



## U.S. Department of Energy

Hanford Field Office  
P.O. Box 550  
Richland, Washington 99352

January 8, 2025

24-ECD-0202

Addressees: See page 3

### U.S. DEPARTMENT OF ENERGY, HANFORD FIELD OFFICE SUBMITS MODIFICATION REQUEST TO THE WTP ANALYTICAL LABORATORY LB-S1 AND LB-S2 EMISSION UNIT CONDITIONAL RADIOACTIVE AIR OPERATING LICENSES

The U.S. Department of Energy, Hanford Field Office submits 24590-WTP-RPT-ENV-24-002, Rev 0, "Radioactive Air Emissions Notice of Construction Modification to the Waste Treatment and Immobilization Plant Analytical Laboratory LB-S1 and LB-S2 Emission Units." This modification will allow for an increase in the annual number of tank waste samples and incorporates radioactive calibration standard development in preparation for tank waste operations. The intent is to pursue Washington State Department of Health issuance of the Final Operating Licenses once confirmation of completion of Condition of Acceptance 3.h included in the existing Laboratory Conditional Operating Licenses is submitted for these two emission units.

The Notification of Off-Permit Change is being submitted to the Washington State Department of Ecology for its administration of the Hanford Air Operating Permit (AOP), as well as to the U.S. Environmental Protection Agency, Region 10, as part of the notification process for off permit changes outlined in the Hanford AOP.

If you have any questions, please contact me, or you may contact Corey A. Low, Assistant Manager for Safety and Environment, at (509) 376-4820.

Sincerely,

Brian T.  
Vance

Digitally signed by Brian  
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Attachments and cc: See page 2

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24-ECD-0202

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January 8, 2025

Attachments:

1. Modification WTP Analytical Laboratory  
LB-S1 and LB-S2 Emission Units
2. Notification of Off-Permit Change

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Addressees  
24-ECD-0202

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January 8, 2025

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Attachment 1  
24-ECD-0202

Radioactive Air Emissions Notice of Construction Modification  
to the WTP Analytical Laboratory LB-S1 and LB-S2 Emission Units

24590-WTP-RPT-ENV-002, Rev 0

(112 pages including cover sheet)



# Radioactive Air Emissions Notice of Construction Modification to the WTP Analytical Laboratory LB-S1 and LB-S2 Emission Units

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10/07/2024  
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# History Sheet

Rev	Reason for revision	Revised by
0	Initial Issue.	Brian Walker

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## Acronyms

ACFM	actual cubic feet per minute
AG-1	Code on Nuclear Air and Gas
AHL	analytical hot cell laboratory
AHU	air handling unit
$\alpha$	alpha radiation
ANSI	American National Standards Institute
AOP	Air Operating Permit
APQ	annual possession quantity
ARL	analytical radiological laboratory
ARV	atmospheric reference ventilation system
ASME	American Society of Mechanical Engineers
ASX	autosampling system
BARCT	best available radionuclide control technology
$\beta/\gamma$	beta/gamma radiation
CAP88-PC	Clean Air Act Assessment Package – Personal Computer
CAS	Chemical Abstracts Service
CCM	Code Compliance Matrix
CCN	Correspondence Control Number
CFR	Code of Federal Regulations
Ci	curie
DF	decontamination factor
DFLAW	Direct Feed Low-Activity Waste
DOE	US Department of Energy
EMF	Effluent Management Facility
EPA	US Environmental Protection Agency
HEPA	high-efficiency particulate air (filter)
HLW	High-Level Waste (Facility)
HVAC	heating, ventilation, and air-conditioning
Lab	Analytical Laboratory
LIMS	laboratory information management system
LAW	Low-Activity Waste (Facility)

**24590-WTP-RPT-ENV-24-002, Rev 0**  
**Radioactive Air Emissions Notice of Construction**  
**Modification to the WTP Analytical Laboratory LB-S1**  
**and LB-S2 Emission Units**

MEI	maximally exposed individual
NEPA	National Environmental Policy Act
NOC	notice of construction
PIC	potential impact category
PT	Pretreatment (Facility)
RCW	Revised Code of Washington
RLD	radioactive liquid waste disposal system
SDJ	stack discharge monitoring system
SEPA	State Environmental Policy Act
TEDE	total effective dose equivalent
VSL	vessel
WAC	Washington Administrative Code
WC	water column
WDOH	Washington State Department of Health
WTP	Hanford Tank Waste Treatment and Immobilization Plant

## Executive Summary

This radioactive air emission operating license modification request is being submitted to the Washington State Department of Health (WDOH) in accordance with Washington Administrative Code (WAC) 246-247, *Radiation Protection—Air Emissions*, to propose an emission increase from the Analytical Laboratory (Lab) LB-S1 and LB-S2 emission units. This is a modification to the original application [*Radioactive Air Emissions Notice of Construction Operating License Application for the WTP LAW, LAB, and EMF* (24590-WTP-RPT-ENV-18-002 Rev 1)] through the Conditions of Acceptance process. Currently, the LB-S1 and LB-S2 operating licenses are not final. This application does not include any changes to the Low-Activity Waste (LAW) Facility, Effluent Management Facility (EMF), High-Level Waste (HLW) Facility, Pretreatment (PT) Facility, and Lab LB-C2 radioactive air emission units.

Consistent with previous Waste Treatment Plant (WTP) Notice of Construction (NOC) Applications, a total of 46 radionuclide constituents of potential concern may be present in the Lab and assessed for potential to emit. Radionuclides may be present as particulates, aerosols, and (or) gases and the specific physical forms and release forms are discussed in Sections 11 and 12 of this application.

The selected Best Available Radionuclide Control Technology (BARCT) and associated BARCT instrumentation were previously approved by WDOH with issuance of NOC IDs 1045 and 1331 and are not proposed for change. High-efficiency particulate air (HEPA) filters (either one stage or two stages) provide BARCT to control radioactive particulate and aerosol emissions from Lab LB-S1 and LB-S2 emission units.

This modification requests emissions increase due to a proposed increase in the tank waste sample volume and the addition of radiological standards during tank waste operations.

Dose modeling using the US Environmental Protection Agency- approved Clean Air Act Assessment Package – Personal Computer [CAP88-PC], version 4, was previously performed in *Radioactive Air Emissions Notice of Construction Operating License Application for the WTP LAW, LAB, and EMF* (24590-WTP-RPT-ENV-18-002 Rev 1) to estimate dose contributions from radionuclide releases to the atmosphere. Since there are no changes proposed to emission unit characteristics or dose modeling parameters, this application uses the same dose conversion factors as provided in 24590-WTP-RPT-ENV-18-002 Rev 1. The Total Effective Dose Equivalent (TEDE) to the Maximally Exposed Individual (MEI) is summarized for each emission unit in Table 1 below. Also, Table 1 compares dose from the previous license application (24590-WTP-RPT-ENV-18-002 Rev 1) to the increase proposed in this modification. Section 15 of this application presents the air emissions and TEDE to the MEI for each radionuclide of each emission unit.

**Table 1 TEDE to the MEI by Emission Unit**

Facility	Emission Unit	24590-WTP-RPT-ENV-18-002 Rev 1 Unabated Dose (mrem/yr)	24590-WTP-RPT-ENV-24-002 Rev 0 Unabated Dose (mrem/yr)	24590-WTP-RPT-ENV-18-002 Rev 1 Abated Dose (mrem/yr)	24590-WTP-RPT-ENV-24-002 Rev 0 Abated Dose (mrem/yr)
Lab	LB-S1	7.66E-06	1.70E-05	3.83E-09	9.69E-09
Lab	LB-S2	8.51E-06	1.89E-05	4.36E-11	1.46E-09

# 1 Location

The Lab facility is located on the WTP site on the eastern part of the 200 East Area on the U.S. Department of Energy (DOE) Hanford Site. The WTP site is northwest of Richland, Washington; on the 7.5-minute quadrangle topographic map of Gable Butte, it is in Section 3, T12N, R26E, Willamette Meridian. The latitude and longitude coordinates corresponding to the general WTP site are approximately N 46°33'4", W 119°30'9". Visuals of the WTP and individual facilities mapped locations are shown in Figure 1 and Figure 2.

The address for the WTP site is as follows:

US Department of Energy, Hanford Field Office  
Hanford Site  
200 East Area, Waste Treatment Plant  
Richland, WA 99354

Figure 1 Location of the WTP on the Hanford Site

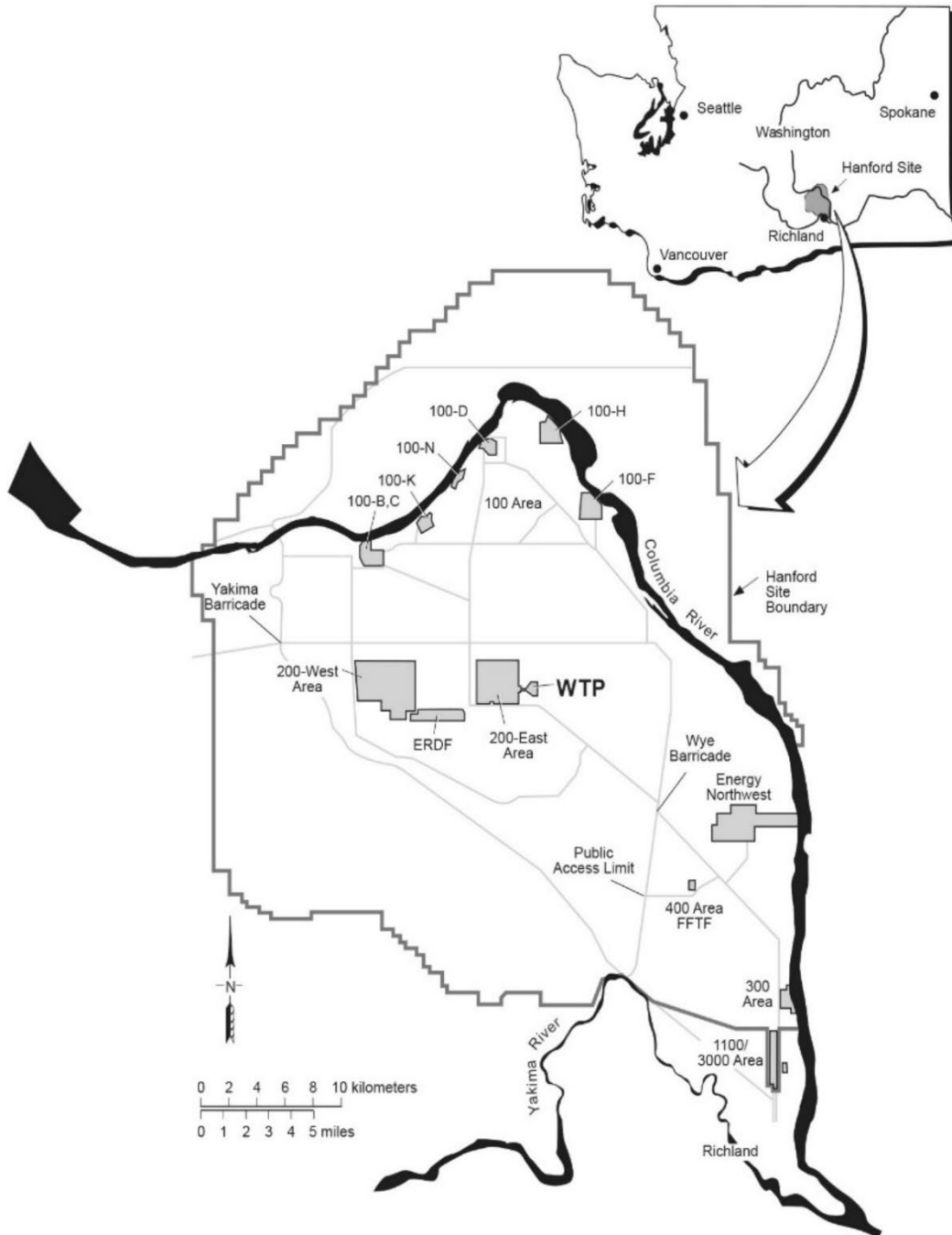
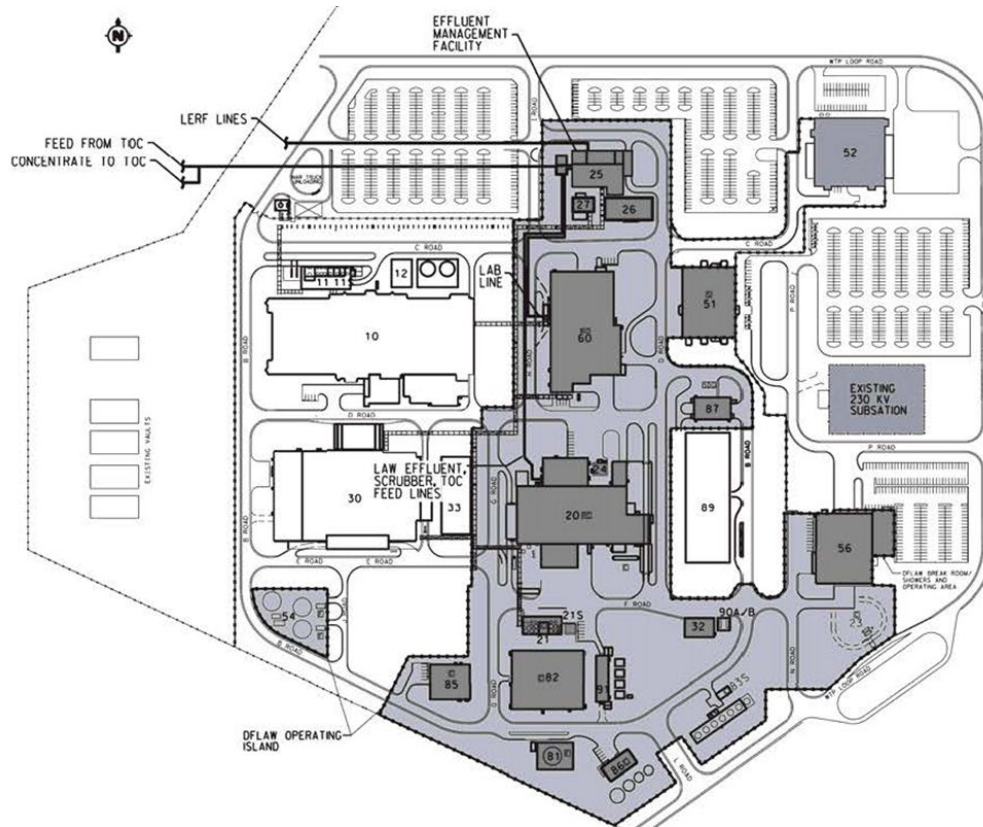


Figure 2 Location of WTP Lab



Notes:

1. Building 60 is the Analytical Laboratory.
2. The Direct Feed Low-Activity Waste (DFLAW) operating island is shaded.

## 2 Responsible Manager

Mr. Brian T. Vance, Manager  
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## 3 Proposed Action

The proposed action pursues modification to the WTP Lab LB-S1 and LB-S2 emission units for an increase in Annual Possession Quantity (APQ) and associated emissions and dose. The WTP is a complex of buildings being designed and constructed to treat and process radioactive waste into a stable glass form. The DFLAW configuration of WTP (which includes LAW, Lab, and EMF), is designed to treat the LAW portion of the radioactive waste until the HLW and PT facilities are completed.

## **4 State Environmental Policy Act**

This Project fulfills the requirements of WAC 197-11, State Environmental Policy Act (SEPA) Rules, and Revised Code of Washington (RCW) 43.21C.030(2)(c), Guidelines for State Agencies, Local Governments—Statements—Reports—Advice—Information, per RCW 43.21C.150, State Environmental Policy: RCW 43.21C.030(2)(c) Inapplicable When Statement Previously Prepared Pursuant to National Environmental Policy Act of 1969 (NEPA), which states the following:

The requirements of RCW 43.21C.030(2)(c) pertaining to the preparation of a detailed statement by branches of government shall not apply when an adequate detailed statement has been previously prepared pursuant to NEPA, in which event said prepared statement may be utilized in lieu of a separately prepared statement under RCW 43.21C.030(2)(c).

DOE/EIS-0391, *Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site*, Richland, Washington (TC & WM EIS), meets the agencies' [i.e., DOE, Washington State Department of Ecology, US Environmental Protection Agency (EPA)] review needs for the current application. The lead reviewing agency is the DOE Hanford Field Office.

## **5 Process Description**

The Lab provides a WTP support function by preparing and analyzing sample materials. In the current DFLAW configuration, only materials from the EMF and LAW facilities will be sampled and analyzed. Capabilities of analyzing samples from HLW and PT are not discussed, because that scope is not applicable to current DFLAW configuration of the Lab.

The Lab is designed to incorporate the features and capability necessary to ensure efficient WTP operations and meet permitting, process control, authorization basis, and waste form qualification requirements. The Lab is a process support facility designed for 365 days per year of operation to support peak throughput for each WTP Facility.

The Lab contains both high-activity and low-activity laboratories. Low-activity samples are managed and analyzed in the analytical radiological laboratory (ARL). The ARL also includes a sample receiving/shipping area designed to manage the inflow of manually transported samples. High-activity samples are managed in the analytical hot cell laboratory (AHL). The AHL will only operate in the Baseline configuration and will be isolated using closed dampers in the DFLAW configuration. C5 ventilation areas, hotcell drain collection vessel (RLD-VSL-00165), and associated components are not operational in the Baseline configuration but will maintain ventilation in DFLAW configuration.

The Lab workstations are logically segregated to provide a degree of isolation from possible cross-contamination that could reduce the validity of the analytical results. Isolation is also provided to enhance the ability of the laboratory to function even when a room or workstation is nonfunctioning. Redundant capabilities are provided, as appropriate, to mitigate contamination incidents and to maintain required support to the processes when one system fails.

The facility is designed to coordinate the management of samples that are outsourced and analyzed at off-site laboratories. Outsource laboratories are used to analyze the majority of very low-activity samples, such as water quality and air emission samples.

Samples are transported to the Lab in two ways. The majority of samples are collected and transported from the processing facilities via the autosampling system (ASX). The ASX collects samples and transfers them from the requesting facility to the Lab via a pneumatic transfer system to a hotcell or fume hood sample receipt area. Samples are collected in a sample bottle or vial and transferred into a sample carrier. Low-activity samples from the LAW vitrification facility are transferred directly to the sample receipt area through a dedicated low-activity transfer system. EMF samples and a small percentage of samples from other facilities are transported to the Lab manually in appropriately shielded transportation casks or containers.

A laboratory information management system (LIMS) network tracks and maintains an inventory of samples, reagents, and materials in the Lab including sample analyses and data collection. The objective is to provide a centralized electronic repository for data supporting analytical operations and generated as a result of analyses performed on samples collected from various points in the waste treatment process. The LIMS tracks the flow of samples through the Lab. Samples received in the Lab are identified with a unique identification label.

The Lab ventilation system is segmented into four subsystems. The subsystems are classified by contamination zones C1, C2, C3, and C5 to establish a hierarchy for pressure control and decrease likelihood of contamination. The facility control philosophy uses a cascading ventilation system wherein air cascades from areas of less potential for contamination to areas of greater potential for contamination, to provide confinement of contamination at or near the source. Zones classified as C5 are potentially the most contaminated, and zones classified as C1 have low potential to be contaminated. The C4 designation is not used. Lab ventilation emission unit operating conditions are provided below.

- Areas classified as C1 areas consist of administrative spaces. These areas have low potential to be contaminated. The C1 ventilation system provides filtered and tempered air as needed to maintain an acceptable work environment for both personnel and equipment.
- The atmospheric reference ventilation system (ARV) provides an accessible link from outside air to the differential pressure instrumentation used in monitoring and controlling the building ventilation system. The ARV provides a common pressure reference point outside the building and above the roof. Space negative pressure in C2, C3, and C5 areas is measured in reference to this common atmospheric reference port.
- Areas classified as C2 areas consist of the tertiary confinement spaces; these areas are bounded by the walls, floors, roofs, and associated ventilation systems of the process facility. This system provides supply air to the facility process spaces that require heating and cooling for indoor temperature control. The C2V system also provides exhaust necessary for the establishment of the design pressure gradients relative to atmosphere as measured and reported by the ARV. The establishment of the design pressure gradients relative to atmosphere, in conjunction with controls in C3V and C5V systems, ensures cascading airflow. The C2V system air handling units (AHUs) draw in outside air, where it is filtered and conditioned, before the AHUs deliver the air via distribution ductwork primarily to the Lab C2 areas and selected C3 areas. A portion of the air delivered to the C2 areas is exhausted to the atmosphere through HEPA filters by the C2V system exhaust fans via the C2V exhaust stack. The remaining air cascades to the surrounding C3 and C5 areas. The C2V system is designed to maintain the C2 areas at a pressure slightly negative to the outside atmosphere (approximately  $-0.1''$  water column [WC]). This negative pressurization will provide a net inleakage of air into the building. Electric unit heaters are located throughout the building in various areas as necessary to provide additional heating as required.

- Areas classified as C3 areas within the Lab include the individual laboratories and maintenance areas. The C3V system is designed to maintain the C3 areas in a pressure range between the set pressures of the C2 and C5 areas and to provide space cooling as required. The C3 areas will generally be held at approximately  $-0.4''$  WC depression with respect to atmosphere. In general, supply air to the C3 areas is drawn from the surrounding C2 spaces. A portion of this air cascades through the C3 areas into adjacent C5 areas. Air from the C3 areas that is not cascaded to the C5 areas is filtered through a single stage of HEPA filters and discharged to atmosphere by the C3V system exhaust fans via the C3V system exhaust stack. Areas that require more supply air than available through cascaded airflow are provided with C2V system supply air to the C3 area, using a backdraft damper in the supply air duct for zone separation.
- Areas classified as C5 areas consist of the primary confinement spaces. The C5 areas will generally be held at approximately  $-1.4''$  WC depression. Inleed assemblies include backdraft dampers to prevent flow reversals. The C5 areas are filtered through two stages of HEPA filters and discharged to atmosphere by the C5V system exhaust fans via the C5V system exhaust stack.

Containment is achieved by maintaining C5 areas at the greatest negative pressure, with airflows cascaded through engineered routes from C2 areas to C3 areas and on to the C5 areas. The cascade system, in which air passes through more than one area, reduces the number of separate ventilation streams and hence the amount of air requiring treatment. Adherence to this concept in the design and operation of the Lab ensures that the ventilation air does not become a significant source of exposure to operators, and that the air emissions do not endanger human health or the environment.

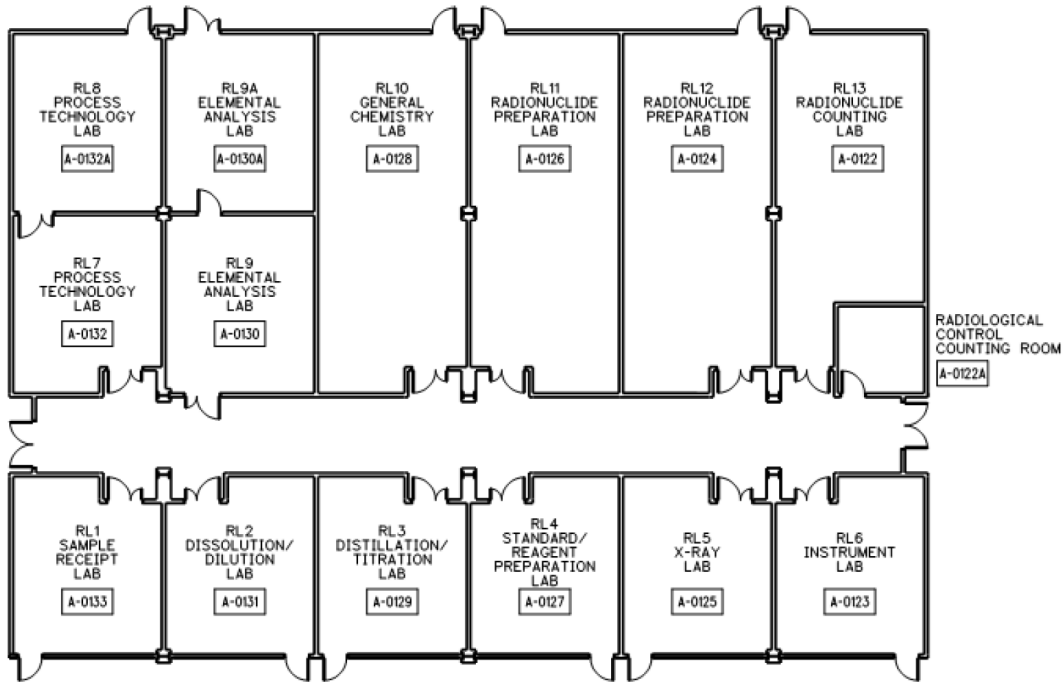
### **Emission Unit LB-S1**

Emission sources for LB-S1 include the ARL, C3 Maintenance Shop, and Radioactive Solid Waste Management Area.

### **Analytical Radiological Laboratory (ARL)**

The ARL is designed to support the preparation and analysis of low-activity dangerous/mixed waste samples. The ARL is capable of receiving the low-activity samples transferred from the process facilities via the ASX as well as manually transported from the process facilities. The ARL consists of the rooms depicted in Figure 3 below to support activities in the preparation and analysis of samples.

Figure 3 General Arrangement of the Analytical Radiological Laboratory



### **C3 Maintenance Shop**

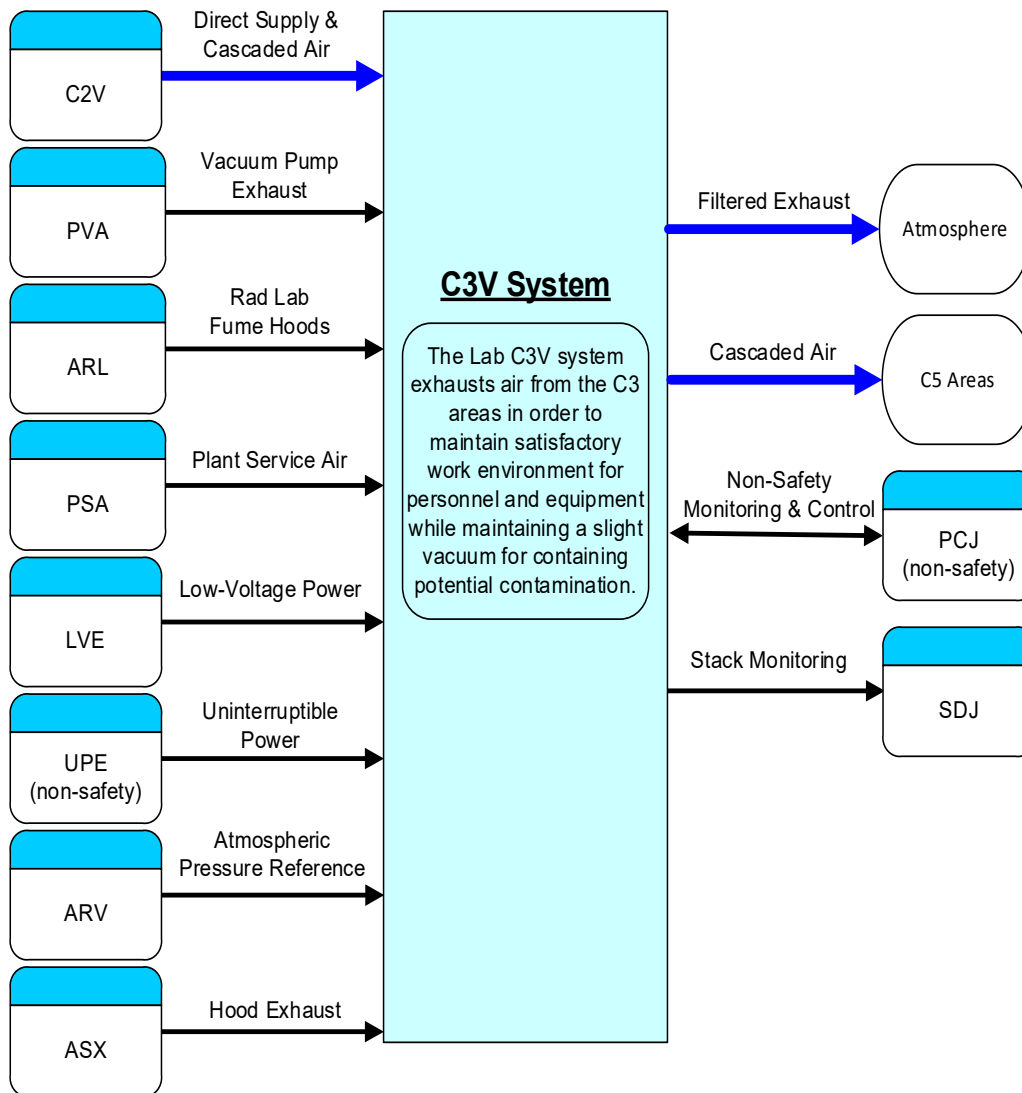
The C3 Maintenance Shop allows decontamination, maintenance, and storage of contaminated equipment. Maintenance activities will include: valve maintenance, pump maintenance, repair and maintenance of fabricated equipment, auto sampler repair, waste packaging, routine preventative maintenance, and equipment maintenance. The C3 Maintenance Shop is located directly across the hallway from ARL Room A-0131.

### **Radioactive Solid Waste Management Area**

Solid wastes and organic lab pack wastes from the ARL and maintenance areas are accumulated in the Radioactive Solid Waste Management Area. This waste management area is in rooms A-0139, A-0139A, A-0139B, A-0139C, and A-0139D. These rooms are located directly across the hallway from ARL rooms A-0125 and A-0127.

A pictorial illustration of the Lab C3V system can be found in the *Analytical Laboratory Ventilation System Design Description* (24590-LAB-3ZD-60-00002) and is provided below in Figure 4.

Figure 4 Lab C3V System Diagram



**Emission Unit LB-S2**

The emission source for LB-S2 is ventilation from the laboratory area collection vessel (RLD-VSL-00164) in the DFLAW configuration. The RLD-VSL-00164 vessel collects liquid effluents from radiological labs and maintenance activities. Effluents collected in this vessel include radiological lab fume hood cup sink drains, C3 maintenance shops, C3 area floor drains, personnel decontamination showers and sinks, and hot cell access area airlock floor drains. The RLD-VSL-00164 vessel contents will be transferred to EMF for processing in the DFLAW configuration. Other emission sources that would be used in the WTP Baseline configuration will not be in operation during DFLAW. Pictorial

illustrations of the Lab C5V system can be found in the *Analytical Laboratory Ventilation System Design Description* (24590-LAB-3ZD-60-00002) and in Figure 5. Figure 6 shows a pictorial illustration of all three Lab emission units.

**Figure 5 Lab C5V System Diagram**

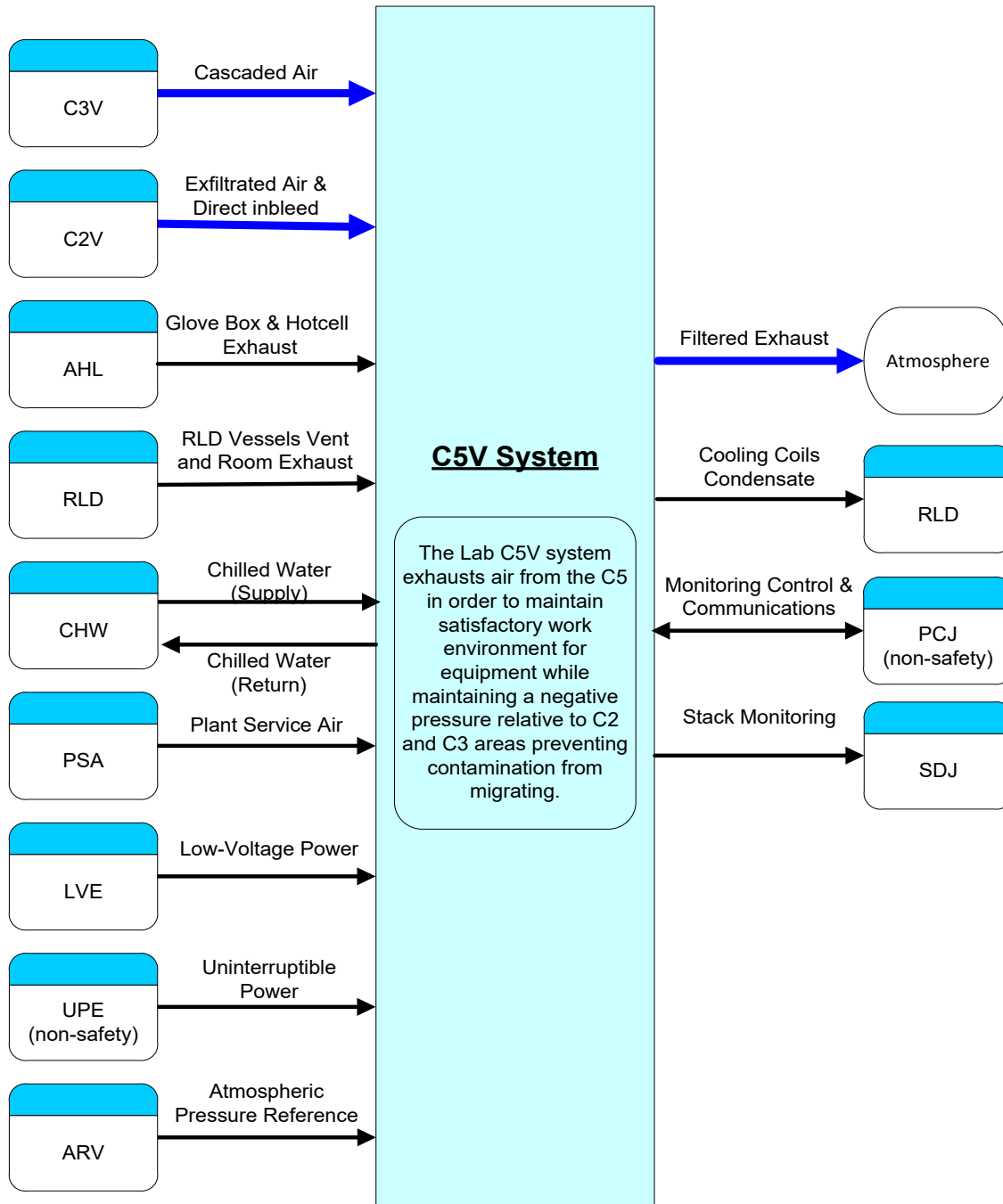
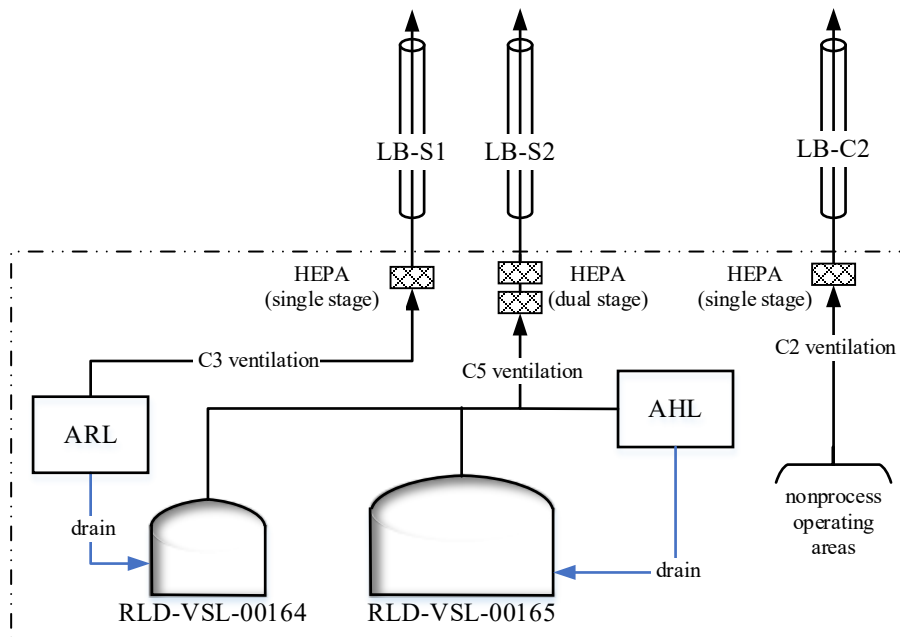


Figure 6 Lab Ventilation System



Note: The AHL and RLD-VSL-00165 are not operational in the DFLAW configuration.

## 6 Best Available Radionuclide Control Technology

The previously approved BARCT and associated BARCT instrumentation are provided in Table 2. Single or two stage HEPA filters are BARCT for the control of radioactive particulates and aerosols for Lab LB-S1 and LB-S2 emission units.

Table 2 WDOH Approved Best Available Radionuclide Control

Facility	Emission Unit/Source	Controls and Protective Feature		
		Particulates and Aerosols	Particulate and Aerosol Overall Decontamination Factor (DF)	Radioactive Gas / Overall DF
Lab	LB-S1	One stage of HEPA filters	2.0E+03	N/A
	LB-S2	Two stages of HEPA filters	2.0E+05	N/A

BARCT indicators, indication devices, and operating ranges are provided in Table 3.

Table 3 BARCT Indicators, Indication Devices, and Operating Ranges

Facility	Emission Unit / Source	Selected BARCT	BARCT Indicator	BARCT Indication Device	Equipment Number	Anticipated BARCT Indication Operating Value/Range	Comment
Lab	LB-S1	HEPA Filters	Pressure differential	Strain gauge pressure sensor	C3V-HEPA-00005A-00005P & C3V-HEPA-00005R C3V-PDT-6354 -C3V-PDI-6355	Max = 8.0 inH <sub>2</sub> O	HEPA filters remove radioactive particulate/aerosols from the ventilation stream. Pressure differential is used to determine when the HEPA filters need replacement. The exhaust system HEPA filter housings have a high differential pressure monitor and alarm.
			Flow	Average pitot tube with magnehelic differential gauge or transmitter	C3V-HEPA-00005A-00005P & C3V-HEPA-00005R C3V-FI-6337 -C3V-FI-6350	<u>Individual HEPA Housing Qualified Range</u> Min = 1,600 acfm Max = 8,000 acfm	The identified flow instruments monitor flow to inform operation of the HEPA filter housings and filters within their qualified range [1,600 actual cubic feet per minute (acfm) to 8,000 acfm per housing]. Each housing has 4 filters. 12 housings are in operation and 2 in standby.
		Exhaust Fans	Flow	Average pitot tube with magnehelic differential gauge or transmitter	C3V-FAN-0007A C3V-FAN-0007B C3V-FAN-0007C  <u>System Flow Indicator</u> SDJ-FI-6106	<u>DFLAW Qualified Stack Flow Rate Range</u> Min = 16,000 scfm Max = 80,000 scfm	The exhausters provide the motive force for exhausting ventilation air through the HEPA filters and out the stack. The stack flow instrument monitors flow through the exhausters. 2 fans are in operation and 1 in standby. DFLAW qualified stack flow rate range is provided in the "horseblanket" which was provided in Correspondence Control Number (CCN) 333348.
Lab	LB-S2	HEPA Filters	Pressure differential	Strain gauge pressure sensor	C5V-HEPA-00034A-00034D C5V-HEPA-00035A-00035D C5V-PDI-6238	Max = 8.3 inH <sub>2</sub> O	HEPA filters remove radioactive particulate/aerosols from the offgas stream. Pressure differential is used to determine when the HEPA filters need replacement. The exhaust system HEPA filter housings have a high differential pressure monitor and alarm.
			Flow	Average pitot tube with magnehelic differential gauge or transmitter	C5V-HEPA-00034A-00034D C5V-HEPA-00035A-00035D C5V-FI-6230 -C5V-FI-6233	<u>Individual HEPA Housing Qualified Range</u> Min = 1,600 acfm Max = 8,000 acfm	The identified flow instruments monitor flow to inform operation of the HEPA filter housings and filters within their qualified range (1,600 acfm to 8,000 acfm per housing). Each housing has 4 filters. 3 operational filter housings and 1 in standby in the first stage of HEPAs. 3 operational filter housings and 1 in standby in the second stage of HEPAs.
		Exhaust Fans	Flow	Average pitot tube with magnehelic differential gauge or transmitter	C5V-FAN-00011A C5V-FAN-00011B  <u>System Flow Indicator</u> SDJ-FI-6110	<u>DFLAW Qualified Stack Flow Rate Range</u> Min = 4,800 scfm Max = 18,019 scfm	The exhauster provides the motive force for exhausting ventilation air through the HEPA filters and out the stack. 1 is in operation and 1 in standby. DFLAW qualified stack flow rate range is provided in the "horseblanket" which was provided in CCN 333348.

Radionuclide particulate and aerosols emissions are expected in the Lab exhaust systems as a result of the activities associated with handling and analysis of various samples. HEPA filters are the approved BARCT for the control of radioactive particulates and aerosols from each Lab emission unit. The LB-S1 emission unit is equipped with single-stage HEPA filtration, while the LB-S2 emission unit is equipped with two-stage HEPA filtration. Laboratory sample preparation and analysis are performed in the ARL, which supports analyses of low- and medium-activity radioactive samples. The ARL system also includes a sample management area designed to manage the inflow of manually transported samples as well as samples that will be analyzed at off-site laboratories. Most samples analyzed offsite are low activity and environmental samples. Fume hoods in the ARL will be discharged to the C3V system and abated through one-stage of HEPA filtration via the LB-S1 emission unit. The only emission source for LB-S2 in the DFLAW configuration of the Lab is ventilation from the laboratory area sink collection vessel (RLD-VSL-00164).

The WDOH approved the selected BARCT indication devices used to monitor proper operation of BARCT components with issuance of Radioactive Air Emissions Licenses that authorized construction of the Lab. The BARCT indication devices and their associated operating ranges are summarized in Table 3. Note that exhaust fans do not perform a BARCT abatement function but they are critical to emission unit function.

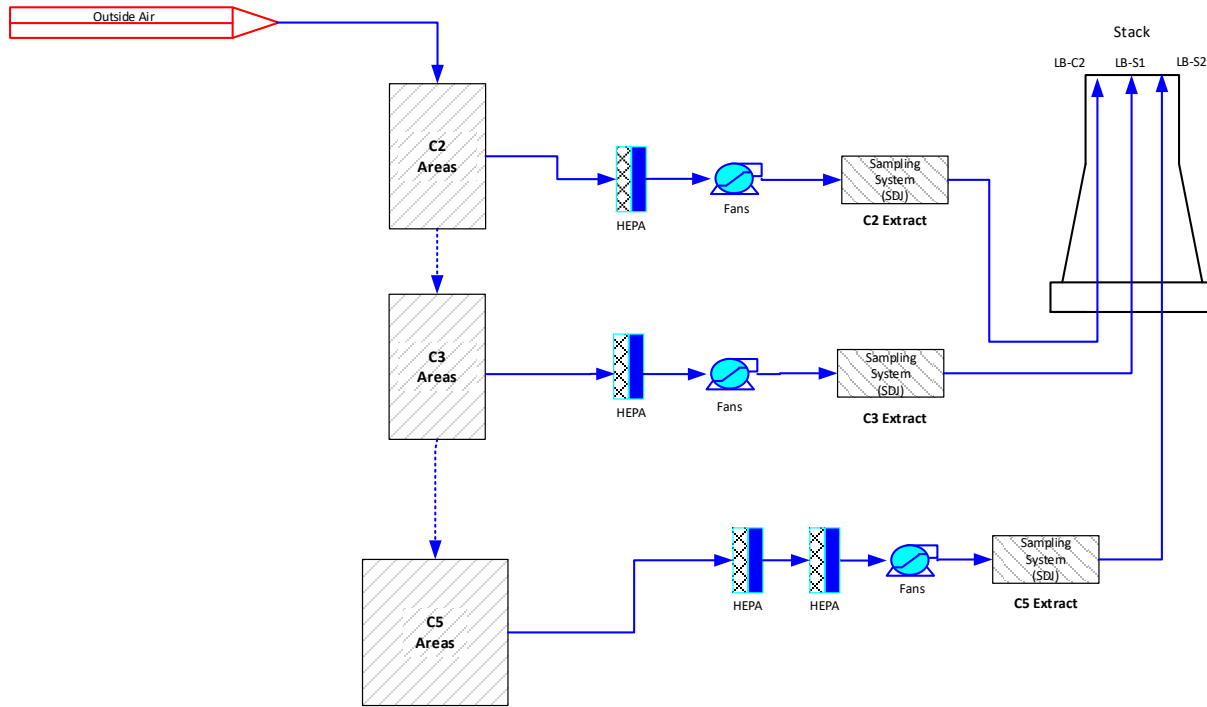
The selected BARCT monitoring parameters for all laboratory BARCT HEPA filters include flow and differential pressure. Utilizing these parameters provides a focused assessment of HEPA filter performance and loading rates. During startup and commissioning of the ventilation systems, operating ranges may vary from the projected ranges. If this occurs, WDOH will be notified and updated operating ranges will be negotiated.

Maintenance activities may require the use of engineering controls and containment devices to maintain contamination control. Engineered devices may include glove bags, gloveboxes, tents, and portable air-handling equipment equipped with HEPA filters for contamination control. The use and design of these engineered contamination control devices will be determined and managed in accordance with the *Waste Treatment Plant Construction and Commissioning Radiological Control Manual*, 24590-WTP-REQM-RARP-RP-0001.

## **7 Drawings**

Refer to Figure 7 for the simplified drawings of the selected control systems for radioactive air emissions.

Figure 7 Lab C2, C3, and C5 Area Ventilation Controls



## 8 Radionuclides of Concern

The radionuclides of concern are identified in Section 15.

## 9 Monitoring

Each Laboratory emission unit is equipped with radiological sampling equipment that is designed and installed with the applicable requirements of 40 CFR 61.93, *National Emission Standards for Hazardous Air Pollutants: Emission Monitoring and Test Procedures*, and American National Standards Institute (ANSI) N13.1-1999, *Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities*. The sampling parameters for the Lab LB-S1 and LB-S2 emission units are identified in Table 4 below.

The Lab sampling programs are developed based on the ANSI N13.1-1999 potential impact categories (PIC). Each emission unit's PIC category is based on total potential to emit identified in Section 15 of this application. Over the Lab's permitting evolution LB-S1 has always been a PIC 3 but LB-S2 was originally designed as PIC 2 but based on DFLAW emissions is now a PIC 3. During the initial years of DFLAW both emission units will be operated in a continuous sampling mode per agreements with the WDOH.

**Table 4 Emission Unit Sampling and Monitoring**

Facility	Emission Unit	PIC <sub>1,2,3</sub>	CAM	Record Sampling and Isotopic Analysis <sup>4</sup>
Lab	LB-S1	3	NO	Continuous sampling for gross $\alpha$ and $\beta/\gamma$ .
Lab	LB-S2	3 <sup>5</sup>	NO	Continuous sampling for gross $\alpha$ and $\beta/\gamma$ .

Notes:

- 1 Based on emission and dose rates presented in Section 15.
- 2 Potential impact categories: PIC 1 = Emission units with TEDE greater than 5 mrem/yr; PIC 2 = Emission units with TEDE less than 5 mrem/yr but greater than 0.1 mrem/yr; PIC 3 = Emission units with TEDE less than 0.1 mrem/yr.
- 3 For PIC 3 emission units, continuous sampling will be performed initially but designed for periodic sampling in accordance with ANSI N13.1-1999.
- 4 Record sampling analysis is determined as follows: americium-241 for  $\alpha$  emitters; strontium-90 for  $\beta$  emitters; and cesium-137 for  $\gamma$  emitters.
- 5 LB-S2 was designed and installed as PIC 2.

### **Compliance with ANSI N13.1-1999**

Emission unit discharge sampling and monitoring systems vary based on the emission unit and their corresponding PIC category. The following components are provided for the identified emission unit(s):

- Sample probes and lines
- Stack flow monitoring equipment
- Vacuum system
- Sampling equipment
- Sample flow measurement and control equipment

### **Sample Probe Location and Design**

The sample point will be provided to collect a representative sample of the air in the duct and allow the sample to be routed to the instrumentation enclosures housing the sample collection instruments. The layout of the sample point will follow 40 CFR 60, *Standards of Performance for New Stationary Sources*, Appendix A, Test Method 1 and ANSI N13.1-1999. These standards detail the acceptance criteria for a sampling location. Before any onsite testing to confirm and document that the criteria have been satisfied, careful consideration will be given to the design of the ducting and the location of the emission unit sampling system. This will ensure the following:

- At each point, the flow will be stable, well-mixed, and representative of the effluent being discharged.
- The flow will not exhibit excessive angularity or swirl.
- Temperature range and variations in effluent flow rate will be understood.
- Temperature range and variations in effluent flow rate will not present a problem for testing and maintenance activities.

Testing will be conducted to confirm that emission unit sampling points will be located where there are no cyclonic or swirling airflow patterns. The design will minimize the lengths of sample lines and provide accessible locations for testing and routine maintenance activities. The sampling probe will be located where it can be demonstrated that the contaminants are well mixed and the flow is fully developed. Emission units will use ANSI N13.1-1999 compliant single-shrouded probes.

### **Sample Lines**

The sample lines will be provided to transport the air sample from the probe to the measurement instrument for sampling. The lengths of the sample lines and number of bends will be minimized to reduce transmission losses. Wherever possible, the enclosures will be located near the ventilation ducts.

Sample lines will be heat traced and insulated for instances where condensation of the sample may occur. The arrangement of sample probes, sample lines, and monitors will be reviewed in accordance with Section B2 of ANSI N13.1-1999 to confirm the transmission losses in the overall systems are within the acceptable limits (less than 50%) defined in ANSI N13.1-1999.

### **Flow Measurement Equipment**

Flow measurement instruments will be provided in accordance with standards in ANSI N13.1-1999. The techniques selected will be of the low-maintenance type and will be designed to facilitate calibration and testing. Flow measurements are designed to achieve an accuracy of at least 90% (uncertainty of less than 10%), in accordance with ANSI N13.1-1999.

### **Equipment Layout and Enclosures**

The control and instrument panels are located close to the sample points to minimize the length of sample lines. Enclosures will be provided as necessary to house the radiometric instrumentation and associated equipment. Associated equipment will include isolation valves, flow adjustment, flow metering, and vacuum pumps which will be used to pull air from the ducts through the radiometric instrumentation.

## **10 Annual Possession Quantity**

The estimated APQ for each emission unit are identified in the tables below. The APQ is defined in WAC 246-247-030(5) as the sum of the quantity of a radionuclide on hand at the beginning of the calendar year and the quantity of that radionuclide received or produced during the calendar year.

The proposed APQ increases are driven by an increase of the number of LAW Melter Feed Preparation Vessel samples (identified as LAW 6) from 411 to 1,643 per year, and by the addition of radiological standards that are used for Laboratory training purposes.

The total Lab APQ including the LAW 6 sample increase is provided in Table 5 below. Tank waste samples include a contingency factor of 1.5 and radiological standards include a contingency factor of 2. Contingency factors ensure any future proposed increases are bound by the modification. All other sample types and number of samples identified in *WTP Analytical Laboratory Emissions Estimate*, 24590-WTP-RPT-ENV-18-001, remain the same.

The approach for estimating Lab LB-S1 and LB-S2 APQ is to multiply the total annual volume of sample material from the Analytical Radiological Laboratory (ARL) by the mass fraction of each constituent from a corresponding or representative bounding process stream to derive a sample concentration plus Lab radiological standards.

The ARL is ventilated by the C3V area that discharges to the LB-S1 emission unit. Since the hot cells are not operational in the C5V area, the only source of emissions to LB-S2 is the RLD-VSL-00164, which is filled by a portion of the waste sample material from the ARL. The total annual volume of sample material from the ARL is conservatively assumed to be discharged into RLD-VSL-00164.

**Table 5 Lab Annual Possession Quantities**

<b>Radionuclide</b>	<b>Lab LB-S1 Tank Waste APQ (Ci/yr)</b>	<b>Lab LB-S1 Rad Standards APQ (Ci/yr)</b>	<b>Lab LB-S2 Tank Waste APQ (Ci/yr)</b>	<b>Lab LB-S2 Rad Standards APQ (Ci/yr)</b>	<b>Total (Ci/yr)</b>
Ru-106	9.40E-11	0.00E+00	9.40E-11	0.00E+00	1.88E-10
Cd-113m	4.40E-04	0.00E+00	4.40E-04	0.00E+00	8.80E-04
Sb-125	4.55E-05	1.09E-06	4.55E-05	1.09E-06	9.32E-05
Sn-126	2.61E-04	0.00E+00	2.61E-04	0.00E+00	5.22E-04
I-129	9.85E-06	8.90E-07	9.85E-06	8.90E-07	2.15E-05
Cs-134	2.66E-10	0.00E+00	2.66E-10	0.00E+00	5.32E-10
Cs-137	1.83E-03	3.25E-05	1.83E-03	3.25E-05	3.73E-03
Ba-137m	1.73E-03	0.00E+00	1.73E-03	0.00E+00	3.47E-03
C-14	2.52E-04	0.00E+00	2.52E-04	0.00E+00	5.03E-04
Sm-151	2.21E-07	0.00E+00	2.21E-07	0.00E+00	4.42E-07
Eu-152	3.94E-11	0.00E+00	3.94E-11	0.00E+00	7.88E-11
Eu-154	2.13E-10	0.00E+00	2.13E-10	0.00E+00	4.25E-10
Eu-155	8.22E-11	0.00E+00	8.22E-11	0.00E+00	1.64E-10
Ra-226	5.70E-09	0.00E+00	5.70E-09	0.00E+00	1.14E-08
Ac-227	7.22E-07	0.00E+00	7.22E-07	0.00E+00	1.44E-06
Ra-228	3.42E-07	0.00E+00	3.42E-07	0.00E+00	6.83E-07
Th-229	4.98E-14	0.00E+00	4.98E-14	0.00E+00	9.96E-14
Pa-231	1.00E-13	0.00E+00	1.00E-13	0.00E+00	2.00E-13
Th-232	1.11E-13	0.00E+00	1.11E-13	0.00E+00	2.22E-13
U-232	4.41E-08	0.00E+00	4.41E-08	0.00E+00	8.83E-08
U-233	2.44E-06	1.76E-06	2.44E-06	1.76E-06	8.40E-06
U-234	7.11E-07	0.00E+00	7.11E-07	0.00E+00	1.42E-06
U-235	2.94E-08	0.00E+00	2.94E-08	0.00E+00	5.89E-08
U-236	2.37E-08	0.00E+00	2.37E-08	0.00E+00	4.74E-08

**Table 5 Lab Annual Possession Quantities**

Radionuclide	Lab LB-S1 Tank Waste APQ (Ci/yr)	Lab LB-S1 Rad Standards APQ (Ci/yr)	Lab LB-S2 Tank Waste APQ (Ci/yr)	Lab LB-S2 Rad Standards APQ (Ci/yr)	Total (Ci/yr)
Np-237	6.99E-06	1.41E-07	6.99E-06	1.41E-07	1.43E-05
Pu-238	9.97E-06	8.44E-07	9.97E-06	8.44E-07	2.16E-05
U-238	6.48E-07	0.00E+00	6.48E-07	0.00E+00	1.30E-06
Pu-239	2.23E-04	2.11E-07	2.23E-04	2.11E-07	4.46E-04
Pu-240	5.25E-05	0.00E+00	5.25E-05	0.00E+00	1.05E-04
Am-241	1.27E-03	3.97E-05	1.27E-03	3.97E-05	2.62E-03
Pu-241	1.36E-04	5.52E-05	1.36E-04	5.52E-05	3.82E-04
Cm-242	6.57E-05	0.00E+00	6.57E-05	0.00E+00	1.31E-04
Pu-242	7.92E-09	2.92E-06	7.92E-09	2.92E-06	5.85E-06
Am-243	7.40E-07	2.02E-07	7.40E-07	2.02E-07	1.88E-06
Cm-243	4.82E-06	0.00E+00	4.82E-06	0.00E+00	9.65E-06
Cm-244	8.09E-05	2.11E-06	8.09E-05	2.11E-06	1.66E-04
H-3	2.05E-04	0.00E+00	2.05E-04	0.00E+00	4.09E-04
Ni-59	3.65E-06	0.00E+00	3.65E-06	0.00E+00	7.29E-06
Co-60	1.75E-11	1.11E-06	1.75E-11	1.11E-06	2.21E-06
Ni-63	2.75E-04	1.68E-06	2.75E-04	1.68E-06	5.54E-04
Se-79	3.96E-04	0.00E+00	3.96E-04	0.00E+00	7.92E-04
Sr-90	3.70E-02	1.75E-06	3.70E-02	1.75E-06	7.40E-02
Y-90	3.70E-02	0.00E+00	3.70E-02	0.00E+00	7.40E-02
Nb-93m	8.12E-10	0.00E+00	8.12E-10	0.00E+00	1.62E-09
Zr-93	8.88E-10	0.00E+00	8.88E-10	0.00E+00	1.78E-09
Tc-99	3.68E-02	4.41E-05	3.68E-02	4.41E-05	7.37E-02
Pu-236	1.89E-08	1.18E-08	1.89E-08	1.18E-08	6.14E-08
<b>Total</b>	<b>1.18E-01</b>	<b>1.86E-04</b>	<b>1.18E-01</b>	<b>1.86E-04</b>	

## 11 Physical Form

Code WAC 246-247-110(11), Radiation Protection—Air Emissions: Appendix A—Application Information Requirements, defines the physical form of any radionuclide as solids, particulates, or gas. The physical form of each radionuclide in the waste inventory by emission unit is provided in Table 6 below.

**Table 6 Physical and Release Forms for Each Radionuclide by Emission Unit**

<b>Chemical Abstract Service (CAS) Number</b>	<b>Radionuclide <sup>1</sup></b>	<b>Lab LB-S1 Release Form <sup>2,3</sup></b>	<b>Lab LB-S2 Release Form <sup>2,3</sup></b>
13967-48-1	Ruthenium-106	Particulate	Particulate
378253-44-2	Cadmium-113m	Particulate	Particulate
14234-35-6	Antimony-125	Particulate	Particulate
15832-50-5	Tin-126	Particulate	Particulate
15046-84-1	Iodine-129	Particulate	Particulate
13967-70-9	Cesium-134	Particulate	Particulate
10045-97-3	Cesium-137	Particulate	Particulate
13981-97-0	Barium-137m	Particulate	Particulate
14762-75-5	Carbon-14	Particulate	Particulate
15715-94-3	Samarium-151	Particulate	Particulate
14683-23-9	Europium-152	Particulate	Particulate
15585-10-1	Europium-154	Particulate	Particulate
14391-16-3	Europium-155	Particulate	Particulate
13982-63-3	Radium-226	Particulate	Particulate
14952-40-0	Actinium-227	Particulate	Particulate
15262-20-1	Radium-228	Particulate	Particulate
15594-54-4	Thorium-229	Particulate	Particulate
14331-85-2	Protactinium-231	Particulate	Particulate
7440-29-1	Thorium-232	Particulate	Particulate
14158-29-3	Uranium-232	Particulate	Particulate
13968-55-3	Uranium-233	Particulate	Particulate
13966-29-5	Uranium-234	Particulate	Particulate
15117-96-1	Uranium-235	Particulate	Particulate
13982-70-2	Uranium-236	Particulate	Particulate
13994-20-2	Neptunium-237	Particulate	Particulate
13981-16-3	Plutonium-238	Particulate	Particulate
7440-61-1	Uranium-238	Particulate	Particulate
15117-48-3	Plutonium-239	Particulate	Particulate
14119-33-6	Plutonium-240	Particulate	Particulate
14596-10-2	Americium-241	Particulate	Particulate
14119-32-5	Plutonium-241	Particulate	Particulate

**Table 6 Physical and Release Forms for Each Radionuclide by Emission Unit**

Chemical Abstract Service (CAS) Number	Radionuclide <sup>1</sup>	Lab LB-S1 Release Form <sup>2,3</sup>	Lab LB-S2 Release Form <sup>2,3</sup>
15510-73-3	Curium-242	Particulate	Particulate
13982-10-0	Plutonium-242	Particulate	Particulate
14993-75-0	Americium-243	Particulate	Particulate
15757-87-6	Curium-243	Particulate	Particulate
13981-15-2	Curium-244	Particulate	Particulate
10028-17-8	Tritium	Vapor	Vapor
14336-70-0	Nickel-59	Particulate	Particulate
10198-40-0	Cobalt-60	Particulate	Particulate
13981-37-8	Nickel-63	Particulate	Particulate
15758-45-9	Selenium-79	Particulate	Particulate
10098-97-2	Strontium-90	Particulate	Particulate
10098-91-6	Yttrium-90	Particulate	Particulate
7440-03-1	Niobium-93m	Particulate	Particulate
15751-77-6	Zirconium-93	Particulate	Particulate
14133-76-7	Technetium-99	Particulate	Particulate
15411-92-4	Plutonium-236	Particulate	Particulate

Note:

- 1 Alpha, beta, and gamma radiation are represented by Am-241, Sr-90, and Cs-137.
- 2 Release forms identified are for tank waste samples. Radioactive standards are all particulate.
- 3 ARL will perform a minimal amount of laser ablation in DFLAW tank waste samples which is addressed in 24590-LAB-RPT-ENV-18-001 and 24590-WTP-RPT-ENV-18-002. Laser ablation samples use a gas release fraction of 1.0 in accordance with WAC 246-247(21)(a).

## 12 Release Form

WAC 246-247-110(12) defines the release form of any radionuclide as solids, particulates, liquid, or gas (vapor). The release form of each radionuclide at each emission unit is included in Section 11.

## 13 Release Rates

The estimated unabated (potential to emit) and abated release rates from emissions sources contributing to stack emissions are presented in Section 15 of this application. Estimation methodologies by emission unit are described below.

All emission units employ HEPA filtration as BARCT to abate radionuclide emissions. The LB-S2 emission unit is equipped with two stages of HEPA filters that provide a 99.9995% particulate and aerosol removal efficiency, and LB-S1 is equipped with single-stage HEPA filters that provide a 99.95% removal efficiency. The first HEPA filter in a two-stage train is credited with a DF of 2,000 while the second HEPA filter is credited with a DF of 100. The following equations were used to calculate abated emissions from unabated emissions.

- Abated emissions (two-stages of HEPA) (curie/year) = Unabated emissions (curie/year) / 200,000
- Abated emissions (single stage of HEPA) (curie/year) = Unabated emissions (curie/year) / 2,000

Gases/vapors are not abated by HEPA filters. Release fractions applied to the APQ are consistent with WAC 246-247-030(21)(a). The Lab emission rates and the TEDE to the MEI for each radionuclide are identified in Section 15.

### **LB-S1 Emission Unit**

The LB-S1 emission unit ventilates areas of the facility classified with the C3 designation. Activities with the potential to generate radioactive air emissions from areas ventilated by the LB-S1 emission unit were reviewed to determine a bounding source term. The review considered the following activities with the potential to emit to the LB-S1 emission unit:

1. Cascaded emissions from the C2 and C3 areas
2. Waste sample analysis in the ARL
3. Calibration standards

The review concluded that item items 2 and 3 are the primary contributors to the potential emission source. The APQ and unabated radioactive air emissions and supporting methodology were based on Appendix A.

### **LB-S2 Emission Unit**

The LB-S2 emission unit consists of areas classified with the C5 designation. LB-S2 has two stages of HEPA filtration. In the DFLAW configuration, this consists of vessel ventilation from vessel RLD-VSL-00164. Activities with the potential to generate radioactive air emissions from areas ventilated by the LB-S2 emission unit were reviewed to determine a bounding source term. The review considered the following activities with the potential to emit:

1. Cascaded emissions from the C3 and C5 areas
2. Waste sample analysis from the ARL discharged into vessel RLD-VSL-00164
3. Calibration standards discharged into vessel RLD-VSL-00164

The review concluded that items 2 and 3 are the primary contributors to the potential emission source.

## **14 Location of Maximally Exposed Individual**

The MEI is an offsite receptor 12.05 km east from the WTP, near the Columbia River. The primary factors that contributed to the identification of the MEI were the wind direction, effective stack height,

and distance to the receptor location. CAP88-PC modeling that resulted in the creation of the dose conversion factors used in this license modification can be found in Appendix B.

## **15 Total Effective Dose Equivalent to the Maximally Exposed Individual**

### **15.1 Radionuclide Modeling Approach**

The TEDE to the MEI resulting from the operation of LAW, Lab, and EMF was generated using the CAP88 PC, version 4. CAP88 PC is an EPA-approved computer model for estimating doses from radionuclide emission releases to the atmosphere. The EPA developed the CAP88 PC model for the purpose of demonstrating compliance with radionuclide emissions into the air under 40 CFR 61, National Emission Standards for Hazardous Air Pollutants. The CAP88-PC model is a mathematical program that integrates procedures for calculating environmental transport and dose estimation of radionuclide emissions.

The CAP88-PC model provides a methodology for assessing collective populations and MEIs. The MEI location used assessed “worst-case” dose levels. The CAP88-PC synopsis report and dose and risk summaries for the Lab LB-S1 and LB-S2 emission units are provided in Appendix B. The model generates dose conversion factors in millirems per curie for the radionuclides of potential concern. For each emission unit dose assessment, the emission rates for each radionuclide were set at 1 curie/year to create individual dose conversion factors. The individual dose conversion factors are then multiplied by corresponding radionuclide emission rates to produce unabated and abated dose.

#### **Air Dispersion Parameters**

The CAP88-PC model uses a modified Gaussian plume equation to estimate the dispersion of radionuclides in the air. The results of the air dispersion analysis are sector-averaged air concentrations used in the dose estimation.

#### **Plume Rise**

The plume rise is added to the actual physical stack height to determine the effective stack height. The plume centerline is shifted from the physical height to the effective stack height as it moves downwind. The plume rise can be calculated in the model by assuming either a momentum-driven or buoyant-driven plume. Momentum-driven plume rise was selected based on WDOH guidance for use in support of notices of construction for the WTP—as required by WAC 246-247-060, *Radiation Protection—Air Emissions: Applications, Registration, and Licensing*, and WAC 246-247-110(2). The plume rise from release points with stack gas temperatures that are equal to or near ambient air temperature will depend on the plume’s momentum.

#### **Meteorological Data**

The CAP88-PC modeling used a composite, 10-year, sector-averaging, stability array, meteorological data set for CY 2004 through 2013. The array includes annual-average frequencies for wind speed, wind direction, and each Pasquill atmospheric stability category. The meteorological data was obtained from the Hanford Site 200 East Area meteorological station (station 6). The prevailing wind direction is from the west; the radionuclide emissions will primarily be transported east from EMF, LAW, and Lab.

Modeling input parameters were assumed to be 17.1 cm/yr for annual precipitation, 12 °C for ambient air temperature, a mixing height at 1,000 m, and an absolute humidity at 8 g/m<sup>3</sup>.

**Release Point Source Data**

Stack-specific release characteristics were used for modeling each emission unit. The stack height, stack diameter, and stack gas exit velocity are provided in the table below.

**Table 7      Modeled Stack Parameters**

<b>Facility</b>	<b>Emission Unit</b>	<b>Stack Height (meters)</b>	<b>Stack Diameter (meters)</b>	<b>Stack Gas Exit Velocity (meters/second)</b>
Lab	LB-S1	36.00	1.52	18
	LB-S2	36.00	0.71	17

Stack release parameters using the metric system are in the modeling output files in Appendix B. Using the stack release parameters and dose assessment parameters, unit dose conversion factors were calculated for each emission unit. The resulting individual radionuclide dose conversion factors are listed in the CAP88-PC modeling output files and identified in the tables below.

**Dose Assessment Parameters**

The CAP88-PC modeling was performed using Hanford Site-specific default values, as agreed upon by DOE and WDOH for use in support of notices of construction for the WTP—as required by WAC 246-247-060, *Radiation Protection—Air Emissions: Applications, Registration, and Licensing*, and WAC 246-247-110(2). However, one update recommended by WDOH for consistency with EPA guidance was to change the buildup time from 50 to 100 years. The CAP88-PC model also allows for the assessment of dose based on different food scenarios for the intake of vegetables, beef, and milk. The CAP88-PC model was run assuming a “local” food source for offsite receptors (all food is grown at the location of the receptor), which maximizes the potential exposure due to the presence of vegetable gardens and meat or milk-producing animals in unrestricted areas surrounding the WTP.

**Location of Maximally Exposed Individual**

Modeling concluded that the prevailing wind direction transports the radionuclides east, so the highest doses occur in that sector. The location of the MEI for all stacks was an offsite location near the Hanford Site property boundary 12.05 km to the east of the EMF, LAW, and Lab facilities. The MEI near the property boundary uses a local food source.

**15.2 Radionuclide Emission and Dose**

The unabated emission rates and the TEDE to the MEI contributed by each radionuclide and the percent contribution of each radionuclide to the unabated TEDE, are in Table 7 through Table 12. The unabated dose is calculated using the equation below.

$$\text{Unabated dose (mrem/yr)} = \text{Unabated emissions (curie/year)} \times \text{Dose conversion factor (mrem/curie)}$$

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The abated emission rates and the TEDE to the MEI for each radionuclide and each emission unit are in Table 8 through Table 13. The abated dose is calculated using the equation below.

$$\text{Abated dose (mrem/yr)} = \text{Abated emissions (curie/year)} \times \text{Dose conversion factor (mrem/curie)}$$

**Table 8 Lab LB-S1 (Tank Waste) Emissions and Dose**

Radio nuclide	APQ (Ci/yr) <sup>1</sup>	Unabated Emission (Ci/yr)	Abated Emission (Ci/yr)	Dose Conversion Factor (mrem/Ci) <sup>2</sup>	Unabated Dose (mrem/yr)	Percent of Total Unabated Dose (%)	Abated Dose (mrem/yr)	Percent of Total Abated Dose (%)
Ru-106	9.40E-11	2.18E-13	1.09E-16	2.70E-03	5.89E-16	0.00%	2.95E-19	0.00%
Cd-113m	4.40E-04	1.02E-06	5.12E-10	3.87E-02	3.96E-08	0.23%	1.98E-11	0.21%
Sb-125	4.55E-05	9.76E-08	4.88E-11	1.10E-02	1.07E-09	0.01%	5.37E-13	0.01%
Sn-126	2.61E-04	6.08E-07	3.04E-10	3.26E-02	1.98E-08	0.12%	9.91E-12	0.10%
I-129	9.85E-06	9.85E-09	4.93E-12	1.40E+00	1.38E-08	0.08%	6.90E-12	0.07%
Cs-134	2.66E-10	5.70E-13	2.85E-16	6.89E-02	3.92E-14	0.00%	1.96E-17	0.00%
Cs-137	1.83E-03	3.93E-06	1.96E-09	7.02E-02	2.76E-07	1.63%	1.38E-10	1.43%
Ba-137m	1.73E-03	3.71E-06	1.86E-09	1.12E-14	4.16E-20	0.00%	2.08E-23	0.00%
C-14	2.52E-04	2.52E-07	1.26E-10	5.64E-04	1.42E-10	0.00%	7.10E-14	0.00%
Sm-151	2.21E-07	5.15E-10	2.57E-13	1.66E-04	8.55E-14	0.00%	4.27E-17	0.00%
Eu-152	3.94E-11	9.17E-14	4.58E-17	1.08E-01	9.90E-15	0.00%	4.95E-18	0.00%
Eu-154	2.13E-10	4.95E-13	2.47E-16	8.32E-02	4.12E-14	0.00%	2.06E-17	0.00%
Eu-155	8.22E-11	1.91E-13	9.57E-17	2.58E-03	4.94E-16	0.00%	2.47E-19	0.00%
Ra-226	5.70E-09	1.22E-11	6.11E-15	2.72E-01	3.32E-12	0.00%	1.66E-15	0.00%
Ac-227	7.22E-07	1.68E-09	8.41E-13	2.55E+00	4.29E-09	0.03%	2.14E-12	0.02%
Ra-228	3.42E-07	7.32E-10	3.66E-13	3.23E-01	2.36E-10	0.00%	1.18E-13	0.00%
Th-229	4.98E-14	1.16E-16	5.80E-20	2.57E+00	2.98E-16	0.00%	1.49E-19	0.00%
Pa-231	1.00E-13	2.33E-16	1.17E-19	3.41E+00	7.95E-16	0.00%	3.97E-19	0.00%
Th-232	1.11E-13	2.59E-16	1.29E-19	9.28E-01	2.40E-16	0.00%	1.20E-19	0.00%
U-232	4.41E-08	1.03E-10	5.14E-14	3.27E-01	3.36E-11	0.00%	1.68E-14	0.00%
U-233	2.44E-06	5.69E-09	2.84E-12	1.12E-01	6.37E-10	0.00%	3.18E-13	0.00%
U-234	7.11E-07	1.66E-09	8.28E-13	1.10E-01	1.82E-10	0.00%	9.10E-14	0.00%
U-235	2.94E-08	6.85E-11	3.43E-14	1.43E-01	9.80E-12	0.00%	4.90E-15	0.00%
U-236	2.37E-08	5.52E-11	2.76E-14	1.02E-01	5.63E-12	0.00%	2.82E-15	0.00%
Np-237	6.99E-06	1.63E-08	8.14E-12	8.22E-01	1.34E-08	0.08%	6.69E-12	0.07%
Pu-238	9.97E-06	2.32E-08	1.16E-11	1.64E+00	3.80E-08	0.23%	1.90E-11	0.20%

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**Table 8 Lab LB-S1 (Tank Waste) Emissions and Dose**

<b>Radio nuclide</b>	<b>APQ (Ci/yr) <sup>1</sup></b>	<b>Unabated Emission (Ci/yr)</b>	<b>Abated Emission (Ci/yr)</b>	<b>Dose Conversion Factor (mrem/Ci) <sup>2</sup></b>	<b>Unabated Dose (mrem/yr)</b>	<b>Percent of Total Unabated Dose (%)</b>	<b>Abated Dose (mrem/yr)</b>	<b>Percent of Total Abated Dose (%)</b>
U-238	6.48E-07	1.51E-09	7.55E-13	9.18E-02	1.39E-10	0.00%	6.93E-14	0.00%
Pu-239	2.23E-04	5.19E-07	2.59E-10	1.79E+00	9.28E-07	5.50%	4.64E-10	4.81%
Pu-240	5.25E-05	1.22E-07	6.12E-11	1.79E+00	2.19E-07	1.30%	1.09E-10	1.13%
Am-241	1.27E-03	2.95E-06	1.47E-09	1.49E+00	4.39E-06	26.02%	2.20E-09	22.77%
Pu-241	1.36E-04	3.16E-07	1.58E-10	3.27E-02	1.03E-08	0.06%	5.17E-12	0.05%
Cm-242	6.57E-05	1.53E-07	7.65E-11	1.49E-01	2.28E-08	0.13%	1.14E-11	0.12%
Pu-242	7.92E-09	1.84E-11	9.22E-15	1.70E+00	3.14E-11	0.00%	1.57E-14	0.00%
Am-243	7.40E-07	1.72E-09	8.59E-13	1.48E+00	2.54E-09	0.02%	1.27E-12	0.01%
Cm-243	4.82E-06	1.12E-08	5.61E-12	1.12E+00	1.26E-08	0.07%	6.29E-12	0.07%
Cm-244	8.09E-05	1.88E-07	9.42E-11	9.25E-01	1.74E-07	1.03%	8.71E-11	0.90%
H-3	2.05E-04	2.05E-04	2.05E-04	5.88E-06	1.20E-09	0.01%	1.20E-09	12.47%
Ni-59	3.65E-06	8.49E-09	4.25E-12	2.04E-04	1.73E-12	0.00%	8.66E-16	0.00%
Co-60	1.75E-11	4.07E-14	2.04E-17	1.12E-02	4.56E-16	0.00%	2.28E-19	0.00%
Ni-63	2.75E-04	6.41E-07	3.20E-10	4.16E-04	2.67E-10	0.00%	1.33E-13	0.00%
Se-79	3.96E-04	8.49E-07	4.24E-10	2.41E-02	2.05E-08	0.12%	1.02E-11	0.11%
Sr-90	3.70E-02	8.61E-05	4.30E-08	1.02E-01	8.78E-06	51.99%	4.39E-09	45.51%
Y-90	3.70E-02	8.61E-05	4.30E-08	5.32E-05	4.58E-09	0.03%	2.29E-12	0.02%
Nb-93m	8.12E-10	1.89E-12	9.45E-16	1.19E-04	2.25E-16	0.00%	1.12E-19	0.00%
Zr-93	8.88E-10	2.07E-12	1.04E-15	5.89E-04	1.22E-15	0.00%	6.11E-19	0.00%
Tc-99	3.68E-02	7.27E-05	3.63E-08	2.63E-02	1.91E-06	11.32%	9.56E-10	9.91%
<b>Total</b>	<b>1.18E-01</b>	<b>4.65E-04</b>	<b>2.05E-04</b>		<b>1.69E-05</b>		<b>9.65E-09</b>	

Notes:

- 1 APQ is based on Appendix A
- 2 Dose conversion factors are provided in the CAP88-PC output files in Appendix B.

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**Table 9 Lab LB-S1 (Rad Standards) Emissions and Dose**

Radio nuclide	APQ (Ci/yr)	Unabated Emission (Ci/yr)	Abated Emission (Ci/yr)	Dose Conversion Factor (mrem/Ci) <sup>1</sup>	Unabated Dose (mrem/yr)	Percent of Total Unabated Dose (%)	Abated Dose (mrem/yr)	Percent of Total Abated Dose (%)
Ru-106	0.00E+00	0.00E+00	0.00E+00	2.70E-03	0.00E+00	0.00%	0.00E+00	0.00%
Cd-113m	0.00E+00	0.00E+00	0.00E+00	3.87E-02	0.00E+00	0.00%	0.00E+00	0.00%
Sb-125	1.09E-06	1.09E-09	5.44E-13	1.10E-02	1.20E-11	0.02%	5.99E-15	0.02%
Sn-126	0.00E+00	0.00E+00	0.00E+00	3.26E-02	0.00E+00	0.00%	0.00E+00	0.00%
I-129	8.90E-07	8.90E-10	4.45E-13	1.40E+00	1.25E-09	1.66%	6.23E-13	1.66%
Cs-134	0.00E+00	0.00E+00	0.00E+00	6.89E-02	0.00E+00	0.00%	0.00E+00	0.00%
Cs-137	3.25E-05	3.25E-08	1.63E-11	7.02E-02	2.28E-09	3.04%	1.14E-12	3.04%
Ba-137m	0.00E+00	0.00E+00	0.00E+00	1.12E-14	0.00E+00	0.00%	0.00E+00	0.00%
C-14	0.00E+00	0.00E+00	0.00E+00	5.64E-04	0.00E+00	0.00%	0.00E+00	0.00%
Sm-151	0.00E+00	0.00E+00	0.00E+00	1.66E-04	0.00E+00	0.00%	0.00E+00	0.00%
Eu-152	0.00E+00	0.00E+00	0.00E+00	1.08E-01	0.00E+00	0.00%	0.00E+00	0.00%
Eu-154	0.00E+00	0.00E+00	0.00E+00	8.32E-02	0.00E+00	0.00%	0.00E+00	0.00%
Eu-155	0.00E+00	0.00E+00	0.00E+00	2.58E-03	0.00E+00	0.00%	0.00E+00	0.00%
Ra-226	0.00E+00	0.00E+00	0.00E+00	2.72E-01	0.00E+00	0.00%	0.00E+00	0.00%
Ac-227	0.00E+00	0.00E+00	0.00E+00	2.55E+00	0.00E+00	0.00%	0.00E+00	0.00%
Ra-228	0.00E+00	0.00E+00	0.00E+00	3.23E-01	0.00E+00	0.00%	0.00E+00	0.00%
Th-229	0.00E+00	0.00E+00	0.00E+00	2.57E+00	0.00E+00	0.00%	0.00E+00	0.00%
Pa-231	0.00E+00	0.00E+00	0.00E+00	3.41E+00	0.00E+00	0.00%	0.00E+00	0.00%
Th-232	0.00E+00	0.00E+00	0.00E+00	9.28E-01	0.00E+00	0.00%	0.00E+00	0.00%
U-232	0.00E+00	0.00E+00	0.00E+00	3.27E-01	0.00E+00	0.00%	0.00E+00	0.00%
U-233	1.76E-06	1.76E-09	8.79E-13	1.12E-01	1.97E-10	0.26%	9.84E-14	0.26%
U-234	0.00E+00	0.00E+00	0.00E+00	1.10E-01	0.00E+00	0.00%	0.00E+00	0.00%
U-235	0.00E+00	0.00E+00	0.00E+00	1.43E-01	0.00E+00	0.00%	0.00E+00	0.00%
U-236	0.00E+00	0.00E+00	0.00E+00	1.02E-01	0.00E+00	0.00%	0.00E+00	0.00%
Np-237	1.41E-07	1.41E-10	7.04E-14	8.22E-01	1.16E-10	0.15%	5.78E-14	0.15%
Pu-238	8.44E-07	8.44E-10	4.22E-13	1.64E+00	1.38E-09	1.84%	6.92E-13	1.84%
U-238	0.00E+00	0.00E+00	0.00E+00	9.18E-02	0.00E+00	0.00%	0.00E+00	0.00%
Pu-239	2.11E-07	2.11E-10	1.06E-13	1.79E+00	3.78E-10	0.50%	1.89E-13	0.50%

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**Table 9 Lab LB-S1 (Rad Standards) Emissions and Dose**

Radio nuclide	APQ (Ci/yr)	Unabated Emission (Ci/yr)	Abated Emission (Ci/yr)	Dose Conversion Factor (mrem/Ci) <sup>1</sup>	Unabated Dose (mrem/yr)	Percent of Total Unabated Dose (%)	Abated Dose (mrem/yr)	Percent of Total Abated Dose (%)
Pu-240	0.00E+00	0.00E+00	0.00E+00	1.79E+00	0.00E+00	0.00%	0.00E+00	0.00%
Am-241	3.97E-05	3.97E-08	1.99E-11	1.49E+00	5.92E-08	78.72%	2.96E-11	78.73%
Pu-241	5.52E-05	5.52E-08	2.76E-11	3.27E-02	1.81E-09	2.40%	9.03E-13	2.40%
Cm-242	0.00E+00	0.00E+00	0.00E+00	1.49E-01	0.00E+00	0.00%	0.00E+00	0.00%
Pu-242	2.92E-06	2.92E-09	1.46E-12	1.70E+00	4.96E-09	6.60%	2.48E-12	6.60%
Am-243	2.02E-07	2.02E-10	1.01E-13	1.48E+00	2.99E-10	0.40%	1.49E-13	0.40%
Cm-243	0.00E+00	0.00E+00	0.00E+00	1.12E+00	0.00E+00	0.00%	0.00E+00	0.00%
Cm-244	2.11E-06	2.11E-09	1.06E-12	9.25E-01	1.95E-09	2.60%	9.76E-13	2.60%
H-3	0.00E+00	0.00E+00	0.00E+00	5.88E-06	0.00E+00	0.00%	0.00E+00	0.00%
Ni-59	0.00E+00	0.00E+00	0.00E+00	2.04E-04	0.00E+00	0.00%	0.00E+00	0.00%
Co-60	1.11E-06	1.11E-09	5.53E-13	1.12E-02	1.24E-11	0.02%	6.19E-15	0.02%
Ni-63	1.68E-06	1.68E-09	8.40E-13	4.16E-04	6.99E-13	0.00%	3.49E-16	0.00%
Se-79	0.00E+00	0.00E+00	0.00E+00	2.41E-02	0.00E+00	0.00%	0.00E+00	0.00%
Sr-90	1.75E-06	1.75E-09	8.73E-13	1.02E-01	1.78E-10	0.24%	8.90E-14	0.24%
Y-90	0.00E+00	0.00E+00	0.00E+00	5.32E-05	0.00E+00	0.00%	0.00E+00	0.00%
Nb-93m	0.00E+00	0.00E+00	0.00E+00	1.19E-04	0.00E+00	0.00%	0.00E+00	0.00%
Zr-93	0.00E+00	0.00E+00	0.00E+00	5.89E-04	0.00E+00	0.00%	0.00E+00	0.00%
Tc-99	4.41E-05	4.41E-08	2.21E-11	2.63E-02	1.16E-09	1.54%	5.80E-13	1.54%
Pu-236	1.18E-08	1.18E-11	5.90E-15	6.71E-01	7.92E-12	0.01%	3.96E-15	0.01%
<b>Total</b>	<b>1.86E-04</b>	<b>1.86E-07</b>	<b>9.31E-11</b>		<b>7.51E-08</b>		<b>3.76E-11</b>	

Notes:

1 Dose conversion factors are provided in the CAP88-PC output files in Appendix B.

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**Table 10 Lab LB-S1 (Waste + Standards) Emissions and Dose**

<b>Radio nuclide</b>	<b>APQ (Ci/yr) <sup>1</sup></b>	<b>Unabated Emission (Ci/yr)</b>	<b>Abated Emission (Ci/yr)</b>	<b>Dose Conversion Factor (mrem/Ci) <sup>2</sup></b>	<b>Unabated Dose (mrem/yr)</b>	<b>Percent of Total Unabated Dose (%)</b>	<b>Abated Dose (mrem/yr)</b>	<b>Percent of Total Abated Dose (%)</b>
Ru-106	9.40E-11	2.18E-13	1.09E-16	2.70E-03	5.89E-16	0.00%	2.95E-19	0.00%
Cd-113m	4.40E-04	1.02E-06	5.12E-10	3.87E-02	3.96E-08	0.23%	1.98E-11	0.20%
Sb-125	4.66E-05	9.87E-08	4.93E-11	1.10E-02	1.09E-09	0.01%	5.43E-13	0.01%
Sn-126	2.61E-04	6.08E-07	3.04E-10	3.26E-02	1.98E-08	0.12%	9.91E-12	0.10%
I-129	1.07E-05	1.07E-08	5.37E-12	1.40E+00	1.50E-08	0.09%	7.52E-12	0.08%
Cs-134	2.66E-10	5.70E-13	2.85E-16	6.89E-02	3.92E-14	0.00%	1.96E-17	0.00%
Cs-137	1.87E-03	3.96E-06	1.98E-09	7.02E-02	2.78E-07	1.64%	1.39E-10	1.43%
Ba-137m	1.73E-03	3.71E-06	1.86E-09	1.12E-14	4.16E-20	0.00%	2.08E-23	0.00%
C-14	2.52E-04	2.52E-07	1.26E-10	5.64E-04	1.42E-10	0.00%	7.10E-14	0.00%
Sm-151	2.21E-07	5.15E-10	2.57E-13	1.66E-04	8.55E-14	0.00%	4.27E-17	0.00%
Eu-152	3.94E-11	9.17E-14	4.58E-17	1.08E-01	9.90E-15	0.00%	4.95E-18	0.00%
Eu-154	2.13E-10	4.95E-13	2.47E-16	8.32E-02	4.12E-14	0.00%	2.06E-17	0.00%
Eu-155	8.22E-11	1.91E-13	9.57E-17	2.58E-03	4.94E-16	0.00%	2.47E-19	0.00%
Ra-226	5.70E-09	1.22E-11	6.11E-15	2.72E-01	3.32E-12	0.00%	1.66E-15	0.00%
Ac-227	7.22E-07	1.68E-09	8.41E-13	2.55E+00	4.29E-09	0.03%	2.14E-12	0.02%
Ra-228	3.42E-07	7.32E-10	3.66E-13	3.23E-01	2.36E-10	0.00%	1.18E-13	0.00%
Th-229	4.98E-14	1.16E-16	5.80E-20	2.57E+00	2.98E-16	0.00%	1.49E-19	0.00%
Pa-231	1.00E-13	2.33E-16	1.17E-19	3.41E+00	7.95E-16	0.00%	3.97E-19	0.00%
Th-232	1.11E-13	2.59E-16	1.29E-19	9.28E-01	2.40E-16	0.00%	1.20E-19	0.00%
U-232	4.41E-08	1.03E-10	5.14E-14	3.27E-01	3.36E-11	0.00%	1.68E-14	0.00%
U-233	4.20E-06	7.44E-09	3.72E-12	1.12E-01	8.34E-10	0.00%	4.17E-13	0.00%
U-234	7.11E-07	1.66E-09	8.28E-13	1.10E-01	1.82E-10	0.00%	9.10E-14	0.00%
U-235	2.94E-08	6.85E-11	3.43E-14	1.43E-01	9.80E-12	0.00%	4.90E-15	0.00%
U-236	2.37E-08	5.52E-11	2.76E-14	1.02E-01	5.63E-12	0.00%	2.82E-15	0.00%
Np-237	7.13E-06	1.64E-08	8.21E-12	8.22E-01	1.35E-08	0.08%	6.75E-12	0.07%
Pu-238	1.08E-05	2.40E-08	1.20E-11	1.64E+00	3.94E-08	0.23%	1.97E-11	0.20%
U-238	6.48E-07	1.51E-09	7.55E-13	9.18E-02	1.39E-10	0.00%	6.93E-14	0.00%
Pu-239	2.23E-04	5.19E-07	2.59E-10	1.79E+00	9.29E-07	5.47%	4.64E-10	4.79%
Pu-240	5.25E-05	1.22E-07	6.12E-11	1.79E+00	2.19E-07	1.29%	1.09E-10	1.13%
Am-241	1.31E-03	2.99E-06	1.49E-09	1.49E+00	4.45E-06	26.25%	2.23E-09	22.99%

**Table 10 Lab LB-S1 (Waste + Standards) Emissions and Dose**

<b>Radio nuclide</b>	<b>APQ (Ci/yr) <sup>1</sup></b>	<b>Unabated Emission (Ci/yr)</b>	<b>Abated Emission (Ci/yr)</b>	<b>Dose Conversion Factor (mrem/Ci) <sup>2</sup></b>	<b>Unabated Dose (mrem/yr)</b>	<b>Percent of Total Unabated Dose (%)</b>	<b>Abated Dose (mrem/yr)</b>	<b>Percent of Total Abated Dose (%)</b>
Pu-241	1.91E-04	3.71E-07	1.86E-10	3.27E-02	1.21E-08	0.07%	6.07E-12	0.06%
Cm-242	6.57E-05	1.53E-07	7.65E-11	1.49E-01	2.28E-08	0.13%	1.14E-11	0.12%
Pu-242	2.93E-06	2.94E-09	1.47E-12	1.70E+00	4.99E-09	0.03%	2.50E-12	0.03%
Am-243	9.42E-07	1.92E-09	9.60E-13	1.48E+00	2.84E-09	0.02%	1.42E-12	0.01%
Cm-243	4.82E-06	1.12E-08	5.61E-12	1.12E+00	1.26E-08	0.07%	6.29E-12	0.06%
Cm-244	8.30E-05	1.90E-07	9.52E-11	9.25E-01	1.76E-07	1.04%	8.81E-11	0.91%
H-3	2.05E-04	2.05E-04	2.05E-04	5.88E-06	1.20E-09	0.01%	1.20E-09	12.43%
Ni-59	3.65E-06	8.49E-09	4.25E-12	2.04E-04	1.73E-12	0.00%	8.66E-16	0.00%
Co-60	1.11E-06	1.11E-09	5.53E-13	1.12E-02	1.24E-11	0.00%	6.19E-15	0.00%
Ni-63	2.77E-04	6.43E-07	3.21E-10	4.16E-04	2.67E-10	0.00%	1.34E-13	0.00%
Se-79	3.96E-04	8.49E-07	4.24E-10	2.41E-02	2.05E-08	0.12%	1.02E-11	0.11%
Sr-90	3.70E-02	8.61E-05	4.30E-08	1.02E-01	8.78E-06	51.76%	4.39E-09	45.33%
Y-90	3.70E-02	8.61E-05	4.30E-08	5.32E-05	4.58E-09	0.03%	2.29E-12	0.02%
Nb-93m	8.12E-10	1.89E-12	9.45E-16	1.19E-04	2.25E-16	0.00%	1.12E-19	0.00%
Zr-93	8.88E-10	2.07E-12	1.04E-15	5.89E-04	1.22E-15	0.00%	6.11E-19	0.00%
Tc-99	3.68E-02	7.27E-05	3.64E-08	2.63E-02	1.91E-06	11.27%	9.56E-10	9.87%
Pu-236	3.07E-08	6.08E-10	3.04E-13	6.71E-01	4.08E-10	0.00%	2.04E-13	0.00%
<b>Total</b>	<b>1.18E-01</b>	<b>4.65E-04</b>	<b>2.05E-04</b>		<b>1.70E-05</b>		<b>9.69E-09</b>	

Notes:

- 1 The tank waste portion of APQ is based on Appendix A
- 2 Dose conversion factors are provided in the CAP88-PC output files in Appendix B.

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**Radioactive Air Emissions Notice of Construction**  
**Modification to the WTP Analytical Laboratory LB-S1**  
**and LB-S2 Emission Units**

**Table 11 Lab LB-S2 (Tank Waste) Emissions and Dose**

<b>Radio nuclide</b>	<b>APQ (Ci/yr) <sup>1</sup></b>	<b>Unabated Emission (Ci/yr)</b>	<b>Abated Emission (Ci/yr)</b>	<b>Dose Conversion Factor (mrem/Ci) <sup>2</sup></b>	<b>Unabated Dose (mrem/yr)</b>	<b>Percent of Total Unabated Dose (%)</b>	<b>Abated Dose (mrem/yr)</b>	<b>Percent of Total Abated Dose (%)</b>
Ru-106	9.40E-11	2.18E-13	1.09E-18	3.01E-03	6.57E-16	0.00%	3.28E-21	0.00%
Cd-113m	4.40E-04	1.02E-06	5.12E-12	4.29E-02	4.39E-08	0.23%	2.20E-13	0.02%
Sb-125	4.55E-05	9.76E-08	4.88E-13	1.22E-02	1.19E-09	0.01%	5.95E-15	0.00%
Sn-126	2.61E-04	6.08E-07	3.04E-12	3.62E-02	2.20E-08	0.12%	1.10E-13	0.01%
I-129	9.85E-06	9.85E-09	4.93E-14	1.33E+00	1.31E-08	0.07%	6.55E-14	0.00%
Cs-134	2.66E-10	5.70E-13	2.85E-18	7.64E-02	4.35E-14	0.00%	2.18E-19	0.00%
Cs-137	1.83E-03	3.93E-06	1.96E-11	7.78E-02	3.05E-07	1.63%	1.53E-12	0.10%
Ba-137m	1.73E-03	3.71E-06	1.86E-11	1.15E-14	4.27E-20	0.00%	2.14E-25	0.00%
C-14	2.52E-04	2.52E-07	1.26E-12	6.42E-04	1.62E-10	0.00%	8.08E-16	0.00%
Sm-151	2.21E-07	5.15E-10	2.57E-15	1.86E-04	9.58E-14	0.00%	4.79E-19	0.00%
Eu-152	3.94E-11	9.17E-14	4.58E-19	1.20E-01	1.10E-14	0.00%	5.50E-20	0.00%
Eu-154	2.13E-10	4.95E-13	2.47E-18	9.22E-02	4.56E-14	0.00%	2.28E-19	0.00%
Eu-155	8.22E-11	1.91E-13	9.57E-19	2.86E-03	5.47E-16	0.00%	2.74E-21	0.00%
Ra-226	5.70E-09	1.22E-11	6.11E-17	3.03E-01	3.70E-12	0.00%	1.85E-17	0.00%
Ac-227	7.22E-07	1.68E-09	8.41E-15	2.87E+00	4.83E-09	0.03%	2.41E-14	0.00%
Ra-228	3.42E-07	7.32E-10	3.66E-15	3.59E-01	2.63E-10	0.00%	1.31E-15	0.00%
Th-229	4.98E-14	1.16E-16	5.80E-22	2.89E+00	3.35E-16	0.00%	1.68E-21	0.00%
Pa-231	1.00E-13	2.33E-16	1.17E-21	3.83E+00	8.93E-16	0.00%	4.46E-21	0.00%
Th-232	1.11E-13	2.59E-16	1.29E-21	1.04E+00	2.69E-16	0.00%	1.35E-21	0.00%
U-232	4.41E-08	1.03E-10	5.14E-16	3.66E-01	3.76E-11	0.00%	1.88E-16	0.00%
U-233	2.44E-06	5.69E-09	2.84E-14	1.26E-01	7.16E-10	0.00%	3.58E-15	0.00%
U-234	7.11E-07	1.66E-09	8.28E-15	1.23E-01	2.04E-10	0.00%	1.02E-15	0.00%
U-235	2.94E-08	6.85E-11	3.43E-16	1.60E-01	1.10E-11	0.00%	5.48E-17	0.00%
U-236	2.37E-08	5.52E-11	2.76E-16	1.14E-01	6.30E-12	0.00%	3.15E-17	0.00%
Np-237	6.99E-06	1.63E-08	8.14E-14	9.24E-01	1.50E-08	0.08%	7.52E-14	0.01%
Pu-238	9.97E-06	2.32E-08	1.16E-13	1.85E+00	4.29E-08	0.23%	2.15E-13	0.01%
U-238	6.48E-07	1.51E-09	7.55E-15	1.03E-01	1.55E-10	0.00%	7.77E-16	0.00%
Pu-239	2.23E-04	5.19E-07	2.59E-12	2.01E+00	1.04E-06	5.55%	5.21E-12	0.36%
Pu-240	5.25E-05	1.22E-07	6.12E-13	2.01E+00	2.46E-07	1.31%	1.23E-12	0.08%
Am-241	1.27E-03	2.95E-06	1.47E-11	1.67E+00	4.93E-06	26.22%	2.46E-11	1.69%

**Table 11 Lab LB-S2 (Tank Waste) Emissions and Dose**

<b>Radio nuclide</b>	<b>APQ (Ci/yr) <sup>1</sup></b>	<b>Unabated Emission (Ci/yr)</b>	<b>Abated Emission (Ci/yr)</b>	<b>Dose Conversion Factor (mrem/Ci) <sup>2</sup></b>	<b>Unabated Dose (mrem/yr)</b>	<b>Percent of Total Unabated Dose (%)</b>	<b>Abated Dose (mrem/yr)</b>	<b>Percent of Total Abated Dose (%)</b>
Pu-241	1.36E-04	3.16E-07	1.58E-12	3.68E-02	1.16E-08	0.06%	5.82E-14	0.00%
Cm-242	6.57E-05	1.53E-07	7.65E-13	1.68E-01	2.57E-08	0.14%	1.28E-13	0.01%
Pu-242	7.92E-09	1.84E-11	9.22E-17	1.91E+00	3.52E-11	0.00%	1.76E-16	0.00%
Am-243	7.40E-07	1.72E-09	8.59E-15	1.66E+00	2.85E-09	0.02%	1.43E-14	0.00%
Cm-243	4.82E-06	1.12E-08	5.61E-14	1.26E+00	1.41E-08	0.08%	7.07E-14	0.00%
Cm-244	8.09E-05	1.88E-07	9.42E-13	1.04E+00	1.96E-07	1.04%	9.79E-13	0.07%
H-3	2.05E-04	2.05E-04	2.05E-04	6.68E-06	1.37E-09	0.01%	1.37E-09	93.57%
Ni-59	3.65E-06	8.49E-09	4.25E-14	2.26E-04	1.92E-12	0.00%	9.59E-18	0.00%
Co-60	1.75E-11	4.07E-14	2.04E-19	1.24E-01	5.05E-15	0.00%	2.53E-20	0.00%
Ni-63	2.75E-04	6.41E-07	3.20E-12	4.62E-04	2.96E-10	0.00%	1.48E-15	0.00%
Se-79	3.96E-04	8.49E-07	4.24E-12	2.67E-02	2.27E-08	0.12%	1.13E-13	0.01%
Sr-90	3.70E-02	8.61E-05	4.30E-10	1.13E-01	9.73E-06	51.78%	4.86E-11	3.33%
Y-90	3.70E-02	8.61E-05	4.30E-10	5.96E-05	5.13E-09	0.03%	2.57E-14	0.00%
Nb-93m	8.12E-10	1.89E-12	9.45E-18	1.33E-04	2.51E-16	0.00%	1.26E-21	0.00%
Zr-93	8.88E-10	2.07E-12	1.04E-17	6.58E-04	1.37E-15	0.00%	6.83E-21	0.00%
Tc-99	3.68E-02	7.27E-05	3.63E-10	2.91E-02	2.11E-06	11.26%	1.06E-11	0.72%
<b>Total</b>	<b>1.18E-01</b>	<b>4.65E-04</b>	<b>2.05E-04</b>		<b>1.88E-05</b>		<b>1.46E-09</b>	

Notes:

- 1 APQ is based on Appendix A.
- 2 Dose conversion factors are provided in the CAP88-PC output files in Appendix B.

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**Table 12 Lab LB-S2 (Rad Standards) Emissions and Dose**

Radio nuclide	APQ (Ci/yr)	Unabated Emission (Ci/yr)	Abated Emission (Ci/yr)	Dose Conversion Factor (mrem/Ci) <sup>1</sup>	Unabated Dose (mrem/yr)	Percent of Total Unabated Dose (%)	Abated Dose (mrem/yr)	Percent of Total Abated Dose (%)
Ru-106	0.00E+00	0.00E+00	0.00E+00	3.01E-03	0.00E+00	0.00%	0.00E+00	0.00%
Cd-113m	0.00E+00	0.00E+00	0.00E+00	4.29E-02	0.00E+00	0.00%	0.00E+00	0.00%
Sb-125	1.09E-06	1.09E-09	5.44E-15	1.22E-02	1.33E-11	0.02%	6.64E-17	0.02%
Sn-126	0.00E+00	0.00E+00	0.00E+00	3.62E-02	0.00E+00	0.00%	0.00E+00	0.00%
I-129	8.90E-07	8.90E-10	4.45E-15	1.33E+00	1.18E-09	1.41%	5.92E-15	1.41%
Cs-134	0.00E+00	0.00E+00	0.00E+00	7.64E-02	0.00E+00	0.00%	0.00E+00	0.00%
Cs-137	3.25E-05	3.25E-08	1.63E-13	7.78E-02	2.53E-09	3.01%	1.26E-14	3.01%
Ba-137m	0.00E+00	0.00E+00	0.00E+00	1.15E-14	0.00E+00	0.00%	0.00E+00	0.00%
C-14	0.00E+00	0.00E+00	0.00E+00	6.42E-04	0.00E+00	0.00%	0.00E+00	0.00%
Sm-151	0.00E+00	0.00E+00	0.00E+00	1.86E-04	0.00E+00	0.00%	0.00E+00	0.00%
Eu-152	0.00E+00	0.00E+00	0.00E+00	1.20E-01	0.00E+00	0.00%	0.00E+00	0.00%
Eu-154	0.00E+00	0.00E+00	0.00E+00	9.22E-02	0.00E+00	0.00%	0.00E+00	0.00%
Eu-155	0.00E+00	0.00E+00	0.00E+00	2.86E-03	0.00E+00	0.00%	0.00E+00	0.00%
Ra-226	0.00E+00	0.00E+00	0.00E+00	3.03E-01	0.00E+00	0.00%	0.00E+00	0.00%
Ac-227	0.00E+00	0.00E+00	0.00E+00	2.87E+00	0.00E+00	0.00%	0.00E+00	0.00%
Ra-228	0.00E+00	0.00E+00	0.00E+00	3.59E-01	0.00E+00	0.00%	0.00E+00	0.00%
Th-229	0.00E+00	0.00E+00	0.00E+00	2.89E+00	0.00E+00	0.00%	0.00E+00	0.00%
Pa-231	0.00E+00	0.00E+00	0.00E+00	3.83E+00	0.00E+00	0.00%	0.00E+00	0.00%
Th-232	0.00E+00	0.00E+00	0.00E+00	1.04E+00	0.00E+00	0.00%	0.00E+00	0.00%
U-232	0.00E+00	0.00E+00	0.00E+00	3.66E-01	0.00E+00	0.00%	0.00E+00	0.00%
U-233	1.76E-06	1.76E-09	8.79E-15	1.26E-01	2.21E-10	0.26%	1.11E-15	0.26%
U-234	0.00E+00	0.00E+00	0.00E+00	1.23E-01	0.00E+00	0.00%	0.00E+00	0.00%
U-235	0.00E+00	0.00E+00	0.00E+00	1.60E-01	0.00E+00	0.00%	0.00E+00	0.00%
U-236	0.00E+00	0.00E+00	0.00E+00	1.14E-01	0.00E+00	0.00%	0.00E+00	0.00%
Np-237	1.41E-07	1.41E-10	7.04E-16	9.24E-01	1.30E-10	0.15%	6.50E-16	0.15%
Pu-238	8.44E-07	8.44E-10	4.22E-15	1.85E+00	1.56E-09	1.86%	7.81E-15	1.86%
U-238	0.00E+00	0.00E+00	0.00E+00	1.03E-01	0.00E+00	0.00%	0.00E+00	0.00%
Pu-239	2.11E-07	2.11E-10	1.06E-15	2.01E+00	4.24E-10	0.50%	2.12E-15	0.50%
Pu-240	0.00E+00	0.00E+00	0.00E+00	2.01E+00	0.00E+00	0.00%	0.00E+00	0.00%

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**Table 12 Lab LB-S2 (Rad Standards) Emissions and Dose**

Radio nuclide	APQ (Ci/yr)	Unabated Emission (Ci/yr)	Abated Emission (Ci/yr)	Dose Conversion Factor (mrem/Ci) <sup>1</sup>	Unabated Dose (mrem/yr)	Percent of Total Unabated Dose (%)	Abated Dose (mrem/yr)	Percent of Total Abated Dose (%)
Am-241	3.97E-05	3.97E-08	1.99E-13	1.67E+00	6.63E-08	78.81%	3.31E-13	78.81%
Pu-241	5.52E-05	5.52E-08	2.76E-13	3.68E-02	2.03E-09	2.41%	1.02E-14	2.41%
Cm-242	0.00E+00	0.00E+00	0.00E+00	1.68E-01	0.00E+00	0.00%	0.00E+00	0.00%
Pu-242	2.92E-06	2.92E-09	1.46E-14	1.91E+00	5.57E-09	6.63%	2.79E-14	6.63%
Am-243	2.02E-07	2.02E-10	1.01E-15	1.66E+00	3.35E-10	0.40%	1.68E-15	0.40%
Cm-243	0.00E+00	0.00E+00	0.00E+00	1.26E+00	0.00E+00	0.00%	0.00E+00	0.00%
Cm-244	2.11E-06	2.11E-09	1.06E-14	1.04E+00	2.19E-09	2.61%	1.10E-14	2.61%
H-3	0.00E+00	0.00E+00	0.00E+00	6.68E-06	0.00E+00	0.00%	0.00E+00	0.00%
Ni-59	0.00E+00	0.00E+00	0.00E+00	2.26E-04	0.00E+00	0.00%	0.00E+00	0.00%
Co-60	1.11E-06	1.11E-09	5.53E-15	1.24E-01	1.37E-10	0.16%	6.86E-16	0.16%
Ni-63	1.68E-06	1.68E-09	8.40E-15	4.62E-04	7.76E-13	0.00%	3.88E-18	0.00%
Se-79	0.00E+00	0.00E+00	0.00E+00	2.67E-02	0.00E+00	0.00%	0.00E+00	0.00%
Sr-90	1.75E-06	1.75E-09	8.73E-15	1.13E-01	1.97E-10	0.23%	9.86E-16	0.23%
Y-90	0.00E+00	0.00E+00	0.00E+00	5.96E-05	0.00E+00	0.00%	0.00E+00	0.00%
Nb-93m	0.00E+00	0.00E+00	0.00E+00	1.33E-04	0.00E+00	0.00%	0.00E+00	0.00%
Zr-93	0.00E+00	0.00E+00	0.00E+00	6.58E-04	0.00E+00	0.00%	0.00E+00	0.00%
Tc-99	4.41E-05	4.41E-08	2.21E-13	2.91E-02	1.28E-09	1.53%	6.42E-15	1.53%
Pu-236	1.18E-08	1.18E-11	5.90E-17	7.54E-01	8.90E-12	0.01%	4.45E-17	0.01%
<b>Total</b>	<b>1.86E-04</b>	<b>1.86E-07</b>	<b>9.31E-13</b>		<b>8.41E-08</b>		<b>4.21E-13</b>	

Notes:

1 Dose conversion factors are provided in the CAP88-PC output files in Appendix B.

**24590-WTP-RPT-ENV-24-002, Rev 0**  
**Radioactive Air Emissions Notice of Construction**  
**Modification to the WTP Analytical Laboratory LB-S1**  
**and LB-S2 Emission Units**

**Table 13 Lab LB-S2 (Waste + Standards) Emissions and Dose**

Radio nuclide	APQ (Ci/yr) <sup>1</sup>	Unabated Emission (Ci/yr)	Abated Emission (Ci/yr)	Dose Conversion Factor (mrem/Ci) <sup>2</sup>	Unabated Dose (mrem/yr)	Percent of Total Unabated Dose (%)	Abated Dose (mrem/yr)	Percent of Total Abated Dose (%)
Ru-106	0.00E+00	2.18E-13	1.09E-18	3.01E-03	6.57E-16	0.00%	3.28E-21	0.00%
Cd-113m	4.40E-04	1.02E-06	5.12E-12	4.29E-02	4.39E-08	0.23%	2.20E-13	0.02%
Sb-125	4.66E-05	9.87E-08	4.93E-13	1.22E-02	1.20E-09	0.01%	6.02E-15	0.00%
Sn-126	2.61E-04	6.08E-07	3.04E-12	3.62E-02	2.20E-08	0.12%	1.10E-13	0.01%
I-129	1.07E-05	1.07E-08	5.37E-14	1.33E+00	1.43E-08	0.08%	7.14E-14	0.00%
Cs-134	2.66E-10	5.70E-13	2.85E-18	7.64E-02	4.35E-14	0.00%	2.18E-19	0.00%
Cs-137	1.87E-03	3.96E-06	1.98E-11	7.78E-02	3.08E-07	1.63%	1.54E-12	0.11%
Ba-137m	1.73E-03	3.71E-06	1.86E-11	1.15E-14	4.27E-20	0.00%	2.14E-25	0.00%
C-14	2.52E-04	2.52E-07	1.26E-12	6.42E-04	1.62E-10	0.00%	8.08E-16	0.00%
Sm-151	2.21E-07	5.15E-10	2.57E-15	1.86E-04	9.58E-14	0.00%	4.79E-19	0.00%
Eu-152	3.94E-11	9.17E-14	4.58E-19	1.20E-01	1.10E-14	0.00%	5.50E-20	0.00%
Eu-154	2.13E-10	4.95E-13	2.47E-18	9.22E-02	4.56E-14	0.00%	2.28E-19	0.00%
Eu-155	8.22E-11	1.91E-13	9.57E-19	2.86E-03	5.47E-16	0.00%	2.74E-21	0.00%
Ra-226	5.70E-09	1.22E-11	6.11E-17	3.03E-01	3.70E-12	0.00%	1.85E-17	0.00%
Ac-227	7.22E-07	1.68E-09	8.41E-15	2.87E+00	4.83E-09	0.03%	2.41E-14	0.00%
Ra-228	3.42E-07	7.32E-10	3.66E-15	3.59E-01	2.63E-10	0.00%	1.31E-15	0.00%
Th-229	4.98E-14	1.16E-16	5.80E-22	2.89E+00	3.35E-16	0.00%	1.68E-21	0.00%
Pa-231	1.00E-13	2.33E-16	1.17E-21	3.83E+00	8.93E-16	0.00%	4.46E-21	0.00%
Th-232	1.11E-13	2.59E-16	1.29E-21	1.04E+00	2.69E-16	0.00%	1.35E-21	0.00%
U-232	4.41E-08	1.03E-10	5.14E-16	3.66E-01	3.76E-11	0.00%	1.88E-16	0.00%
U-233	4.20E-06	7.44E-09	3.72E-14	1.26E-01	9.38E-10	0.00%	4.69E-15	0.00%
U-234	7.11E-07	1.66E-09	8.28E-15	1.23E-01	2.04E-10	0.00%	1.02E-15	0.00%
U-235	2.94E-08	6.85E-11	3.43E-16	1.60E-01	1.10E-11	0.00%	5.48E-17	0.00%
U-236	2.37E-08	5.52E-11	2.76E-16	1.14E-01	6.30E-12	0.00%	3.15E-17	0.00%
Np-237	7.13E-06	1.64E-08	8.21E-14	9.24E-01	1.52E-08	0.08%	7.59E-14	0.01%
Pu-238	1.08E-05	2.40E-08	1.20E-13	1.85E+00	4.45E-08	0.24%	2.22E-13	0.02%
U-238	6.48E-07	1.51E-09	7.55E-15	1.03E-01	1.55E-10	0.00%	7.77E-16	0.00%
Pu-239	2.23E-04	5.19E-07	2.59E-12	2.01E+00	1.04E-06	5.53%	5.21E-12	0.36%
Pu-240	5.25E-05	1.22E-07	6.12E-13	2.01E+00	2.46E-07	1.30%	1.23E-12	0.08%
Am-241	1.31E-03	2.99E-06	1.49E-11	1.67E+00	4.99E-06	26.45%	2.50E-11	1.71%

**Table 13 Lab LB-S2 (Waste + Standards) Emissions and Dose**

Radio nuclide	APQ (Ci/yr) <sup>1</sup>	Unabated Emission (Ci/yr)	Abated Emission (Ci/yr)	Dose Conversion Factor (mrem/Ci) <sup>2</sup>	Unabated Dose (mrem/yr)	Percent of Total Unabated Dose (%)	Abated Dose (mrem/yr)	Percent of Total Abated Dose (%)
Pu-241	1.91E-04	3.71E-07	1.86E-12	3.68E-02	1.37E-08	0.07%	6.84E-14	0.00%
Cm-242	6.57E-05	1.53E-07	7.65E-13	1.68E-01	2.57E-08	0.14%	1.28E-13	0.01%
Pu-242	2.93E-06	2.94E-09	1.47E-14	1.91E+00	5.61E-09	0.03%	2.80E-14	0.00%
Am-243	9.42E-07	1.92E-09	9.60E-15	1.66E+00	3.19E-09	0.02%	1.59E-14	0.00%
Cm-243	4.82E-06	1.12E-08	5.61E-14	1.26E+00	1.41E-08	0.07%	7.07E-14	0.00%
Cm-244	8.30E-05	1.90E-07	9.52E-13	1.04E+00	1.98E-07	1.05%	9.90E-13	0.07%
H-3	2.05E-04	2.05E-04	2.05E-04	6.68E-06	1.37E-09	0.01%	1.37E-09	93.55%
Ni-59	3.65E-06	8.49E-09	4.25E-14	2.26E-04	1.92E-12	0.00%	9.59E-18	0.00%
Co-60	1.11E-06	1.11E-09	5.53E-15	1.24E-01	1.37E-10	0.00%	6.86E-16	0.00%
Ni-63	2.77E-04	6.43E-07	3.21E-12	4.62E-04	2.97E-10	0.00%	1.48E-15	0.00%
Se-79	3.96E-04	8.49E-07	4.24E-12	2.67E-02	2.27E-08	0.12%	1.13E-13	0.01%
Sr-90	3.70E-02	8.61E-05	4.30E-10	1.13E-01	9.73E-06	51.55%	4.86E-11	3.33%
Y-90	3.70E-02	8.61E-05	4.30E-10	5.96E-05	5.13E-09	0.03%	2.57E-14	0.00%
Nb-93m	8.12E-10	1.89E-12	9.45E-18	1.33E-04	2.51E-16	0.00%	1.26E-21	0.00%
Zr-93	8.88E-10	2.07E-12	1.04E-17	6.58E-04	1.37E-15	0.00%	6.83E-21	0.00%
Tc-99	3.68E-02	7.27E-05	3.64E-10	2.91E-02	2.12E-06	11.21%	1.06E-11	0.72%
Pu-236	3.07E-08	6.08E-10	3.04E-15	7.54E-01	4.59E-10	0.00%	2.29E-15	0.00%
<b>Total</b>	<b>1.18E-01</b>	<b>4.65E-04</b>	<b>2.05E-04</b>		<b>1.89E-05</b>		<b>1.46E-09</b>	

Notes:

- 1 APQ is based on Appendix A.
- 2 Dose conversion factors are provided in the CAP88-PC output files in Appendix B.

## 16 Cost Factors of Control Technology Components

Cost factors for the construction, operation, and maintenance of the selected control technologies are presented in *Best Available Radionuclide Control Technology Analysis for the WTP (24590-WTP-RPT-ENV-01-004)*.

## 17 Duration or Lifetime

The design life of the Lab is 40 years.

## 18 Standards

The WTP compliance strategy for the Lab emission units is to design, procure, and install components and systems in compliance with the applicable standards identified in WAC 246-247-110(18) and 40 CFR 60 Appendix A. If a deviation to a standard is identified, WDOH's approval of the deviation will be pursued for the system or component. To document compliance, code compliance matrices for the standards listed below have been submitted to WDOH for the Lab emission units.

American Society of Mechanical Engineers (ASME) Code on Nuclear Air and Gas (AG) AG-1 is the primary code applied to the design and operation of emission units. This code specifies requirements regarding process, controls and instrumentation, electrical, mechanical, and structural support design. It also includes requirements regarding manufacturing and quality inspection and testing. The purpose of WTP code compliance matrices (CCM) is to present the Project position relative to the appropriate sections of AG-1. Below are the CCMs for Lab which were previously submitted to WDOH.

- *WDOH Code Compliance Matrix for LAB HVAC Systems*, 24590-LAB-RPT-ENG-02-001
- *Cost Benefit Analysis for the C2V and C3V HVAC Systems*, 24590-WTP-RPT-HV-02-001
- *ASME AG-1 Code Compliance Matrix Verification Report for the LAB C5V Fans*, 24590-LAB-RPT-HV-10-001
- *ASME AG-1 Code Compliance Matrix Verification Report for the LAB C5V Ductwork*, 24590-LAB-RPT-HV-11-001
- *ASME AG-1 Code Compliance Matrix Verification Report for the Safe Change HEPA Filter Housings*, 24590-WTP-RPT-HV-05-0001
- *ASME AG-1 Code Compliance Matrix Verification Report for the HVAC Dampers*, 24590-WTP-RPT-HV-05-0003
- *ASME AG-1 Code Compliance Matrix Verification Report for the Radial HEPA Filters*, 24590-WTP-RPT-HV-10-001

ANSI N13.1-1999 is the code applied for sampling and monitoring of airborne radioactive substances. The Lab LB-S1 and LB-S2 ANSI N13.1 CCMs listed below supported previous WDOH approval of the sampling system design.

- *ANSI N13.1-1999 Compliance Matrix for Analytical Laboratory (LAB) Facility C3V Ventilation Emission Unit – LAB C3V (LB-S1)*, 24590-LAB-RPT-ENG-12-002
- *ANSI N13.1-1999 Compliance Matrix for Analytical Laboratory (LAB) Facility C5V Ventilation Emission Unit – LAB C5V (LB-S2)*, 24590-LAB-RPT-ENG-12-003

## 19 References

### 19.1 Project Documents

CCN 315579, Letter, from B. T. Vance, DOE, to J. P. Martell, WDOH, *U.S. Department of Energy, Office of River Protection Submittal of 24590-WTP-RPT-ENV-18-002, Rev. 1, "Radioactive Air Emissions Notice of Construction Operating License Application for LAW, LAB, and EMF,"* 19-ECD-0053, dated July 18, 2019.

CCN 333348, Memorandum, from B. A. Walker, BNI, to J. L. Julyk, BNI, *Lab (C2V, C3V, C5V) Horse Blanket Supporting Final Radioactive Air Emissions Licensing*, dated October 12, 2023.

24590-LAB-3ZD-60-00002, *Analytical Laboratory Ventilation System Design Description*

24590-LAB-RPT-ENG-02-001, *WDOH Code Compliance Matrix for LAB HVAC Systems*

24590-LAB-RPT-ENG-12-002, *ANSI N13.1-1999 Compliance Matrix for Analytical Laboratory (LAB) Facility C3V Ventilation Emission Unit – LAB C3V (LB-S1)*

24590-LAB-RPT-ENG-12-003, *ANSI N13.1-1999 Compliance Matrix for Analytical Laboratory (LAB) Facility C5V Ventilation Emission Unit – LAB C5V (LB-S2)*

24590-LAB-RPT-HV-10-001, *ASME AG-1 Code Compliance Matrix Verification Report for the LAB C5V Fans*

24590-LAB-RPT-HV-11-001, *ASME AG-1 Code Compliance Matrix Verification Report for the LAB C5V Ductwork*

24590-LAB-RPT-ENV-18-001, *WTP Analytical Laboratory Emissions Estimate*

24590-WTP-REQM-RARP-RP-0001, *Waste Treatment Plant Construction and Commissioning Radiological Control Manual*

24590-WTP-RPT-HV-02-001, *Cost Benefit Analysis for the C2V and C3V HVAC Systems*

24590-WTP-RPT-ENV-01-004, *Best Available Radionuclide Control Technology Analysis for the WTP*

24590-WTP-RPT-HV-05-0001, *ASME AG-1 Code Compliance Matrix Verification Report for the Safe Change HEPA Filter Housings*

24590-WTP-RPT-HV-05-0003, *ASME AG-1 Code Compliance Matrix Verification Report for the HVAC Dampers*

24590-WTP-RPT-HV-10-001, *ASME AG-1 Code Compliance Matrix Verification Report for the Radial HEPA Filters*

## **19.2 Codes and Standards**

40 CFR 60. *Standards of Performance for New Stationary Sources*. Code of Federal Regulations.

40 CFR 61. *National Emission Standards for Hazardous Air Pollutants*. Code of Federal Regulations.

40 CFR 61.93. *National Emission Standards for Hazardous Air Pollutants: Emission Monitoring and Test Procedures*. Code of Federal Regulations.

ANSI N13.1-1999. *Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stack and Ducts of Nuclear Facilities*. American National Standards Institute, New York, NY.

AOP 00-05-006, *Final Hanford Site Air Operating Permit (AOP) 00-05-006 Renewal 3*

ASME AG-1. *Code on Nuclear Air and Gas Treatment Systems*. The American Society of Mechanical Engineers, New York, NY.

RCW 43.21C.030. *Guidelines for State Agencies: Local Governments—Statements—Reports—Advice—Information*. Revised Code of Washington, Olympia, WA.

RCW 43.21C.150. *State Environmental Policy: RCW 43.21C.030(2)(c) Inapplicable When Statement Previously Prepared Pursuant to National Environmental Policy Act*. Revised Code of Washington, Olympia, WA.

WAC 197-11. *SEPA Rules*. Washington Administrative Code, Olympia, WA.

WAC 246-247. *Radiation Protection—Air Emissions*. Washington Administrative Code. Olympia, WA.

WAC 246-247-030. *Radiation Protection—Air Emissions: Definitions*. Washington Administrative Code, Olympia, WA.

WAC 246-247-060. *Radiation Protection—Air Emissions: Applications, Registration, and Licensing*. Washington Administrative Code, Olympia, WA.

WAC 246-247-110. *Radiation Protection—Air Emissions: Appendix A—Application Information Requirements*. Washington Administrative Code, Olympia, WA.

WAC 246-247-120. *Radiation Protection—Air Emissions: Appendix B—BARCT Compliance Demonstration*. Washington Administrative Code, Olympia, WA.

### **19.3 Other Documents**

DOE/EIS-0391. *Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site*, Richland, Washington (TC & WM EIS). US Department of Energy, Hanford Field Office, Richland, WA.

NOC ID 1045. *Approval of Notice of Construction (NOC) 1045 for the Hanford Tank Waste Treatment and Immobilization Plant (WTP) for LB-S1 Stack for the C3V Exhaust System of the Analytical Radiological Laboratory (ARL) Construction*. Washington State Department of Health, Olympia, WA.

NOC ID 1331. *Approval of Notice of Construction (NOC) 1331 for the Hanford Tank Waste Treatment and Immobilization Plant (WTP) for LB-S2 Stack for the C5V Exhaust System of the Analytical Radiological Laboratory (ARL) Construction*. Washington State Department of Health, Olympia, WA.

## **Appendix A**

### **LAW 6 Sample Modification**

## Appendix A

### LAW 6 Sample Modification

**Table 14 Lab Annual Samples**

Sample Point	Sample Description	Total Samples per Year	
		Current Limit	Proposed New Limit
LAWPS 1A/1B	LAWPS Lag Vessels	527	---
LAW 1A/1B	LAW Concentration Receipt Vessel	1,232	---
LAW 3	Plant Wash Vessel	18	---
LAW 6	LAW Melter Feed Preparation Vessel	411	1,643
LAW 10A/10B	SBS Condensate Collection Vessel	551	---
EMF 1A/1B	Evaporator Concentrate Vessel DEP-VSL-00003 A/B/C	137	---
EMF 2	Overhead Condensate Vessel RLD-VSL-00004 A/B	548	---
EMF 3	ETF/LERF Lab Storage Vessels RLD-VSL-00005 A/B	110	---

**Table 15 DFLAW Waste/Wastewater Sample Inventory**

Reference	Sample Point	Description	Stream Used for Mass Fractions	Sample Bottles per Event	Sample Events	Samples per Year for WTP Lab <sup>1</sup>	Sample Volume (mL) per Bottle <sup>2</sup>	Sample Volume (mL) to Lab per Year
24590-LAB-RPT-ENV-18-001 <sup>3</sup>	LAW 6	LAW Melter Feed Preparation	LFP04	1	274	411	30	12,319
24590-WTP-RPT-ENV-24-002 <sup>4</sup>	LAW 6	LAW Melter Feed Preparation	LFP04	1	1095	1,643	30	49,275

Notes:

- 1 Includes a contingency factor of 1.5.
- 2 Laser ablation uses only 0.1 ml per LAW 6 sample bottle.
- 3 24590-LAB-RPT-ENV-18-001 was the source document used for 24590-WTP-RPT-ENV-18-002.
- 4 Represents this application.

**Table 16 LAW 6 Sample Point Description**

Sample Point	Purpose	Sample Location	Frequency	Comments	Representative Stream
LAW 6	LAW Melter Feed Preparation Vessel	LFP-VSL-00001/3	Each vessel is sampled per transfer of treated LAW feed	Verify the correct glass formulation mixture was added	LFP04 Melter Feed

**Table 17 Detailed Tank Waste APQ Calculation**

<b>Radionuclide</b>	<b>LCP01 DFLAW (curies/year)</b>	<b>LFP04 Melter Feed (curies/year)</b>	<b>RLD21 Rad Liquid (curies/year)</b>	<b>DEP13 Conc Recycle (curies/year)</b>	<b>DEP20 Rad (curies/year)</b>	<b>LB-S1 APQ (curies /year)<sup>1</sup></b>	<b>LB-S2 APQ (curies/year)<sup>1</sup></b>
Ruthenium-106	5.54E-11	3.73E-11	3.51E-13	1.03E-12	3.26E-19	9.40E-11	9.40E-11
Cadmium-113m	2.61E-04	1.75E-04	7.63E-07	3.15E-06	7.75E-10	4.40E-04	4.40E-04
Antimony-125	2.32E-05	1.56E-05	2.25E-06	4.41E-06	1.08E-09	4.55E-05	4.55E-05
Tin-126	1.55E-04	1.04E-04	5.00E-07	1.96E-06	4.82E-10	2.61E-04	2.61E-04
Iodine-129	5.87E-06	3.95E-06	0.00E+00	2.89E-08	2.51E-09	9.85E-06	9.85E-06
Cesium-134	1.35E-10	9.11E-11	1.33E-11	2.60E-11	1.08E-19	2.66E-10	2.66E-10
Cesium-137	9.34E-04	6.28E-04	9.14E-05	1.80E-04	7.45E-13	1.83E-03	1.83E-03
Barium-137m	8.83E-04	5.94E-04	8.65E-05	1.70E-04	7.05E-13	1.73E-03	1.73E-03
Carbon-14	1.50E-04	1.01E-04	0.00E+00	9.82E-07	2.42E-10	2.52E-04	2.52E-04
Samarium-151	1.31E-07	8.81E-08	4.24E-10	1.66E-09	0.00E+00	2.21E-07	2.21E-07
Europium-152	2.33E-11	1.57E-11	7.54E-14	2.96E-13	0.00E+00	3.94E-11	3.94E-11
Europium-154	1.26E-10	8.47E-11	4.07E-13	1.60E-12	0.00E+00	2.13E-10	2.13E-10
Europium-155	4.87E-11	3.27E-11	1.57E-13	6.18E-13	0.00E+00	8.22E-11	8.22E-11
Radium-226	2.90E-09	1.95E-09	2.85E-10	5.59E-10	1.37E-13	5.70E-09	5.70E-09
Actinium-227	4.28E-07	2.88E-07	1.38E-09	5.43E-09	1.33E-12	7.22E-07	7.22E-07
Radium-228	1.74E-07	1.17E-07	1.70E-08	3.35E-08	8.23E-12	3.42E-07	3.42E-07
Thorium-229	2.95E-14	1.98E-14	9.54E-17	3.75E-16	0.00E+00	4.98E-14	4.98E-14
Protactinium-231	5.93E-14	3.99E-14	1.92E-16	7.53E-16	0.00E+00	1.00E-13	1.00E-13
Thorium-232	6.58E-14	4.43E-14	2.13E-16	8.36E-16	0.00E+00	1.11E-13	1.11E-13
Uranium-232	2.61E-08	1.76E-08	8.46E-11	3.32E-10	8.16E-14	4.41E-08	4.41E-08
Uranium-233	1.45E-06	9.73E-07	4.68E-09	1.84E-08	4.51E-12	2.44E-06	2.44E-06

**Table 17 Detailed Tank Waste APQ Calculation**

Radionuclide	LCP01 DFLAW (curies/year)	LFP04 Melter Feed (curies/year)	RLD21 Rad Liquid (curies/year)	DEP13 Conc Recycle (curies/year)	DEP20 Rad (curies/year)	LB-S1 APQ (curies /year) <sup>1</sup>	LB-S2 APQ (curies/year) <sup>1</sup>
Uranium-234	4.21E-07	2.83E-07	1.36E-09	5.34E-09	1.31E-12	7.11E-07	7.11E-07
Uranium-235	1.74E-08	1.17E-08	5.64E-11	2.21E-10	5.44E-14	2.94E-08	2.94E-08
Uranium-236	1.40E-08	9.45E-09	4.55E-11	1.78E-10	4.38E-14	2.37E-08	2.37E-08
Neptunium-237	4.14E-06	2.79E-06	1.34E-08	5.25E-08	1.29E-11	6.99E-06	6.99E-06
Plutonium-238	5.90E-06	3.97E-06	1.91E-08	7.50E-08	4.88E-15	9.97E-06	9.97E-06
Uranium-238	3.84E-07	2.58E-07	1.24E-09	4.87E-09	1.20E-12	6.48E-07	6.48E-07
Plutonium-239	1.32E-04	8.88E-05	4.27E-07	1.68E-06	1.08E-13	2.23E-04	2.23E-04
Plutonium-240	3.11E-05	2.09E-05	1.01E-07	3.95E-07	2.55E-14	5.25E-05	5.25E-05
Americium-241	7.48E-04	5.04E-04	4.75E-06	1.39E-05	2.44E-12	1.27E-03	1.27E-03
Plutonium-241	8.04E-05	5.41E-05	2.60E-07	1.02E-06	6.63E-14	1.36E-04	1.36E-04
Curium-242	3.89E-05	2.62E-05	1.26E-07	4.94E-07	1.21E-10	6.57E-05	6.57E-05
Plutonium-242	4.69E-09	3.16E-09	1.52E-11	5.96E-11	3.95E-18	7.92E-09	7.92E-09
Americium-243	4.36E-07	2.93E-07	2.77E-09	8.12E-09	1.42E-15	7.40E-07	7.40E-07
Curium-243	2.86E-06	1.92E-06	9.24E-09	3.62E-08	8.91E-12	4.82E-06	4.82E-06
Curium-244	4.79E-05	3.22E-05	1.55E-07	6.08E-07	1.49E-10	8.09E-05	8.09E-05
Tritium	9.58E-05	6.45E-05	2.75E-05	4.27E-06	1.27E-05	2.05E-04	2.05E-04
Nickel-59	2.16E-06	1.45E-06	6.95E-09	2.73E-08	6.78E-12	3.65E-06	3.65E-06
Cobalt-60	1.04E-11	6.97E-12	3.30E-14	1.31E-13	0.00E+00	1.75E-11	1.75E-11
Nickel-63	1.63E-04	1.10E-04	5.24E-07	2.06E-06	5.12E-10	2.75E-04	2.75E-04
Selenium-79	2.02E-04	1.36E-04	1.98E-05	3.88E-05	9.54E-09	3.96E-04	3.96E-04
Strontium-90	2.19E-02	1.47E-02	7.00E-05	2.76E-04	2.87E-10	3.70E-02	3.70E-02

**Table 17 Detailed Tank Waste APQ Calculation**

Radionuclide	LCP01 DFLAW (curies/year)	LFP04 Melter Feed (curies/year)	RLD21 Rad Liquid (curies/year)	DEP13 Conc Recycle (curies/year)	DEP20 Rad (curies/year)	LB-S1 APQ (curies/year) <sup>1</sup>	LB-S2 APQ (curies/year) <sup>1</sup>
Yttrium-90	2.19E-02	1.47E-02	7.00E-05	2.76E-04	2.87E-10	3.70E-02	3.70E-02
Niobium-93m	4.81E-10	3.23E-10	1.55E-12	6.10E-12	0.00E+00	8.12E-10	8.12E-10
Zirconium-93	5.29E-10	3.56E-10	3.81E-14	3.54E-12	0.00E+00	8.88E-10	8.88E-10
Technetium-99	1.60E-02	1.08E-02	3.43E-03	6.60E-03	1.62E-06	3.68E-02	3.68E-02

Notes:

1 APQ is calculated using the following equation (LCP01 DFLAW + LFP04 Melter Feed + RLD21 Rad Liquid + DEP13 Conc Recycle + DEP20 Rad = LB-S1 APQ). Also, because of cascading ventilation, LB-S1 APQ equals LB-S2 APQ. This creates a double counting of APQ for conservatism.

**Table 18 Tank Waste Air Emission Calculation**

Radionuclide	LAW Sample Unabated Air Emission at Lab (curies/year)	EMF Sample Unabated Air Emission at Lab (curies/year)	LB-S1 Unabated Air Emissions (curies/year)	LB-S2 Unabated Air Emissions (curies/year)
Ruthenium-106	2.17E-13	1.03E-15	2.18E-13	2.18E-13
Cadmium-113m	1.02E-06	3.15E-09	1.02E-06	1.02E-06
Antimony-125	9.32E-08	4.41E-09	9.76E-08	9.76E-08
Tin-126	6.06E-07	1.96E-09	6.08E-07	6.08E-07
Iodine-129	9.82E-09	3.14E-11	9.85E-09	9.85E-09
Cesium-134	5.44E-13	2.60E-14	5.70E-13	5.70E-13
Cesium-137	3.75E-06	1.80E-07	3.93E-06	3.93E-06
Barium-137m	3.54E-06	1.70E-07	3.71E-06	3.71E-06
Carbon-14	2.51E-07	9.82E-10	2.52E-07	2.52E-07

**Table 18 Tank Waste Air Emission Calculation**

<b>Radionuclide</b>	<b>LAW Sample Unabated Air Emission at Lab (curies/year)</b>	<b>EMF Sample Unabated Air Emission at Lab (curies/year)</b>	<b>LB-S1 Unabated Air Emissions (curies/year)</b>	<b>LB-S2 Unabated Air Emissions (curies/year)</b>
Samarium-151	5.13E-10	1.66E-12	5.15E-10	5.15E-10
Europium-152	9.14E-14	2.96E-16	9.17E-14	9.17E-14
Europium-154	4.93E-13	1.60E-15	4.95E-13	4.95E-13
Europium-155	1.91E-13	6.18E-16	1.91E-13	1.91E-13
Radium-226	1.17E-11	5.59E-13	1.22E-11	1.22E-11
Actinium-227	1.68E-09	5.43E-12	1.68E-09	1.68E-09
Radium-228	6.98E-10	3.35E-11	7.32E-10	7.32E-10
Thorium-229	1.16E-16	3.75E-19	1.16E-16	1.16E-16
Protactinium-231	2.32E-16	7.53E-19	2.33E-16	2.33E-16
Thorium-232	2.58E-16	8.36E-19	2.59E-16	2.59E-16
Uranium-232	1.02E-10	3.32E-13	1.03E-10	1.03E-10
Uranium-233	5.67E-09	1.84E-11	5.69E-09	5.69E-09
Uranium-234	1.65E-09	5.34E-12	1.66E-09	1.66E-09
Uranium-235	6.83E-11	2.21E-13	6.85E-11	6.85E-11
Uranium-236	5.51E-11	1.78E-13	5.52E-11	5.52E-11
Neptunium-237	1.62E-08	5.26E-11	1.63E-08	1.63E-08
Plutonium-238	2.31E-08	7.50E-11	2.32E-08	2.32E-08
Uranium-238	1.50E-09	4.87E-12	1.51E-09	1.51E-09
Plutonium-239	5.17E-07	1.68E-09	5.19E-07	5.19E-07
Plutonium-240	1.22E-07	3.95E-10	1.22E-07	1.22E-07
Americium-241	2.94E-06	1.39E-08	2.95E-06	2.95E-06

**Table 18 Tank Waste Air Emission Calculation**

<b>Radionuclide</b>	<b>LAW Sample Unabated Air Emission at Lab (curies/year)</b>	<b>EMF Sample Unabated Air Emission at Lab (curies/year)</b>	<b>LB-S1 Unabated Air Emissions (curies/year)</b>	<b>LB-S2 Unabated Air Emissions (curies/year)</b>
Plutonium-241	3.15E-07	1.02E-09	3.16E-07	3.16E-07
Curium-242	1.52E-07	4.94E-10	1.53E-07	1.53E-07
Plutonium-242	1.84E-11	5.96E-14	1.84E-11	1.84E-11
Americium-243	1.71E-09	8.12E-12	1.72E-09	1.72E-09
Curium-243	1.12E-08	3.63E-11	1.12E-08	1.12E-08
Curium-244	1.88E-07	6.08E-10	1.88E-07	1.88E-07
Tritium	1.88E-04	1.69E-05	2.05E-04	2.05E-04
Nickel-59	8.46E-09	2.73E-11	8.49E-09	8.49E-09
Cobalt-60	4.06E-14	1.31E-16	4.07E-14	4.07E-14
Nickel-63	6.39E-07	2.06E-09	6.41E-07	6.41E-07
Selenium-79	8.10E-07	3.88E-08	8.49E-07	8.49E-07
Strontium-90	8.58E-05	2.76E-07	8.61E-05	8.61E-05
Yttrium-90	8.58E-05	2.76E-07	8.61E-05	8.61E-05
Niobium-93m	1.88E-12	6.10E-15	1.89E-12	1.89E-12
Zirconium-93	2.07E-12	3.54E-15	2.07E-12	2.07E-12
Technetium-99	6.61E-05	6.60E-06	7.27E-05	7.27E-05

Notes:

- Air emissions are calculated using the following equation (LAW Sample Unabated Air Emissions at Lab + EMF Sample Unabated Air Emissions at Lab = LB-S1 Unabated Air Emissions). Also, because of cascading ventilation, LB-S1 APQ equals LB-S2 APQ. This creates a double counting of air emissions for conservatism.

## **Appendix B**

### **Lab CAP88-PC Reports**

## Appendix B Lab CAP88-PC Reports

C A P 8 8 - P C

Version 4.0

Clean Air Act Assessment Package - 1988

### S Y N O P S I S R E P O R T

Non-Radon Population Assessment  
Fri May 25 13:14:09 2018

Facility: Analytical Laboratory LB-S1  
Address:  
City:  
State: WA Zip:

Source Category:  
Source Type: Stack  
Emission Year: 2018  
DOSE Age Group: Adult

Comments:

Committed Effective Dose Equivalent  
(mrem)

---

2.60E+01

---

At This Location: 12050 Meters East  
Dataset Name: LB-S1.  
Dataset Date: May 25, 2018 01:13 PM  
Wind File: C:\Users\bawalker\Documents\CAP88\Wind Files\a13200E10.  
p File: C:\Users\bawalker\Documents\CAP88\Population Files\10WTPT1.POP

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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 12050 Meters East  
Lifetime Fatal Cancer Risk: 3.21E-06

ORGAN DOSE EQUIVALENT SUMMARY  
(RN-222 Working Level Calculations Excluded)

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	2.37E+00	1.11E+02
UB_Wall	2.42E+00	1.13E+02
Bone_Sur	7.57E+02	3.47E+04
Brain	2.36E+00	1.10E+02
Breasts	2.49E+00	1.14E+02
St_Wall	2.49E+00	1.16E+02
SI_Wall	2.42E+00	1.13E+02
ULI_Wall	2.77E+00	1.30E+02
LLI_Wall	3.56E+00	1.68E+02
Kidneys	8.56E+00	4.00E+02
Liver	8.17E+01	3.75E+03
Muscle	2.49E+00	1.15E+02
Ovaries	1.12E+01	5.15E+02
Pancreas	2.39E+00	1.12E+02
R_Marrow	3.41E+01	1.57E+03
Skin	2.93E+00	1.35E+02
Spleen	2.45E+00	1.14E+02
Testes	1.14E+01	5.22E+02
Thymus	2.39E+00	1.11E+02
Thyroid	2.97E+01	3.19E+02
GB_Wall	2.37E+00	1.11E+02
Ht_Wall	2.39E+00	1.11E+02
Uterus	2.38E+00	1.11E+02
ET_Reg	1.34E+01	6.16E+02
Lung_66	4.35E+01	1.99E+03
Effectiv	2.60E+01	1.14E+03

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FREQUENCY DISTRIBUTION OF LIFETIME FATAL CANCER RISKS

Risk Range	# of People in This Risk Range or Higher	Deaths in This Risk Range	Deaths in This Risk Range or Higher
1.0E+00 TO 1.0E-01	0.00E+00	0.00E+00	0.00E+00
1.0E-01 TO 1.0E-02	0.00E+00	0.00E+00	0.00E+00
1.0E-02 TO 1.0E-03	0.00E+00	0.00E+00	0.00E+00
1.0E-03 TO 1.0E-04	0.00E+00	0.00E+00	0.00E+00
1.0E-04 TO 1.0E-05	0.00E+00	0.00E+00	0.00E+00
1.0E-05 TO 1.0E-06	4.84E+03	7.00E+00	7.00E+00
LESS THAN 1.0E-06	5.49E+05	1.41E+02	1.48E+02

RADIONUCLIDE EMISSIONS DURING THE YEAR 2018

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
Am-241	M	1.000	1.0E+00	1.0E+00
C-14	G	0.000	1.0E+00	1.0E+00
Co-60	M	1.000	1.0E+00	1.0E+00
Cm-243	M	1.000	1.0E+00	1.0E+00
Cm-244	M	1.000	1.0E+00	1.0E+00
Cs-137	F	1.000	1.0E+00	1.0E+00
Eu-152	M	1.000	1.0E+00	1.0E+00
Eu-154	M	1.000	1.0E+00	1.0E+00
Eu-155	M	1.000	1.0E+00	1.0E+00
H-3	V	0.000	1.0E+00	1.0E+00
I-129	F	1.000	1.0E+00	1.0E+00
Ni-63	M	1.000	1.0E+00	1.0E+00
Np-237	M	1.000	1.0E+00	1.0E+00
Pu-238	M	1.000	1.0E+00	1.0E+00
Pu-239	M	1.000	1.0E+00	1.0E+00
Pu-240	M	1.000	1.0E+00	1.0E+00
Pu-241	M	1.000	1.0E+00	1.0E+00
Sb-125	M	1.000	1.0E+00	1.0E+00
Sm-151	M	1.000	1.0E+00	1.0E+00
Sn-126	M	1.000	1.0E+00	1.0E+00
Sr-90	M	1.000	1.0E+00	1.0E+00
Tc-99	M	1.000	1.0E+00	1.0E+00
Th-232	S	1.000	1.0E+00	1.0E+00
U-233	M	1.000	1.0E+00	1.0E+00
U-234	M	1.000	1.0E+00	1.0E+00
U-235	M	1.000	1.0E+00	1.0E+00
U-236	M	1.000	1.0E+00	1.0E+00
U-238	M	1.000	1.0E+00	1.0E+00
Y-90	M	1.000	1.0E+00	1.0E+00
Ru-106	M	1.000	1.0E+00	1.0E+00
Cs-134	F	1.000	1.0E+00	1.0E+00
Ba-137m	B	0.000	1.0E+00	1.0E+00
Pu-242	M	1.000	1.0E+00	1.0E+00
Ra-226	M	1.000	1.0E+00	1.0E+00
U-232	M	1.000	1.0E+00	1.0E+00
Pa-231	M	1.000	1.0E+00	1.0E+00
Ni-59	M	1.000	1.0E+00	1.0E+00
Ac-227	M	1.000	1.0E+00	1.0E+00
Am-243	M	1.000	1.0E+00	1.0E+00
Ra-228	M	1.000	1.0E+00	1.0E+00
Cm-242	M	1.000	1.0E+00	1.0E+00
Th-229	S	1.000	1.0E+00	1.0E+00
Zr-93	M	1.000	1.0E+00	1.0E+00
Nb-93m	M	1.000	1.0E+00	1.0E+00

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Cd-113m	M	1.000	1.0E+00	1.0E+00
Se-79	F	1.000	1.0E+00	1.0E+00

SITE INFORMATION

Temperature: 12.000 degrees C  
Precipitation: 17.100 cm/y  
Humidity: 8.000 g/cu m  
Mixing Height: 1000.0 m

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SOURCE INFORMATION

Source Number:     1  
                                  \_\_\_\_\_

Stack Height (m):   36.00  
Diameter (m):      1.52

Plume Rise  
Momentum (m/s):   18.00  
(Exit Velocity)

AGRICULTURAL DATA

	Vegetable	Milk	Meat
	_____	_____	_____
Fraction Home Produced:	1.0000	1.0000	1.0000
Fraction From Assessment Area:	0.0000	0.0000	0.0000
Fraction Imported:	0.0000	0.0000	0.0000
Beef Cattle Density:	5.62E-02		
Milk Cattle Density:	1.50E-02		
Land Fraction Cultivated for Vegetable Crops:	5.20E-02		

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POPULATION DATA

Distance (m)							
Direction	800	2400	4000	5600	7200	12050	24150
N	0	0	0	0	0	0	74
NNW	0	0	0	0	0	0	362
NW	0	0	0	0	0	0	330
WNW	0	0	0	0	0	0	229
W	0	0	0	0	0	0	53
WSW	0	0	0	0	0	0	13
SW	0	0	0	0	0	0	12
SSW	0	0	0	0	0	0	281
S	0	0	0	0	0	0	4593
SSE	0	0	0	0	0	0	6156
SE	0	0	0	0	0	0	1105
ESE	0	0	0	0	0	0	796
E	0	0	0	0	0	6	1924
ENE	0	0	0	0	0	14	525
NE	0	0	0	0	0	0	336
NNE	0	0	0	0	0	0	228

Distance (m)			
Direction	40250	56350	72450
N	3568	515	3815
NNW	924	1541	8748
NW	6243	103	753
WNW	1935	0	7807
W	163	3693	111278
WSW	17403	20533	6231
SW	19699	5296	74
SSW	10924	152	492
S	3169	189	9809
SSE	94138	14378	9131
SE	58907	48995	372
ESE	999	165	794
E	978	1844	321
ENE	909	2818	164
NE	13525	3596	380
NNE	1094	9887	28027

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D O S E   A N D   R I S K   S U M M A R I E S

Non-Radon Population Assessment  
Fri May 25 13:14:09 2018

Facility: Analytical Laboratory LB-S1  
Address:  
City:  
State: WA                      Zip:

Source Category:  
Source Type: Stack  
Emission Year: 2018  
DOSE Age Group: Adult

Comments:

Dataset Name: LB-S1.  
Dataset Date: May 25, 2018 01:13 PM  
Wind File: C:\Users\bawalker\Documents\CAP88\Wind Files\al3200E10.wnd  
Pop File: C:\Users\bawalker\Documents\CAP88\Population Files\10WTPT1.POP

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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	2.37E+00	1.11E+02
UB_Wall	2.42E+00	1.13E+02
Bone_Sur	7.57E+02	3.47E+04
Brain	2.36E+00	1.10E+02
Breasts	2.49E+00	1.14E+02
St_Wall	2.49E+00	1.16E+02
SI_Wall	2.42E+00	1.13E+02
ULI_Wall	2.77E+00	1.30E+02
LLI_Wall	3.56E+00	1.68E+02
Kidneys	8.56E+00	4.00E+02
Liver	8.17E+01	3.75E+03
Muscle	2.49E+00	1.15E+02
Ovaries	1.12E+01	5.15E+02
Pancreas	2.39E+00	1.12E+02
R_Marrow	3.41E+01	1.57E+03
Skin	2.93E+00	1.35E+02
Spleen	2.45E+00	1.14E+02
Testes	1.14E+01	5.22E+02
Thymus	2.39E+00	1.11E+02
Thyroid	2.97E+01	3.19E+02
GB_Wall	2.37E+00	1.11E+02
Ht_Wall	2.39E+00	1.11E+02
Uterus	2.38E+00	1.11E+02
ET_Reg	1.34E+01	6.16E+02
Lung_66	4.35E+01	1.99E+03
Effectiv	2.60E+01	1.14E+03

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem)	Collective Population (person-rem)
INGESTION	2.99E+00	9.05E+01
INHALATION	2.25E+01	1.03E+03
AIR IMMERSION	7.42E-05	3.39E-03
GROUND SURFACE	5.15E-01	2.40E+01
INTERNAL	2.55E+01	1.12E+03
EXTERNAL	5.15E-01	2.40E+01
TOTAL	2.60E+01	1.14E+03

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NUCLIDE COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclides	Selected Individual (mrem)	Collective Population (person-rem)
Am-241	1.49E+00	6.80E+01
C-14	5.64E-04	3.30E-02
Co-60	1.12E-01	5.57E+00
Cm-243	1.12E+00	5.14E+01
Cm-244	9.25E-01	4.23E+01
Cs-137	7.02E-02	3.48E+00
Eu-152	1.08E-01	5.36E+00
Eu-154	8.32E-02	4.12E+00
Eu-155	2.58E-03	1.27E-01
H-3	5.88E-06	3.43E-04
I-129	1.40E+00	1.05E+01
Ni-63	4.16E-04	2.06E-02
Np-237	8.22E-01	3.77E+01
Pu-238	1.64E+00	7.51E+01
Pu-239	1.79E+00	8.19E+01
Pu-240	1.79E+00	8.19E+01
Pu-241	3.27E-02	1.50E+00
Sb-125	1.10E-02	5.46E-01
Sm-151	1.66E-04	7.69E-03
Sn-126	3.26E-02	1.61E+00
Sr-90	1.02E-01	5.05E+00
Tc-99	2.63E-02	1.30E+00
Th-232	9.28E-01	4.26E+01
U-233	1.12E-01	5.18E+00
U-234	1.10E-01	5.07E+00
U-235	1.43E-01	6.75E+00
U-236	1.02E-01	4.69E+00
U-238	9.18E-02	4.24E+00
Y-90	5.32E-05	2.32E-03
Ru-106	2.70E-03	1.30E-01
Cs-134	6.89E-02	3.42E+00
Ba-137m	1.12E-14	3.04E-15
Pu-242	1.70E+00	7.78E+01
Ra-226	2.72E-01	1.31E+01
U-232	3.27E-01	1.53E+01
Pa-231	3.41E+00	1.56E+02
Ni-59	2.04E-04	1.01E-02
Ac-227	2.55E+00	1.17E+02
Am-243	1.48E+00	6.76E+01
Ra-228	3.23E-01	1.56E+01
Cm-242	1.49E-01	6.81E+00
Th-229	2.57E+00	1.18E+02
Zr-93	5.89E-04	2.78E-02
Nb-93m	1.19E-04	5.86E-03
Cd-113m	3.87E-02	1.91E+00
Se-79	2.41E-02	1.19E+00
TOTAL	2.60E+01	1.14E+03

**24590-WTP-RPT-ENV-24-002, Rev 0**  
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CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk	Total Collective Population Fatal Cancer Risk Per Year
Esophagu	7.66E-01	5.79E+02
Stomach	3.64E-08	2.25E-05
Colon	1.37E-07	8.65E-05
Liver	5.57E-07	3.31E-04
LUNG	1.78E-06	1.05E-03
Bone	3.01E-07	1.81E-04
Skin	1.51E-09	8.98E-07
Breast	3.71E-08	2.18E-05
Ovary	6.18E-08	3.71E-05
Bladder	3.09E-08	1.87E-05
Kidneys	2.27E-08	1.38E-05
Thyroid	2.53E-08	3.98E-06
Leukemia	8.40E-08	5.11E-05
Residual	1.23E-07	7.59E-05
Total	3.21E-06	1.90E-03

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk	Total Collective Population Fatal Cancer Risk Per Year
INGESTION	2.96E-07	1.77E-04
INHALATION	2.64E-06	1.56E-03
AIR IMMERSION	4.04E-11	2.39E-08
GROUND SURFACE	2.74E-07	1.68E-04
INTERNAL	2.93E-06	1.74E-03
EXTERNAL	2.74E-07	1.68E-04
TOTAL	3.21E-06	1.90E-03

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NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk	Total Collective Population Fatal Cancer Risk Per Year
Am-241	1.13E-07	6.71E-05
C-14	2.28E-09	1.72E-06
Co-60	5.85E-08	3.76E-05
Cm-243	1.16E-07	6.94E-05
Cm-244	9.94E-08	5.90E-05
Cs-137	1.19E-09	7.62E-07
Eu-152	5.92E-08	3.80E-05
Eu-154	4.53E-08	2.91E-05
Eu-155	1.45E-09	9.31E-07
H-3	5.25E-12	3.97E-09
I-129	3.88E-08	3.77E-06
Ni-63	1.16E-08	7.46E-06
Np-237	6.42E-08	3.82E-05
Pu-238	1.41E-07	8.36E-05
Pu-239	1.32E-07	7.83E-05
Pu-240	1.40E-07	8.30E-05
Pu-241	1.42E-09	8.42E-07
Sb-125	5.82E-09	3.74E-06
Sm-151	2.88E-11	1.73E-08
Sn-126	8.09E-09	5.18E-06
Sr-90	2.27E-09	1.44E-06
Tc-99	4.46E-10	2.85E-07
Th-232	1.95E-07	1.15E-04
U-233	3.83E-08	2.28E-05
U-234	3.75E-08	2.24E-05
U-235	5.42E-08	3.33E-05
U-236	3.47E-08	2.07E-05
U-238	2.80E-08	1.66E-05
Y-90	1.77E-11	1.00E-08
Ru-106	3.55E-10	2.11E-07
Cs-134	1.81E-08	1.16E-05
Ba-137m	6.13E-21	2.15E-20
Pu-242	1.33E-07	7.90E-05
Ra-226	2.05E-07	1.30E-04
U-232	6.38E-08	3.79E-05
Pa-231	1.44E-07	8.52E-05
Ni-59	5.13E-10	3.30E-07
Ac-227	3.13E-07	1.85E-04
Am-243	1.10E-07	6.55E-05
Ra-228	3.12E-08	1.92E-05
Cm-242	4.86E-08	2.89E-05
Th-229	7.04E-07	4.17E-04
Zr-93	6.16E-10	3.93E-07
Nb-93m	1.51E-10	9.69E-08
Cd-113m	6.30E-09	4.03E-06
Se-79	3.08E-10	1.97E-07
TOTAL	3.21E-06	1.90E-03

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INDIVIDUAL COMMITTED EFFECTIVE DOSE EQUIVALENT (mrem)  
(All Radionuclides and Pathways)

Direction	Distance (m)						
	800	2400	4000	5600	7200	12050	24150
N	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.4E+00
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.8E+00
NW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.8E+00
WNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.1E+00
W	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.3E+00
WSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.5E+00
SW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.4E+00
SSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.6E+00
S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.2E+00
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.2E+00
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.0E+01
ESE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.7E+01
E	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.6E+01	1.1E+01
ENE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.6E+01	6.7E+00
NE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.7E+00
NNE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.6E+00

Direction	Distance (m)		
	40250	56350	72450
N	2.4E+00	1.4E+00	9.6E-01
NNW	3.1E+00	1.9E+00	1.3E+00
NW	3.1E+00	1.9E+00	1.2E+00
WNW	2.1E+00	0.0E+00	8.4E-01
W	1.7E+00	9.9E-01	6.5E-01
WSW	1.2E+00	7.3E-01	4.7E-01
SW	1.2E+00	7.0E-01	4.6E-01
SSW	1.3E+00	7.7E-01	5.1E-01
S	1.6E+00	9.5E-01	6.3E-01
SSE	2.1E+00	1.2E+00	8.1E-01
SSE	5.3E+00	3.3E+00	2.2E+00
ESE	9.6E+00	6.2E+00	4.3E+00
E	6.1E+00	3.9E+00	2.6E+00
ENE	3.6E+00	2.3E+00	1.5E+00
NE	2.5E+00	1.6E+00	1.0E+00
NNE	1.9E+00	1.2E+00	7.7E-01

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COLLECTIVE COMMITTED EFFECTIVE DOSE EQUIVALENT (person rem)  
(All Radionuclides and Pathways)

Distance (m)							
Direction	800	2400	4000	5600	7200	12050	24150
N	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.3E-01
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.1E+00
NW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.9E+00
WNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.5E-01
W	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.8E-01
WSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.2E-02
SW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.9E-02
SSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.3E-01
S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.5E+01
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.6E+01
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E+01
ESE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.4E+01
E	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.6E-01	2.1E+01
ENE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.2E-01	3.5E+00
NE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.6E+00
NNE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.2E-01

Distance (m)			
Direction	40250	56350	72450
N	8.5E+00	7.4E-01	3.6E+00
NNW	2.9E+00	3.0E+00	1.1E+01
NW	1.9E+01	1.9E-01	9.3E-01
WNW	4.1E+00	0.0E+00	6.6E+00
W	2.7E-01	3.7E+00	7.2E+01
WSW	2.2E+01	1.5E+01	3.0E+00
SW	2.4E+01	3.7E+00	3.4E-02
SSW	1.4E+01	1.2E-01	2.5E-01
S	5.1E+00	1.8E-01	6.1E+00
SSE	2.0E+02	1.8E+01	7.4E+00
SSE	3.1E+02	1.6E+02	8.3E-01
ESE	9.6E+00	1.0E+00	3.4E+00
E	6.0E+00	7.1E+00	8.5E-01
ENE	3.3E+00	6.4E+00	2.5E-01
NE	3.4E+01	5.6E+00	4.0E-01
NNE	2.1E+00	1.2E+01	2.2E+01

**24590-WTP-RPT-ENV-24-002, Rev 0**  
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INDIVIDUAL LIFETIME RISK (deaths)  
(All Radionuclides and Pathways)

Distance (m)							
Direction	800	2400	4000	5600	7200	12050	24150
N	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.7E-07
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.4E-07
NW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.5E-07
WNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.3E-07
W	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.3E-07
WSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.2E-07
SW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.1E-07
SSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.3E-07
S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.1E-07
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.4E-07
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-06
ESE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.2E-06
E	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.2E-06	1.4E-06
ENE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.9E-06	8.5E-07
NE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.0E-07
NNE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.6E-07

Distance (m)			
Direction	40250	56350	72450
N	3.1E-07	1.9E-07	1.2E-07
NNW	4.0E-07	2.5E-07	1.7E-07
NW	4.0E-07	2.4E-07	1.6E-07
WNW	2.8E-07	0.0E+00	1.1E-07
W	2.2E-07	1.3E-07	8.5E-08
WSW	1.6E-07	9.5E-08	6.2E-08
SW	1.6E-07	9.2E-08	6.0E-08
SSW	1.7E-07	1.0E-07	6.6E-08
S	2.1E-07	1.2E-07	8.2E-08
SSE	2.7E-07	1.6E-07	1.1E-07
SSE	6.8E-07	4.2E-07	2.9E-07
ESE	1.2E-06	7.9E-07	5.5E-07
E	7.8E-07	5.0E-07	3.4E-07
ENE	4.7E-07	2.9E-07	2.0E-07
NE	3.2E-07	2.0E-07	1.4E-07
NNE	2.5E-07	1.5E-07	1.0E-07

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COLLECTIVE FATAL CANCER RISK Per Year  
(All Radionuclides and Pathways)

Distance (m)							
Direction	800	2400	4000	5600	7200	12050	24150
N	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.4E-07
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.5E-06
NW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.2E-06
WNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.6E-06
W	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.9E-07
WSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.4E-08
SW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.8E-08
SSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E-06
S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.5E-05
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.3E-05
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.8E-05
ESE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.3E-05
E	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.5E-07	3.5E-05
ENE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.5E-07	5.8E-06
NE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.6E-06
NNE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.4E-06

Distance (m)			
Direction	40250	56350	72450
N	1.4E-05	1.2E-06	6.1E-06
NNW	4.8E-06	4.9E-06	1.9E-05
NW	3.2E-05	3.2E-07	1.6E-06
WNW	6.9E-06	0.0E+00	1.1E-05
W	4.6E-07	6.2E-06	1.2E-04
WSW	3.6E-05	2.5E-05	5.0E-06
SW	4.0E-05	6.3E-06	5.8E-08
SSW	2.4E-05	2.0E-07	4.2E-07
S	8.6E-06	3.0E-07	1.0E-05
SSE	3.3E-04	3.0E-05	1.3E-05
SSE	5.2E-04	2.7E-04	1.4E-06
ESE	1.6E-05	1.7E-06	5.7E-06
E	9.9E-06	1.2E-05	1.4E-06
ENE	5.5E-06	1.1E-05	4.2E-07
NE	5.7E-05	9.4E-06	6.7E-07
NNE	3.5E-06	1.9E-05	3.6E-05

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C A P 8 8 - P C

Version 4.0

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Population Assessment  
Thu Apr 22 12:48:52 2021

Facility: Analytical Laboratory LB-S1  
Address:  
City:  
State: WA Zip:

Source Category:  
Source Type: Stack  
Emission Year: 2021  
DOSE Age Group: Adult

Comments:

Committed Effective Dose Equivalent  
(mrem)

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6.71E-01

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At This Location: 12050 Meters East  
Dataset Name: LB-S1 Pu-236.  
Dataset Date: Apr 22, 2021 12:48 PM  
Wind File: C:\Users\bawalker\Documents\CAP88\Wind Files\al3200E10.  
p File: C:\Users\bawalker\Documents\CAP88\Population Files\10WTPT1.POP

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SYNOPSIS  
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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 12050 Meters East  
Lifetime Fatal Cancer Risk: 8.82E-08

ORGAN DOSE EQUIVALENT SUMMARY  
(RN-222 Working Level Calculations Excluded)

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	3.17E-02	1.45E+00
UB_Wall	3.15E-02	1.44E+00
Bone_Sur	1.77E+01	8.11E+02
Brain	3.16E-02	1.44E+00
Breasts	3.16E-02	1.45E+00
St_Wall	3.19E-02	1.46E+00
SI_Wall	3.23E-02	1.48E+00
ULI_Wall	3.58E-02	1.66E+00
LLI_Wall	4.39E-02	2.06E+00
Kidneys	1.04E-01	4.76E+00
Liver	3.69E+00	1.69E+02
Muscle	3.16E-02	1.45E+00
Ovaries	2.28E-01	1.04E+01
Pancreas	3.17E-02	1.45E+00
R_Marrow	1.02E+00	4.68E+01
Skin	3.18E-02	1.46E+00
Spleen	3.16E-02	1.44E+00
Testes	2.32E-01	1.06E+01
Thymus	3.16E-02	1.44E+00
Thyroid	3.16E-02	1.44E+00
GB_Wall	3.18E-02	1.45E+00
Ht_Wall	3.16E-02	1.45E+00
Uterus	3.16E-02	1.44E+00
ET_Reg	2.05E-01	9.33E+00
Lung_66	1.02E+00	4.67E+01
Effectiv	6.71E-01	3.07E+01

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SYNOPSIS  
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FREQUENCY DISTRIBUTION OF LIFETIME FATAL CANCER RISKS

Risk Range	# of People # of People Range or Higher	Deaths in This Risk Range	Deaths in This Risk Range or Higher
1.0E+00 TO 1.0E-01	0.00E+00 0.00E+00	0.00E+00	0.00E+00
1.0E-01 TO 1.0E-02	0.00E+00 0.00E+00	0.00E+00	0.00E+00
1.0E-02 TO 1.0E-03	0.00E+00 0.00E+00	0.00E+00	0.00E+00
1.0E-03 TO 1.0E-04	0.00E+00 0.00E+00	0.00E+00	0.00E+00
1.0E-04 TO 1.0E-05	0.00E+00 0.00E+00	0.00E+00	0.00E+00
1.0E-05 TO 1.0E-06	0.00E+00 0.00E+00	0.00E+00	0.00E+00
LESS THAN 1.0E-06	5.54E+05 5.54E+05	4.05E-01	4.05E-01

RADIONUCLIDE EMISSIONS DURING THE YEAR 2021

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
Pu-236	M	1.000	1.0E+00	1.0E+00

SITE INFORMATION

Temperature: 12.000 degrees C  
Precipitation: 17.100 cm/y  
Humidity: 8.000 g/cu m  
Mixing Height: 1000.0 m

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SYNOPSIS  
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SOURCE INFORMATION

Source Number:     1  


---

Stack Height (m):   36.00  
Diameter (m):       1.52  
  
Plume Rise  
Momentum (m/s):   18.00  
(Exit Velocity)

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	1.0000	1.0000	1.0000
Fraction From Assessment Area:	0.0000	0.0000	0.0000
Fraction Imported:	0.0000	0.0000	0.0000
Beef Cattle Density:	5.62E-02		
Milk Cattle Density:	1.50E-02		
Land Fraction Cultivated for Vegetable Crops:	5.20E-02		

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POPULATION DATA

Distance (m)							
Direction	800	2400	4000	5600	7200	12050	24150
N	0	0	0	0	0	0	74
NNW	0	0	0	0	0	0	362
NW	0	0	0	0	0	0	330
WNW	0	0	0	0	0	0	229
W	0	0	0	0	0	0	53
WSW	0	0	0	0	0	0	13
SW	0	0	0	0	0	0	12
SSW	0	0	0	0	0	0	281
S	0	0	0	0	0	0	4593
SSE	0	0	0	0	0	0	6156
SE	0	0	0	0	0	0	1105
ESE	0	0	0	0	0	0	796
E	0	0	0	0	0	6	1924
ENE	0	0	0	0	0	14	525
NE	0	0	0	0	0	0	336
NNE	0	0	0	0	0	0	228

Distance (m)			
Direction	40250	56350	72450
N	3568	515	3815
NNW	924	1541	8748
NW	6243	103	753
WNW	1935	0	7807
W	163	3693	111278
WSW	17403	20533	6231
SW	19699	5296	74
SSW	10924	152	492
S	3169	189	9809
SSE	94138	14378	9131
SE	58907	48995	372
ESE	999	165	794
E	978	1844	321
ENE	909	2818	164
NE	13525	3596	380
NNE	1094	9887	28027

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D O S E   A N D   R I S K   S U M M A R I E S

Non-Radon Population Assessment  
Thu Apr 22 12:48:52 2021

Facility: Analytical Laboratory    LB-S1  
Address:  
  City:  
  State: WA                    Zip:

Source Category:  
  Source Type: Stack  
  Emission Year: 2021  
  DOSE Age Group: Adult

Comments:

Dataset Name: LB-S1 Pu-236.  
Dataset Date: Apr 22, 2021 12:48 PM  
Wind File: C:\Users\bawalker\Documents\CAP88\Wind Files\al3200E10.wnd  
Pop File: C:\Users\bawalker\Documents\CAP88\Population Files\10WTPT1.POP

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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	3.17E-02	1.45E+00
UB_Wall	3.15E-02	1.44E+00
Bone_Sur	1.77E+01	8.11E+02
Brain	3.16E-02	1.44E+00
Breasts	3.16E-02	1.45E+00
St_Wall	3.19E-02	1.46E+00
SI_Wall	3.23E-02	1.48E+00
ULI_Wall	3.58E-02	1.66E+00
LLI_Wall	4.39E-02	2.06E+00
Kidneys	1.04E-01	4.76E+00
Liver	3.69E+00	1.69E+02
Muscle	3.16E-02	1.45E+00
Ovaries	2.28E-01	1.04E+01
Pancreas	3.17E-02	1.45E+00
R_Marrow	1.02E+00	4.68E+01
Skin	3.18E-02	1.46E+00
Spleen	3.16E-02	1.44E+00
Testes	2.32E-01	1.06E+01
Thymus	3.16E-02	1.44E+00
Thyroid	3.16E-02	1.44E+00
GB_Wall	3.18E-02	1.45E+00
Ht_Wall	3.16E-02	1.45E+00
Uterus	3.16E-02	1.44E+00
ET_Reg	2.05E-01	9.33E+00
Lung_66	1.02E+00	4.67E+01
Effectiv	6.71E-01	3.07E+01

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem)	Collective Population (person-rem)
INGESTION	1.74E-02	8.64E-01
INHALATION	6.53E-01	2.98E+01
AIR IMMERSION	9.28E-10	4.23E-08
GROUND SURFACE	1.77E-05	8.78E-04
INTERNAL	6.71E-01	3.07E+01
EXTERNAL	1.77E-05	8.78E-04
TOTAL	6.71E-01	3.07E+01

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NUCLIDE	COMMITTED EFFECTIVE DOSE EQUIVALENT	SUMMARY
Nuclides	Selected Individual (mrem)	Collective Population (person-rem)
-----	-----	-----
Pu-236	6.71E-01	3.07E+01
TOTAL	6.71E-01	3.07E+01

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CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk	Total Collective Population Fatal Cancer Risk Per Year
Esophagu	1.73E-10	1.04E-07
Stomach	2.79E-10	1.69E-07
Colon	1.83E-09	1.16E-06
Liver	2.81E-08	1.68E-05
LUNG	4.45E-08	2.63E-05
Bone	8.26E-09	4.93E-06
Skin	1.04E-11	6.26E-09
Breast	1.64E-10	9.94E-08
Ovary	1.45E-09	8.64E-07
Bladder	4.22E-10	2.52E-07
Kidneys	3.39E-10	2.02E-07
Thyroid	2.57E-11	1.55E-08
Leukemia	1.82E-09	1.09E-06
Residual	9.29E-10	5.63E-07
Total	8.82E-08	5.25E-05

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk	Total Collective Population Fatal Cancer Risk Per Year
INGESTION	7.01E-09	4.50E-06
INHALATION	8.12E-08	4.80E-05
AIR IMMERSION	3.73E-16	2.20E-13
GROUND SURFACE	5.64E-12	3.62E-09
INTERNAL	8.82E-08	5.25E-05
EXTERNAL	5.64E-12	3.62E-09
TOTAL	8.82E-08	5.25E-05

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NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk	Total Collective Population Fatal Cancer Risk Per Year
Pu-236	8.82E-08	5.25E-05
TOTAL	8.82E-08	5.25E-05

**24590-WTP-RPT-ENV-24-002, Rev 0**  
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INDIVIDUAL COMMITTED EFFECTIVE DOSE EQUIVALENT (mrem)  
(All Radionuclides and Pathways)

Direction	Distance (m)						
	800	2400	4000	5600	7200	12050	24150
N	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E-01
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.6E-01
NW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.6E-01
WNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-01
W	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.8E-02
WSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.6E-02
SW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.4E-02
SSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.9E-02
S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.6E-02
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-01
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.7E-01
ESE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.7E-01
E	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.7E-01	3.0E-01
ENE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.1E-01	1.8E-01
NE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-01
NNE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.7E-02

Direction	Distance (m)		
	40250	56350	72450
N	6.4E-02	3.9E-02	2.6E-02
NNW	8.4E-02	5.2E-02	3.5E-02
NW	8.3E-02	5.0E-02	3.3E-02
WNW	5.7E-02	0.0E+00	2.3E-02
W	4.5E-02	2.7E-02	1.7E-02
WSW	3.3E-02	2.0E-02	1.3E-02
SW	3.2E-02	1.9E-02	1.2E-02
SSW	3.5E-02	2.1E-02	1.4E-02
S	4.3E-02	2.6E-02	1.7E-02
SSE	5.7E-02	3.3E-02	2.2E-02
SSE	1.4E-01	8.9E-02	6.0E-02
ESE	2.6E-01	1.7E-01	1.2E-01
E	1.7E-01	1.0E-01	7.2E-02
ENE	9.8E-02	6.2E-02	4.2E-02
NE	6.8E-02	4.2E-02	2.8E-02
NNE	5.2E-02	3.2E-02	2.1E-02

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COLLECTIVE COMMITTED EFFECTIVE DOSE EQUIVALENT (person rem)  
(All Radionuclides and Pathways)

Distance (m)							
Direction	800	2400	4000	5600	7200	12050	24150
N	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.8E-03
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.6E-02
NW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.2E-02
WNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.5E-02
W	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.7E-03
WSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.6E-04
SW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.6E-04
SSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.9E-02
S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.9E-01
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.9E-01
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.0E-01
ESE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.7E-01
E	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.0E-03	5.7E-01
ENE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.7E-03	9.4E-02
NE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.2E-02
NNE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.2E-02

Distance (m)			
Direction	40250	56350	72450
N	2.3E-01	2.0E-02	9.9E-02
NNW	7.8E-02	8.0E-02	3.0E-01
NW	5.2E-01	5.2E-03	2.5E-02
WNW	1.1E-01	0.0E+00	1.8E-01
W	7.4E-03	9.8E-02	1.9E+00
WSW	5.8E-01	4.0E-01	7.9E-02
SW	6.3E-01	1.0E-01	9.1E-04
SSW	3.8E-01	3.1E-03	6.7E-03
S	1.4E-01	4.8E-03	1.6E-01
SSE	5.3E+00	4.8E-01	2.0E-01
SSE	8.4E+00	4.3E+00	2.2E-02
ESE	2.6E-01	2.8E-02	9.2E-02
E	1.6E-01	1.9E-01	2.3E-02
ENE	8.9E-02	1.7E-01	6.8E-03
NE	9.2E-01	1.5E-01	1.1E-02
NNE	5.7E-02	3.1E-01	5.9E-01

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INDIVIDUAL LIFETIME RISK (deaths)  
(All Radionuclides and Pathways)

Distance (m)							
Direction	800	2400	4000	5600	7200	12050	24150
N	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.6E-08
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.1E-08
NW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.1E-08
WNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.5E-08
W	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E-08
WSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.8E-09
SW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.4E-09
SSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.1E-09
S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-08
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.5E-08
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.5E-08
ESE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.1E-08
E	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.8E-08	3.9E-08
ENE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.3E-08	2.3E-08
NE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.7E-08
NNE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-08

Distance (m)			
Direction	40250	56350	72450
N	8.5E-09	5.2E-09	3.4E-09
NNW	1.1E-08	6.8E-09	4.6E-09
NW	1.1E-08	6.6E-09	4.4E-09
WNW	7.6E-09	0.0E+00	3.0E-09
W	6.0E-09	3.5E-09	2.3E-09
WSW	4.4E-09	2.6E-09	1.7E-09
SW	4.2E-09	2.5E-09	1.6E-09
SSW	4.6E-09	2.7E-09	1.8E-09
S	5.7E-09	3.4E-09	2.2E-09
SSE	7.5E-09	4.4E-09	2.9E-09
SSE	1.9E-08	1.2E-08	7.9E-09
ESE	3.4E-08	2.2E-08	1.5E-08
E	2.2E-08	1.4E-08	9.4E-09
ENE	1.3E-08	8.1E-09	5.5E-09
NE	9.0E-09	5.6E-09	3.7E-09
NNE	6.9E-09	4.2E-09	2.8E-09

**24590-WTP-RPT-ENV-24-002, Rev 0**  
**Radioactive Air Emissions Notice of Construction**  
**Modification to the WTP Analytical Laboratory LB-S1**  
**and LB-S2 Emission Units**

Thu Apr 22 12:48:52 2021

SUMMARY  
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COLLECTIVE FATAL CANCER RISK Per Year  
 (All Radionuclides and Pathways)

Distance (m)							
Direction	800	2400	4000	5600	7200	12050	24150
N	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.5E-08
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.6E-08
NW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.8E-08
WNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.4E-08
W	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.0E-09
WSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.5E-09
SW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-09
SSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.3E-08
S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.8E-07
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E-06
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.0E-07
ESE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.3E-07
E	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.9E-09	9.8E-07
ENE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.7E-09	1.6E-07
NE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.2E-08
NNE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.8E-08

Distance (m)			
Direction	40250	56350	72450
N	3.9E-07	3.5E-08	1.7E-07
NNW	1.3E-07	1.4E-07	5.2E-07
NW	8.8E-07	8.8E-09	4.3E-08
WNW	1.9E-07	0.0E+00	3.0E-07
W	1.3E-08	1.7E-07	3.3E-06
WSW	1.0E-06	6.9E-07	1.4E-07
SW	1.1E-06	1.7E-07	1.6E-09
SSW	6.5E-07	5.4E-09	1.2E-08
S	2.4E-07	8.3E-09	2.8E-07
SSE	9.1E-06	8.2E-07	3.4E-07
SSE	1.4E-05	7.4E-06	3.8E-08
ESE	4.4E-07	4.7E-08	1.6E-07
E	2.8E-07	3.3E-07	3.9E-08
ENE	1.5E-07	3.0E-07	1.2E-08
NE	1.6E-06	2.6E-07	1.8E-08
NNE	9.8E-08	5.4E-07	1.0E-06

**24590-WTP-RPT-ENV-24-002, Rev 0**  
**Radioactive Air Emissions Notice of Construction**  
**Modification to the WTP Analytical Laboratory LB-S1**  
**and LB-S2 Emission Units**

C A P 8 8 - P C

Version 4.0

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Population Assessment  
Fri May 25 13:15:09 2018

Facility: Analytical Laboratory LB-S2  
Address:  
City:  
State: WA                      Zip:

Source Category:  
Source Type: Stack  
Emission Year: 2018  
DOSE Age Group: Adult

Comments:

Committed Effective Dose Equivalent  
(mrem)

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2.89E+01

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At This Location: 12050 Meters East  
Dataset Name: LB-S2.  
Dataset Date: May 25, 2018 01:14 PM  
Wind File: C:\Users\bawalker\Documents\CAP88\Wind Files\al3200E10.  
p File: C:\Users\bawalker\Documents\CAP88\Population Files\10WTPT1.POP

**24590-WTP-RPT-ENV-24-002, Rev 0**  
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**Modification to the WTP Analytical Laboratory LB-S1**  
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SYNOPSIS  
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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 12050 Meters East  
Lifetime Fatal Cancer Risk: 3.59E-06

ORGAN DOSE EQUIVALENT SUMMARY  
(RN-222 Working Level Calculations Excluded)

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	2.65E+00	1.18E+02
UB_Wall	2.70E+00	1.21E+02
Bone_Sur	8.51E+02	3.74E+04
Brain	2.63E+00	1.18E+02
Breasts	2.77E+00	1.22E+02
St_Wall	2.79E+00	1.25E+02
SI_Wall	2.70E+00	1.21E+02
ULI_Wall	3.10E+00	1.39E+02
LLI_Wall	3.98E+00	1.80E+02
Kidneys	9.58E+00	4.29E+02
Liver	9.19E+01	4.04E+03
Muscle	2.77E+00	1.23E+02
Ovaries	1.26E+01	5.55E+02
Pancreas	2.67E+00	1.20E+02
R_Marrow	3.83E+01	1.69E+03
Skin	3.26E+00	1.44E+02
Spleen	2.74E+00	1.22E+02
Testes	1.28E+01	5.62E+02
Thymus	2.67E+00	1.19E+02
Thyroid	2.85E+01	3.20E+02
GB_Wall	2.65E+00	1.18E+02
Ht_Wall	2.67E+00	1.19E+02
Uterus	2.66E+00	1.19E+02
ET_Reg	1.51E+01	6.64E+02
Lung_66	4.89E+01	2.14E+03
Effectiv	2.89E+01	1.23E+03

**24590-WTP-RPT-ENV-24-002, Rev 0**  
**Radioactive Air Emissions Notice of Construction**  
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**and LB-S2 Emission Units**

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SYNOPSIS

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FREQUENCY DISTRIBUTION OF LIFETIME FATAL CANCER RISKS

Risk Range	# of People in This Risk Range or Higher	Deaths in This Risk Range	Deaths in This Risk Range or Higher
1.0E+00 TO 1.0E-01	0.00E+00	0.00E+00	0.00E+00
1.0E-01 TO 1.0E-02	0.00E+00	0.00E+00	0.00E+00
1.0E-02 TO 1.0E-03	0.00E+00	0.00E+00	0.00E+00
1.0E-03 TO 1.0E-04	0.00E+00	0.00E+00	0.00E+00
1.0E-04 TO 1.0E-05	0.00E+00	0.00E+00	0.00E+00
1.0E-05 TO 1.0E-06	4.84E+03	7.54E+00	7.54E+00
LESS THAN 1.0E-06	5.49E+05	1.49E+02	1.57E+02

RADIONUCLIDE EMISSIONS DURING THE YEAR 2018

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
Am-241	M	1.000	1.0E+00	1.0E+00
C-14	G	0.000	1.0E+00	1.0E+00
Co-60	M	1.000	1.0E+00	1.0E+00
Cm-243	M	1.000	1.0E+00	1.0E+00
Cm-244	M	1.000	1.0E+00	1.0E+00
Cs-137	F	1.000	1.0E+00	1.0E+00
Eu-152	M	1.000	1.0E+00	1.0E+00
Eu-154	M	1.000	1.0E+00	1.0E+00
Eu-155	M	1.000	1.0E+00	1.0E+00
H-3	V	0.000	1.0E+00	1.0E+00
I-129	F	1.000	1.0E+00	1.0E+00
Ni-63	M	1.000	1.0E+00	1.0E+00
Np-237	M	1.000	1.0E+00	1.0E+00
Pu-238	M	1.000	1.0E+00	1.0E+00
Pu-239	M	1.000	1.0E+00	1.0E+00
Pu-240	M	1.000	1.0E+00	1.0E+00
Pu-241	M	1.000	1.0E+00	1.0E+00
Sb-125	M	1.000	1.0E+00	1.0E+00
Sm-151	M	1.000	1.0E+00	1.0E+00
Sn-126	M	1.000	1.0E+00	1.0E+00
Sr-90	M	1.000	1.0E+00	1.0E+00
Tc-99	M	1.000	1.0E+00	1.0E+00
Th-232	S	1.000	1.0E+00	1.0E+00
U-233	M	1.000	1.0E+00	1.0E+00
U-234	M	1.000	1.0E+00	1.0E+00
U-235	M	1.000	1.0E+00	1.0E+00
U-236	M	1.000	1.0E+00	1.0E+00
U-238	M	1.000	1.0E+00	1.0E+00
Y-90	M	1.000	1.0E+00	1.0E+00
Ru-106	M	1.000	1.0E+00	1.0E+00
Cs-134	F	1.000	1.0E+00	1.0E+00
Ba-137m	B	0.000	1.0E+00	1.0E+00
Pu-242	M	1.000	1.0E+00	1.0E+00
Ra-226	M	1.000	1.0E+00	1.0E+00
U-232	M	1.000	1.0E+00	1.0E+00
Pa-231	M	1.000	1.0E+00	1.0E+00
Ni-59	M	1.000	1.0E+00	1.0E+00
Ac-227	M	1.000	1.0E+00	1.0E+00
Am-243	M	1.000	1.0E+00	1.0E+00
Ra-228	M	1.000	1.0E+00	1.0E+00
Cm-242	M	1.000	1.0E+00	1.0E+00
Th-229	S	1.000	1.0E+00	1.0E+00
Zr-93	M	1.000	1.0E+00	1.0E+00
Nb-93m	M	1.000	1.0E+00	1.0E+00

**24590-WTP-RPT-ENV-24-002, Rev 0**  
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**and LB-S2 Emission Units**

Cd-113m	M	1.000	1.0E+00	1.0E+00
Se-79	F	1.000	1.0E+00	1.0E+00

SITE INFORMATION

Temperature:	12.000 degrees C
Precipitation:	17.100 cm/y
Humidity:	8.000 g/cu m
Mixing Height:	1000.0 m

**24590-WTP-RPT-ENV-24-002, Rev 0**  
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SYNOPSIS  
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SOURCE INFORMATION

Source Number: 1  


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Stack Height (m): 36.00  
Diameter (m): 0.71  
  
Plume Rise  
Momentum (m/s): 17.00  
(Exit Velocity)

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	1.0000	1.0000	1.0000
Fraction From Assessment Area:	0.0000	0.0000	0.0000
Fraction Imported:	0.0000	0.0000	0.0000
Beef Cattle Density:	5.62E-02		
Milk Cattle Density:	1.50E-02		
Land Fraction Cultivated for Vegetable Crops:	5.20E-02		

**24590-WTP-RPT-ENV-24-002, Rev 0**  
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**and LB-S2 Emission Units**

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SYNOPSIS  
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POPULATION DATA

Distance (m)							
Direction	800	2400	4000	5600	7200	12050	24150
N	0	0	0	0	0	0	74
NNW	0	0	0	0	0	0	362
NW	0	0	0	0	0	0	330
WNW	0	0	0	0	0	0	229
W	0	0	0	0	0	0	53
WSW	0	0	0	0	0	0	13
SW	0	0	0	0	0	0	12
SSW	0	0	0	0	0	0	281
S	0	0	0	0	0	0	4593
SSE	0	0	0	0	0	0	6156
SE	0	0	0	0	0	0	1105
ESE	0	0	0	0	0	0	796
E	0	0	0	0	0	6	1924
ENE	0	0	0	0	0	14	525
NE	0	0	0	0	0	0	336
NNE	0	0	0	0	0	0	228

Distance (m)			
Direction	40250	56350	72450
N	3568	515	3815
NNW	924	1541	8748
NW	6243	103	753
WNW	1935	0	7807
W	163	3693	111278
WSW	17403	20533	6231
SW	19699	5296	74
SSW	10924	152	492
S	3169	189	9809
SSE	94138	14378	9131
SE	58907	48995	372
ESE	999	165	794
E	978	1844	321
ENE	909	2818	164
NE	13525	3596	380
NNE	1094	9887	28027

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**and LB-S2 Emission Units**

D O S E   A N D   R I S K   S U M M A R I E S

Non-Radon Population Assessment  
Fri May 25 13:15:09 2018

Facility: Analytical Laboratory LB-S2  
Address:  
City:  
State: WA                      Zip:

Source Category:  
Source Type: Stack  
Emission Year: 2018  
DOSE Age Group: Adult

Comments:

Dataset Name: LB-S2.  
Dataset Date: May 25, 2018 01:14 PM  
Wind File: C:\Users\bawalker\Documents\CAP88\Wind Files\a13200E10.wnd  
Pop File: C:\Users\bawalker\Documents\CAP88\Population Files\10WTPPT1.POP

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SUMMARY  
Page 1

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	2.65E+00	1.18E+02
UB_Wall	2.70E+00	1.21E+02
Bone_Sur	8.51E+02	3.74E+04
Brain	2.63E+00	1.18E+02
Breasts	2.77E+00	1.22E+02
St_Wall	2.79E+00	1.25E+02
SI_Wall	2.70E+00	1.21E+02
ULI_Wall	3.10E+00	1.39E+02
LLI_Wall	3.98E+00	1.80E+02
Kidneys	9.58E+00	4.29E+02
Liver	9.19E+01	4.04E+03
Muscle	2.77E+00	1.23E+02
Ovaries	1.26E+01	5.55E+02
Pancreas	2.67E+00	1.20E+02
R_Marrow	3.83E+01	1.69E+03
Skin	3.26E+00	1.44E+02
Spleen	2.74E+00	1.22E+02
Testes	1.28E+01	5.62E+02
Thymus	2.67E+00	1.19E+02
Thyroid	2.85E+01	3.20E+02
GE_Wall	2.65E+00	1.18E+02
Ht_Wall	2.67E+00	1.19E+02
Uterus	2.66E+00	1.19E+02
ET_Reg	1.51E+01	6.64E+02
Lung_66	4.89E+01	2.14E+03
Effectiv	2.89E+01	1.23E+03

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem)	Collective Population (person-rem)
INGESTION	3.09E+00	9.49E+01
INHALATION	2.53E+01	1.11E+03
AIR IMMERSION	8.35E-05	3.65E-03
GROUND SURFACE	5.65E-01	2.54E+01
INTERNAL	2.84E+01	1.20E+03
EXTERNAL	5.65E-01	2.54E+01
TOTAL	2.89E+01	1.23E+03

**24590-WTP-RPT-ENV-24-002, Rev 0**  
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SUMMARY  
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NUCLIDE COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclides	Selected Individual (mrem)	Collective Population (person-rem)
Am-241	1.67E+00	7.33E+01
C-14	6.42E-04	3.74E-02
Co-60	1.24E-01	5.89E+00
Cm-243	1.26E+00	5.54E+01
Cm-244	1.04E+00	4.56E+01
Cs-137	7.78E-02	3.68E+00
Eu-152	1.20E-01	5.67E+00
Eu-154	9.22E-02	4.36E+00
Eu-155	2.86E-03	1.34E-01
H-3	6.68E-06	3.89E-04
I-129	1.33E+00	1.02E+01
Ni-63	4.62E-04	2.18E-02
Np-237	9.24E-01	4.06E+01
Pu-238	1.85E+00	8.10E+01
Pu-239	2.01E+00	8.83E+01
Pu-240	2.01E+00	8.83E+01
Pu-241	3.68E-02	1.61E+00
Sb-125	1.22E-02	5.78E-01
Sm-151	1.86E-04	8.27E-03
Sn-126	3.62E-02	1.71E+00
Sr-90	1.13E-01	5.35E+00
Tc-99	2.91E-02	1.38E+00
Th-232	1.04E+00	4.59E+01
U-233	1.26E-01	5.58E+00
U-234	1.23E-01	5.45E+00
U-235	1.60E-01	7.22E+00
U-236	1.14E-01	5.05E+00
U-238	1.03E-01	4.56E+00
Y-90	5.96E-05	2.49E-03
Ru-106	3.01E-03	1.38E-01
Cs-134	7.64E-02	3.62E+00
Ba-137m	1.15E-14	3.05E-15
Pu-242	1.91E+00	8.38E+01
Ra-226	3.03E-01	1.40E+01
U-232	3.66E-01	1.64E+01
Pa-231	3.83E+00	1.68E+02
Ni-59	2.26E-04	1.07E-02
Ac-227	2.87E+00	1.26E+02
Am-243	1.66E+00	7.29E+01
Ra-228	3.59E-01	1.66E+01
Cm-242	1.68E-01	7.34E+00
Th-229	2.89E+00	1.27E+02
Zr-93	6.58E-04	2.97E-02
Nb-93m	1.33E-04	6.21E-03
Cd-113m	4.29E-02	2.02E+00
Se-79	2.67E-02	1.26E+00
TOTAL	2.89E+01	1.23E+03

**24590-WTP-RPT-ENV-24-002, Rev 0**  
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SUMMARY  
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CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk	Total Collective Population Fatal Cancer Risk Per Year
Esophagu	8.71E-01	6.56E+02
Stomach	4.03E-08	2.38E-05
Colon	1.52E-07	9.17E-05
Liver	6.26E-07	3.57E-04
LUNG	2.00E-06	1.13E-03
Bone	3.38E-07	1.94E-04
Skin	1.66E-09	9.53E-07
Breast	4.06E-08	2.30E-05
Ovary	6.92E-08	3.98E-05
Bladder	3.44E-08	1.99E-05
Kidneys	2.53E-08	1.48E-05
Thyroid	2.44E-08	4.02E-06
Leukemia	9.36E-08	5.46E-05
Residual	1.36E-07	8.05E-05
Total	3.59E-06	2.05E-03

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk	Total Collective Population Fatal Cancer Risk Per Year
INGESTION	3.24E-07	1.88E-04
INHALATION	2.97E-06	1.68E-03
AIR IMMERSION	4.55E-11	2.58E-08
GROUND SURFACE	3.01E-07	1.77E-04
INTERNAL	3.29E-06	1.87E-03
EXTERNAL	3.01E-07	1.77E-04
TOTAL	3.59E-06	2.05E-03

**24590-WTP-RPT-ENV-24-002, Rev 0**  
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SUMMARY  
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NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk	Total Collective Population Fatal Cancer Risk Per Year
Am-241	1.27E-07	7.23E-05
C-14	2.59E-09	1.95E-06
Co-60	6.48E-08	3.97E-05
Cm-243	1.30E-07	7.46E-05
Cm-244	1.12E-07	6.36E-05
Cs-137	1.32E-09	8.07E-07
Eu-152	6.56E-08	4.02E-05
Eu-154	5.02E-08	3.08E-05
Eu-155	1.61E-09	9.87E-07
H-3	5.97E-12	4.50E-09
I-129	3.67E-08	3.64E-06
Ni-63	1.29E-08	7.90E-06
Np-237	7.22E-08	4.11E-05
Pu-238	1.58E-07	9.00E-05
Pu-239	1.49E-07	8.45E-05
Pu-240	1.57E-07	8.95E-05
Pu-241	1.60E-09	9.07E-07
Sb-125	6.45E-09	3.95E-06
Sm-151	3.23E-11	1.86E-08
Sn-126	8.97E-09	5.48E-06
Sr-90	2.52E-09	1.52E-06
Tc-99	4.95E-10	3.02E-07
Th-232	2.19E-07	1.24E-04
U-233	4.30E-08	2.46E-05
U-234	4.21E-08	2.41E-05
U-235	6.05E-08	3.56E-05
U-236	3.90E-08	2.23E-05
U-238	3.14E-08	1.78E-05
Y-90	1.98E-11	1.08E-08
Ru-106	3.99E-10	2.27E-07
Cs-134	2.01E-08	1.23E-05
Ba-137m	6.29E-21	2.16E-20
Pu-242	1.49E-07	8.51E-05
Ra-226	2.28E-07	1.38E-04
U-232	7.17E-08	4.09E-05
Pa-231	1.62E-07	9.19E-05
Ni-59	5.69E-10	3.49E-07
Ac-227	3.52E-07	2.00E-04
Am-243	1.24E-07	7.05E-05
Ra-228	3.49E-08	2.05E-05
Cm-242	5.46E-08	3.11E-05
Th-229	7.92E-07	4.50E-04
Zr-93	6.83E-10	4.17E-07
Nb-93m	1.68E-10	1.03E-07
Cd-113m	6.98E-09	4.27E-06
Se-79	3.41E-10	2.09E-07
TOTAL	3.59E-06	2.05E-03

**24590-WTP-RPT-ENV-24-002, Rev 0**  
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INDIVIDUAL COMMITTED EFFECTIVE DOSE EQUIVALENT (mrem)  
(All Radionuclides and Pathways)

Distance (m)							
Direction	800	2400	4000	5600	7200	12050	24150
N	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.0E+00
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.6E+00
NW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.6E+00
WNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.7E+00
W	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.7E+00
WSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.7E+00
SW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.6E+00
SSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.7E+00
S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.4E+00
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.5E+00
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E+01
ESE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.9E+01
E	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.9E+01	1.2E+01
ENE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.8E+01	7.4E+00
NE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.2E+00
NNE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.1E+00

Distance (m)			
Direction	40250	56350	72450
N	2.7E+00	1.6E+00	1.0E+00
NNW	3.5E+00	2.1E+00	1.4E+00
NW	3.4E+00	2.1E+00	1.3E+00
WNW	2.4E+00	0.0E+00	8.9E-01
W	1.9E+00	1.1E+00	6.7E-01
WSW	1.4E+00	7.7E-01	4.8E-01
SW	1.3E+00	7.4E-01	4.6E-01
SSW	1.4E+00	8.0E-01	5.1E-01
S	1.7E+00	9.9E-01	6.4E-01
SSE	2.3E+00	1.3E+00	8.4E-01
SSE	5.7E+00	3.5E+00	2.3E+00
ESE	1.0E+01	6.7E+00	4.6E+00
E	6.7E+00	4.2E+00	2.9E+00
ENE	4.0E+00	2.5E+00	1.7E+00
NE	2.8E+00	1.7E+00	1.1E+00
NNE	2.2E+00	1.3E+00	8.3E-01

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COLLECTIVE COMMITTED EFFECTIVE DOSE EQUIVALENT (person rem)  
(All Radionuclides and Pathways)

Distance (m)							
Direction	800	2400	4000	5600	7200	12050	24150
N	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.7E-01
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.4E+00
NW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.2E+00
WNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E+00
W	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.9E-01
WSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.6E-02
SW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.1E-02
SSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.6E-01
S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.6E+01
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.8E+01
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E+01
ESE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.5E+01
E	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.7E-01	2.4E+01
ENE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.5E-01	3.9E+00
NE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.8E+00
NNE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.3E-01

Distance (m)			
Direction	40250	56350	72450
N	9.5E+00	8.3E-01	3.9E+00
NNW	3.3E+00	3.3E+00	1.2E+01
NW	2.2E+01	2.1E-01	1.0E+00
WNW	4.6E+00	0.0E+00	6.9E+00
W	3.0E-01	3.9E+00	7.5E+01
WSW	2.4E+01	1.6E+01	3.0E+00
SW	2.5E+01	3.9E+00	3.4E-02
SSW	1.5E+01	1.2E-01	2.5E-01
S	5.4E+00	1.9E-01	6.2E+00
SSE	2.1E+02	1.9E+01	7.7E+00
SSE	3.4E+02	1.7E+02	8.7E-01
ESE	1.0E+01	1.1E+00	3.6E+00
E	6.6E+00	7.8E+00	9.2E-01
ENE	3.6E+00	7.0E+00	2.7E-01
NE	3.8E+01	6.1E+00	4.2E-01
NNE	2.4E+00	1.3E+01	2.3E+01

**24590-WTP-RPT-ENV-24-002, Rev 0**  
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INDIVIDUAL LIFETIME RISK (deaths)  
(All Radionuclides and Pathways)

Distance (m)							
Direction	800	2400	4000	5600	7200	12050	24150
N	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.4E-07
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.4E-07
NW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.4E-07
WNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.0E-07
W	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.7E-07
WSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.5E-07
SW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.4E-07
SSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.5E-07
S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.4E-07
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.8E-07
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.4E-06
ESE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.4E-06
E	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.6E-06	1.6E-06
ENE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.2E-06	9.4E-07
NE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.7E-07
NNE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.3E-07

Distance (m)			
Direction	40250	56350	72450
N	3.4E-07	2.1E-07	1.3E-07
NNW	4.5E-07	2.8E-07	1.8E-07
NW	4.4E-07	2.7E-07	1.7E-07
WNW	3.1E-07	0.0E+00	1.2E-07
W	2.4E-07	1.4E-07	8.8E-08
WSW	1.8E-07	1.0E-07	6.3E-08
SW	1.7E-07	9.6E-08	6.1E-08
SSW	1.8E-07	1.0E-07	6.7E-08
S	2.2E-07	1.3E-07	8.3E-08
SSE	2.9E-07	1.7E-07	1.1E-07
SSE	7.3E-07	4.5E-07	3.0E-07
ESE	1.3E-06	8.5E-07	5.9E-07
E	8.6E-07	5.5E-07	3.7E-07
ENE	5.1E-07	3.2E-07	2.1E-07
NE	3.6E-07	2.2E-07	1.4E-07
NNE	2.8E-07	1.7E-07	1.1E-07

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COLLECTIVE FATAL CANCER RISK Per Year  
 (All Radionuclides and Pathways)

Distance (m)							
Direction	800	2400	4000	5600	7200	12050	24150
N	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.2E-07
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.9E-06
NW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.6E-06
WNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.8E-06
W	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.3E-07
WSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.0E-08
SW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.2E-08
SSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-06
S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.6E-05
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.6E-05
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.0E-05
ESE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.5E-05
E	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.8E-07	3.9E-05
ENE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.0E-07	6.4E-06
NE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.9E-06
NNE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.6E-06

Distance (m)			
Direction	40250	56350	72450
N	1.6E-05	1.4E-06	6.6E-06
NNW	5.4E-06	5.5E-06	2.1E-05
NW	3.6E-05	3.6E-07	1.7E-06
WNW	7.7E-06	0.0E+00	1.2E-05
W	5.1E-07	6.6E-06	1.3E-04
WSW	4.0E-05	2.7E-05	5.1E-06
SW	4.3E-05	6.6E-06	5.8E-08
SSW	2.5E-05	2.0E-07	4.3E-07
S	9.0E-06	3.2E-07	1.1E-05
SSE	3.6E-04	3.2E-05	1.3E-05
SSE	5.6E-04	2.9E-04	1.5E-06
ESE	1.7E-05	1.8E-06	6.0E-06
E	1.1E-05	1.3E-05	1.5E-06
ENE	6.0E-06	1.2E-05	4.5E-07
NE	6.3E-05	1.0E-05	7.1E-07
NNE	4.0E-06	2.1E-05	3.9E-05

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C A P 8 8 - P C

Version 4.0

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Population Assessment  
Thu Apr 22 13:42:06 2021

Facility: Analytical Laboratory LB-S2  
Address:  
City:  
State: WA Zip:

Source Category:  
Source Type: Stack  
Emission Year: 2021  
DOSE Age Group: Adult

Comments:

Committed Effective Dose Equivalent  
(mrem)

---

7.54E-01

---

At This Location: 12050 Meters East  
Dataset Name: LB-S2 Pu-236.  
Dataset Date: Apr 22, 2021 01:42 PM  
Wind File: C:\Users\bawalker\Documents\CAP88\Wind Files\al3200E10.  
p File: C:\Users\bawalker\Documents\CAP88\Population Files\10WTPT1.POP

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MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 12050 Meters East  
Lifetime Fatal Cancer Risk: 9.91E-08

ORGAN DOSE EQUIVALENT SUMMARY  
(RN-222 Working Level Calculations Excluded)

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	3.57E-02	1.56E+00
UB_Wall	3.55E-02	1.56E+00
Bone_Sur	1.99E+01	8.75E+02
Brain	3.55E-02	1.56E+00
Breasts	3.55E-02	1.56E+00
St_Wall	3.58E-02	1.57E+00
SI_Wall	3.63E-02	1.59E+00
ULI_Wall	4.02E-02	1.78E+00
LLI_Wall	4.92E-02	2.20E+00
Kidneys	1.17E-01	5.13E+00
Liver	4.15E+00	1.82E+02
Muscle	3.55E-02	1.56E+00
Ovaries	2.56E-01	1.12E+01
Pancreas	3.56E-02	1.56E+00
R_Marrow	1.15E+00	5.05E+01
Skin	3.58E-02	1.57E+00
Spleen	3.55E-02	1.56E+00
Testes	2.61E-01	1.14E+01
Thymus	3.55E-02	1.56E+00
Thyroid	3.55E-02	1.56E+00
GB_Wall	3.58E-02	1.57E+00
Ht_Wall	3.56E-02	1.56E+00
Uterus	3.55E-02	1.56E+00
ET_Reg	2.30E-01	1.01E+01
Lung_66	1.15E+00	5.04E+01
Effectiv	7.54E-01	3.31E+01

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SYNOPSIS  
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FREQUENCY DISTRIBUTION OF LIFETIME FATAL CANCER RISKS

Risk Range	# of People in This Risk Range or Higher	Deaths in This Risk Range	Deaths in This Risk Range or Higher
1.0E+00 TO 1.0E-01	0.00E+00	0.00E+00	0.00E+00
1.0E-01 TO 1.0E-02	0.00E+00	0.00E+00	0.00E+00
1.0E-02 TO 1.0E-03	0.00E+00	0.00E+00	0.00E+00
1.0E-03 TO 1.0E-04	0.00E+00	0.00E+00	0.00E+00
1.0E-04 TO 1.0E-05	0.00E+00	0.00E+00	0.00E+00
1.0E-05 TO 1.0E-06	0.00E+00	0.00E+00	0.00E+00
LESS THAN 1.0E-06	5.54E+05	4.30E-01	4.30E-01

RADIONUCLIDE EMISSIONS DURING THE YEAR 2021

Nuclide	Type	Size	Source	
			#1 Ci/y	TOTAL Ci/y
Pu-236	M	1.000	1.0E+00	1.0E+00

SITE INFORMATION

Temperature: 12.000 degrees C  
Precipitation: 17.100 cm/y  
Humidity: 8.000 g/cu m  
Mixing Height: 1000.0 m

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SYNOPSIS  
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SOURCE INFORMATION

Source Number: 1  
-----  
Stack Height (m): 36.00  
Diameter (m): 0.71  
  
Plume Rise  
Momentum (m/s): 17.00  
(Exit Velocity)

AGRICULTURAL DATA

	Vegetable	Milk	Meat
	-----	-----	-----
Fraction Home Produced:	1.0000	1.0000	1.0000
Fraction From Assessment Area:	0.0000	0.0000	0.0000
Fraction Imported:	0.0000	0.0000	0.0000
Beef Cattle Density:	5.62E-02		
Milk Cattle Density:	1.50E-02		
Land Fraction Cultivated for Vegetable Crops:	5.20E-02		

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SYNOPSIS  
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POPULATION DATA

Direction	Distance (m)						
	800	2400	4000	5600	7200	12050	24150
N	0	0	0	0	0	0	74
NNW	0	0	0	0	0	0	362
NW	0	0	0	0	0	0	330
WNW	0	0	0	0	0	0	229
W	0	0	0	0	0	0	53
WSW	0	0	0	0	0	0	13
SW	0	0	0	0	0	0	12
SSW	0	0	0	0	0	0	281
S	0	0	0	0	0	0	4593
SSE	0	0	0	0	0	0	6156
SE	0	0	0	0	0	0	1105
ESE	0	0	0	0	0	0	796
E	0	0	0	0	0	6	1924
ENE	0	0	0	0	0	14	525
NE	0	0	0	0	0	0	336
NNE	0	0	0	0	0	0	228

Direction	Distance (m)		
	40250	56350	72450
N	3568	515	3815
NNW	924	1541	8748
NW	6243	103	753
WNW	1935	0	7807
W	163	3693	111278
WSW	17403	20533	6231
SW	19699	5296	74
SSW	10924	152	492
S	3169	189	9809
SSE	94138	14378	9131
SE	58907	48995	372
ESE	999	165	794
E	978	1844	321
ENE	909	2818	164
NE	13525	3596	380
NNE	1094	9887	28027

**24590-WTP-RPT-ENV-24-002, Rev 0**  
**Radioactive Air Emissions Notice of Construction**  
**Modification to the WTP Analytical Laboratory LB-S1**  
**and LB-S2 Emission Units**

D O S E   A N D   R I S K   S U M M A R I E S

Non-Radon Population Assessment  
Thu Apr 22 13:42:06 2021

Facility: Analytical Laboratory LB-S2  
Address:  
City:  
State: WA                      Zip:

Source Category:  
Source Type: Stack  
Emission Year: 2021  
DOSE Age Group: Adult

Comments:

Dataset Name: LB-S2 Pu-236.  
Dataset Date: Apr 22, 2021 01:42 PM  
Wind File: C:\Users\bawalker\Documents\CAP88\Wind Files\al3200E10.wnd  
Pop File: C:\Users\bawalker\Documents\CAP88\Population Files\10WTPT1.POP

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SUMMARY  
Page 1

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem)	Collective Population (person-rem)
Adrenal	3.57E-02	1.56E+00
UB_Wall	3.55E-02	1.56E+00
Bone_Sur	1.99E+01	8.75E+02
Brain	3.55E-02	1.56E+00
Breasts	3.55E-02	1.56E+00
St_Wall	3.58E-02	1.57E+00
SI_Wall	3.63E-02	1.59E+00
ULI_Wall	4.02E-02	1.78E+00
LLI_Wall	4.92E-02	2.20E+00
Kidneys	1.17E-01	5.13E+00
Liver	4.15E+00	1.82E+02
Muscle	3.55E-02	1.56E+00
Ovaries	2.56E-01	1.12E+01
Pancreas	3.56E-02	1.56E+00
R_Marrow	1.15E+00	5.05E+01
Skin	3.58E-02	1.57E+00
Spleen	3.55E-02	1.56E+00
Testes	2.61E-01	1.14E+01
Thymus	3.55E-02	1.56E+00
Thyroid	3.55E-02	1.56E+00
GB_Wall	3.58E-02	1.57E+00
Ht_Wall	3.56E-02	1.56E+00
Uterus	3.55E-02	1.56E+00
ET_Reg	2.30E-01	1.01E+01
Lung_66	1.15E+00	5.04E+01
Effectiv	7.54E-01	3.31E+01

PATHWAY COMMITTED EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem)	Collective Population (person-rem)
INGESTION	1.93E-02	9.15E-01
INHALATION	7.35E-01	3.22E+01
AIR IMMERSION	1.04E-09	4.57E-08
GROUND SURFACE	1.96E-05	9.29E-04
INTERNAL	7.54E-01	3.31E+01
EXTERNAL	1.96E-05	9.29E-04
TOTAL	7.54E-01	3.31E+01

**24590-WTP-RPT-ENV-24-002, Rev 0**  
**Radioactive Air Emissions Notice of Construction**  
**Modification to the WTP Analytical Laboratory LB-S1**  
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SUMMARY  
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NUCLIDE	COMMITTED EFFECTIVE DOSE EQUIVALENT	SUMMARY
Nuclides	Selected Individual (mrem)	Collective Population (person-rem)
-----	-----	-----
Pu-236	7.54E-01	3.31E+01
TOTAL	7.54E-01	3.31E+01

**24590-WTP-RPT-ENV-24-002, Rev 0**  
**Radioactive Air Emissions Notice of Construction**  
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SUMMARY  
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CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk	Total Collective Population Fatal Cancer Risk Per Year
Esophagu	1.95E-10	1.12E-07
Stomach	3.12E-10	1.81E-07
Colon	2.03E-09	1.23E-06
Liver	3.15E-08	1.80E-05
LUNG	5.00E-08	2.84E-05
Bone	9.28E-09	5.31E-06
Skin	1.17E-11	6.72E-09
Breast	1.84E-10	1.07E-07
Ovary	1.62E-09	9.29E-07
Bladder	4.73E-10	2.71E-07
Kidneys	3.81E-10	2.17E-07
Thyroid	2.88E-11	1.67E-08
Leukemia	2.05E-09	1.17E-06
Residual	1.04E-09	6.03E-07
Total	9.91E-08	5.65E-05

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk	Total Collective Population Fatal Cancer Risk Per Year
INGESTION	7.77E-09	4.77E-06
INHALATION	9.14E-08	5.18E-05
AIR IMMERSION	4.19E-16	2.38E-13
GROUND SURFACE	6.25E-12	3.83E-09
INTERNAL	9.91E-08	5.65E-05
EXTERNAL	6.25E-12	3.83E-09
TOTAL	9.91E-08	5.65E-05

**24590-WTP-RPT-ENV-24-002, Rev 0**  
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NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk	Total Collective Population Fatal Cancer Risk Per Year
Pu-236	9.91E-08	5.65E-05
TOTAL	9.91E-08	5.65E-05

**24590-WTP-RPT-ENV-24-002, Rev 0**  
**Radioactive Air Emissions Notice of Construction**  
**Modification to the WTP Analytical Laboratory LB-S1**  
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INDIVIDUAL COMMITTED EFFECTIVE DOSE EQUIVALENT (mrem)  
 (All Radionuclides and Pathways)

Direction	Distance (m)						
	800	2400	4000	5600	7200	12050	
N	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.4E-01
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.8E-01
NW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.8E-01
WNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-01
W	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.9E-02
WSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.4E-02
SW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.0E-02
SSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.3E-02
S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.1E-02
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E-01
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.9E-01
ESE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.1E-01
E	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.5E-01	3.3E-01
ENE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.6E-01	2.0E-01
NE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.4E-01
NNE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-01

Direction	Distance (m)		
	40250	56350	72450
N	7.3E-02	4.4E-02	2.8E-02
NNW	9.5E-02	5.8E-02	3.8E-02
NW	9.3E-02	5.6E-02	3.6E-02
WNW	6.4E-02	0.0E+00	2.4E-02
W	5.0E-02	2.9E-02	1.8E-02
WSW	3.7E-02	2.1E-02	1.3E-02
SW	3.5E-02	2.0E-02	1.2E-02
SSW	3.6E-02	2.1E-02	1.4E-02
S	4.6E-02	2.7E-02	1.7E-02
SSE	6.1E-02	3.5E-02	2.3E-02
SSE	1.5E-01	9.5E-02	6.4E-02
ESE	2.8E-01	1.8E-01	1.2E-01
E	1.8E-01	1.2E-01	7.8E-02
ENE	1.1E-01	6.8E-02	4.5E-02
NE	7.6E-02	4.6E-02	3.0E-02
NNE	5.9E-02	3.5E-02	2.3E-02

**24590-WTP-RPT-ENV-24-002, Rev 0**  
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COLLECTIVE COMMITTED EFFECTIVE DOSE EQUIVALENT (person rem)  
(All Radionuclides and Pathways)

Direction	Distance (m)						
	800	2400	4000	5600	7200	12050	24150
N	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.0E-02
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.4E-02
NW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.8E-02
WNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.9E-02
W	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.2E-03
WSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.6E-04
SW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.4E-04
SSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.0E-02
S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.2E-01
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.4E-01
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.2E-01
ESE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.1E-01
E	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.5E-03	6.4E-01
ENE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.4E-03	1.0E-01
NE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.7E-02
NNE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.5E-02

Direction	Distance (m)		
	40250	56350	72450
N	2.6E-01	2.3E-02	1.1E-01
NNW	8.8E-02	9.0E-02	3.3E-01
NW	5.8E-01	5.8E-03	2.7E-02
WNW	1.2E-01	0.0E+00	1.9E-01
W	8.1E-03	1.1E-01	2.0E+00
WSW	6.4E-01	4.3E-01	8.1E-02
SW	6.8E-01	1.0E-01	9.2E-04
SSW	4.0E-01	3.2E-03	6.8E-03
S	1.4E-01	5.0E-03	1.7E-01
SSE	5.7E+00	5.1E-01	2.1E-01
SSE	9.1E+00	4.7E+00	2.4E-02
ESE	2.8E-01	3.0E-02	9.9E-02
E	1.8E-01	2.1E-01	2.5E-02
ENE	9.8E-02	1.9E-01	7.4E-03
NE	1.0E+00	1.7E-01	1.2E-02
NNE	6.4E-02	3.5E-01	6.3E-01

**24590-WTP-RPT-ENV-24-002, Rev 0**  
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INDIVIDUAL LIFETIME RISK (deaths)  
(All Radionuclides and Pathways)

Direction	Distance (m)						
	800	2400	4000	5600	7200	12050	
N	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.8E-08
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.3E-08
NW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.3E-08
WNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.7E-08
W	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-08
WSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.7E-09
SW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.2E-09
SSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.6E-09
S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E-08
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.6E-08
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.8E-08
ESE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.7E-08
E	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.9E-08	4.4E-08
ENE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.0E-08	2.6E-08
NE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.9E-08
NNE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.5E-08

Direction	Distance (m)		
	40250	56350	72450
N	9.6E-09	5.8E-09	3.7E-09
NNW	1.3E-08	7.7E-09	5.0E-09
NW	1.2E-08	7.4E-09	4.8E-09
WNW	8.5E-09	0.0E+00	3.2E-09
W	6.6E-09	3.8E-09	2.4E-09
WSW	4.8E-09	2.8E-09	1.7E-09
SW	4.6E-09	2.6E-09	1.7E-09
SSW	4.8E-09	2.8E-09	1.8E-09
S	6.0E-09	3.5E-09	2.3E-09
SSE	8.0E-09	4.7E-09	3.0E-09
SSE	2.0E-08	1.3E-08	8.4E-09
ESE	3.7E-08	2.4E-08	1.6E-08
E	2.4E-08	1.5E-08	1.0E-08
ENE	1.4E-08	8.9E-09	5.9E-09
NE	1.0E-08	6.1E-09	4.0E-09
NNE	7.8E-09	4.7E-09	3.0E-09

**24590-WTP-RPT-ENV-24-002, Rev 0**  
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COLLECTIVE FATAL CANCER RISK Per Year  
(All Radionuclides and Pathways)

Direction	Distance (m)						
	800	2400	4000	5600	7200	12050	24150
N	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.7E-08
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-07
NW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.0E-07
WNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.9E-08
W	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.0E-09
WSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.6E-09
SW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.4E-09
SSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.5E-08
S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.2E-07
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-06
SSE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.5E-07
ESE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.9E-07
E	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.7E-09	1.1E-06
ENE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-08	1.8E-07
NE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.1E-08
NNE	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.3E-08

Direction	Distance (m)		
	40250	56350	72450
N	4.4E-07	3.8E-08	1.8E-07
NNW	1.5E-07	1.5E-07	5.7E-07
NW	9.9E-07	9.9E-09	4.7E-08
WNW	2.1E-07	0.0E+00	3.2E-07
W	1.4E-08	1.8E-07	3.5E-06
WSW	1.1E-06	7.3E-07	1.4E-07
SW	1.2E-06	1.8E-07	1.6E-09
SSW	6.8E-07	5.6E-09	1.2E-08
S	2.5E-07	8.7E-09	2.9E-07
SSE	9.8E-06	8.7E-07	3.5E-07
SSE	1.5E-05	8.0E-06	4.0E-08
ESE	4.8E-07	5.1E-08	1.7E-07
E	3.0E-07	3.6E-07	4.2E-08
ENE	1.7E-07	3.2E-07	1.3E-08
NE	1.7E-06	2.8E-07	2.0E-08
NNE	1.1E-07	6.0E-07	1.1E-06

Attachment 2  
24-ECD-0202

Notification of Off-Permit Change

(2 pages including cover sheet)

**HANFORD SITE AIR OPERATING PERMIT**  
**Notification of Off-Permit Change**  
**Permit Number: 00-05-006, Renewal 3**

This notification is provided to Washington State Department of Ecology, Washington State Department of Health, and the U.S. Environmental Protection Agency as notice of an off-permit change described as follows.

This change is allowed pursuant to WAC 173-401-724(1), WAC 173-401-724(2), and WAC 173-401-724(6):

- (1) Change is not specifically addressed or prohibited by the permit terms and conditions;
- (2) Change does not weaken the enforceability of the existing permit conditions;
- (3) Change is not a Title I modification or a change subject to the acid rain requirements under Title IV of the FCAA;
- (4) Change meets all applicable requirements and does not violate an existing permit term or condition;
- (5) Change has complied with applicable preconstruction review requirements established pursuant to RCW 70.94.152.

The following information is provided pursuant to WAC-173-401-724(3):

<b>Description of change:</b>
The modification to the WTP Analytical Lab LB-S1(Emission Unit 558) and LB-S2 (Emission Unit 559) pursues WDOH approval to increase the annual number of Tank Waste samples and incorporates radioactive calibration standard development in preparation for Tank Waste operations.
<b>Date of change:</b>
The change will be effective upon Washington State Department of Health issuance of Final Radioactive Operating Licenses.
<b>Describe the emissions resulting from the change:</b>
<p>The increases in annual possession quantities for all licensed radionuclides will result in the following increases in potential unabated doses:</p> <ul style="list-style-type: none"> <li>• LB-S1 (Emission Unit 558, NOC 1641): unabated dose (all radionuclides) will increase by 9.34E-06 mrem/year, and abated dose (all radionuclides) will increase by 5.85E-09 mrem/year.</li> <li>• LB-S2 (Emission Unit 559, NOC 1642): unabated dose (all radionuclides) will increase by 1.04E-05 mrem/year, and abated dose (all radionuclides) will increase by 1.42E-09 mrem/year.</li> </ul>
<b>Describe the new applicable requirements that will apply as a result of the change:</b>
Requirements will be provided in the agency issued Final Operating Licenses.