0.09	0.33	0.33	0.32	0.13	0.08	0.45	0.69	**3.15**
	E	0.32	0.11	0.09	0.03	0.00	0.00	0.02	0.03	0.07	0.22	0.32	0.13	0.05	0.03	0.44	0.53	**2.39**
	F	0.04	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.02	0.08	0.13	0.00	0.00	0.00	0.00	0.02	**0.31**
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.04	0.00	0.00	0.00	0.00	0.00	**0.08**
	Total	**1.04**	**0.51**	**0.17**	**0.04**	**0.00**	**0.00**	**0.07**	**0.05**	**0.21**	**0.76**	**1.50**	**0.95**	**0.29**	**0.18**	**1.01**	**1.31**	**8.09**
9.8	A	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.12	0.02	0.01	0.01	0.07	0.01	**0.27**
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.01	0.00	0.00	0.01	**0.06**
	C	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.00	0.02	0.03	**0.12**
	D	0.08	0.02	0.04	0.01	0.00	0.00	0.00	0.00	0.01	0.03	0.08	0.07	0.00	0.01	0.22	0.35	**0.92**
	E	0.06	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.15	0.00	0.00	0.00	0.07	0.10	**0.52**
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	**0.05**
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.00	0.00	0.00	0.00	0.00	**0.06**
	Total	**0.18**	**0.08**	**0.09**	**0.01**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.11**	**0.46**	**0.13**	**0.03**	**0.02**	**0.38**	**0.50**	**2.00**
12.7	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	**0.02**
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	**0.01**
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
	D	0.04	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.10	0.16	**0.34**
	E	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.09	0.00	0.00	0.00	0.05	0.01	**0.20**
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
	Total	**0.08**	**0.00**	**0.00**	**0.01**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.13**	**0.01**	**0.00**	**0.00**	**0.15**	**0.18**	**0.57**

Table A.1 (contd)

Wind Speed (m/sec)	Stability Class	Wind Direction Toward																Total
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	
15.6	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	**0.01**
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
	D	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.06	**0.10**
	E	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	**0.03**
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
	Total	**0.02**	**0.00**	**0.01**	**0.01**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.04**	**0.06**	**0.14**
19	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
	D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
	Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Total	A	0.16	0.43	0.20	0.05	0.07	0.10	0.08	0.10	0.08	0.40	0.68	0.38	0.09	0.14	0.21	0.14	**3.31**
	B	0.20	0.43	0.23	0.23	0.23	0.49	0.42	0.24	0.29	0.61	0.86	0.35	0.13	0.08	0.05	0.06	**4.90**
	C	0.33	0.48	0.47	0.47	0.47	0.74	0.73	0.33	0.37	0.95	0.89	0.51	0.12	0.08	0.11	0.30	**7.35**
	D	3.51	1.38	0.78	0.85	0.88	2.11	2.79	1.37	1.75	2.48	2.26	1.64	1.06	0.96	2.82	5.00	**31.64**
	E	3.57	0.96	0.43	0.46	0.36	1.77	2.99	1.57	2.13	2.39	2.42	1.14	1.18	1.37	2.48	3.66	**28.88**
	F	1.89	0.35	0.19	0.16	0.30	1.87	2.59	1.61	1.39	1.33	1.01	0.48	0.51	0.86	1.50	1.90	**17.94**
	G	0.72	0.18	0.10	0.10	0.12	0.50	1.01	0.45	0.38	0.36	0.29	0.15	0.24	0.30	0.40	0.63	**5.93**
	Total	**10.38**	**4.21**	**2.40**	**2.32**	**2.43**	**7.58**	**10.61**	**5.67**	**6.39**	**8.52**	**8.41**	**4.65**	**3.33**	**3.79**	**7.57**	**11.69**	**99.95**

Table A.2. Exposure and Consumption Data for the PNNL Richland Campus

FOOD SOURCE FOR THE MAXIMALLY EXPOSED INDIVIDUAL
(fraction of food produced at indicated location)

Food	Local	Regional	Imported
Vegetable	1.000	0.000	0.000
Meat	1.000	0.000	0.000
Milk	1.000	0.000	0.000

VALUES FOR RADIONUCLIDE-INDEPENDENT VARIABLES

HUMAN INHALATION RATE (cm^3/hr) = 5.26 E+03

SOIL PARAMETERS
Effective surface density, kg/sq m, dry weight
(assumes 15-cm plow layer) = 2.15 E+02

BUILDUP TIMES
For activity in soil (yr) = 1.00 E+02
For radionuclides deposited on ground/water (d) = 3.65E+04

DELAY TIMES
Ingestion of pasture grass by animals (hr) = 0.00 E+00
Ingestion of stored feed by animals (hr) = 2.16 E+03
Ingestion of leafy vegetables by man (hr) = 3.36 E+02
Ingestion of produce by man (hours) = 3.36 E+02
Transport time from animal feed-milk-man (d) = 2.00 E+00
Time from slaughter to consumption (d) = 2.00 E+01

WEATHERING
Removal rate constant for physical loss (per hr) = 2.90 E–03

CROP EXPOSURE DURATION
Pasture grass (hr) = 7.20 E+02
Crops/leafy vegetables (hr) = 1.44 E+03

AGRICULTURAL PRODUCTIVITY
Grass-cow-milk-man pathway (kg/m^2) = 2.80 E–01
Produce/leafy veg for human consumption (kg/m^2) = 7.16 E-01

FALLOUT INTERCEPTION FRACTIONS
Vegetables = 2.00 E-01
Pasture = 5.70 E-01

GRAZING PARAMETERS
Fraction of year animals graze on pasture = 4.00 E-01
Fraction of daily feed that is pasture grass when animal grazes on pasture = 4.30 E-01

ANIMAL FEED CONSUMPTION FACTORS
Contaminated feed/forage (kg/day, dry weight) = 1.56 E+01

DAIRY PRODUCTIVITY
Milk production of cow (L/day) = 1.10 E+01

Table A.2. (contd)

MEAT ANIMAL SLAUGHTER PARAMETERS
Muscle mass of animal at slaughter (kg) = 2.00 E+02
Fraction of herd slaughtered (per day) = 3.81 E-03

DECONTAMINATION
Fraction of radioactivity retained after washing
or leafy vegetables and produce = 5.00 E-01

FRACTIONS GROWN IN GARDEN OF INTEREST
Produce ingested = 1.00 E+0
Leafy vegetables ingested = 1.00 E+00

INGESTION RATIOS:
IMMEDIATE SURROUNDING AREA/TOTAL WITHIN AREA
Vegetables = 1.00 E+00
Meat = 1.00 E+00
Milk = 1.00 E+00

MINIMUM INGESTION FRACTIONS FROM OUTSIDE AREA
(Minimum fractions of food types from outside area listed below are actual fixed values.)
Vegetables = 0.00 E+00
Meat = 0.00 E+00
Milk = 0.00 E+00

HUMAN FOOD UTILIZATION FACTORS
Produce ingestion (kg/yr) = 7.62 E+01
Milk ingestion (L/yr) = 5.30 E+01
Meat ingestion (kg/yr) = 8.40 E+01
Leafy vegetable ingestion (kg/yr) = 7.79 E+00

SWIMMING PARAMETERS
Fraction of time spent swimming = 0.00 E+00
Dilution depth for water (cm) = 1.00 E+00

EXTERNAL DOSE
Ground surface contamination correction factor = 5.00 E-01

Table A.3. PNNL Richland Campus Meteorological Data — General Information

HEIGHT OF LID
LIDAI = 1,000 m

RAINFALL RATE [2019]
RR = 23.6 cm/yr (9.29 in/yr)

AVERAGE AIR TEMPERATURE [2019]
A = 11.33 degrees C (52.4 degrees F; 284.8 K)

SURFACE ROUGHNESS LENGTH
0 = 0.010 m

VERTICAL TEMPERATURE GRADIENTS: (TG) (K/m)

STABILITY E	0.073
STABILITY F	0.109
STABILITY G	0.146

Appendix B

List of Radioactive Materials Handled or Potentially Handled at the PNNL Richland Campus in 2019

Appendix B

List of Radioactive Materials Handled or Potentially Handled at the PNNL Richland Campus in 2019

Table B.1. Radionuclides Handled and/or Potentially Handled at the PNNL Richland Campus in 2019

Ac-225	Au-194	Br-84	Cm-250	Eu-154	Hg-205	Ir-189	Na-24	P-33
Ac-226	Au-195	Br-84m	Co-56	Eu-154m	Hg-206	Ir-190	Na-24m	Pa-231
Ac-227	Au-195m	Br-85	Co-57	Eu-155	Ho-163	Ir-192	Nb-100	Pa-232
Ac-228	Au-196	C-11	Co-58	Eu-156	Ho-164	Ir-194	Nb-101	Pa-233
Ag-105	Au-196m	C-14	Co-58m	Eu-157	Ho-164m	K-40	Nb-103	Pa-234
Ag-106m	Au-198	C-15	Co-60	F-18	Ho-166	K-42	Nb-91	Pa-234m
Ag-108	Au-198m	Ca-41	Co-60m	Fe-55	Ho-166m	Kr-81	Nb-91m	Pb-203
Ag-108m	Au-199	Ca-45	Cr-49	Fe-59	I-122	Kr-81m	Nb-92	Pb-204m
Ag-109m	Ba-131	Ca-47	Cr-51	Fr-221	I-123	Kr-83m	Nb-92m	Pb-205
Ag-110	Ba-131m	Cd-107	Cr-55	Fr-222	I-124	Kr-85	Nb-93m	Pb-209
Ag-110m	Ba-133	Cd-109	Cs-131	Fr-223	I-125	Kr-85m	Nb-94	Pb-210
Ag-111	Ba-133m	Cd-111m	Cs-132	Ga-67	I-126	Kr-87	Nb-94m	Pb-211
Ag-111m	Ba-135m	Cd-113	Cs-134	Ga-68	I-128	Kr-88	Nb-95	Pb-212
Ag-112	Ba-137m	Cd-113m	Cs-134m	Ga-70	I-129	Kr-89	Nb-95m	Pb-214
Al-26	Ba-139	Cd-115	Cs-135	Ga-72	I-130	Kr-90	Nb-96	Pd-103
Al-28	Ba-140	Cd-115m	Cs-135m	Gd-148	I-130m	La-137	Nb-97	Pd-107
Am-240	Ba-141	Cd-117	Cs-136	Gd-149	I-131	La-138	Nb-97m	Pd-109
Am-241	Ba-142	Cd-117m	Cs-137	Gd-150	I-132	La-140	Nb-98	Pd-109m
Am-242	Ba-143	Ce-139	Cs-138	Gd-151	I-132m	La-141	Nd-144	Pd-111
Am-242m	Be-10	Ce-141	Cs-138m	Gd-152	I-133	La-142	Nd-147	Pd-112
Am-243	Be-7	Ce-142	Cs-139	Gd-153	I-133m	La-144	Ni-56	Pm-143
Am-244	Bi-207	Ce-143	Cs-140	Gd-159	I-134	Lu-177	Ni-57	Pm-144
Am-244m	Bi-208	Ce-144	Cs-141	Ge-68	I-134m	Lu-177m	Ni-59	Pm-145
Am-245	Bi-210	Cf-249	Cu-64	Ge-69	I-135	Mg-27	Ni-63	Pm-146
Am-246	Bi-210m	Cf-250	Cu-66	Ge-71	In-106	Mg-28	Ni-65	Pm-147
Ar-37	Bi-211	Cf-251	Cu-67	Ge-71m	In-111	Mn-52	Np-235	Pm-148
Ar-39	Bi-212	Cf-252	Dy-159	Ge-75	In-111m	Mn-52m	Np-236	Pm-148m
Ar-41	Bi-212m	Cl-36	Dy-165	Ge-77	In-112	Mn-53	Np-236m	Pm-149
Ar-42	Bi-212n	Cl-38	Dy-169	Ge-77m	In-112m	Mn-54	Np-237	Pm-150
As-73	Bi-213	Cm-241	Er-169	H-3	In-113m	Mn-56	Np-238	Pm-151
As-74	Bi-214	Cm-242	Er-171	Hf-175	In-114	Mo-93	Np-239	Po-208
As-76	Bk-247	Cm-243	ES-253	Hf-177m	In-114m	Mo-93m	Np-240	Po-209
As-77	Bk-248m	Cm-244	Es-254	Hf-178m	In-115	Mo-99	Np-240m	Po-210
At-211	Bk-249	Cm-245	Eu-150	Hf-179m	In-115m	Mo-103	O-15	Po-211
At-217	Bk-250	Cm-246	Eu-150m	Hf-180m	In-116	Mo-104	O-19	Po-212
At-218	Br-82	Cm-247	Eu-152	Hf-181	In-116m	Mo-105	Os-185	Po-212m
Au-193	Br-82m	Cm-248	Eu-152m	Hf-182	In-117	N-13	Os-191	Po-213
Au-193m	Br-83	Cm-249	Eu-152n	Hg-203	In-117m	Na-22	P-32	Po-214

Table B.1 (contd)

Po-215	Pu-246	Rh-102	Sb-128	Sn-121	Tc-96	Th-229	U-236	Y-89m
Po-216	Ra-223	Rh-102m	Sb-128m	Sn-121m	Tc-96m	Th-230	U-237	Y-90
Po-218	Ra-224	Rh-103m	Sb-129	Sn-123	Tc-97	Th-231	U-238	Y-90m
Pr-142	Ra-225	Rh-104	Sc-44	Sn-123m	Tc-97m	Th-232	U-239	Y-91
Pr-142m	Ra-226	Rh-104m	Sc-44m	Sn-125	Tc-98	Th-233	U-240	Y-91m
Pr-143	Ra-227	Rh-105	Sc-46	Sn-125m	Tc-99	Th-234	V-48	Y-92
Pr-144	Ra-228	Rh-105m	Sc-47	Sn-126	Tc-99m	Ti-44	V-49	Y-93
Pr-144m	Rb-81	Rh-106	Sc-48	Sr-82	Tc-101	Ti-45	W-181	Yb-164
Pt-191	Rb-81m	Rn-218	Se-75	Sr-83	Tc-103	Ti-51	W-185	Yb-165
Pt-193	Rb-82	Rn-219	Se-77m	Sr-85	Tc-106	Tl-200	W-185m	Yb-166
Pt-193m	Rb-82m	Rn-220	Se-79	Sr-85m	Te-121	Tl-201	W-187	Yb-167
Pt-195m	Rb-83	Rn-222	Se-79m	Sr-87m	Te-121m	Tl-202	W-188	Yb-169
Pt-197	Rb-84	Rn-224	Si-31	Sr-89	Te-123	Tl-204	Xe-122	Yb-175
Pt-197m	Rb-84m	Ru-103	Si-32	Sr-90	Te-123m	Tl-206	Xe-123	Yb-177
Pt-199	Rb-86	Ru-105	Sm-145	Sr-91	Te-125m	Tl-206m	Xe-125	Zn-65
Pt-199m	Rb-86m	Ru-106	Sm-146	Sr-92	Te-127	Tl-207	Xe-127	Zn-69
Pu-234	Rb-87	Ru-97	Sm-147	Ta-179	Te-127m	Tl-208	Xe-127m	Zn-69m
Pu-235	Rb-88	S-35	Sm-148	Ta-180	Te-129	Tl-209	Xe-129m	Zr-88
Pu-236	Rb-89	Sb-122	Sm-151	Ta-182	Te-129m	Tl-210	Xe-131m	Zr-89
Pu-237	Rb-90	Sb-122m	Sm-153	Ta-182m	Te-131	Tm-168	Xe-133	Zr-89m
Pu-238	Rb-90m	Sb-124	Sm-155	Ta-183	Te-131m	Tm-170	Xe-133m	Zr-93
Pu-239	Re-186	Sb-124m	Sm-156	Tb-157	Te-132	Tm-171	Xe-135	Zr-95
Pu-240	Re-186m	Sb-124n	Sm-157	Tb-158	Te-133	U-232	Xe-135m	Zr-97
Pu-241	Re-187	Sb-125	Sn-113	Tb-160	Te-133m	U-233	Xe-137	Zr-98
Pu-242	Re-188	Sb-126	Sn-113m	Tb-161	Te-134	U-234	Xe-138	Zr-99
Pu-243	Rh-101	Sb-126m	Sn-117m	Tc-95	Th-227	U-235	Xe-139	Zr-100
Pu-244	Rh-101m	Sb-127	Sn-119m	Tc-95m	Th-228	U-235m	Y-88	-

Appendix C

Ambient Particulate Air Sampling Results for PNNL Richland Campus Air Surveillance in 2019

Appendix C

Ambient Particulate Air Sampling Results for the PNNL Richland Campus Air Surveillance in 2019

Table C.1. Definitions for Air Sampling Data

Column Heading	Data Type/Format	Content
SAMP SITE NAME	text	Location of monitoring station: PNNL Richland Campus monitoring stations: PNL-1, PNL-2, PNL-3, PNL-4 Background Location: PNL-5
SAMP MTHD	text	The method used to collect the sample: FILTER2 — 2" filter paper; 120-volt AC system FILTER2 SOLAR — 2" filter paper; 24-volt solar-powered system
LAB SAMP ID	9-digit number	
SAMP DATE TIME ON	date (DD-MMM-YY HH:MM [24 hr])	Date and time when air sampling started (time field is truncated and not displayed in Table C.2).
SAMP DATE TIME	date (DD-MMM-YY HH:MM [24 hr])	Date and time when air sampling ended (time field is truncated and not displayed in Table C.2).
CON SHORT NAME	text	ALPHA, BETA, Am-241, Am-243, Be-7, Cm-243/244, Co-60, Cs-134, Cs-137, Eu-152, Eu-154, Eu-155, K-40, Pu-238, Pu-239/240, Ru-106, Sb-125, U-233/234, U-234, U-235, U-238. The sum of U-233 and U-234 is reported as either U-233/234 or U-234 and used for U-233 reporting.
VALUE RPTD	number (usually scientific notation)	Result reported by the analytical laboratory.
ANAL UNITS RPTD	text	Picocuries per cubic meter. Units associated with the values shown in the VALUE RPTD, COUNTING ERROR, and TOTAL ANAL ERROR 2-SIGMA columns.
COUNTING ERROR	number (usually scientific notation)	The 2-sigma counting error for the radioanalytical results only.
TOTAL ANAL ERROR 2-SIGMA	number (usually scientific notation)	The 2-sigma total analytical error for the radioanalytical results only.
LAB QUALIFIER	text or blank	If “U”, the VALUE RPTD was not detected above limiting criteria, which may include any of the following: value_rptd < 0, or < counting_error, or < total_analytical_error, or <= contract method detection limit/instrument detection limit/minimum detectable activity/practical quantitation limit. If “O”, the case narrative contains additional information regarding a quality control criteria not being met. If blank, no qualifier was needed.
SAMP COMMENT	text or blank	Contains pertinent information about the sample. If blank, no comment was needed
RESULT COMMENT	text or blank	Comment on the result. If blank, no comment was needed.
COMPOSITE FLAG	Y or blank	If “Y”, several samples from the same sampling station were composited and the composite measured for radioactivity. If blank, a single sample was evaluated.

Further details on each PNNL Richland Campus sample event (e.g., sample volume, analysis method) can be obtained from the project Site Environmental Monitoring (SEM) database and/or the Hanford Environmental Information Systems (HEIS 1989) database.

Table C.2. Air Sampling Results for the PNNL Richland Campus for Calendar Year 2019

SAMP SITE NAME	SAMP MTHD	LAB SAMP ID	SAMP DATE TIME ON	SAMP DATE TIME	CON SHORT NAME	VALUE RPTD	ANAL UNITS RPTD	COUNT-ING ERROR	TOTAL ANAL ERROR 2-SIGMA	LAB QUAL-IFIER	SAMP COMMENT	RESULT COMMENT	COM-POSITE FLAG
PNL-1	FILTER2 SOLAR	468032001	19-Dec-18	2-Jan-19	ALPHA	4.25E-04	pCi/m3	3.30E-04	3.30E-04	U			
PNL-1	FILTER2 SOLAR	469344001	2-Jan-19	16-Jan-19	ALPHA	5.79E-04	pCi/m3	3.45E-04	3.45E-04				
PNL-1	FILTER2 SOLAR	470521001	16-Jan-19	30-Jan-19	ALPHA	8.10E-04	pCi/m3	3.45E-04	3.45E-04	O			
PNL-1	FILTER2 SOLAR	471766001	30-Jan-19	14-Feb-19	ALPHA	7.57E-04	pCi/m3	3.52E-04	3.53E-04		DISPLAY PANEL INDICATED AIR FLOW FAILURE, SAMPLER WAS RUNNING AND DISPLAYED REALISTIC MONITORING DATA; DUE TO 02/13/19 INCLEMENT WEATHER WORK CANCELLATION, SAMPLE COLLECTION OCCURRED 02/14/19.		
PNL-1	FILTER2 SOLAR	472570001	14-Feb-19	27-Feb-19	ALPHA	1.44E-03	pCi/m3	4.69E-04	4.70E-04				
PNL-1	FILTER2 SOLAR	473913001	27-Feb-19	13-Mar-19	ALPHA	8.91E-04	pCi/m3	4.18E-04	4.18E-04				
PNL-1	FILTER2 SOLAR	475098001	13-Mar-19	27-Mar-19	ALPHA	1.33E-03	pCi/m3	4.84E-04	4.84E-04				
PNL-1	FILTER2 SOLAR	476578001	27-Mar-19	10-Apr-19	ALPHA	2.58E-04	pCi/m3	2.64E-04	2.64E-04	U			
PNL-1	FILTER2 SOLAR	477749001	10-Apr-19	24-Apr-19	ALPHA	6.68E-04	pCi/m3	3.72E-04	3.72E-04				
PNL-1	FILTER2 SOLAR	478918001	24-Apr-19	8-May-19	ALPHA	7.51E-04	pCi/m3	4.31E-04	4.31E-04				
PNL-1	FILTER2 SOLAR	479958001	8-May-19	22-May-19	ALPHA	7.06E-04	pCi/m3	3.34E-04	3.35E-04				
PNL-1	FILTER2 SOLAR	481287001	22-May-19	5-Jun-19	ALPHA	3.64E-04	pCi/m3	2.76E-04	2.77E-04	U			
PNL-1	FILTER2 SOLAR	482645001	5-Jun-19	19-Jun-19	ALPHA	5.80E-04	pCi/m3	3.14E-04	3.15E-04				
PNL-1	FILTER2 SOLAR	484146001	19-Jun-19	3-Jul-19	ALPHA	3.17E-04	pCi/m3	2.47E-04	2.47E-04	U			
PNL-1	FILTER2 SOLAR	485075001	3-Jul-19	17-Jul-19	ALPHA	5.70E-04	pCi/m3	2.92E-04	2.92E-04	O			
PNL-1	FILTER2 SOLAR	486736001	17-Jul-19	31-Jul-19	ALPHA	3.38E-04	pCi/m3	2.45E-04	2.45E-04				
PNL-1	FILTER2 SOLAR	487945001	31-Jul-19	14-Aug-19	ALPHA	6.05E-04	pCi/m3	3.46E-04	3.46E-04				
PNL-1	FILTER2 SOLAR	489671001	14-Aug-19	28-Aug-19	ALPHA	2.26E-04	pCi/m3	2.41E-04	2.41E-04	U			
PNL-1	FILTER2 SOLAR	490526001	28-Aug-19	11-Sep-19	ALPHA	4.40E-04	pCi/m3	2.80E-04	2.80E-04				
PNL-1	FILTER2 SOLAR	491398001	11-Sep-19	25-Sep-19	ALPHA	8.58E-04	pCi/m3	4.17E-04	4.17E-04	O			
PNL-1	FILTER2 SOLAR	492938001	25-Sep-19	9-Oct-19	ALPHA	2.32E-04	pCi/m3	2.95E-04	2.95E-04	U			
PNL-1	FILTER2 SOLAR	494542001	9-Oct-19	23-Oct-19	ALPHA	8.62E-04	pCi/m3	3.63E-04	3.63E-04				
PNL-1	FILTER2 SOLAR	496008001	23-Oct-19	6-Nov-19	ALPHA	1.14E-03	pCi/m3	4.67E-04	4.69E-04	O	DISPLAY PANEL INDICATED AIR FLOW FAILURE, SAMPLER WAS RUNNING AND DISPLAYED REALISTIC MONITORING DATA; AIR STAGNATION EVIDENT.		
PNL-1	FILTER2 SOLAR	497547001	6-Nov-19	20-Nov-19	ALPHA	1.32E-03	pCi/m3	5.03E-04	5.04E-04				
PNL-1	FILTER2 SOLAR	498542001	20-Nov-19	4-Dec-19	ALPHA	7.38E-04	pCi/m3	3.84E-04	3.84E-04				
PNL-1	FILTER2 SOLAR	499986001	4-Dec-19	18-Dec-19	ALPHA	1.13E-03	pCi/m3	4.09E-04	4.10E-04				
PNL-1	FILTER2 SOLAR	500032001	18-Dec-19	31-Dec-19	ALPHA	5.32E-04	pCi/m3	3.43E-04	3.43E-04				

Table C.2 (contd)

SAMP SITE NAME	SAMP MTHD	LAB SAMP ID	SAMP DATE TIME ON	SAMP DATE TIME	CON SHORT NAME	VALUE RPTD	ANAL UNITS RPTD	COUNT-ING ERROR	TOTAL ANAL ERROR 2-SIGMA	LAB QUAL-IFIER	SAMP COMMENT	RESULT COMMENT	COM-POSITE FLAG
PNL-1	FILTER2 SOLAR	468032001	19-Dec-18	2-Jan-19	BETA	1.26E-02	pCi/m3	9.03E-04	1.02E-03	O			
PNL-1	FILTER2 SOLAR	469344001	2-Jan-19	16-Jan-19	BETA	2.12E-02	pCi/m3	1.17E-03	1.26E-03	O			
PNL-1	FILTER2 SOLAR	470521001	16-Jan-19	30-Jan-19	BETA	2.24E-02	pCi/m3	1.28E-03	1.37E-03	O			
PNL-1	FILTER2 SOLAR	471766001	30-Jan-19	14-Feb-19	BETA	3.27E-02	pCi/m3	1.42E-03	1.90E-03	O	DISPLAY PANEL INDICATED AIR FLOW FAILURE, SAMPLER WAS RUNNING AND DISPLAYED REALISTIC MONITORING DATA; DUE TO 02/13/19 INCLEMENT WEATHER WORK CANCELLATION, SAMPLE COLLECTION OCCURRED 02/14/19.		
PNL-1	FILTER2 SOLAR	472570001	14-Feb-19	27-Feb-19	BETA	3.37E-02	pCi/m3	1.55E-03	1.62E-03	O			
PNL-1	FILTER2 SOLAR	473913001	27-Feb-19	13-Mar-19	BETA	2.74E-02	pCi/m3	1.36E-03	1.49E-03	O			
PNL-1	FILTER2 SOLAR	475098001	13-Mar-19	27-Mar-19	BETA	1.89E-02	pCi/m3	1.11E-03	1.13E-03	O			
PNL-1	FILTER2 SOLAR	476578001	27-Mar-19	10-Apr-19	BETA	1.21E-02	pCi/m3	9.10E-04	9.92E-04	O			
PNL-1	FILTER2 SOLAR	477749001	10-Apr-19	24-Apr-19	BETA	9.92E-03	pCi/m3	8.08E-04	8.93E-04	O			
PNL-1	FILTER2 SOLAR	478918001	24-Apr-19	8-May-19	BETA	1.79E-02	pCi/m3	1.10E-03	1.13E-03	O			
PNL-1	FILTER2 SOLAR	479958001	8-May-19	22-May-19	BETA	1.36E-02	pCi/m3	9.50E-04	1.04E-03	O			
PNL-1	FILTER2 SOLAR	481287001	22-May-19	5-Jun-19	BETA	1.59E-02	pCi/m3	1.09E-03	1.24E-03	O			
PNL-1	FILTER2 SOLAR	482645001	5-Jun-19	19-Jun-19	BETA	1.12E-02	pCi/m3	8.92E-04	9.05E-04	O			
PNL-1	FILTER2 SOLAR	484146001	19-Jun-19	3-Jul-19	BETA	9.52E-03	pCi/m3	8.27E-04	8.63E-04	O			
PNL-1	FILTER2 SOLAR	485075001	3-Jul-19	17-Jul-19	BETA	1.27E-02	pCi/m3	9.26E-04	9.43E-04	O			
PNL-1	FILTER2 SOLAR	486736001	17-Jul-19	31-Jul-19	BETA	1.35E-02	pCi/m3	9.55E-04	9.74E-04	O			
PNL-1	FILTER2 SOLAR	487945001	31-Jul-19	14-Aug-19	BETA	1.49E-02	pCi/m3	1.02E-03	1.17E-03	O			
PNL-1	FILTER2 SOLAR	489671001	14-Aug-19	28-Aug-19	BETA	1.25E-02	pCi/m3	9.26E-04	9.42E-04	O			
PNL-1	FILTER2 SOLAR	490526001	28-Aug-19	11-Sep-19	BETA	1.60E-02	pCi/m3	1.01E-03	1.04E-03	O			
PNL-1	FILTER2 SOLAR	491398001	11-Sep-19	25-Sep-19	BETA	1.03E-02	pCi/m3	8.51E-04	9.70E-04	O			
PNL-1	FILTER2 SOLAR	492938001	25-Sep-19	9-Oct-19	BETA	9.53E-03	pCi/m3	7.91E-04	8.07E-04	O			
PNL-1	FILTER2 SOLAR	494542001	9-Oct-19	23-Oct-19	BETA	2.17E-02	pCi/m3	1.20E-03	1.24E-03	O			
PNL-1	FILTER2 SOLAR	496008001	23-Oct-19	6-Nov-19	BETA	3.13E-02	pCi/m3	1.50E-03	2.03E-03	O	DISPLAY PANEL INDICATED AIR FLOW FAILURE, SAMPLER WAS RUNNING AND DISPLAYED REALISTIC MONITORING DATA; AIR STAGNATION EVIDENT.		
PNL-1	FILTER2 SOLAR	497547001	6-Nov-19	20-Nov-19	BETA	4.26E-02	pCi/m3	1.73E-03	1.80E-03	O			
PNL-1	FILTER2 SOLAR	498542001	20-Nov-19	4-Dec-19	BETA	2.78E-02	pCi/m3	1.35E-03	1.38E-03	O			
PNL-1	FILTER2 SOLAR	499986001	4-Dec-19	18-Dec-19	BETA	2.84E-02	pCi/m3	1.36E-03	1.40E-03	O			
PNL-1	FILTER2 SOLAR	500032001	18-Dec-19	31-Dec-19	BETA	2.10E-02	pCi/m3	1.24E-03	1.27E-03	O			
PNL-1	FILTER2 SOLAR	484049001	19-Dec-18	19-Jun-19	Be-7	5.71E-02	pCi/m3	2.81E-03	5.69E-03				Y

Table C.2 (contd)

SAMP SITE NAME	SAMP MTHD	LAB SAMP ID	SAMP DATE TIME ON	SAMP DATE TIME	CON SHORT NAME	VALUE RPTD	ANAL UNITS RPTD	COUNT-ING ERROR	TOTAL ANAL ERROR 2-SIGMA	LAB QUAL-IFIER	SAMP COMMENT	RESULT COMMENT	COM-POSITE FLAG
PNL-1	FILTER2 SOLAR	502227001	28-Aug-19	31-Dec-19	Be-7	2.87E-02	pCi/m3	2.57E-03	3.81E-03				Y
PNL-1	FILTER2 SOLAR	484049001	19-Dec-18	19-Jun-19	Co-60	9.79E-05	pCi/m3	8.11E-05	9.28E-05	U			Y
PNL-1	FILTER2 SOLAR	502227001	28-Aug-19	31-Dec-19	Co-60	-3.77E-05	pCi/m3	1.07E-04	1.08E-04	U			Y
PNL-1	FILTER2 SOLAR	484049001	19-Dec-18	19-Jun-19	Cs-134	4.15E-05	pCi/m3	1.60E-04	1.61E-04	U			Y
PNL-1	FILTER2 SOLAR	502227001	28-Aug-19	31-Dec-19	Cs-134	4.76E-06	pCi/m3	5.65E-05	5.66E-05	U			Y
PNL-1	FILTER2 SOLAR	484049001	19-Dec-18	19-Jun-19	Cs-137	5.43E-05	pCi/m3	7.95E-05	8.33E-05	U			Y
PNL-1	FILTER2 SOLAR	502227001	28-Aug-19	31-Dec-19	Cs-137	1.91E-05	pCi/m3	6.41E-05	6.47E-05	U			Y
PNL-1	FILTER2 SOLAR	484049001	19-Dec-18	19-Jun-19	Eu-152	9.87E-05	pCi/m3	2.52E-04	2.56E-04	U			Y
PNL-1	FILTER2 SOLAR	502227001	28-Aug-19	31-Dec-19	Eu-152	2.13E-04	pCi/m3	1.39E-04	1.71E-04	U			Y
PNL-1	FILTER2 SOLAR	484049001	19-Dec-18	19-Jun-19	Eu-154	1.38E-04	pCi/m3	2.08E-04	2.18E-04	U			Y
PNL-1	FILTER2 SOLAR	502227001	28-Aug-19	31-Dec-19	Eu-154	3.28E-04	pCi/m3	2.26E-04	2.71E-04	U			Y
PNL-1	FILTER2 SOLAR	484049001	19-Dec-18	19-Jun-19	Eu-155	2.57E-04	pCi/m3	2.86E-04	3.10E-04	U			Y
PNL-1	FILTER2 SOLAR	502227001	28-Aug-19	31-Dec-19	Eu-155	-4.49E-05	pCi/m3	1.47E-04	1.49E-04	U			Y
PNL-1	FILTER2 SOLAR	484049001	19-Dec-18	19-Jun-19	K-40	-1.27E-03	pCi/m3	2.08E-03	2.16E-03	U			Y
PNL-1	FILTER2 SOLAR	502227001	28-Aug-19	31-Dec-19	K-40	3.00E-03	pCi/m3	1.43E-03	1.46E-03				Y
PNL-1	FILTER2 SOLAR	484049001	19-Dec-18	19-Jun-19	Ru-106	-2.49E-04	pCi/m3	7.57E-04	7.66E-04	U			Y
PNL-1	FILTER2 SOLAR	502227001	28-Aug-19	31-Dec-19	Ru-106	-3.70E-04	pCi/m3	6.56E-04	6.78E-04	U			Y
PNL-1	FILTER2 SOLAR	484049001	19-Dec-18	19-Jun-19	Sb-125	6.86E-05	pCi/m3	2.29E-04	2.31E-04	U			Y
PNL-1	FILTER2 SOLAR	502227001	28-Aug-19	31-Dec-19	Sb-125	5.46E-05	pCi/m3	1.42E-04	1.44E-04	U			Y
PNL-1	FILTER2 SOLAR	484049001	19-Dec-18	19-Jun-19	Am-241	9.13E-06	pCi/m3	1.05E-05	1.06E-05	U			Y
PNL-1	FILTER2 SOLAR	502227001	28-Aug-19	31-Dec-19	Am-241	1.86E-06	pCi/m3	3.21E-06	3.22E-06	U			Y
PNL-1	FILTER2 SOLAR	484049001	19-Dec-18	19-Jun-19	Am-243	8.59E-06	pCi/m3	1.32E-05	1.33E-05	U			Y
PNL-1	FILTER2 SOLAR	502227001	28-Aug-19	31-Dec-19	Am-243	0.00E+00	pCi/m3	4.83E-06	4.83E-06	U			Y
PNL-1	FILTER2 SOLAR	484049001	19-Dec-18	19-Jun-19	Cm-243/244	-1.30E-06	pCi/m3	6.72E-06	6.72E-06	U			Y
PNL-1	FILTER2 SOLAR	502227001	28-Aug-19	31-Dec-19	Cm-243/244	1.23E-06	pCi/m3	3.80E-06	3.81E-06	U			Y
PNL-1	FILTER2 SOLAR	484049001	19-Dec-18	19-Jun-19	Pu-238	5.25E-06	pCi/m3	1.03E-05	1.03E-05	U			Y
PNL-1	FILTER2 SOLAR	502227001	28-Aug-19	31-Dec-19	Pu-238	1.11E-06	pCi/m3	6.18E-06	6.19E-06	U			Y
PNL-1	FILTER2 SOLAR	484049001	19-Dec-18	19-Jun-19	Pu-239/240	4.66E-06	pCi/m3	9.00E-06	9.01E-06	U			Y
PNL-1	FILTER2 SOLAR	502227001	28-Aug-19	31-Dec-19	Pu-239/240	2.22E-06	pCi/m3	7.59E-06	7.60E-06	U			Y
PNL-1	FILTER2 SOLAR	484049001	19-Dec-18	19-Jun-19	U-233/234	2.05E-05	pCi/m3	2.50E-05	2.53E-05	U			Y
PNL-1	FILTER2 SOLAR	502227001	28-Aug-19	31-Dec-19	U-233/234	4.61E-05	pCi/m3	2.93E-05	3.02E-05				Y
PNL-1	FILTER2 SOLAR	484049001	19-Dec-18	19-Jun-19	U-235	-3.48E-06	pCi/m3	1.05E-05	1.05E-05	U			Y
PNL-1	FILTER2 SOLAR	502227001	28-Aug-19	31-Dec-19	U-235	7.52E-06	pCi/m3	1.48E-05	1.48E-05	U			Y
PNL-1	FILTER2 SOLAR	484049001	19-Dec-18	19-Jun-19	U-238	4.91E-05	pCi/m3	3.01E-05	3.07E-05				Y
PNL-1	FILTER2 SOLAR	502227001	28-Aug-19	31-Dec-19	U-238	4.85E-05	pCi/m3	2.73E-05	2.83E-05				Y
PNL-2	FILTER2 SOLAR	468032002	19-Dec-18	2-Jan-19	ALPHA	2.06E-04	pCi/m3	2.63E-04	2.63E-04	U			

Table C.2 (contd)

SAMP SITE NAME	SAMP MTHD	LAB SAMP ID	SAMP DATE TIME ON	SAMP DATE TIME	CON SHORT NAME	VALUE RPTD	ANAL UNITS RPTD	COUNT-ING ERROR	TOTAL ANAL ERROR 2-SIGMA	LAB QUAL-IFIER	SAMP COMMENT	RESULT COMMENT	COM-POSITE FLAG
PNL-2	FILTER2 SOLAR	469344002	2-Jan-19	16-Jan-19	ALPHA	4.32E-04	pCi/m3	3.20E-04	3.20E-04	U	DISPLAY PANEL INDICATED AIR FLOW FAILURE, SAMPLER WAS RUNNING AND DISPLAYED REALISTIC MONITORING DATA; COLD TEMPERATURES.		
PNL-2	FILTER2 SOLAR	470521002	16-Jan-19	30-Jan-19	ALPHA	4.21E-04	pCi/m3	2.70E-04	2.70E-04	O	DISPLAY PANEL INDICATED AIR FLOW FAILURE, SAMPLER WAS RUNNING AND DISPLAYED REALISTIC MONITORING DATA; COLD TEMPERATURES.		
PNL-2	FILTER2 SOLAR	471766002	30-Jan-19	14-Feb-19	ALPHA	9.96E-04	pCi/m3	3.85E-04	3.88E-04		DISPLAY PANEL INDICATED AIR FLOW FAILURE, SAMPLER WAS RUNNING AND DISPLAYED REALISTIC MONITORING DATA; DUE TO 02/13/19 INCLEMENT WEATHER WORK CANCELLATION, SAMPLE COLLECTION OCCURRED 02/14/19.		
PNL-2	FILTER2 SOLAR	472570002	14-Feb-19	27-Feb-19	ALPHA	7.32E-04	pCi/m3	3.57E-04	3.57E-04				
PNL-2	FILTER2 SOLAR	473913002	27-Feb-19	13-Mar-19	ALPHA	7.92E-04	pCi/m3	4.02E-04	4.02E-04				
PNL-2	FILTER2 SOLAR	475098002	13-Mar-19	27-Mar-19	ALPHA	1.36E-03	pCi/m3	4.53E-04	4.53E-04				
PNL-2	FILTER2 SOLAR	476578002	27-Mar-19	10-Apr-19	ALPHA	6.08E-04	pCi/m3	3.32E-04	3.33E-04				
PNL-2	FILTER2 SOLAR	477749002	10-Apr-19	24-Apr-19	ALPHA	4.54E-04	pCi/m3	2.83E-04	2.83E-04				
PNL-2	FILTER2 SOLAR	478918002	24-Apr-19	8-May-19	ALPHA	9.59E-04	pCi/m3	4.30E-04	4.31E-04				
PNL-2	FILTER2 SOLAR	479958002	8-May-19	22-May-19	ALPHA	5.76E-04	pCi/m3	3.05E-04	3.05E-04				
PNL-2	FILTER2 SOLAR	481287002	22-May-19	5-Jun-19	ALPHA	7.48E-04	pCi/m3	3.31E-04	3.31E-04				
PNL-2	FILTER2 SOLAR	482645002	5-Jun-19	19-Jun-19	ALPHA	4.33E-04	pCi/m3	3.49E-04	3.49E-04	U			
PNL-2	FILTER2 SOLAR	484146002	19-Jun-19	3-Jul-19	ALPHA	4.89E-04	pCi/m3	3.10E-04	3.10E-04				
PNL-2	FILTER2 SOLAR	485075002	3-Jul-19	17-Jul-19	ALPHA	4.99E-04	pCi/m3	2.89E-04	2.90E-04	O			
PNL-2	FILTER2 SOLAR	486736002	17-Jul-19	31-Jul-19	ALPHA	5.61E-04	pCi/m3	2.96E-04	2.97E-04				
PNL-2	FILTER2 SOLAR	487945002	31-Jul-19	14-Aug-19	ALPHA	2.47E-04	pCi/m3	2.47E-04	2.47E-04	U			
PNL-2	FILTER2 SOLAR	489671002	14-Aug-19	28-Aug-19	ALPHA	9.15E-04	pCi/m3	4.08E-04	4.09E-04				
PNL-2	FILTER2 SOLAR	490526002	28-Aug-19	11-Sep-19	ALPHA	2.09E-04	pCi/m3	2.06E-04	2.06E-04	U			
PNL-2	FILTER2 SOLAR	491398002	11-Sep-19	25-Sep-19	ALPHA	4.24E-04	pCi/m3	3.37E-04	3.37E-04	UO			
PNL-2	FILTER2 SOLAR	492938002	25-Sep-19	9-Oct-19	ALPHA	3.30E-04	pCi/m3	2.75E-04	2.76E-04	U			
PNL-2	FILTER2 SOLAR	494542002	9-Oct-19	23-Oct-19	ALPHA	1.51E-03	pCi/m3	4.97E-04	4.99E-04				
PNL-2	FILTER2 SOLAR	496008002	23-Oct-19	6-Nov-19	ALPHA	8.82E-04	pCi/m3	4.34E-04	4.35E-04	O			
PNL-2	FILTER2 SOLAR	497547002	6-Nov-19	20-Nov-19	ALPHA	1.87E-03	pCi/m3	5.75E-04	5.83E-04				
PNL-2	FILTER2 SOLAR	498542002	20-Nov-19	4-Dec-19	ALPHA	6.59E-04	pCi/m3	3.46E-04	3.46E-04				

Table C.2 (contd)

SAMP SITE NAME	SAMP MTHD	LAB SAMP ID	SAMP DATE TIME ON	SAMP DATE TIME	CON SHORT NAME	VALUE RPTD	ANAL UNITS RPTD	COUNT-ING ERROR	TOTAL ANAL ERROR 2-SIGMA	LAB QUAL-IFIER	SAMP COMMENT	RESULT COMMENT	COM-POSITE FLAG
PNL-2	FILTER2 SOLAR	499986002	4-Dec-19	18-Dec-19	ALPHA	1.46E-03	pCi/m3	5.16E-04	5.16E-04				
PNL-2	FILTER2 SOLAR	500032002	18-Dec-19	31-Dec-19	ALPHA	7.80E-04	pCi/m3	3.75E-04	3.75E-04				
PNL-2	FILTER2 SOLAR	468032002	19-Dec-18	2-Jan-19	BETA	1.27E-02	pCi/m3	9.40E-04	9.52E-04	O			
PNL-2	FILTER2 SOLAR	469344002	2-Jan-19	16-Jan-19	BETA	2.15E-02	pCi/m3	1.19E-03	1.36E-03	O	DISPLAY PANEL INDICATED AIR FLOW FAILURE, SAMPLER WAS RUNNING AND DISPLAYED REALISTIC MONITORING DATA; COLD TEMPERATURES.		
PNL-2	FILTER2 SOLAR	470521002	16-Jan-19	30-Jan-19	BETA	2.02E-02	pCi/m3	1.18E-03	1.20E-03	O	DISPLAY PANEL INDICATED AIR FLOW FAILURE, SAMPLER WAS RUNNING AND DISPLAYED REALISTIC MONITORING DATA; COLD TEMPERATURES.		
PNL-2	FILTER2 SOLAR	471766002	30-Jan-19	14-Feb-19	BETA	3.31E-02	pCi/m3	1.42E-03	1.79E-03	O	DISPLAY PANEL INDICATED AIR FLOW FAILURE, SAMPLER WAS RUNNING AND DISPLAYED REALISTIC MONITORING DATA; DUE TO 02/13/19 INCLEMENT WEATHER WORK CANCELLATION, SAMPLE COLLECTION OCCURRED 02/14/19.		
PNL-2	FILTER2 SOLAR	472570002	14-Feb-19	27-Feb-19	BETA	2.80E-02	pCi/m3	1.42E-03	1.52E-03	O			
PNL-2	FILTER2 SOLAR	473913002	27-Feb-19	13-Mar-19	BETA	2.47E-02	pCi/m3	1.30E-03	1.49E-03	O			
PNL-2	FILTER2 SOLAR	475098002	13-Mar-19	27-Mar-19	BETA	1.77E-02	pCi/m3	1.10E-03	1.19E-03	O			
PNL-2	FILTER2 SOLAR	476578002	27-Mar-19	10-Apr-19	BETA	1.31E-02	pCi/m3	1.01E-03	1.12E-03	O			
PNL-2	FILTER2 SOLAR	477749002	10-Apr-19	24-Apr-19	BETA	9.36E-03	pCi/m3	7.90E-04	8.02E-04	O			
PNL-2	FILTER2 SOLAR	478918002	24-Apr-19	8-May-19	BETA	1.61E-02	pCi/m3	1.13E-03	1.20E-03	O			
PNL-2	FILTER2 SOLAR	479958002	8-May-19	22-May-19	BETA	1.16E-02	pCi/m3	8.63E-04	9.91E-04	O			
PNL-2	FILTER2 SOLAR	481287002	22-May-19	5-Jun-19	BETA	1.60E-02	pCi/m3	1.03E-03	1.05E-03	O			
PNL-2	FILTER2 SOLAR	482645002	5-Jun-19	19-Jun-19	BETA	8.58E-03	pCi/m3	8.20E-04	8.33E-04	O			
PNL-2	FILTER2 SOLAR	484146002	19-Jun-19	3-Jul-19	BETA	8.46E-03	pCi/m3	7.82E-04	7.90E-04	O			
PNL-2	FILTER2 SOLAR	485075002	3-Jul-19	17-Jul-19	BETA	9.52E-03	pCi/m3	8.16E-04	8.35E-04	O			
PNL-2	FILTER2 SOLAR	486736002	17-Jul-19	31-Jul-19	BETA	1.03E-02	pCi/m3	8.44E-04	8.67E-04	O			
PNL-2	FILTER2 SOLAR	487945002	31-Jul-19	14-Aug-19	BETA	1.36E-02	pCi/m3	9.74E-04	1.02E-03	O			
PNL-2	FILTER2 SOLAR	489671002	14-Aug-19	28-Aug-19	BETA	1.24E-02	pCi/m3	9.15E-04	9.38E-04	O			
PNL-2	FILTER2 SOLAR	490526002	28-Aug-19	11-Sep-19	BETA	1.41E-02	pCi/m3	9.66E-04	9.89E-04	O			
PNL-2	FILTER2 SOLAR	491398002	11-Sep-19	25-Sep-19	BETA	9.85E-03	pCi/m3	8.59E-04	8.86E-04	O			
PNL-2	FILTER2 SOLAR	492938002	25-Sep-19	9-Oct-19	BETA	1.05E-02	pCi/m3	8.26E-04	8.31E-04	O			
PNL-2	FILTER2 SOLAR	494542002	9-Oct-19	23-Oct-19	BETA	1.96E-02	pCi/m3	1.14E-03	1.16E-03	O			
PNL-2	FILTER2 SOLAR	496008002	23-Oct-19	6-Nov-19	BETA	3.30E-02	pCi/m3	1.55E-03	1.64E-03	O			
PNL-2	FILTER2 SOLAR	497547002	6-Nov-19	20-Nov-19	BETA	3.71E-02	pCi/m3	1.59E-03	2.47E-03	O			

Table C.2 (contd)

SAMP SITE NAME	SAMP MTHD	LAB SAMP ID	SAMP DATE TIME ON	SAMP DATE TIME	CON SHORT NAME	VALUE RPTD	ANAL UNITS RPTD	COUNT-ING ERROR	TOTAL ANAL ERROR 2-SIGMA	LAB QUAL-IFIER	SAMP COMMENT	RESULT COMMENT	COM-POSITE FLAG
PNL-2	FILTER2 SOLAR	498542002	20-Nov-19	4-Dec-19	BETA	2.67E-02	pCi/m3	1.31E-03	1.42E-03	O			
PNL-2	FILTER2 SOLAR	499986002	4-Dec-19	18-Dec-19	BETA	2.88E-02	pCi/m3	1.38E-03	1.45E-03	O			
PNL-2	FILTER2 SOLAR	500032002	18-Dec-19	31-Dec-19	BETA	2.14E-02	pCi/m3	1.27E-03	1.30E-03	O			
PNL-2	FILTER2 SOLAR	484049002	19-Dec-18	19-Jun-19	Be-7	5.15E-02	pCi/m3	2.44E-03	5.31E-03				Y
PNL-2	FILTER2 SOLAR	502227002	28-Aug-19	31-Dec-19	Be-7	2.63E-02	pCi/m3	2.97E-03	3.83E-03				Y
PNL-2	FILTER2 SOLAR	484049002	19-Dec-18	19-Jun-19	Co-60	4.12E-05	pCi/m3	7.31E-05	7.55E-05	U			Y
PNL-2	FILTER2 SOLAR	502227002	28-Aug-19	31-Dec-19	Co-60	-2.94E-05	pCi/m3	8.02E-05	8.13E-05	U			Y
PNL-2	FILTER2 SOLAR	484049002	19-Dec-18	19-Jun-19	Cs-134	1.48E-04	pCi/m3	8.04E-05	1.06E-04	U			Y
PNL-2	FILTER2 SOLAR	502227002	28-Aug-19	31-Dec-19	Cs-134	1.73E-05	pCi/m3	8.41E-05	8.45E-05	U			Y
PNL-2	FILTER2 SOLAR	484049002	19-Dec-18	19-Jun-19	Cs-137	7.35E-06	pCi/m3	7.01E-05	7.02E-05	U			Y
PNL-2	FILTER2 SOLAR	502227002	28-Aug-19	31-Dec-19	Cs-137	1.18E-05	pCi/m3	6.78E-05	6.80E-05	U			Y
PNL-2	FILTER2 SOLAR	484049002	19-Dec-18	19-Jun-19	Eu-152	-1.68E-04	pCi/m3	2.04E-04	2.18E-04	U			Y
PNL-2	FILTER2 SOLAR	502227002	28-Aug-19	31-Dec-19	Eu-152	6.04E-05	pCi/m3	1.52E-04	1.54E-04	U			Y
PNL-2	FILTER2 SOLAR	484049002	19-Dec-18	19-Jun-19	Eu-154	2.77E-05	pCi/m3	2.09E-04	2.10E-04	U			Y
PNL-2	FILTER2 SOLAR	502227002	28-Aug-19	31-Dec-19	Eu-154	2.25E-04	pCi/m3	2.38E-04	2.59E-04	U			Y
PNL-2	FILTER2 SOLAR	484049002	19-Dec-18	19-Jun-19	Eu-155	2.13E-05	pCi/m3	1.51E-04	1.51E-04	U			Y
PNL-2	FILTER2 SOLAR	502227002	28-Aug-19	31-Dec-19	Eu-155	5.36E-07	pCi/m3	1.51E-04	1.51E-04	U			Y
PNL-2	FILTER2 SOLAR	484049002	19-Dec-18	19-Jun-19	K-40	4.23E-03	pCi/m3	2.57E-03	2.60E-03				Y
PNL-2	FILTER2 SOLAR	502227002	28-Aug-19	31-Dec-19	K-40	2.78E-03	pCi/m3	2.32E-03	2.33E-03				Y
PNL-2	FILTER2 SOLAR	484049002	19-Dec-18	19-Jun-19	Ru-106	7.83E-04	pCi/m3	6.73E-04	7.64E-04	U			Y
PNL-2	FILTER2 SOLAR	502227002	28-Aug-19	31-Dec-19	Ru-106	-2.22E-04	pCi/m3	6.64E-04	6.72E-04	U			Y
PNL-2	FILTER2 SOLAR	484049002	19-Dec-18	19-Jun-19	Sb-125	-1.17E-05	pCi/m3	1.74E-04	1.74E-04	U			Y
PNL-2	FILTER2 SOLAR	502227002	28-Aug-19	31-Dec-19	Sb-125	-4.84E-05	pCi/m3	1.51E-04	1.52E-04	U			Y
PNL-2	FILTER2 SOLAR	484049002	19-Dec-18	19-Jun-19	Am-241	1.66E-06	pCi/m3	6.09E-06	6.10E-06	U			Y
PNL-2	FILTER2 SOLAR	502227002	28-Aug-19	31-Dec-19	Am-241	2.32E-06	pCi/m3	2.12E-06	2.14E-06	U			Y
PNL-2	FILTER2 SOLAR	484049002	19-Dec-18	19-Jun-19	Am-243	1.64E-06	pCi/m3	7.52E-06	7.52E-06	U			Y
PNL-2	FILTER2 SOLAR	502227002	28-Aug-19	31-Dec-19	Am-243	3.08E-07	pCi/m3	2.89E-06	2.89E-06	U			Y
PNL-2	FILTER2 SOLAR	484049002	19-Dec-18	19-Jun-19	Cm-243/244	-1.65E-06	pCi/m3	4.58E-06	4.58E-06	U			Y
PNL-2	FILTER2 SOLAR	502227002	28-Aug-19	31-Dec-19	Cm-243/244	8.62E-07	pCi/m3	1.69E-06	1.69E-06	U			Y
PNL-2	FILTER2 SOLAR	484049002	19-Dec-18	19-Jun-19	Pu-238	-3.54E-06	pCi/m3	4.46E-06	4.46E-06	U			Y
PNL-2	FILTER2 SOLAR	502227002	28-Aug-19	31-Dec-19	Pu-238	-7.05E-07	pCi/m3	3.12E-06	3.12E-06	U			Y
PNL-2	FILTER2 SOLAR	484049002	19-Dec-18	19-Jun-19	Pu-239/240	-2.14E-06	pCi/m3	5.79E-06	5.80E-06	U			Y
PNL-2	FILTER2 SOLAR	502227002	28-Aug-19	31-Dec-19	Pu-239/240	4.69E-07	pCi/m3	5.35E-06	5.35E-06	U			Y
PNL-2	FILTER2 SOLAR	484049002	19-Dec-18	19-Jun-19	U-233/234	2.68E-05	pCi/m3	1.48E-05	1.53E-05				Y
PNL-2	FILTER2 SOLAR	502227002	28-Aug-19	31-Dec-19	U-233/234	5.13E-05	pCi/m3	2.12E-05	2.28E-05				Y
PNL-2	FILTER2 SOLAR	484049002	19-Dec-18	19-Jun-19	U-235	-4.38E-07	pCi/m3	6.57E-06	6.57E-06	U			Y
PNL-2	FILTER2 SOLAR	502227002	28-Aug-19	31-Dec-19	U-235	1.15E-06	pCi/m3	6.42E-06	6.43E-06	U			Y

Table C.2 (contd)

SAMP SITE NAME	SAMP MTHD	LAB SAMP ID	SAMP DATE TIME ON	SAMP DATE TIME	CON SHORT NAME	VALUE RPTD	ANAL UNITS RPTD	COUNT-ING ERROR	TOTAL ANAL ERROR 2-SIGMA	LAB QUAL-IFIER	SAMP COMMENT	RESULT COMMENT	COM-POSITE FLAG
PNL-2	FILTER2 SOLAR	484049002	19-Dec-18	19-Jun-19	U-238	3.41E-05	pCi/m3	1.60E-05	1.66E-05				Y
PNL-2	FILTER2 SOLAR	502227002	28-Aug-19	31-Dec-19	U-238	5.89E-05	pCi/m3	2.09E-05	2.29E-05				Y
PNL-3	FILTER2	468032003	19-Dec-18	2-Jan-19	ALPHA	3.86E-04	pCi/m3	3.19E-04	3.19E-04	U			
PNL-3	FILTER2	469344003	2-Jan-19	16-Jan-19	ALPHA	9.62E-04	pCi/m3	4.37E-04	4.39E-04				
PNL-3	FILTER2	470521003	16-Jan-19	30-Jan-19	ALPHA	3.93E-04	pCi/m3	2.69E-04	2.69E-04	O			
PNL-3	FILTER2	471766003	30-Jan-19	14-Feb-19	ALPHA	1.10E-03	pCi/m3	4.28E-04	4.30E-04		DUE TO 02/13/19 INCLEMENT WEATHER WORK CANCELLATION, SAMPLE COLLECTION OCCURRED 02/14/19.		
PNL-3	FILTER2	472570003	14-Feb-19	27-Feb-19	ALPHA	1.04E-03	pCi/m3	4.54E-04	4.55E-04				
PNL-3	FILTER2	473913003	27-Feb-19	13-Mar-19	ALPHA	1.00E-03	pCi/m3	5.17E-04	5.19E-04				
PNL-3	FILTER2	475098003	13-Mar-19	27-Mar-19	ALPHA	8.89E-04	pCi/m3	4.32E-04	4.32E-04				
PNL-3	FILTER2	476578003	27-Mar-19	10-Apr-19	ALPHA	9.14E-04	pCi/m3	3.87E-04	3.87E-04				
PNL-3	FILTER2	477749003	10-Apr-19	24-Apr-19	ALPHA	3.12E-04	pCi/m3	2.70E-04	2.71E-04	U			
PNL-3	FILTER2	478918003	24-Apr-19	8-May-19	ALPHA	2.71E-04	pCi/m3	3.82E-04	3.82E-04	U			
PNL-3	FILTER2	479958003	8-May-19	22-May-19	ALPHA	3.42E-04	pCi/m3	2.99E-04	2.99E-04	U			
PNL-3	FILTER2	481287003	22-May-19	5-Jun-19	ALPHA	4.52E-04	pCi/m3	2.59E-04	2.59E-04				
PNL-3	FILTER2	482645003	5-Jun-19	19-Jun-19	ALPHA	1.22E-04	pCi/m3	2.57E-04	2.57E-04	U			
PNL-3	FILTER2	484146003	19-Jun-19	3-Jul-19	ALPHA	5.13E-04	pCi/m3	3.07E-04	3.08E-04				
PNL-3	FILTER2	485075003	3-Jul-19	17-Jul-19	ALPHA	3.44E-04	pCi/m3	2.43E-04	2.43E-04	O			
PNL-3	FILTER2	486736003	17-Jul-19	31-Jul-19	ALPHA	6.07E-04	pCi/m3	3.10E-04	3.10E-04				
PNL-3	FILTER2	487945003	31-Jul-19	14-Aug-19	ALPHA	8.34E-04	pCi/m3	3.59E-04	3.60E-04				
PNL-3	FILTER2	489671003	14-Aug-19	28-Aug-19	ALPHA	3.06E-04	pCi/m3	2.70E-04	2.70E-04	U			
PNL-3	FILTER2	490526003	28-Aug-19	11-Sep-19	ALPHA	7.13E-04	pCi/m3	3.60E-04	3.60E-04				
PNL-3	FILTER2	491398003	11-Sep-19	25-Sep-19	ALPHA	6.31E-04	pCi/m3	3.86E-04	3.86E-04	O			
PNL-3	FILTER2	492938003	25-Sep-19	9-Oct-19	ALPHA	3.13E-04	pCi/m3	3.18E-04	3.18E-04	U			
PNL-3	FILTER2	494542003	9-Oct-19	23-Oct-19	ALPHA	7.03E-04	pCi/m3	3.84E-04	3.85E-04				
PNL-3	FILTER2	496008003	23-Oct-19	6-Nov-19	ALPHA	8.13E-04	pCi/m3	3.83E-04	3.84E-04	O			
PNL-3	FILTER2	497547003	6-Nov-19	20-Nov-19	ALPHA	1.59E-03	pCi/m3	4.87E-04	4.89E-04				
PNL-3	FILTER2	498542003	20-Nov-19	4-Dec-19	ALPHA	6.98E-04	pCi/m3	3.42E-04	3.42E-04				
PNL-3	FILTER2	499986003	4-Dec-19	18-Dec-19	ALPHA	1.24E-03	pCi/m3	4.67E-04	4.67E-04				
PNL-3	FILTER2	500032003	18-Dec-19	31-Dec-19	ALPHA	8.26E-04	pCi/m3	3.61E-04	3.61E-04				
PNL-3	FILTER2	468032003	19-Dec-18	2-Jan-19	BETA	1.46E-02	pCi/m3	1.04E-03	1.06E-03	O			
PNL-3	FILTER2	469344003	2-Jan-19	16-Jan-19	BETA	2.45E-02	pCi/m3	1.39E-03	1.73E-03	O			
PNL-3	FILTER2	470521003	16-Jan-19	30-Jan-19	BETA	2.31E-02	pCi/m3	1.31E-03	1.54E-03	O			

Table C.2 (contd)

SAMP SITE NAME	SAMP MTHD	LAB SAMP ID	SAMP DATE TIME ON	SAMP DATE TIME	CON SHORT NAME	VALUE RPTD	ANAL UNITS RPTD	COUNT-ING ERROR	TOTAL ANAL ERROR 2-SIGMA	LAB QUAL-IFIER	SAMP COMMENT	RESULT COMMENT	COM-POSITE FLAG
PNL-3	FILTER2	471766003	30-Jan-19	14-Feb-19	BETA	3.77E-02	pCi/m3	1.70E-03	2.18E-03	O	DUE TO 02/13/19 INCLEMENT WEATHER WORK CANCELLATION, SAMPLE COLLECTION OCCURRED 02/14/19.		
PNL-3	FILTER2	472570003	14-Feb-19	27-Feb-19	BETA	3.32E-02	pCi/m3	1.65E-03	1.81E-03	O			
PNL-3	FILTER2	473913003	27-Feb-19	13-Mar-19	BETA	2.64E-02	pCi/m3	1.40E-03	1.48E-03	O			
PNL-3	FILTER2	475098003	13-Mar-19	27-Mar-19	BETA	1.95E-02	pCi/m3	1.22E-03	1.25E-03	O			
PNL-3	FILTER2	476578003	27-Mar-19	10-Apr-19	BETA	1.39E-02	pCi/m3	1.03E-03	1.05E-03	O			
PNL-3	FILTER2	477749003	10-Apr-19	24-Apr-19	BETA	9.42E-03	pCi/m3	8.93E-04	9.04E-04	O			
PNL-3	FILTER2	478918003	24-Apr-19	8-May-19	BETA	1.67E-02	pCi/m3	1.08E-03	1.20E-03	O			
PNL-3	FILTER2	479958003	8-May-19	22-May-19	BETA	1.14E-02	pCi/m3	8.78E-04	8.89E-04	O			
PNL-3	FILTER2	481287003	22-May-19	5-Jun-19	BETA	1.39E-02	pCi/m3	9.27E-04	9.64E-04	O			
PNL-3	FILTER2	482645003	5-Jun-19	19-Jun-19	BETA	7.90E-03	pCi/m3	7.29E-04	7.36E-04	O			
PNL-3	FILTER2	484146003	19-Jun-19	3-Jul-19	BETA	7.69E-03	pCi/m3	7.11E-04	7.37E-04	O			
PNL-3	FILTER2	485075003	3-Jul-19	17-Jul-19	BETA	1.09E-02	pCi/m3	8.64E-04	8.98E-04	O			
PNL-3	FILTER2	486736003	17-Jul-19	31-Jul-19	BETA	1.07E-02	pCi/m3	8.75E-04	9.07E-04	O			
PNL-3	FILTER2	487945003	31-Jul-19	14-Aug-19	BETA	1.50E-02	pCi/m3	1.06E-03	1.19E-03	O			
PNL-3	FILTER2	489671003	14-Aug-19	28-Aug-19	BETA	1.18E-02	pCi/m3	8.94E-04	9.98E-04	O			
PNL-3	FILTER2	490526003	28-Aug-19	11-Sep-19	BETA	1.52E-02	pCi/m3	9.80E-04	9.96E-04	O			
PNL-3	FILTER2	491398003	11-Sep-19	25-Sep-19	BETA	9.46E-03	pCi/m3	8.14E-04	8.62E-04	O			
PNL-3	FILTER2	492938003	25-Sep-19	9-Oct-19	BETA	1.01E-02	pCi/m3	7.93E-04	8.04E-04	O			
PNL-3	FILTER2	494542003	9-Oct-19	23-Oct-19	BETA	1.92E-02	pCi/m3	1.11E-03	1.48E-03	O			
PNL-3	FILTER2	496008003	23-Oct-19	6-Nov-19	BETA	3.11E-02	pCi/m3	1.47E-03	1.90E-03	O			
PNL-3	FILTER2	497547003	6-Nov-19	20-Nov-19	BETA	4.13E-02	pCi/m3	1.60E-03	1.69E-03	O			
PNL-3	FILTER2	498542003	20-Nov-19	4-Dec-19	BETA	2.87E-02	pCi/m3	1.39E-03	1.44E-03	O			
PNL-3	FILTER2	499986003	4-Dec-19	18-Dec-19	BETA	2.66E-02	pCi/m3	1.29E-03	1.41E-03	O			
PNL-3	FILTER2	500032003	18-Dec-19	31-Dec-19	BETA	2.03E-02	pCi/m3	1.16E-03	1.19E-03	O			
PNL-3	FILTER2	484049003	19-Dec-18	19-Jun-19	Be-7	5.30E-02	pCi/m3	2.41E-03	5.12E-03				Y
PNL-3	FILTER2	502227003	28-Aug-19	31-Dec-19	Be-7	2.76E-02	pCi/m3	2.99E-03	3.91E-03				Y
PNL-3	FILTER2	484049003	19-Dec-18	19-Jun-19	Co-60	5.96E-05	pCi/m3	8.02E-05	8.47E-05	U			Y
PNL-3	FILTER2	502227003	28-Aug-19	31-Dec-19	Co-60	3.21E-06	pCi/m3	7.46E-05	7.46E-05	U			Y
PNL-3	FILTER2	484049003	19-Dec-18	19-Jun-19	Cs-134	2.88E-05	pCi/m3	8.30E-05	8.40E-05	U			Y
PNL-3	FILTER2	502227003	28-Aug-19	31-Dec-19	Cs-134	-4.63E-05	pCi/m3	8.60E-05	8.86E-05	U			Y
PNL-3	FILTER2	484049003	19-Dec-18	19-Jun-19	Cs-137	1.95E-04	pCi/m3	1.45E-04	1.46E-04				Y
PNL-3	FILTER2	502227003	28-Aug-19	31-Dec-19	Cs-137	-8.17E-05	pCi/m3	7.64E-05	8.51E-05	U			Y
PNL-3	FILTER2	484049003	19-Dec-18	19-Jun-19	Eu-152	2.21E-05	pCi/m3	2.14E-04	2.14E-04	U			Y
PNL-3	FILTER2	502227003	28-Aug-19	31-Dec-19	Eu-152	-8.93E-05	pCi/m3	1.63E-04	1.68E-04	U			Y
PNL-3	FILTER2	484049003	19-Dec-18	19-Jun-19	Eu-154	5.69E-05	pCi/m3	2.07E-04	2.09E-04	U			Y

Table C.2 (contd)

SAMP SITE NAME	SAMP MTHD	LAB SAMP ID	SAMP DATE TIME ON	SAMP DATE TIME	CON SHORT NAME	VALUE RPTD	ANAL UNITS RPTD	COUNT-ING ERROR	TOTAL ANAL ERROR 2-SIGMA	LAB QUAL-IFIER	SAMP COMMENT	RESULT COMMENT	COM-POSITE FLAG
PNL-3	FILTER2	502227003	28-Aug-19	31-Dec-19	Eu-154	6.40E-05	pCi/m3	2.30E-04	2.32E-04	U			Y
PNL-3	FILTER2	484049003	19-Dec-18	19-Jun-19	Eu-155	1.31E-04	pCi/m3	2.38E-04	2.45E-04	U			Y
PNL-3	FILTER2	502227003	28-Aug-19	31-Dec-19	Eu-155	-4.25E-05	pCi/m3	1.38E-04	1.40E-04	U			Y
PNL-3	FILTER2	484049003	19-Dec-18	19-Jun-19	K-40	7.37E-03	pCi/m3	1.98E-03	2.09E-03				Y
PNL-3	FILTER2	502227003	28-Aug-19	31-Dec-19	K-40	4.29E-03	pCi/m3	1.73E-03	1.79E-03				Y
PNL-3	FILTER2	484049003	19-Dec-18	19-Jun-19	Ru-106	3.66E-04	pCi/m3	1.23E-03	1.23E-03	U			Y
PNL-3	FILTER2	502227003	28-Aug-19	31-Dec-19	Ru-106	-4.68E-04	pCi/m3	7.16E-04	7.48E-04	U			Y
PNL-3	FILTER2	484049003	19-Dec-18	19-Jun-19	Sb-125	1.24E-04	pCi/m3	1.98E-04	2.06E-04	U			Y
PNL-3	FILTER2	502227003	28-Aug-19	31-Dec-19	Sb-125	7.64E-05	pCi/m3	1.75E-04	1.79E-04	U			Y
PNL-3	FILTER2	484049003	19-Dec-18	19-Jun-19	Am-241	1.57E-05	pCi/m3	1.30E-05	1.32E-05	U			Y
PNL-3	FILTER2	502227003	28-Aug-19	31-Dec-19	Am-241	2.02E-06	pCi/m3	2.32E-06	2.33E-06	U			Y
PNL-3	FILTER2	484049003	19-Dec-18	19-Jun-19	Am-243	8.34E-06	pCi/m3	7.03E-06	7.11E-06	U			Y
PNL-3	FILTER2	502227003	28-Aug-19	31-Dec-19	Am-243	1.08E-06	pCi/m3	3.07E-06	3.07E-06	U			Y
PNL-3	FILTER2	484049003	19-Dec-18	19-Jun-19	Cm-243/244	5.49E-06	pCi/m3	7.40E-06	7.43E-06	U			Y
PNL-3	FILTER2	502227003	28-Aug-19	31-Dec-19	Cm-243/244	1.25E-13	pCi/m3	1.39E-06	1.39E-06	U			Y
PNL-3	FILTER2	484049003	19-Dec-18	19-Jun-19	Pu-238	-7.86E-06	pCi/m3	8.13E-06	8.13E-06	U			Y
PNL-3	FILTER2	502227003	28-Aug-19	31-Dec-19	Pu-238	1.22E-06	pCi/m3	4.57E-06	4.57E-06	U			Y
PNL-3	FILTER2	484049003	19-Dec-18	19-Jun-19	Pu-239/240	-5.15E-08	pCi/m3	6.81E-06	6.81E-06	U			Y
PNL-3	FILTER2	502227003	28-Aug-19	31-Dec-19	Pu-239/240	3.26E-06	pCi/m3	6.49E-06	6.51E-06	U			Y
PNL-3	FILTER2	484049003	19-Dec-18	19-Jun-19	U-233/234	4.82E-05	pCi/m3	2.39E-05	2.49E-05				Y
PNL-3	FILTER2	502227003	28-Aug-19	31-Dec-19	U-233/234	4.24E-05	pCi/m3	1.67E-05	1.79E-05				Y
PNL-3	FILTER2	484049003	19-Dec-18	19-Jun-19	U-235	7.82E-06	pCi/m3	1.24E-05	1.25E-05	U			Y
PNL-3	FILTER2	502227003	28-Aug-19	31-Dec-19	U-235	5.18E-07	pCi/m3	5.41E-06	5.42E-06	U			Y
PNL-3	FILTER2	484049003	19-Dec-18	19-Jun-19	U-238	5.23E-05	pCi/m3	2.44E-05	2.55E-05				Y
PNL-3	FILTER2	502227003	28-Aug-19	31-Dec-19	U-238	3.57E-05	pCi/m3	1.57E-05	1.66E-05				Y
PNL-4	FILTER2	468032004	19-Dec-18	2-Jan-19	ALPHA	5.12E-04	pCi/m3	2.74E-04	2.74E-04				
PNL-4	FILTER2	469344004	2-Jan-19	16-Jan-19	ALPHA	9.26E-04	pCi/m3	3.97E-04	3.97E-04				
PNL-4	FILTER2	470521004	16-Jan-19	30-Jan-19	ALPHA	4.47E-04	pCi/m3	3.04E-04	3.04E-04	O			
PNL-4	FILTER2	471766004	30-Jan-19	14-Feb-19	ALPHA	1.46E-03	pCi/m3	4.36E-04	4.36E-04		DUE TO 02/13/19 INCLEMENT WEATHER WORK CANCELLATION, SAMPLE COLLECTION OCCURRED 02/14/19.		
PNL-4	FILTER2	472570004	14-Feb-19	27-Feb-19	ALPHA	3.96E-04	pCi/m3	3.40E-04	3.41E-04	U			
PNL-4	FILTER2	473913004	27-Feb-19	13-Mar-19	ALPHA	1.72E-03	pCi/m3	9.63E-04	9.63E-04		TOTAL VOLUME LOW, FAILED PUMP REPLACED.		
PNL-4	FILTER2	475098004	13-Mar-19	27-Mar-19	ALPHA	1.25E-03	pCi/m3	4.37E-04	4.38E-04				
PNL-4	FILTER2	476578004	27-Mar-19	10-Apr-19	ALPHA	5.84E-04	pCi/m3	3.07E-04	3.08E-04				
PNL-4	FILTER2	477749004	10-Apr-19	24-Apr-19	ALPHA	4.83E-04	pCi/m3	3.19E-04	3.20E-04				

Table C.2 (contd)

SAMP SITE NAME	SAMP MTHD	LAB SAMP ID	SAMP DATE TIME ON	SAMP DATE TIME	CON SHORT NAME	VALUE RPTD	ANAL UNITS RPTD	COUNT-ING ERROR	TOTAL ANAL ERROR 2-SIGMA	LAB QUAL-IFIER	SAMP COMMENT	RESULT COMMENT	COM-POSITE FLAG
PNL-4	FILTER2	478918004	24-Apr-19	8-May-19	ALPHA	5.57E-04	pCi/m3	3.52E-04	3.52E-04				
PNL-4	FILTER2	479958004	8-May-19	22-May-19	ALPHA	4.78E-04	pCi/m3	2.97E-04	2.97E-04				
PNL-4	FILTER2	481287004	22-May-19	5-Jun-19	ALPHA	5.49E-04	pCi/m3	3.02E-04	3.02E-04				
PNL-4	FILTER2	482645004	5-Jun-19	19-Jun-19	ALPHA	6.56E-04	pCi/m3	3.36E-04	3.37E-04				
PNL-4	FILTER2	484146004	19-Jun-19	3-Jul-19	ALPHA	5.00E-04	pCi/m3	3.21E-04	3.21E-04				
PNL-4	FILTER2	485075004	3-Jul-19	17-Jul-19	ALPHA	-2.79E-05	pCi/m3	1.56E-04	1.56E-04	UO			
PNL-4	FILTER2	486736004	17-Jul-19	31-Jul-19	ALPHA	4.19E-04	pCi/m3	2.51E-04	2.52E-04				
PNL-4	FILTER2	487945004	31-Jul-19	14-Aug-19	ALPHA	4.60E-04	pCi/m3	2.99E-04	3.00E-04				
PNL-4	FILTER2	489671004	14-Aug-19	28-Aug-19	ALPHA	7.27E-04	pCi/m3	3.59E-04	3.60E-04				
PNL-4	FILTER2	490526004	28-Aug-19	11-Sep-19	ALPHA	7.45E-04	pCi/m3	3.86E-04	3.88E-04				
PNL-4	FILTER2	491398004	11-Sep-19	25-Sep-19	ALPHA	5.84E-04	pCi/m3	4.64E-04	4.64E-04	UO	AIR FILTER COLLECTED LATE IN DAY TO OBTAIN SUFFICIENT VOLUME.		
PNL-4	FILTER2		25-Sep-19	9-Oct-19	ALPHA						NO SAMPLE. DO NOT SAVE FOR COMPOSITE. REFER TO DISCREPANCY REPORT EMP19-001; LOW VOLUME. TOTALIZER #28921 REPLACED WITH #24562, EXPIRES 05/15/20.		
PNL-4	FILTER2	494542004	9-Oct-19	23-Oct-19	ALPHA	1.01E-03	pCi/m3	4.33E-04	4.34E-04				
PNL-4	FILTER2	496008004	23-Oct-19	6-Nov-19	ALPHA	1.13E-03	pCi/m3	4.45E-04	4.46E-04	O			
PNL-4	FILTER2	497547004	6-Nov-19	20-Nov-19	ALPHA	1.58E-03	pCi/m3	5.06E-04	5.06E-04				
PNL-4	FILTER2	498542004	20-Nov-19	4-Dec-19	ALPHA	1.10E-03	pCi/m3	4.35E-04	4.35E-04				
PNL-4	FILTER2	499986004	4-Dec-19	18-Dec-19	ALPHA	1.49E-03	pCi/m3	5.07E-04	5.08E-04				
PNL-4	FILTER2	500032004	18-Dec-19	31-Dec-19	ALPHA	8.34E-04	pCi/m3	4.56E-04	4.56E-04				
PNL-4	FILTER2	468032004	19-Dec-18	2-Jan-19	BETA	1.19E-02	pCi/m3	8.83E-04	9.01E-04	O			
PNL-4	FILTER2	469344004	2-Jan-19	16-Jan-19	BETA	2.00E-02	pCi/m3	1.14E-03	1.17E-03	O			
PNL-4	FILTER2	470521004	16-Jan-19	30-Jan-19	BETA	1.73E-02	pCi/m3	1.13E-03	1.17E-03	O			
PNL-4	FILTER2	471766004	30-Jan-19	14-Feb-19	BETA	3.15E-02	pCi/m3	1.37E-03	1.44E-03	O	DUE TO 02/13/19 INCLEMENT WEATHER WORK CANCELLATION, SAMPLE COLLECTION OCCURRED 02/14/19.		
PNL-4	FILTER2	472570004	14-Feb-19	27-Feb-19	BETA	2.83E-02	pCi/m3	1.40E-03	1.83E-03	O			
PNL-4	FILTER2	473913004	27-Feb-19	13-Mar-19	BETA	2.88E-02	pCi/m3	2.02E-03	2.07E-03	O	TOTAL VOLUME LOW, FAILED PUMP REPLACED.		
PNL-4	FILTER2	475098004	13-Mar-19	27-Mar-19	BETA	1.84E-02	pCi/m3	1.13E-03	1.22E-03	O			
PNL-4	FILTER2	476578004	27-Mar-19	10-Apr-19	BETA	1.16E-02	pCi/m3	9.11E-04	9.48E-04	O			
PNL-4	FILTER2	477749004	10-Apr-19	24-Apr-19	BETA	8.45E-03	pCi/m3	7.68E-04	7.74E-04	O			
PNL-4	FILTER2	478918004	24-Apr-19	8-May-19	BETA	1.66E-02	pCi/m3	1.06E-03	1.12E-03	O			
PNL-4	FILTER2	479958004	8-May-19	22-May-19	BETA	1.20E-02	pCi/m3	8.85E-04	9.02E-04	O			

Table C.2 (contd)

SAMP SITE NAME	SAMP MTHD	LAB SAMP ID	SAMP DATE TIME ON	SAMP DATE TIME	CON SHORT NAME	VALUE RPTD	ANAL UNITS RPTD	COUNT-ING ERROR	TOTAL ANAL ERROR 2-SIGMA	LAB QUAL-IFIER	SAMP COMMENT	RESULT COMMENT	COM-POSITE FLAG
PNL-4	FILTER2	481287004	22-May-19	5-Jun-19	BETA	1.43E-02	pCi/m3	9.87E-04	1.04E-03	O			
PNL-4	FILTER2	482645004	5-Jun-19	19-Jun-19	BETA	9.94E-03	pCi/m3	8.38E-04	9.34E-04	O			
PNL-4	FILTER2	484146004	19-Jun-19	3-Jul-19	BETA	8.71E-03	pCi/m3	7.74E-04	7.96E-04	O			
PNL-4	FILTER2	485075004	3-Jul-19	17-Jul-19	BETA	9.44E-03	pCi/m3	7.88E-04	8.81E-04	O			
PNL-4	FILTER2	486736004	17-Jul-19	31-Jul-19	BETA	1.05E-02	pCi/m3	8.47E-04	8.73E-04	O			
PNL-4	FILTER2	487945004	31-Jul-19	14-Aug-19	BETA	1.43E-02	pCi/m3	9.77E-04	1.14E-03	O			
PNL-4	FILTER2	489671004	14-Aug-19	28-Aug-19	BETA	1.17E-02	pCi/m3	8.92E-04	1.01E-03	O			
PNL-4	FILTER2	490526004	28-Aug-19	11-Sep-19	BETA	1.56E-02	pCi/m3	1.01E-03	1.29E-03	O			
PNL-4	FILTER2	491398004	11-Sep-19	25-Sep-19	BETA	1.36E-02	pCi/m3	1.08E-03	1.10E-03	O	AIR FILTER COLLECTED LATE IN DAY TO OBTAIN SUFFICIENT VOLUME.		
PNL-4	FILTER2		25-Sep-19	9-Oct-19	BETA						NO SAMPLE. DO NOT SAVE FOR COMPOSITE. REFER TO DISCREPANCY REPORT EMP19-001; LOW VOLUME. TOTALIZER #28921 REPLACED WITH #24562, EXPIRES 05/15/20.		
PNL-4	FILTER2	494542004	9-Oct-19	23-Oct-19	BETA	2.03E-02	pCi/m3	1.22E-03	1.25E-03	O			
PNL-4	FILTER2	496008004	23-Oct-19	6-Nov-19	BETA	3.46E-02	pCi/m3	1.59E-03	1.64E-03	O			
PNL-4	FILTER2	497547004	6-Nov-19	20-Nov-19	BETA	4.12E-02	pCi/m3	1.71E-03	1.79E-03	O			
PNL-4	FILTER2	498542004	20-Nov-19	4-Dec-19	BETA	3.14E-02	pCi/m3	1.53E-03	1.64E-03	O			
PNL-4	FILTER2	499986004	4-Dec-19	18-Dec-19	BETA	2.82E-02	pCi/m3	1.40E-03	1.65E-03	O			
PNL-4	FILTER2	500032004	18-Dec-19	31-Dec-19	BETA	2.20E-02	pCi/m3	1.30E-03	1.32E-03	O			
PNL-4	FILTER2	484049004	19-Dec-18	19-Jun-19	Be-7	5.19E-02	pCi/m3	3.63E-03	5.85E-03				Y
PNL-4	FILTER2	502227004	28-Aug-19	31-Dec-19	Be-7	2.73E-02	pCi/m3	3.11E-03	4.01E-03				Y
PNL-4	FILTER2	484049004	19-Dec-18	19-Jun-19	Co-60	-1.33E-05	pCi/m3	8.49E-05	8.52E-05	U			Y
PNL-4	FILTER2	502227004	28-Aug-19	31-Dec-19	Co-60	1.69E-05	pCi/m3	6.98E-05	7.03E-05	U			Y
PNL-4	FILTER2	484049004	19-Dec-18	19-Jun-19	Cs-134	3.54E-05	pCi/m3	1.18E-04	1.20E-04	U			Y
PNL-4	FILTER2	502227004	28-Aug-19	31-Dec-19	Cs-134	1.98E-05	pCi/m3	8.31E-05	8.36E-05	U			Y
PNL-4	FILTER2	484049004	19-Dec-18	19-Jun-19	Cs-137	5.77E-05	pCi/m3	1.03E-04	1.07E-04	U			Y
PNL-4	FILTER2	502227004	28-Aug-19	31-Dec-19	Cs-137	2.54E-05	pCi/m3	1.06E-04	1.06E-04	U			Y
PNL-4	FILTER2	484049004	19-Dec-18	19-Jun-19	Eu-152	1.84E-04	pCi/m3	2.84E-04	2.96E-04	U			Y
PNL-4	FILTER2	502227004	28-Aug-19	31-Dec-19	Eu-152	6.53E-05	pCi/m3	1.87E-04	1.90E-04	U			Y
PNL-4	FILTER2	484049004	19-Dec-18	19-Jun-19	Eu-154	-4.03E-05	pCi/m3	2.35E-04	2.36E-04	U			Y
PNL-4	FILTER2	502227004	28-Aug-19	31-Dec-19	Eu-154	-5.02E-06	pCi/m3	2.69E-04	2.69E-04	U			Y
PNL-4	FILTER2	484049004	19-Dec-18	19-Jun-19	Eu-155	-2.29E-04	pCi/m3	2.68E-04	2.88E-04	U			Y
PNL-4	FILTER2	502227004	28-Aug-19	31-Dec-19	Eu-155	-5.64E-06	pCi/m3	1.45E-04	1.45E-04	U			Y
PNL-4	FILTER2	484049004	19-Dec-18	19-Jun-19	K-40	4.27E-03	pCi/m3	2.63E-03	2.66E-03				Y
PNL-4	FILTER2	502227004	28-Aug-19	31-Dec-19	K-40	3.24E-03	pCi/m3	2.42E-03	2.44E-03				Y

Table C.2 (contd)

SAMP SITE NAME	SAMP MTHD	LAB SAMP ID	SAMP DATE TIME ON	SAMP DATE TIME	CON SHORT NAME	VALUE RPTD	ANAL UNITS RPTD	COUNT-ING ERROR	TOTAL ANAL ERROR 2-SIGMA	LAB QUAL-IFIER	SAMP COMMENT	RESULT COMMENT	COM-POSITE FLAG
PNL-4	FILTER2	484049004	19-Dec-18	19-Jun-19	Ru-106	-2.16E-05	pCi/m3	8.97E-04	8.97E-04	U			Y
PNL-4	FILTER2	502227004	28-Aug-19	31-Dec-19	Ru-106	-3.06E-04	pCi/m3	7.06E-04	7.20E-04	U			Y
PNL-4	FILTER2	484049004	19-Dec-18	19-Jun-19	Sb-125	1.90E-04	pCi/m3	2.77E-04	2.91E-04	U			Y
PNL-4	FILTER2	502227004	28-Aug-19	31-Dec-19	Sb-125	-1.61E-05	pCi/m3	1.61E-04	1.62E-04	U			Y
PNL-4	FILTER2	484049004	19-Dec-18	19-Jun-19	Am-241	5.97E-06	pCi/m3	7.09E-06	7.13E-06	U			Y
PNL-4	FILTER2	502227004	28-Aug-19	31-Dec-19	Am-241	3.92E-06	pCi/m3	4.09E-06	4.12E-06	U			Y
PNL-4	FILTER2	484049004	19-Dec-18	19-Jun-19	Am-243	-9.81E-07	pCi/m3	6.99E-06	6.99E-06	U			Y
PNL-4	FILTER2	502227004	28-Aug-19	31-Dec-19	Am-243	-1.37E-06	pCi/m3	3.14E-06	3.14E-06	U			Y
PNL-4	FILTER2	484049004	19-Dec-18	19-Jun-19	Cm-243/244	-8.47E-07	pCi/m3	6.64E-06	6.64E-06	U			Y
PNL-4	FILTER2	502227004	28-Aug-19	31-Dec-19	Cm-243/244	4.31E-07	pCi/m3	2.80E-06	2.81E-06	U			Y
PNL-4	FILTER2	484049004	19-Dec-18	19-Jun-19	Pu-238	1.09E-05	pCi/m3	1.33E-05	1.34E-05	U			Y
PNL-4	FILTER2	502227004	28-Aug-19	31-Dec-19	Pu-238	1.06E-07	pCi/m3	7.84E-06	7.85E-06	U			Y
PNL-4	FILTER2	484049004	19-Dec-18	19-Jun-19	Pu-239/240	9.07E-06	pCi/m3	1.47E-05	1.47E-05	U			Y
PNL-4	FILTER2	502227004	28-Aug-19	31-Dec-19	Pu-239/240	4.75E-06	pCi/m3	1.08E-05	1.08E-05	U			Y
PNL-4	FILTER2	484049004	19-Dec-18	19-Jun-19	U-233/234	4.88E-05	pCi/m3	2.37E-05	2.48E-05				Y
PNL-4	FILTER2	502227004	28-Aug-19	31-Dec-19	U-233/234	3.28E-05	pCi/m3	1.78E-05	1.86E-05				Y
PNL-4	FILTER2	484049004	19-Dec-18	19-Jun-19	U-235	-2.17E-06	pCi/m3	6.56E-06	6.58E-06	U			Y
PNL-4	FILTER2	502227004	28-Aug-19	31-Dec-19	U-235	4.95E-06	pCi/m3	8.48E-06	8.51E-06	U			Y
PNL-4	FILTER2	484049004	19-Dec-18	19-Jun-19	U-238	4.17E-05	pCi/m3	2.17E-05	2.25E-05				Y
PNL-4	FILTER2	502227004	28-Aug-19	31-Dec-19	U-238	4.76E-05	pCi/m3	2.01E-05	2.15E-05				Y
PNL-5	FILTER2	468032005	19-Dec-18	2-Jan-19	ALPHA	4.93E-04	pCi/m3	2.98E-04	2.98E-04				
PNL-5	FILTER2	469344005	2-Jan-19	16-Jan-19	ALPHA	1.07E-04	pCi/m3	2.22E-04	2.22E-04	U			
PNL-5	FILTER2	470521005	16-Jan-19	30-Jan-19	ALPHA	2.79E-04	pCi/m3	2.34E-04	2.35E-04	UO			
PNL-5	FILTER2		30-Jan-19	14-Feb-19	ALPHA						NO SAMPLE. DO NOT SAVE FOR COMPOSITE. REFER TO DISCREPANCY RPT EMP19-001, LOW EXPOSURE HOURS. DUE TO 02/13/19 INCLEMENT WEATHER WORK CANCELLATION, SAMPLE COLLECTION OCCURRED 02/14/19.		
PNL-5	FILTER2	472570005	15-Feb-19	27-Feb-19	ALPHA	7.63E-04	pCi/m3	3.37E-04	3.38E-04		REFER TO DISCREPANCY RPT EMP19-001, START DATE DELAYED. TOTALIZER #29815 REPLACED ON 02/15/19 WITH TOTALIZER # 41444, EXPIRES 10/09/19. ON 2/27/19 THE TOTAL VOLUME APPEARS HIGH; SENSITIVE PUMP REGULATOR.		
PNL-5	FILTER2	473913005	27-Feb-19	13-Mar-19	ALPHA	6.06E-04	pCi/m3	2.88E-04	2.89E-04				
PNL-5	FILTER2	475098005	13-Mar-19	27-Mar-19	ALPHA	5.93E-04	pCi/m3	2.85E-04	2.85E-04				
PNL-5	FILTER2	476578005	27-Mar-19	10-Apr-19	ALPHA	4.18E-04	pCi/m3	2.26E-04	2.27E-04				

Table C.2 (contd)

SAMP SITE NAME	SAMP MTHD	LAB SAMP ID	SAMP DATE TIME ON	SAMP DATE TIME	CON SHORT NAME	VALUE RPTD	ANAL UNITS RPTD	COUNT-ING ERROR	TOTAL ANAL ERROR 2-SIGMA	LAB QUAL-IFIER	SAMP COMMENT	RESULT COMMENT	COM-POSITE FLAG
PNL-5	FILTER2	477749005	10-Apr-19	24-Apr-19	ALPHA	3.66E-04	pCi/m3	2.60E-04	2.61E-04				
PNL-5	FILTER2	478918005	24-Apr-19	8-May-19	ALPHA	3.13E-04	pCi/m3	2.36E-04	2.36E-04	U			
PNL-5	FILTER2	479958005	8-May-19	22-May-19	ALPHA	3.48E-04	pCi/m3	2.23E-04	2.23E-04				
PNL-5	FILTER2	481287005	22-May-19	5-Jun-19	ALPHA	6.17E-04	pCi/m3	3.08E-04	3.09E-04				
PNL-5	FILTER2	482645005	5-Jun-19	19-Jun-19	ALPHA	3.34E-04	pCi/m3	2.54E-04	2.54E-04	U			
PNL-5	FILTER2	484146005	19-Jun-19	3-Jul-19	ALPHA	2.92E-04	pCi/m3	2.28E-04	2.28E-04	U			
PNL-5	FILTER2	485075005	3-Jul-19	17-Jul-19	ALPHA	1.99E-04	pCi/m3	1.69E-04	1.69E-04	UO			
PNL-5	FILTER2	486736005	17-Jul-19	31-Jul-19	ALPHA	6.00E-04	pCi/m3	2.68E-04	2.70E-04				
PNL-5	FILTER2	487945005	31-Jul-19	14-Aug-19	ALPHA	4.30E-04	pCi/m3	2.09E-04	2.10E-04		REPLACED WIRE SCREEN BETWEEN RAINHAT AND 4 INCH ADAPTOR INLET.		
PNL-5	FILTER2	489671005	14-Aug-19	28-Aug-19	ALPHA	5.30E-04	pCi/m3	2.51E-04	2.51E-04				
PNL-5	FILTER2	490526005	28-Aug-19	11-Sep-19	ALPHA	3.80E-04	pCi/m3	1.99E-04	2.00E-04				
PNL-5	FILTER2	491398005	11-Sep-19	25-Sep-19	ALPHA	3.22E-04	pCi/m3	2.40E-04	2.40E-04	O	TOTALIZER #41444 EXPIRING 10/09/19 WAS REPLACED ON 09/25/19 WITH TOTALIZER #41499, EXPIRES 05/29/20.		
PNL-5	FILTER2	492938005	25-Sep-19	9-Oct-19	ALPHA	6.13E-04	pCi/m3	3.78E-04	3.79E-04				
PNL-5	FILTER2	494542005	9-Oct-19	23-Oct-19	ALPHA	8.56E-04	pCi/m3	3.62E-04	3.63E-04		WATER FOUND INSIDE OF RAINHAT, FILTER PAPER APPEARS DRY.		
PNL-5	FILTER2	496008005	23-Oct-19	6-Nov-19	ALPHA	4.32E-04	pCi/m3	2.72E-04	2.72E-04	O			
PNL-5	FILTER2	497547005	6-Nov-19	20-Nov-19	ALPHA	1.44E-03	pCi/m3	4.67E-04	4.67E-04		UPON ARRIVAL, POWER WAS OFF DUE TO CONSTRUCTION IN AREA. SUFFICIENT VOLUME FOR ANALYSES. PER KI-BE MAINTENANCE, POWER ONLY OFF MID-DAY 11/19/19, RESTORED END OF 11/20/19.		
PNL-5	FILTER2	498542005	20-Nov-19	4-Dec-19	ALPHA	1.05E-03	pCi/m3	4.10E-04	4.11E-04		AFTER 11/20/19 POWER OUTAGE, RETURNED TO STATION ON 11/21/19 AT 11:25. STATION WAS RUNNING WITH AN END VOLUME OF 1125 M3.		
PNL-5	FILTER2	499986005	4-Dec-19	18-Dec-19	ALPHA	1.10E-03	pCi/m3	4.27E-04	4.29E-04				
PNL-5	FILTER2	500032005	18-Dec-19	31-Dec-19	ALPHA	6.51E-04	pCi/m3	3.28E-04	3.28E-04				
PNL-5	FILTER2	468032005	19-Dec-18	2-Jan-19	BETA	1.08E-02	pCi/m3	8.06E-04	8.15E-04	O			
PNL-5	FILTER2	469344005	2-Jan-19	16-Jan-19	BETA	1.81E-02	pCi/m3	1.02E-03	1.05E-03	O			
PNL-5	FILTER2	470521005	16-Jan-19	30-Jan-19	BETA	1.70E-02	pCi/m3	9.92E-04	1.31E-03	O			

Table C.2 (contd)

SAMP SITE NAME	SAMP MTHD	LAB SAMP ID	SAMP DATE TIME ON	SAMP DATE TIME	CON SHORT NAME	VALUE RPTD	ANAL UNITS RPTD	COUNT-ING ERROR	TOTAL ANAL ERROR 2-SIGMA	LAB QUAL-IFIER	SAMP COMMENT	RESULT COMMENT	COM-POSITE FLAG
PNL-5	FILTER2		30-Jan-19	14-Feb-19	BETA						NO SAMPLE. DO NOT SAVE FOR COMPOSITE. REFER TO DISCREPANCY RPT EMP19-001, LOW EXPOSURE HOURS. DUE TO 02/13/19 INCLEMENT WEATHER WORK CANCELLATION, SAMPLE COLLECTION OCCURRED 02/14/19.		
PNL-5	FILTER2	472570005	15-Feb-19	27-Feb-19	BETA	2.25E-02	pCi/m3	1.12E-03	1.21E-03	O	REFER TO DISCREPANCY RPT EMP19-001, START DATE DELAYED. TOTALIZER #29815 REPLACED ON 02/15/19 WITH TOTALIZER # 41444, EXPIRES 10/09/19. ON 2/27/19 THE TOTAL VOLUME APPEARS HIGH; SENSITIVE PUMP REGULATOR.		
PNL-5	FILTER2	473913005	27-Feb-19	13-Mar-19	BETA	1.82E-02	pCi/m3	9.58E-04	9.70E-04	O			
PNL-5	FILTER2	475098005	13-Mar-19	27-Mar-19	BETA	1.31E-02	pCi/m3	8.34E-04	9.76E-04	O			
PNL-5	FILTER2	476578005	27-Mar-19	10-Apr-19	BETA	8.37E-03	pCi/m3	6.46E-04	6.58E-04	O			
PNL-5	FILTER2	477749005	10-Apr-19	24-Apr-19	BETA	7.08E-03	pCi/m3	6.11E-04	7.11E-04	O			
PNL-5	FILTER2	478918005	24-Apr-19	8-May-19	BETA	1.24E-02	pCi/m3	8.04E-04	8.86E-04	O			
PNL-5	FILTER2	479958005	8-May-19	22-May-19	BETA	9.83E-03	pCi/m3	7.46E-04	7.61E-04	O			
PNL-5	FILTER2	481287005	22-May-19	5-Jun-19	BETA	1.12E-02	pCi/m3	8.00E-04	8.95E-04	O			
PNL-5	FILTER2	482645005	5-Jun-19	19-Jun-19	BETA	7.91E-03	pCi/m3	7.03E-04	7.31E-04	O			
PNL-5	FILTER2	484146005	19-Jun-19	3-Jul-19	BETA	7.07E-03	pCi/m3	6.23E-04	6.80E-04	O			
PNL-5	FILTER2	485075005	3-Jul-19	17-Jul-19	BETA	7.73E-03	pCi/m3	6.10E-04	6.29E-04	O			
PNL-5	FILTER2	486736005	17-Jul-19	31-Jul-19	BETA	8.26E-03	pCi/m3	6.28E-04	6.95E-04	O			
PNL-5	FILTER2	487945005	31-Jul-19	14-Aug-19	BETA	8.63E-03	pCi/m3	6.19E-04	6.43E-04	O	REPLACED WIRE SCREEN BETWEEN RAINHAT AND 4 INCH ADAPTOR INLET.		
PNL-5	FILTER2	489671005	14-Aug-19	28-Aug-19	BETA	8.17E-03	pCi/m3	6.47E-04	6.58E-04	O			
PNL-5	FILTER2	490526005	28-Aug-19	11-Sep-19	BETA	8.26E-03	pCi/m3	5.62E-04	5.72E-04	O			
PNL-5	FILTER2	491398005	11-Sep-19	25-Sep-19	BETA	5.57E-03	pCi/m3	4.98E-04	5.05E-04	O	TOTALIZER #41444 EXPIRING 10/09/19 WAS REPLACED ON 09/25/19 WITH TOTALIZER #41499, EXPIRES 05/29/20.		
PNL-5	FILTER2	492938005	25-Sep-19	9-Oct-19	BETA	9.90E-03	pCi/m3	8.79E-04	9.81E-04	O			
PNL-5	FILTER2	494542005	9-Oct-19	23-Oct-19	BETA	1.97E-02	pCi/m3	1.14E-03	1.17E-03	O	WATER FOUND INSIDE OF RAINHAT, FILTER PAPER APPEARS DRY.		
PNL-5	FILTER2	496008005	23-Oct-19	6-Nov-19	BETA	3.12E-02	pCi/m3	1.34E-03	1.39E-03	O			

Table C.2 (contd)

SAMP SITE NAME	SAMP MTHD	LAB SAMP ID	SAMP DATE TIME ON	SAMP DATE TIME	CON SHORT NAME	VALUE RPTD	ANAL UNITS RPTD	COUNT-ING ERROR	TOTAL ANAL ERROR 2-SIGMA	LAB QUAL-IFIER	SAMP COMMENT	RESULT COMMENT	COM-POSITE FLAG
PNL-5	FILTER2	497547005	6-Nov-19	20-Nov-19	BETA	3.99E-02	pCi/m3	1.59E-03	1.67E-03	O	UPON ARRIVAL, POWER WAS OFF DUE TO CONSTRUCTION IN AREA. SUFFICIENT VOLUME FOR ANALYSES. PER KI-BE MAINTENANCE, POWER ONLY OFF MID-DAY 11/19/19, RESTORED END OF 11/20/19.		
PNL-5	FILTER2	498542005	20-Nov-19	4-Dec-19	BETA	2.67E-02	pCi/m3	1.32E-03	1.45E-03	O	AFTER 11/20/19 POWER OUTAGE, RETURNED TO STATION ON 11/21/19 AT 11:25. STATION WAS RUNNING WITH AN END VOLUME OF 1125 M3.		
PNL-5	FILTER2	499986005	4-Dec-19	18-Dec-19	BETA	2.74E-02	pCi/m3	1.26E-03	1.71E-03	O			
PNL-5	FILTER2	500032005	18-Dec-19	31-Dec-19	BETA	1.91E-02	pCi/m3	1.15E-03	1.22E-03	O			
PNL-5	FILTER2	484049005	19-Dec-18	19-Jun-19	Be-7	4.22E-02	pCi/m3	2.57E-03	4.80E-03				Y
PNL-5	FILTER2	502227005	28-Aug-19	31-Dec-19	Be-7	2.25E-02	pCi/m3	2.65E-03	3.41E-03				Y
PNL-5	FILTER2	484049005	19-Dec-18	19-Jun-19	Co-60	9.26E-05	pCi/m3	8.63E-05	9.62E-05	U			Y
PNL-5	FILTER2	502227005	28-Aug-19	31-Dec-19	Co-60	4.33E-06	pCi/m3	6.35E-05	6.36E-05	U			Y
PNL-5	FILTER2	484049005	19-Dec-18	19-Jun-19	Cs-134	-6.55E-05	pCi/m3	1.50E-04	1.53E-04	U			Y
PNL-5	FILTER2	502227005	28-Aug-19	31-Dec-19	Cs-134	5.54E-05	pCi/m3	8.06E-05	8.46E-05	U			Y
PNL-5	FILTER2	484049005	19-Dec-18	19-Jun-19	Cs-137	-9.60E-06	pCi/m3	1.86E-04	1.86E-04	U			Y
PNL-5	FILTER2	502227005	28-Aug-19	31-Dec-19	Cs-137	-1.86E-05	pCi/m3	7.89E-05	7.94E-05	U			Y
PNL-5	FILTER2	484049005	19-Dec-18	19-Jun-19	Eu-152	8.91E-05	pCi/m3	1.73E-04	1.78E-04	U			Y
PNL-5	FILTER2	502227005	28-Aug-19	31-Dec-19	Eu-152	5.29E-05	pCi/m3	1.62E-04	1.64E-04	U			Y
PNL-5	FILTER2	484049005	19-Dec-18	19-Jun-19	Eu-154	3.90E-05	pCi/m3	2.64E-04	2.64E-04	U			Y
PNL-5	FILTER2	502227005	28-Aug-19	31-Dec-19	Eu-154	-6.86E-05	pCi/m3	2.20E-04	2.22E-04	U			Y
PNL-5	FILTER2	484049005	19-Dec-18	19-Jun-19	Eu-155	6.26E-05	pCi/m3	1.14E-04	1.18E-04	U			Y
PNL-5	FILTER2	502227005	28-Aug-19	31-Dec-19	Eu-155	1.34E-05	pCi/m3	1.70E-04	1.70E-04	U			Y
PNL-5	FILTER2	484049005	19-Dec-18	19-Jun-19	K-40	2.43E-03	pCi/m3	3.44E-03	3.44E-03	U			Y
PNL-5	FILTER2	502227005	28-Aug-19	31-Dec-19	K-40	2.26E-03	pCi/m3	1.64E-03	1.65E-03				Y
PNL-5	FILTER2	484049005	19-Dec-18	19-Jun-19	Ru-106	-5.56E-04	pCi/m3	6.73E-04	7.20E-04	U			Y
PNL-5	FILTER2	502227005	28-Aug-19	31-Dec-19	Ru-106	-1.67E-04	pCi/m3	7.37E-04	7.41E-04	U			Y
PNL-5	FILTER2	484049005	19-Dec-18	19-Jun-19	Sb-125	-7.79E-05	pCi/m3	1.80E-04	1.83E-04	U			Y
PNL-5	FILTER2	502227005	28-Aug-19	31-Dec-19	Sb-125	6.09E-06	pCi/m3	2.00E-04	2.00E-04	U			Y
PNL-5	FILTER2	484049005	19-Dec-18	19-Jun-19	Am-241	5.01E-06	pCi/m3	9.21E-06	9.24E-06	U			Y
PNL-5	FILTER2	502227005	28-Aug-19	31-Dec-19	Am-241	2.48E-06	pCi/m3	2.02E-06	2.04E-06	U			Y
PNL-5	FILTER2	484049005	19-Dec-18	19-Jun-19	Am-243	-2.16E-06	pCi/m3	8.71E-06	8.71E-06	U			Y
PNL-5	FILTER2	502227005	28-Aug-19	31-Dec-19	Am-243	2.12E-06	pCi/m3	2.22E-06	2.23E-06	U			Y
PNL-5	FILTER2	484049005	19-Dec-18	19-Jun-19	Cm-243/244	9.96E-07	pCi/m3	6.76E-06	6.77E-06	U			Y

Table C.2 (contd)

SAMP SITE NAME	SAMP MTHD	LAB SAMP ID	SAMP DATE TIME ON	SAMP DATE TIME	CON SHORT NAME	VALUE RPTD	ANAL UNITS RPTD	COUNT-ING ERROR	TOTAL ANAL ERROR 2-SIGMA	LAB QUAL-IFIER	SAMP COMMENT	RESULT COMMENT	COM-POSITE FLAG
PNL-5	FILTER2	502227005	28-Aug-19	31-Dec-19	Cm-243/244	8.93E-07	pCi/m3	1.38E-06	1.39E-06	U			Y
PNL-5	FILTER2	484049005	19-Dec-18	19-Jun-19	Pu-238	-7.76E-07	pCi/m3	7.25E-06	7.25E-06	U			Y
PNL-5	FILTER2	502227005	28-Aug-19	31-Dec-19	Pu-238	5.46E-07	pCi/m3	3.04E-06	3.04E-06	U			Y
PNL-5	FILTER2	484049005	19-Dec-18	19-Jun-19	Pu-239/240	2.09E-06	pCi/m3	8.07E-06	8.07E-06	U			Y
PNL-5	FILTER2	502227005	28-Aug-19	31-Dec-19	Pu-239/240	5.46E-07	pCi/m3	3.03E-06	3.04E-06	U			Y
PNL-5	FILTER2	484049005	19-Dec-18	19-Jun-19	U-233/234	3.79E-05	pCi/m3	1.68E-05	1.76E-05				Y
PNL-5	FILTER2	502227005	28-Aug-19	31-Dec-19	U-233/234	4.33E-05	pCi/m3	1.64E-05	1.78E-05				Y
PNL-5	FILTER2	484049005	19-Dec-18	19-Jun-19	U-235	1.64E-06	pCi/m3	6.15E-06	6.16E-06	U			Y
PNL-5	FILTER2	502227005	28-Aug-19	31-Dec-19	U-235	2.12E-06	pCi/m3	5.85E-06	5.86E-06	U			Y
PNL-5	FILTER2	484049005	19-Dec-18	19-Jun-19	U-238	4.85E-05	pCi/m3	1.85E-05	1.96E-05				Y
PNL-5	FILTER2	502227005	28-Aug-19	31-Dec-19	U-238	3.63E-05	pCi/m3	1.42E-05	1.53E-05				Y

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