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DOE/RL-2008-03
Revision 0

Radionuclide Air Emissions Report for the Hanford Site, Calendar Year 2007

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Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

United States Department of Energy
P.O. Box 550
Richland, Washington 99352

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Radionuclide Air Emissions Report for the Hanford Site, Calendar Year 2007

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RADIONUCLIDE AIR EMISSIONS REPORT FOR THE HANFORD SITE, CALENDAR YEAR 2007

ABSTRACT

This report documents radionuclide air emissions from the U.S. Department of Energy (DOE) Hanford Site in 2007 and the resulting highest effective dose equivalent (EDE) to a member of the public, referred to as the maximally exposed individual (MEI). The report has been prepared in compliance with the Code of Federal Regulations (CFR), Title 40, Protection of the Environment, Part 61, National Emission Standards for Hazardous Air Pollutants *(NESHAP), Subpart H, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities" and Washington Administrative Code (WAC) Chapter 246-247, "Radiation Protection–Air Emissions," as well as in accordance with the quality principles of 10 CFR 830,* Nuclear Safety Management; *DOE Order 414.1C,* Quality Assurance, *"Contractor Requirements Document"; NQA-1,* Quality Assurance Requirements for Nuclear Facility Application; *and EPA QA/R-5,* Requirements for Quality Assurance Project Plans.

Federal regulations in Subpart H of 40 CFR 61 require the measurement and reporting of radionuclides emitted from DOE facilities and the resulting public dose from those emissions. Those regulation impose a standard of 10 mrem/yr EDE, which is not to be exceeded. Washington State adopted the 40 CFR 61 standard of 10 mrem/yr EDE into their regulations that require the calculation and reporting of the EDE to the MEI from both point source emissions and from fugitive source emissions of radionuclides. WAC 246-247 further requires the reporting of radionuclide emissions, including radon, from all Hanford Site sources during routine and nonroutine operations.

The Clean Air Act Amendments of 1990 amended NESHAP regulations (i.e., 40 CFR 61 Subpart H) to govern emissions of radionuclides from DOE facilities. These regulations were intended for the measurement of point source emissions but inclusive of fugitive emissions with regard to complying with the dose standard. Thereafter, the Hanford Site, besides complying with prescriptive NESHAP point source requirements, developed methods for measuring and evaluating fugitive emissions, in accordance with a Memorandum of Understanding (DOE, 1995) between DOE and EPA, as well as estimating associated doses. Thus, dose estimates from fugitive emissions have been included when determining the state of Hanford Site compliance with the 10 mrem/yr EDE dose standard in 40 CFR Part 61 Subpart H adopted by reference in WAC 246-247.

The EDE to the Hanford Site MEI due to routine and nonroutine emissions in 2007 from Hanford Site point sources was 0.13 mrem (0.0013 mSv). The EDE from fugitive emissions at the Hanford Site in 2007 was 3.9 E–03 mrem (3.9 E–05 mSv). The contribution from radon emissions in 2007 was 4.6 E–03 mrem (4.6 E–05 mSv). The total radiological dose for 2007 to the MEI from all Hanford Site radionuclide emissions, including radon, was 0.14 mrem (0.0014 mSv), or 1.4 percent of the federal and state standard of 10 mrem/yr, to which the Hanford Site was in compliance.

The portions of the Hanford Site MEI dose attributable to individual point sources, as listed in Section 2.0, are appropriate for demonstrating the compliance status of abated stack emissions with applicable terms of the Hanford Site Air Operating Permit and of Notices of Construction.

For further information concerning this report, you may contact Ms. Mary F. Jarvis, of the DOE-Richland Operations Office, by telephone at (509) 376-2256 or by e-mail at Mary_F_Jarvis@rl.gov.

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CERTIFICATION OF DOE/RL-2008-03,
RADIONUCLIDE AIR EMISSIONS REPORT
FOR THE HANFORD SITE , CALENDAR YEAR 2007

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

D. A. Brockman, Manager U.S. Department of Energy Richland Operations Office	Date

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TERMS

ALE	Fitzner Eberhardt Arid Lands Ecology Reserve
AOP	Hanford Site Air Operating Permit
BNI	Bechtel National, Inc.
Bq	becquerel
CAM	continuous air monitor
CAP-88	Clean Air Act Assessment Package 1988
CAP88-PC	Clean Air Act Assessment Package 1988-Personal Computer
CFR	Code of Federal Regulations
CH2M HILL	CH2M HILL Hanford Group, Inc.
Ci	curie
CSB	Canister Storage Building
CVDF	Cold Vacuum Drying Facility
CWC	Central Waste Complex
D&D	decontamination and decommissioning
DCRT	double-contained receiver tank
DOE	U.S. Department of Energy
DOE-RL	U.S. Department of Energy-Richland Operations Office
DOE-ORP	U.S. Department of Energy-Office of River Protection
DOE-PNSO	U.S. Department of Energy-Pacific Northwest Site Office
DST	double-shell tank
EDE	effective dose equivalent
EDP	electronic data processing
ENCGS	Energy Northwest Columbia Generating Station
EPA	U.S. Environmental Protection Agency
ERC	Environmental Restoration Contract
ERDF	Environmental Restoration Disposal Facility
ETF	200 Area Effluent Treatment Facility
FF-01	*Department of Energy Hanford Site Air Emissions License #FF-01*
FH	Fluor Hanford
FFCA	*Federal Facilities Compliance Agreement*
FFTF	Fast Flux Test Facility
FSS	fuel supply shutdown
GTF	Grout Treatment Facility
HEPA	high-efficiency particulate air
HT	elemental tritium
HTO	tritiated water
HVAC	heating, ventilation, and air conditioning
ISS	interim safe storage
IWTS	Integrated Water Treatment System
LAW	Low-Activity Waste
LLBG	Low-Level Burial Ground
LIGO	Laser Interferometer Gravitational Wave Observatory

TERMS (cont)

major	a radioactive point source having a radiological dose potential of greater than 0.1 mrem/yr effective dose equivalent after all pollution-control equipment has been removed but operations are otherwise routine
MASF	Maintenance and Storage Facility
MCO	multi-pack canister overpack
MEI	maximally exposed individual
minor	a radioactive point source having a radiological dose potential of less than or equal to 0.1 mrem/yr effective dose equivalent after all pollution-control equipment has been removed but are operations otherwise routine
mrem	millirem [i.e., 1×10^{-3} rem]
NA	not applicable
ND	not detected
NDA	nondestructive analysis
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NF	not factored
NFM	Near-Facility Monitoring
NOC	notice of construction
PFP	Plutonium Finishing Plant
PHMC	Project Hanford Management Contract
PNNL	Pacific Northwest National Laboratory
PTRAEU	portable temporary radioactive air emission unit
PUREX	plutonium-uranium extraction
QA	quality assurance
RCC	River Corridor Closure Project
RCRA	*Resource Conservation and Recovery Act*
REDOX	reduction-oxidation
rem	roentgen equivalent man
RMCS	rotary mode core sampler
RPP	River Protection Project
RSB	Reactor Service Building
SNM	special nuclear materials
SST	single-shell tank
TRU	transuranic
UO_3 Plant	Uranium-Trioxide Plant
WAC	Washington Administrative Code
WCH	Washington Closure Hanford, LLC
WESF	Waste Encapsulation and Storage Facility
WDOH	Washington State Department of Health
WIPP	Waste Isolation Pilot Plant

TERMS (cont)

WRAP	Waste Receiving and Processing Facility
WSCF	Waste Sampling and Characterization Facility
WSU	Washington State University
WTP	Hanford Tank Waste Treatment and Immobilization Plant

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1.0 INTRODUCTION

This report documents radionuclide air emissions from the U.S. Department of Energy (DOE) Hanford Site in 2007, and the resulting effective dose equivalent (EDE) to the maximally exposed individual (MEI) member of the public. The report complies with reporting requirements in the Code of Federal Regulations (CFR), Title 40, Protection of the Environment, Part 61, *National Emission Standards for Hazardous Air Pollutants,* Subpart H, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities" and in the Washington Administrative Code (WAC) Chapter 246-247, "Radiation Protection — Air Emissions." The report also is in accord with the quality principles of 10 CFR 830, *Nuclear Safety Management;* DOE Order 414.1C, *Quality Assurance;* NQA-1, *Quality Assurance Requirements for Nuclear Facility Application;* and EPA QA/R-5, *Requirements for Quality Assurance Project Plans.*

1.1 HANFORD SITE DESCRIPTION

The Hanford Site (refer to Figure 1-1) is located in a rural region of southeastern Washington State, occupying an area of about 586 mi^2 (1,518 km^2). It lies about 200 mi (320 km) northeast of Portland, Oregon; 170 mi (270 km) southeast of Seattle, Washington; and 124 mi (200 km) southwest of Spokane, Washington. More in-depth discussions on the characteristics and activities at the Hanford Site are available in the *Hanford Site National Environmental Policy Act (NEPA) Characterization* (PNNL-6415, Rev 18) and the *Hanford Site Environmental Report for Calendar Year 2007* (PNNL-17603).

1.1.1 Historical Background

In 1943, the federal government acquired the land that became the Hanford Site, where facilities were constructed and operated as part of the atomic weapons program, which began during World War II. For more than 40 years, most facilities at the Hanford Site were dedicated to operations that produced plutonium for national defense and to managing the radioactive and chemical wastes generated from those production processes. In more recent years, defense programs have essentially ceased while new programs have emerged. New programs include the major efforts to clean up contamination in the environment and facilities resulting from past operational practices and the research and development of new and improved waste disposal technologies. Presently, three DOE Offices manage the programs at the Hanford Site. They are the DOE-Richland Operations Office (DOE-RL), the DOE Office of River Protection (DOE-ORP), and the DOE-Pacific NW Site Office (PNSO).

1.1.2 Main Areas, Facilities, and Activities

Five main operational areas at the Hanford Site generated radionuclide air emissions in 2007: the 100, 200, 300, 400, and 600 Areas (refer to Figure 1-1). The 100 Areas have the two 100-K Spent Fuel Storage Basins, the Cold Vacuum Drying Facility (CVDF), and nine deactivated production reactors with support facilities, all located near the Columbia River. The 200 Areas are located on a plateau approximately 21.5 mi (34.7 km) northwest of the City of Richland and 7 mi (11.3 km) from the Columbia River. Facilities in the 200 East Area include the Single-Shell and Double-Shell Tank Farms, Canister Storage Building (CSB), Waste Encapsulation and Storage Facility (WESF), Plutonium Uranium-Extraction (PUREX) Facility, B Plant Complex, Waste Treatment and Immobilization Plant (WTP), 242-A Evaporator, 200 Area Effluent Treatment Facility (ETF), Low-Level Burial Grounds, and the U.S. Ecology Low-Level Burial Site. In the 200 West Area are the Plutonium Finishing Plant (PFP), Uranium-Trioxide (UO_3) Plant, Single-Shell and Double-Shell Tank Farms, T Plant Complex, U Plant,

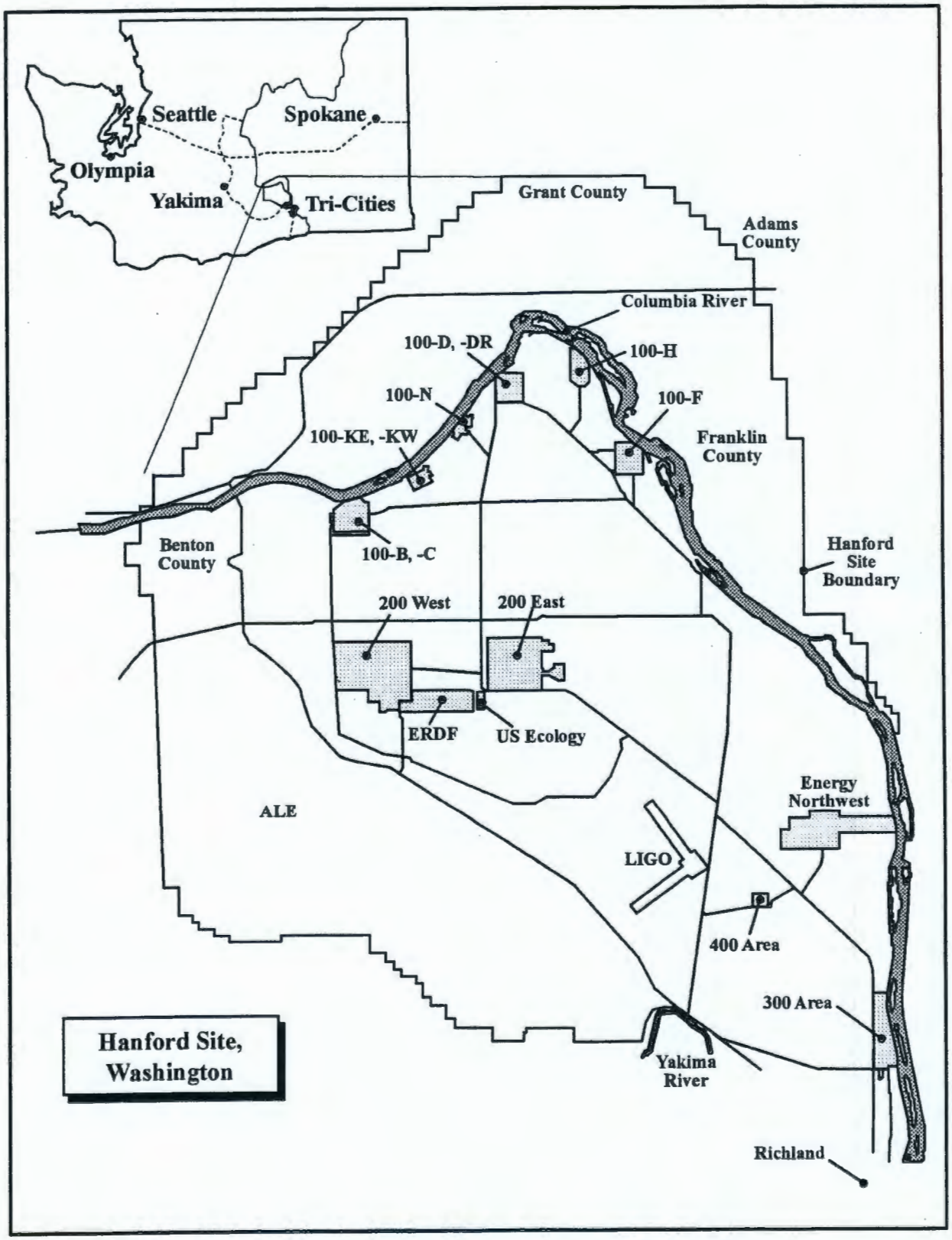

Figure 1-1. Hanford Site Map

Reduction-Oxidation Plant (REDOX), 222-S Laboratory, Central Waste Complex (CWC), Waste Receiving and Processing (WRAP) Facility, and Low-Level Burial Grounds (LLBG). The 300 Area, just north of the City of Richland, has research and development laboratories and some of the remaining deactivated N Reactor Fuel Fabrication Facilities. The 400 Area has the retired Fast Flux Test Facility (FFTF), 8 mi (12.9 km) north of the City of Richland. The 600 Area has the Environmental Restoration Disposal Facility (ERDF) and the Waste Sampling and Characterization Facility (WSCF); both facilities are immediately east of the 200 West Area.

Notable events in calendar year 2007 relevant to radioactive airborne emissions monitoring and reporting are summarized as follows:

- Environmental restoration activities continued along the river in the 100 and 300 Areas of the Hanford Site. Contaminated soil and debris from inactive waste sites were excavated, transported, and disposed of at ERDF as well as at other appropriate locations. Activities were conducted in the 100 Areas toward placing the reactors in interim safe storage (ISS) pending final disposition, which includes decontamination and decommissioning of those facilities as well as ancillary facilities. Several facilities in the 300 Area were also decontaminated, decommissioned, and demolished.
- On July 27, 2007, approximately 85 gallons of radioactive tank waste spilled onto the ground in the vicinity of the 241-S-102 retrieval pump discharge, in the 200 West Area, as tank waste was being retrieved from the 241-S-102 Tank. At the time of the incident, a new retrieval pump was in use, which had clogged. In an attempt to unclog the pump, it was run in reverse, which created back pressure that forced waste into a water line that supplied water to the pump. The waste leaked from the water supply line to the ground. The spill was eventually cleaned up, and no measurable increases in radiological concentrations were detected in samples collected by nearby ambient air monitors and by additional ambient air monitors placed close to the spilled waste.
- Significant amounts of waste were removed from some single-shell tanks in the 200 Area Tank Farms and transferred to the double-shell tank system.
- BNI continued construction of WTP. Four major facilities are being constructed: the Pretreatment Facility, the High-Level Waste Vitrification Facility, the Low-Activity Waste Vitrification Facility, and the Analytical Laboratory. Through 2007, WTP has received no radioactive material; thus, no radioactive airborne emissions were released as a result of construction in 2007.
- The 200 Area Interim Storage Area continued storing spent fuel from non-defense production reactors in a dry-cask storage system.
- The PFP 296-Z-3 major stack was permanently deactivated and demolished under the CERCLA above-grade action. Other CERCLA deactivation work continued at PFP facilities.
- PNNL permanently shut down two of its stacks in the 300 Area: EP-323-01-S and EP-3730-01-S at the 323 Mechanical Properties Laboratory and 3730 Gamma Irradiation Facility, respectively.
- The 200 Area ETF continued treating radioactive-hazardous aqueous waste.
- The 242-A Evaporator continued its operational campaign to evaporate excess liquid from the double-shell tank waste system.
- The 222-S Laboratory continued characterizing tank waste and supporting Hanford operational and remediation projects.
- WSCF analyzed large numbers of effluent, environmental, and groundwater samples.
- Decommissioning of FFTF continued.

1.1.3 Prime Contractors

The DOE-RL prime contractors, along with their management responsibilities, are briefly described in this section.

- **Washington Closure Hanford, LLC.** Washington Closure Hanford, LLC (WCH), manages the River Corridor Closure Project (RCC), for DOE-RL. The scope of work includes surveillance and maintenance of inactive past-practice waste sites and of inactive facilities; remediation of past-practice waste sites; closure of Resource Conservation and Recovery Act land-based treatment, storage, and disposal units; and deactivation, decontamination, decommissioning, and demolition of facilities.

- **Fluor Hanford.** Fluor Hanford (FH) manages the Project Hanford Management Contract (PHMC) for DOE-RL. FH has responsibility for facilities such as 100-K Area Spent Fuel Storage Basins, Cold Vacuum Drying Facility, Canister Storage Building, PFP, FFTF, CWC, LLBG, WSCF, and T Plant Complex. FH monitors liquid effluents and air emissions, performs environmental surveillance near DOE facilities managed by CH2M HILL, FH, and WCH. FH has the responsibility for the surveillance and maintenance of inactive facilities on the Central Plateau, such as the PUREX Facility, B Plant Complex, REDOX, U Plant, and the 209-E Building. FH also has responsibility for groundwater project management, sitewide drilling management, contaminated groundwater remediation, and the environmental remediation, decontamination, and decommissioning of facilities on the Central Plateau in the 200 Areas. Additionally, FH provides Hanford Site support services, such as fire protection, central stores, distribution of electrical power, and generation of steam heat.

The DOE-ORP prime contractors at the Hanford Site are identified next, along with their management responsibilities and the facilities they oversee that have or have had radionuclide air emissions.

- **Bechtel National, Inc.** The mission of Bechtel National, Inc. (BNI) is to design, build, and commission the Hanford Tank Waste Treatment and Immobilization Plant to vitrify the tank waste at the Hanford Site. This project includes a pretreatment facility to separate the tank waste into high-level radioactive and low-activity radioactive streams. The High-Level Vitrification Facility and the Low-Level Vitrification Facility both will immobilize the waste in a glass form encased in canisters.

- **CH2M HILL Hanford Group, Inc.** CH2M HILL Hanford Group, Inc. (CH2M HILL) manages the Tank Farms Contract for DOE-ORP. CH2M HILL has responsibility for storing and retrieving for treatment approximately 54 million gallons of highly radioactive and hazardous waste stored in 177 underground tanks. The company's role includes characterizing the waste and delivering it to an under-construction vitrification facility, where the waste will be converted into a glass-like substance for permanent disposal. CH2M HILL will continue to be responsible for storage of the treated waste until permanent disposal facilities are available.

The DOE-PNSO prime contractor at the Hanford Site is identified next, along with its management responsibilities and the facilities it oversees that have or have had radionuclide air emissions.

- **Battelle Memorial Institute.** Battelle Memorial Institute operates the Pacific Northwest National Laboratory (PNNL) for PNSO. PNNL does research and development in the physical, chemical, life, and environmental sciences; produces advanced methods of nuclear waste management; and conducts environmental monitoring on and off the Hanford Site and liquid effluent and air emission monitoring at the DOE facilities it manages.

Some privately and publicly owned facilities capable of generating airborne radioactive emissions are located at or near the Hanford Site. These facilities include 1) a low-level waste burial site operated by U.S. Ecology on the 200 Area plateau, 2) the Energy Northwest Columbia Generating Station commercial nuclear reactor and office buildings, near the Columbia River, north of the 300 Area and east of the 400 Area, 3) the Severn Trent laboratory south of the 300 Area, 4) the AREVA Federal Services LLC fuel fabrication facility, adjacent to the Hanford Site southern boundary, 5) Perma-Fix Northwest, Inc., adjacent to the east side of the AREVA Federal Services LLC, 6) Interstate Nuclear Services, located 1 mi (1.6 km) south of the southern boundary of the Hanford Site, and 7) Battelle's research laboratories in north Richland. Emissions from these facilities are not included in this report because they are not regulated as part of the Hanford Site.

1.2 POINT SOURCE DESCRIPTIONS

This section includes descriptions of point sources. A point source is reported in this document if it met the following four criteria during 2007: 1) required continuous monitoring or periodic confirmatory measurements in accordance with 40 CFR 61, Subpart H, and with WAC 246-247, 2) was described in the *Department of Energy Hanford Site Air Emissions License #FF-01* (FF-01)FF-01, 3) emitted or had the potential to emit radionuclides, and 4) effluent sampling was the monitoring method used. Point sources not included in the certified sections of this report did not meet all four criteria.

Air emissions from other sources of radioactive materials are reported in Sections 4.0, 5.3, and 5.4. Emissions from those sources were estimated using methods described in Section 4.0.

1.2.1 General Description and Reporting Criteria

Radionuclide air emissions from point sources generally are discharged from stacks and vents (from this point forward, *stack* implies vent as well, unless vent is used as the proper name or description of a point source). Stack sizes, shapes, and discharge paths vary because of facility requirements at the time of construction. Discharge heights range from nearly ground level to 200 ft (61 m), and flow rates range from less than 100 ft^3/min (0.047 m^3/s) to 290,000 ft^3/min (137 m^3/s). Stacks vary in design from horizontal to vertical, rectangular to cylindrical, actively to passively ventilated, and permanent to portable.

A point source is designated "major" when hypothetically in the absence of all pollution control equipment its potential maximum emissions can cause a dose greater than 0.1 mrem/yr EDE to the nearest member of the public not employed by DOE or its contractors associated with the Hanford Site and who lives near and/or has unrestricted access to a place of employment on the Hanford Site. A point source is "minor" when under the same hypothetical conditions its potential maximum emissions in the absence of all pollution control equipment cannot cause a dose greater than 0.1 mrem/yr EDE.

The following emission abatement methods were used singly or in combination to remove radioactive constituents from most stack emissions during 2007: 1) high-efficiency particulate air (HEPA) filters, 2) sand filters, 3) deep-bed fiberglass filters, 4) fiberglass prefilters, and 5) charcoal adsorbers. Generally, from one to three stages of HEPA filtration were used as the final particulate-removal method before an air emission stream was exhausted to the atmosphere.

1.2.2 100 Areas Facilities

The 100 Areas contain nine inactive production reactors and their associated support facilities. Many of the reactors have been placed in ISS and many associated support facilities demolished. The only point

sources of radionuclide air emissions are at facilities in the 100-K and 100-N Areas. Those point sources are briefly described below and their locations illustrated in Figure 1-2.

1.2.2.1 100-N Area

The 100-N Area contains the inactive N Reactor and ancillary facilities.

107-N This minor CERCLA–regulated stack exhausted filtered air from activities conducted to decontaminate and decommission the inactive 107-N Basin Recirculation Facility. Particulate emissions were sampled.

1.2.2.2 100-K East and West Areas

Located in these areas are two retired reactors awaiting decommissioning, two storage basins that previously stored irradiated nuclear fuel under water, a radiological analysis laboratory, and the Cold Vacuum Drying Facility.

105-KE Three minor vents exhausted unfiltered air from the spent fuel storage basin in the 105-KE Building. Particulate radionuclides were sampled from each of these minor (i.e., potential of less than or equal to 0.1 mrem/yr effective dose equivalent [EDE] potential to emit) air emission streams.

105-KW Three minor vents exhausted unfiltered air from the spent fuel storage basin in the 105-KW Building. Particulate radionuclides were sampled from each these minor air emission streams.

1706-KE This minor stack exhausted filtered air from the 1706-KE Laboratory. Particulate emissions were sampled.

296-K-142 This major (i.e., greater than 0.1 mrem/yr EDE potential to emit) stack exhausted filtered air from CVDF. Particulate emissions were sampled.

100-KW Air Sparging Vent. Air from the work area of the 105-KW Integrated Water Treatment System (IWTS) passively moves through this major vent, equipped with a single HEPA filter. During backwashing of system filters, radionuclides may become airborne and captured on the HEPA filter, which is destructively analyzed either quarterly if the air sparger was operated or annually if not.

1.2.3 200 East Area Facilities

The 200 East Area contains facilities for chemical separations, reprocessing, and waste handling and disposal. Locations of radionuclide air emission discharge points in the 200 East Area are illustrated in Figure 1-3. The majority of radionuclides discharged from the 200 Areas are in particulate form. The PUREX Plant and Tank Farm evaporator facilities may still discharge a volatile radionuclide, ^{129}I.

1.2.3.1 Plutonium-Uranium Extraction Facility

The PUREX Facility was deactivated in June 1997.

291-A-1 This major stack exhausted filtered air from the canyon (cells A through M) and vessel and condenser vents. Emissions were sampled for particulate radionuclides and volatile ^{129}I.

296-A-10 This minor stack exhausted filtered air from Storage Tunnel No. 2. This stack has not operated since 1996. When it did operate, particulate emissions were sampled.

1.2.3.2 B Plant Complex

The B Plant Complex separated plutonium from spent nuclear fuel, but its operations were later reconfigured to remove ^{90}Sr and ^{137}Cs from high-level liquid waste. The main canyon building, 221-B, contains radioactive contamination from various production campaigns. The B Plant Complex, excluding WESF, was deactivated in 1998.

296-B-1 This major stack, the replacement B Plant main stack, exhausted filtered air from the main canyon and process cells in the 221-B Building, from the process cell in the 212-B Building, and from the 224-B Building via the vessel vent. Particulate emissions were sampled.

1.2.3.3 Waste Encapsulation and Storage Facility

At WESF, ^{90}Sr and ^{137}Cs from waste separations material were converted to solid strontium fluoride and cesium chloride, respectively. Those cesium and strontium compounds were separately double-encapsulated and placed in water-filled storage basins at WESF. The current mission for WESF is to continue storing these radioactive capsules.

296-B-10 This major stack exhausted filtered air from the 225-B Building. Particulate emissions were sampled.

1.2.3.4 200 East Area Tank Farms

Radioactive waste stored in Tank Farms consists of sludge and saltcake in single-shell tanks (SSTs) and liquid in double-shell tanks (DSTs).

296-A-18 This minor stack exhausted filtered air from the 241-AY-101 Tank annulus. Particulate emissions were sampled.

296-A-19 This minor stack exhausted filtered air from the 241-AY-102 Tank annulus. Particulate emissions were sampled.

296-A-20 This minor stack exhausted filtered air from the 241-AZ-101 and -102 Tank annuli. Particulate emissions were sampled.

296-A-26 This minor stack did not operate in 2007. When in use, it exhausts filtered air from the waste unloading room and sump tank at the 204-AR Waste Unloading Station.

296-A-27 This minor stack exhausted filtered air from the 241-AW tanks. Particulate emissions were sampled.

296-A-28 This minor stack exhausted filtered air from the tank annuli in the 241-AW Tank Farm. Particulate emissions were sampled.

296-A-29 This minor stack exhausted filtered air from the 241-AN tanks. Particulate emissions were sampled.

296-A-30 This minor stack exhausted filtered air from the tank annuli in the 241-AN Tank Farm. Particulate emissions were sampled.

296-A-40 This minor stack exhausted filtered air from the 241-AP tanks. Particulate emissions were sampled.

296-A-41 This minor stack exhausted filtered air from the tank annuli in the 241-AP Tank Farm. Particulate emissions were sampled.

296-A-42 This major stack exhausted filtered air from the tanks in the 241-AY and 241-AZ Tank Farms. Particulate and volatile radionuclide emissions were sampled.

296-A-43 This minor stack exhausted filtered building ventilation air from the 702-AZ Building. Particulate emissions were sampled.

296-P-45 This portable exhauster functioned as a minor point source in 2007, evaporating the ER-311. Particulate emissions were sampled.

296-P-47 This major stack, a portable exhauster, exhausted filtered air from the 241-C-108 and -109 Tanks to retrieve tank contents in support of activities leading to final tank closure. Particulate emissions were sampled.

296-P-48 This major stack, a portable exhauster, did not operate in 2007. When in use, it exhausts filtered air from the 241-C-200 tanks during work to retrieve much of the remaining tank contents.

1.2.3.5 242-A Evaporator

The 242-A Evaporator operated in 2007 to remove liquid from Double-Shell Tank liquid mixed waste, resulting in a more concentrated waste stream, which was transferred back to the Tank Farms.

296-A-21 This minor stack exhausted filtered air from the 242-A Building. Particulate emissions were sampled.

296-A-22 This minor stack exhausted filtered air from the 242-A Evaporator vessel ventilation system. Particulate emissions were sampled.

1.2.3.6 200 Area Effluent Treatment Facility

ETF treats mixed aqueous waste streams prior to their disposal at the State-Approved Land Disposal Site, also designated as the 616-A Crib.

296-E-1 This minor stack exhausted filtered air from the 2025-E Building and ETF processing vents. Particulate emissions were sampled.

1.2.3.7 Canister Storage Building

This facility stores irradiated fuel from the 100-K Spent Fuel Storage Basins. The fuel is contained in specially engineered canisters housed in storage tubes within the facility. Before the fuel was received at CSB, it passed through the Cold Vacuum Drying Facility (CVDF), where it was dried and packaged in the canisters for shipment.

296-H-212 This major stack exhausted filtered air from the 212-H Building. Particulate emissions were sampled.

1.2.3.8 209-E Critical Mass Laboratory

This shut-down facility originally had been used for testing critical mass configurations, but has been in a surveillance-and-maintenance mode for years.

296-P-31 This major stack exhausted filtered building ventilation air from the 209-E Facility. Particulate emissions were sampled. (Note: Refer to Appendix B for further information on the status of this stack in 2006.)

1.2.4 200 West Area Facilities

The 200 West Area contains facilities for laboratory analysis; chemical separations and processing; and waste handling and disposal. Locations of radionuclide air emission discharge points in the 200 West Area are illustrated in Figure 1-4.

1.2.4.1 Reduction-Oxidation Plant

REDOX also is known as the 202-S Building and as S Plant. REDOX operated as a fuel reprocessing facility until it was shut down in 1967.

291-S-1 The REDOX main stack exhausted filtered air from the REDOX canyon. Particulate emissions were sampled from this minor stack.

1.2.4.2 T Plant Complex

The T Plant Complex consists of two main structures: the 221-T Building and the 2706-T Building. The 221-T Building is one of the original fuel-processing facilities. The last fuel processed there was in 1956. The 221-T Building and the 2706-T Building are now used for the treatment, storage, repackaging, sampling, and verification of waste containers. Liquid waste was treated and stored in tank systems and radioactively contaminated equipment decontaminated in both structures.

291-T-1 This major stack exhausted filtered air from the 221-T canyon, 224-T process cells, and process ventilation system. Particulate emissions were sampled.

296-T-7 This minor stack exhausted HEPA-filtered air from the 2706-T and 2706-TA Buildings when decontamination, treatment, storage, sampling, etc., activities were performed or other activities were underway that had the potential to increase airborne radionuclide contamination; otherwise, the stack does not operate. Particulate emissions were sampled.

1.2.4.3 U Plant

U Plant was constructed as a fuel reprocessing plant but never used for that purpose. Instead, it was used to recover uranium from bismuth-phosphate waste and high-level radioactive wastes from Tank Farms. U Plant is now a retired facility.

291-U-1 This minor stack exhausted filtered air from the 221-U canyon ventilation system. Particulate emissions were sampled.

1.2.4.4 Plutonium Finishing Plant

PFP was constructed to produce plutonium metal from plutonium nitrate received from the PUREX Facility. PFP also recovered plutonium, in the form of plutonium nitrate, from plutonium scrap. The current mission for PFP is to maintain a safe and compliant facility, safely and securely store SNM, stabilize nuclear materials for long-term storage, and conduct clean-up activities.

291-Z-1 This major stack exhausted filtered air from the 234-5Z, 236-Z, and 242-Z Buildings. Particulate emissions were sampled.

296-Z-3 This major stack, regulated under CERCLA, was permanently shut down on March 19, 2007, and demolished along with the 241-Z Building. When it operated, it exhausted filtered air from the 241-Z Vault sump and vessel ventilation system. Particulate emissions were sampled.

296-Z-5 This minor stack exhausted filtered air from the 2736-ZB Building, used for shipping and receiving. Particulate emissions were sampled.

296-Z-6 This minor stack exhausted filtered air from the 2736-Z Building and its plutonium storage vault ventilation system. Particulate emissions were sampled.

296-Z-7 This major stack exhausted filtered air from the 2736-ZB Building, in which stabilization and packaging activities were conducted. Particulate emissions were sampled.

296-Z-15 This minor stack, regulated under CERCLA, exhausted filtered air from the 243-Z Liquid Low-Level Waste Treatment Facility. Particulate emissions were sampled.

1.2.4.5 200 West Area Tank Farms

These tank farms hold high-level radioactive waste, consisting of sludge and saltcake in SSTs and liquid and slurry in DSTs.

296-P-22 This minor stack exhausted filtered air from annuli in the 241-SY-101, -102, and -103 Tanks. Particulate emissions were sampled.

296-P-43 This major stack, a portable exhauster, exhausted filtered air from the 241-S-112 tank. Particulate emissions were sampled.

296-P-44 This major stack, a portable exhauster, exhausted filtered air from Tank 241-S-102. Particulate emissions were sampled.

296-S-15 This minor stack did not operate in 2007. When in use, it exhausts filtered air from the 241-SX-101 through -112 and 241-SX-114 tanks.

296-S-25 and alternate 296-P-23 These minor stacks exhausted filtered air from the 241-SY-101, -102, and -103 Tanks. Operation of these two stacks alternates between "A" train, which uses 296-S-25, and "B" train, which uses 296-P-23. Exhaust-system operations for these tanks alternate between the two stacks. Particulate emissions were sampled.

1.2.4.6 200 West Area Evaporators

Two evaporators are in the 200 West Area: the 242-S Evaporator-Crystallizer Building and the 242-T Evaporator-Crystallizer Building. Both of these evaporators were shut down in the early 1980s. The evaporators were designed to remove most of the water from radioactive liquid waste, with the resulting slurry then rerouted to the Tank Farms for interim storage.

296-S-18 This minor stack exhausted filtered air from the 242-S Evaporator-Crystallizer Building. Particulate emissions were sampled.

296-T-17 This minor stack did not operate in 2007. When in use, it exhausts filtered air from the 242-T Evaporator-Crystallizer Building and cold-cell ventilation system.

1.2.4.7 222-S Laboratory

The 222-S Laboratory provides chemical and radiochemical analytical support for Tank Farm waste characterization, research and development, environmental sample analysis, and Hanford operation and remediation projects.

296-S-16 This minor stack exhausted filtered air from the 219-S Building waste tanks. Particulate emissions were sampled.

296-S-21 This major stack exhausted filtered air from 222-S Laboratory hoods, gloveboxes, hot-cells, and room ventilation system. Particulate emissions were sampled.

296-S-23 This minor stack exhausted filtered air from the 219-S Tank System Sample Gallery Hood. To verify low emissions from this stack, nondestructive analysis of the primary HEPA filter is performed every two years (refer to Table 5-3 for analysis results).

1.2.4.8 Waste Verification and Sampling Facility

The contents of drums received from generators used to be verified at this facility, which was transferred to West Tank Farms in 1995.

296-W-3 This minor stack did not operate in 2007, and is not expected to operate again (it has not operated since 1997). When in use, it exhausted filtered air from the 213-W Building.

1.2.4.9 Waste Receiving and Processing Facility

WRAP is used for examining, assaying, characterizing, and repackaging waste, principally transuranic (TRU) waste.

296-W-4 This major stack exhausted filtered air from WRAP. Particulate emissions were sampled.

1.2.5 300 Area Facilities

The 300 Area consists primarily of laboratories, research facilities, a radioactive liquid waste handling facility, and several inactive facilities associated with prior Hanford Site missions. Locations of emission points in the 300 Area are illustrated in Figure 1-5.

1.2.5.1 340 Complex

Within the 340 Complex is the 340-A Building, which contains six aboveground tanks that had been used to temporarily store liquid mixed waste. Those tanks have been flushed and are currently empty. The 340-B Building was used for the railcar loadout of liquid mixed waste and has been shut down since 1998. The 340-B Building is currently used to temporarily store nonradioactive and radioactive solid waste. The 340 Vault houses two tanks, which have been emptied to the maximum extent practical. Operations within the vaults have permanently ceased.

340-NT-EX This minor stack exhausted filtered air from the 340 Building vault, the 340 Building vault tanks, the 340-A Building aboveground storage tanks, and the associated piping system. Particulate emissions were sampled.

340-B This minor stack did not operate in 2007. When last operated in 1998, it exhausted filtered air from the east portion of the 340-B Building.

340-DECON This minor stack exhausted filtered air from the 340 Building Decon Room. Particulate emissions were sampled.

1.2.5.2 318 Radiological Calibrations Laboratory

The building contains areas for calibrating radiation survey instruments and processing personnel dosimeters.

EP-318-01-S This minor stack exhausted emissions from a single fume hood. Particulate emissions were sampled.

1.2.5.3 320 Analytical and Nuclear Research Laboratory

The building contains environmental radiochemistry laboratories.

EP-320-01-S This minor stack exhausted filtered building ventilation air. Particulate emissions were sampled.

EP-320-02-S This minor stack exhausted emissions from a filtered chemistry hood. Particulate emissions were sampled.

EP-320-04-S This minor stack exhausted emissions from filtered chemistry hoods. Particulate emissions were sampled.

1.2.5.4 323 Mechanical Properties Laboratory

The building contains areas for investigating structural properties of irradiated materials.

EP-323-01-S On September 11, 2007, this minor stack was physically capped, electrical lines lifted and gaped, and all HEPA filters removed and ductwork capped. When operated in 2007 prior to these actions, the stack exhausted filtered building ventilation air and particulate emissions were sampled.

1.2.5.5 324 Waste Technology Engineering Laboratory

The building contains laboratories that were used for chemical and process development activities, and is now undergoing clean-out and deactivation under CERCLA.

EP-324-01-S This major stack exhausted filtered building air. Particulate emissions were sampled.

1.2.5.6 325 Radiochemical Processing Laboratory

The building contains radiochemistry laboratories and hot cells used for research process development, mixed waste treatment activities, and radioanalytical services.

EP-325-01-S This major stack exhausted filtered building air. Emissions were sampled using a record particulate sampler and a tritium sampler.

1.2.5.7 326 Materials Sciences Laboratory

The building contains laboratories and equipment for studies of metallurgical, chemical, and physical behavior of reactor components, fuel materials, mixed fission products, mixed activation products, and ceramic composite materials.

EP-326-01-S This minor stack exhausted both filtered and unfiltered building air. Particulate emissions were sampled.

1.2.5.8 327 Post-Irradiation Testing Laboratory

The building, which contains hot-cells that had been used for examining and testing irradiated materials, was undergoing clean-out and deactivation under CERCLA.

EP-327-01-S This major stack exhausted filtered building air. Emissions were sampled using a record particulate sampler.

1.2.5.9 329 Chemical Sciences Laboratory

The building contains chemistry laboratories for radioanalytical studies, environmental radionuclide studies, and radiation detection instrumentation development.

EP-329-01-S This minor stack exhausted filtered building ventilation air. Particulate emissions were sampled.

1.2.5.10 331 Life Sciences Laboratory

The building contains areas for biological and ecological research studies.

EP-331-01-V This major vent exhausted filtered building ventilation air. Particulate emissions were sampled.

1.2.5.11 3730 Gamma Irradiation Facility

The building contains a hot-cell for metallurgical studies of specimens of irradiated metals.

EP-3730-01-S On September 20, 2007, this minor stack was physically capped, electrical lines lifted and gaped, and all HEPA filters removed and ductwork capped. When operated in 2007 prior to these actions, the stack exhausted filtered building ventilation air and particulate emissions were sampled.

1.2.6 400 Area Facilities

The 400 Area consists of FFTF, the Maintenance and Storage Facility (MASF), and the Fuels Materials Examination Facility. Locations of emission points in the 400 Area are illustrated in Figure 1-7.

1.2.6.1 Fast Flux Test Facility

Deactivation of FFTF continued through 2007. Located in the 400 Area, it formally operated as a 400-megawatt thermal, sodium-cooled, low-pressure, high-temperature reactor plant, which had been constructed for irradiation testing of breeder reactor fuels and materials.

FFTF-RE-SB This minor stack, located in the Lower Reactor Service Building (RSB), exhausted unfiltered air from the lower level of the RSB. Particulate emissions were sampled.

FFTF-CB-EX This minor stack, also referred to as the Combined Exhaust, exhausted unfiltered air from the reactor containment and gases from the argon processing system. Standby particulate filters are manually dampered into the system if airborne radioactive particulate concentrations exceed administrative limits, which did not occur in 2007. Emissions were sampled using a record sampler to collect particulate radionuclides and tritium in the form of tritiated water vapor.

FFTF-HT-TR This minor stack, associated with the Heat Transport System South, exhausted ordinarily unfiltered air from portions of FFTF that are exterior to the containment. Standby particulate filters are manually dampered into the system if airborne radioactive particulate concentrations exceed administrative limits. Particulate emissions were sampled.

1.2.6.2 Maintenance and Storage Facility

MASF, or the 437 Building, is a multipurpose service center supporting the specialized maintenance and storage requirements of FFTF. MASF provides the capability for decontamination, repair, and storage of non-fueled components and hardware for FFTF.

437-MN&ST This minor stack exhausted filtered air from MASF. Particulate emissions were sampled.

437-1-61 This minor stack exhausted filtered air from MASF. Particulate emissions were sampled.

1.2.7 600 Area Facilities

In the 600 Area, WSCF emits or has the potential to emit radionuclides. For dose modeling purposes, WSCF was regarded as located in the 200 West Area because of its close proximity to the main entrance to that Area. Hence, WSCF is shown in Figure 1-4.

1.2.7.1 Waste Sampling and Characterization Facility

WSCF provides low-level radiological and chemical analyses on various types of samples and sample media. The majority of the analyzed samples are used to determine compliance with the requirements of environmental regulations and DOE Orders.

696-W-1 This minor stack exhausted filtered air from the analytical laboratory, on the main floor of the 6266 Building. Particulate emissions were sampled.

696-W-2 This minor stack exhausted filtered air from the Nuclear Spectroscopy Laboratory in the 6266 Building. Particulate emissions were sampled.

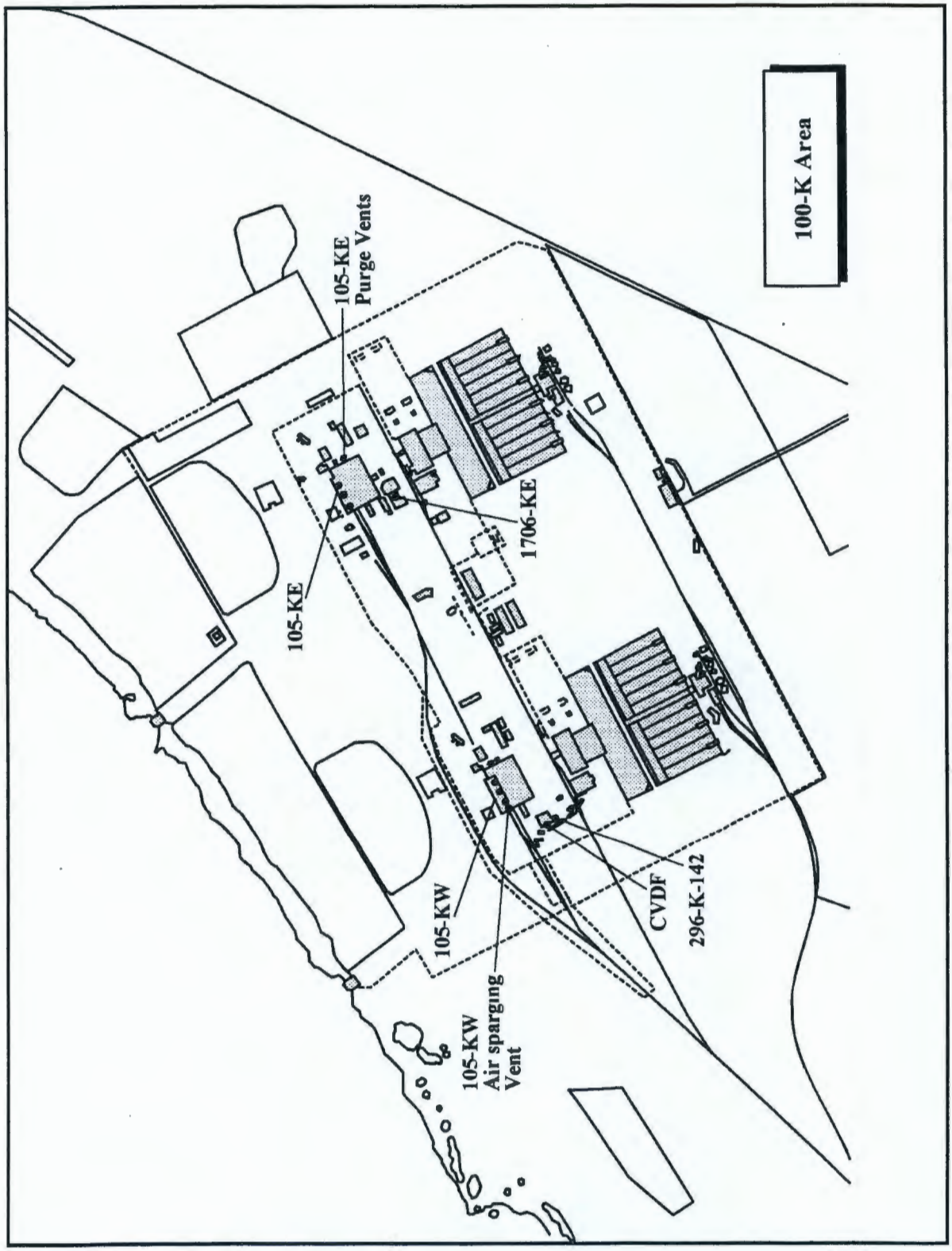

Figure 1-2. 100-K Area Radionuclide Emission Point Sources

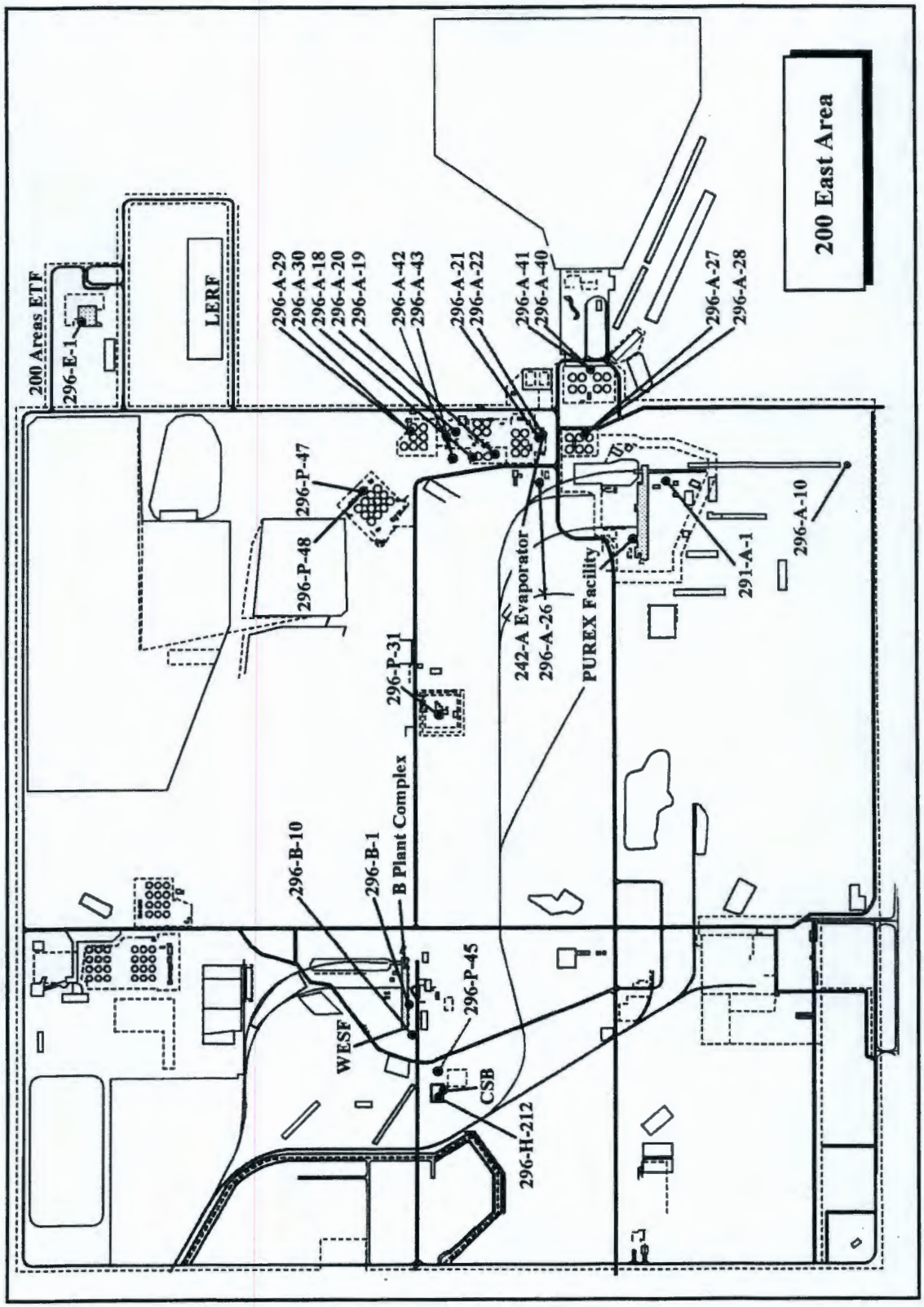

Figure 1-3. 200 East Area Radionuclide Emission Point Sources

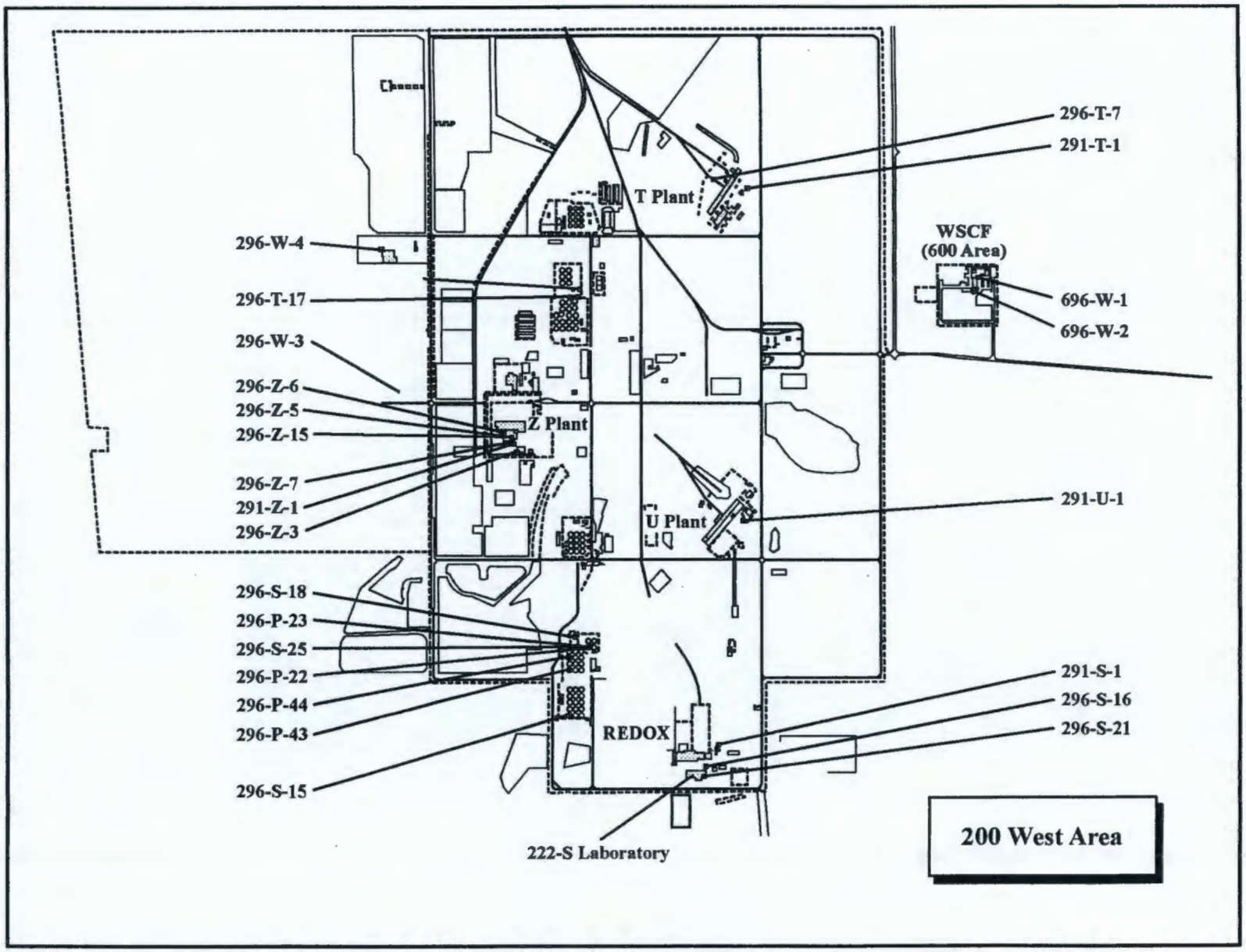

Figure 1-4. 200 West Area Radionuclide Emission Point Sources

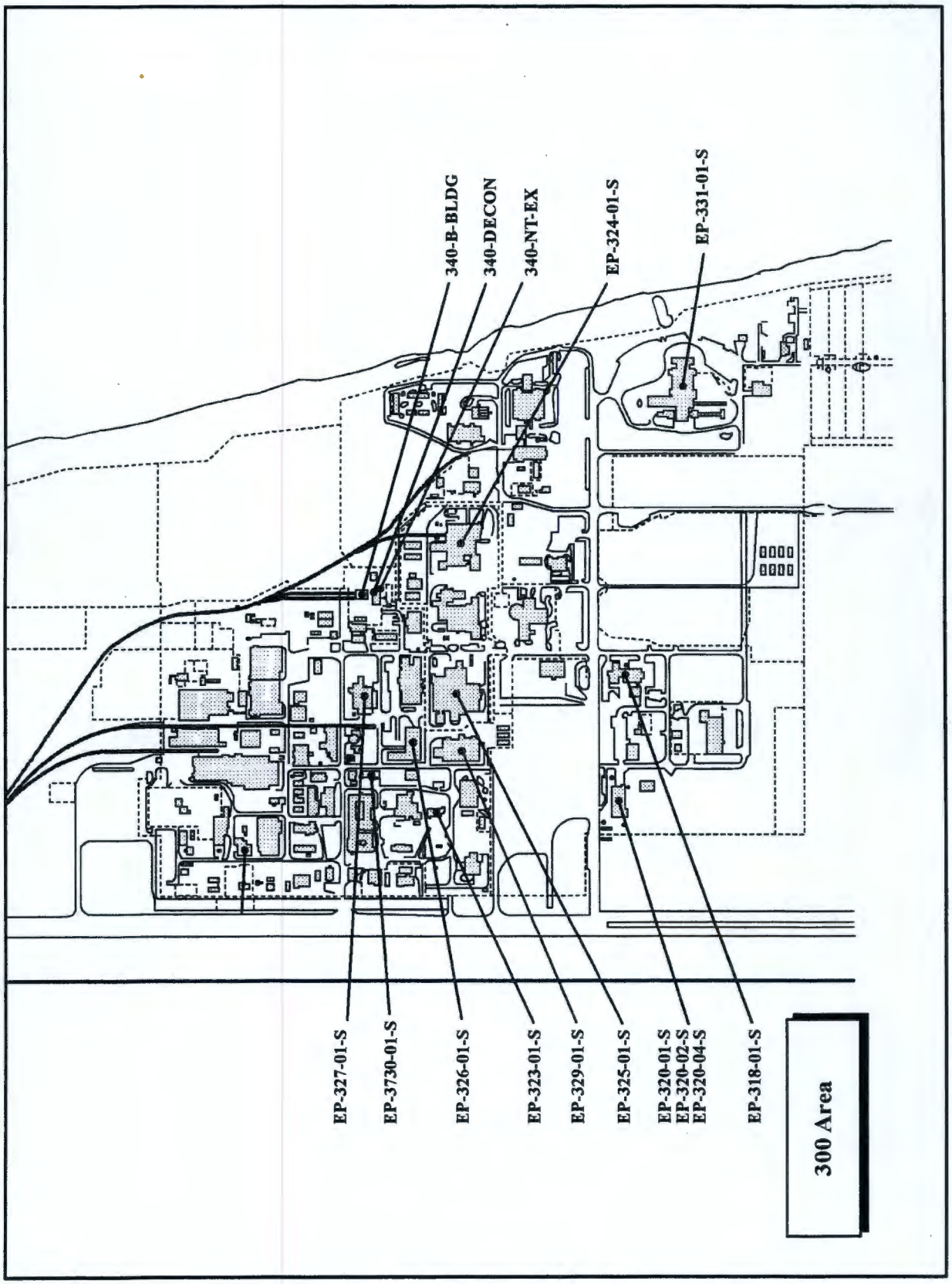

Figure 1-5. 300 Area Radionuclide Emission Point Sources

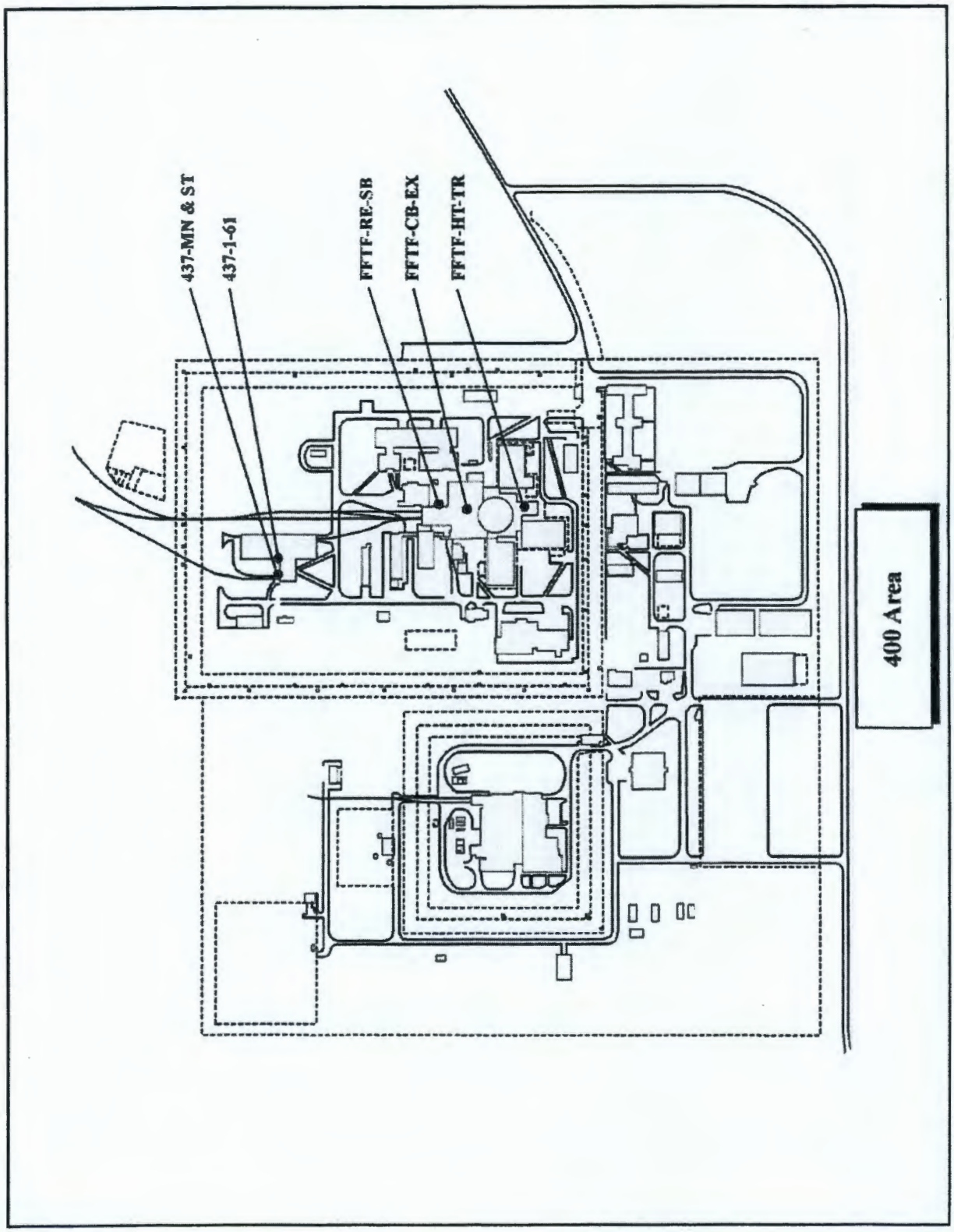

Figure 1-6. 400 Area Radionuclide Emission Point Sources

2.0 RADIONUCLIDE AIR EMISSION DATA FOR POINT SOURCES

This section presents information on point sources of radionuclide emissions at the Hanford Site. The point sources listed are actively ventilated stacks or vents, using electrically powered exhausters and from which emissions are discharged under controlled conditions. The criteria for reporting point source emissions are in Section 1.2, which also describes the basis for including an emission source and its emissions for certification in this report. Data on radionuclides emitted from point sources in 2007 are shown in Tables 2-1 and 2-2.

Tables 2-1 and 2-2 display emission data of 20 major and 46 minor point sources, respectively, that operated during 2007 other than briefly for annual testing. Several point sources listed did not operate in 2007, and among them are a few that should never operate again but have not yet been officially and permanently deactivated. The data include total releases in 2007 of radionuclides or types of radioactivity from each point source and the consequent radiological doses from those releases. Tables 2-3 and 2-4 present information on stack heights and in-place emission control devices.

Each emission point is assigned to the major operational area in which it is located (i.e., 100, 200 East, 200 West, 300, or 400 Areas), except for two minor stacks in the 600 Area. For each of the operational areas, a nearest location (e.g., dwelling, business [which can be on an unrestricted area of the Hanford Site], school, or office) relative to that area is determined for a real or hypothetical public receptor not employed by DOE or its contractors and who has the potential of receiving the maximum exposure to emissions from that area. A common distance to that nearest public receptor is applied to all the emission points within an operational area. Thus, each of the five operational areas has assigned to it a respective location of a nearest public receptor. Radioactive doses calculated for these receptors are used to determine the regulatory category of each emission point source (i.e., whether it is major or minor) as well as requisite monitoring requirements. Information on these nearest receptors is in Table 2-5, including distances to the nearest farms that produce milk, meat, and vegetables.

In contrast to the five nearest public receptors is the Hanford Site MEI, a member of the public who hypothetically receives the highest calculated radiological dose attributable to Hanford Site emissions in one calendar year. Selection of the annual MEI, who cannot be an employee of DOE or its contractors, is contingent on the MEI's place of residence or employment (note: the business also may be at a location on the Hanford Site to which access is unrestricted). Emission data used in the calculations represent those from all point and fugitive sources in the five operational areas and in the 600 Area. For 2007, the MEI was a resident on a farm near Sagemoor Road, Franklin County, directly across the Columbia River from the Hanford Site 300 Area. For 2004, the MEI location was Ringold, also the site of the MEI from 1990 through 1992. From 1993 through 1999, the MEI was at the Sagemoor Road location. In 2000 and 2001, the location of the MEI changed, to two different locations within the 300 Area where non-DOE-related employment existed. Such employment ended in early 2002.

The dose to the MEI was calculated using the EPA-approved dose modeling program, Clean Air Act Assessment Package 1988-Personal Computer Version 3 (CAP88-PC; EPA 1992). This dose value is used in determining the status of Hanford Site compliance with the dose standard in 40 CFR 61, Subpart H, of 10 mrem/yr EDE to any member of the public.

Table 2-1. Hanford Site Radionuclide Air Emissions from Major Point Sources in 2007
(radiological dose potential of >0.1 mrem/yr EDE to nearest public receptor)[a]

Stack (facility; contractor; EDP Code)[b]	Average operating flow rate,[c] ft^3/min (m^3/s)	Volume, ft^3 (m^3)	Radionuclide or type of radioactivity[d]	Average operating concentration,[e] µCi/mL	Emissions, Ci	EDE to MEI,[f] mrem
100 Area Major Point Sources						
296-K-142	16,219	8.5 E+09	^{90}Sr	7.8 E–18	3.3 E–09	8.6 E–11
(CVDF; FH; Y201)	(7.65)	(2.4 E+08)	^{238}Pu	≤0	0	0
			$^{239/240}$Pu	≤0	0	0
			^{241}Pu	≤0	0	0
			^{241}Am	1.8 E–17	7.6 E–09	3.2 E–09
			gross α	3.8 E–17	1.6 E–08	NF
			gross β	5.7 E–16	2.5 E–07	NF
					296-K-142 total dose:	3.3 E–09
200 East Area Major Point Sources						
291-A-1	30,236	1.6 E+10	^{90}Sr	5.0 E–16	4.6 E–07	1.6 E–08
(PUREX Plant; FH; A006)	(14.27)	(4.5 E+08)	^{129}I	3.0 E–12	1.6 E–03	2.3 E–04
			^{137}Cs	1.1 E–15	9.7 E–07	1.8 E–08
			^{238}Pu	≤0	0	0
			$^{239/240}$Pu	2.7 E–16	2.5 E–07	1.5 E–07
			^{241}Am	3.2 E–16	2.9 E–07	1.5 E–07
			gross α	7.0 E–16	6.4 E–07	NF
			gross β	2.3 E–15	2.1 E–06	NF
					291-A-1 total dose:	2.3 E–04
296-A-42	858	4.5 E+08	^{90}Sr	≤0	0	0
(TF; CH2M HILL; E147)	(0.40)	(1.3 E+07)	^{129}I	≤0	0	0
			^{137}Cs	≤0	0	0
			^{238}Pu	3.5 E–17	6.1 E–10	3.5 E–10
			$^{239/240}$Pu	2.2 E–18	3.9 E–11	2.4 E–11
			^{241}Am	6.7 E–20	1.2 E–12	6.2 E–13
			gross α	1.6 E–16	2.8 E–09	NF
			gross β	7.2 E–16	1.3 E–08	NF
					296-A-42 total dose:	3.7 E–10
296-B-1	15,333	8.1 E+09	^{90}Sr	8.0 E–18	2.2 E–09	7.7 E–11
(B Plant; FH; B001)	(7.24)	(2.3 E+08)	^{137}Cs	≤0	0	0
			gross α	1.8 E–17	4.9 E–09	3.0 E–09
			gross β	2.6 E–16	7.3 E–08	NF
					296-B-1 total dose:	3.1 E–09

Table 2-1. Hanford Site Radionuclide Air Emissions from Major Point Sources in 2007
(radiological dose potential of >0.1 mrem/yr EDE to nearest public receptor)[a]

Stack (facility; contractor; EDP Code)[b]	Average operating flow rate,[c] ft^3/min (m^3/s)	Volume, ft^3 (m^3)	Radionuclide or type of radioactivity[d]	Average operating concentration,[e] µCi/mL	Emissions, Ci	EDE to MEI,[f] mrem
296-B-10 (WESF; FH; B748)	24,390 (11.51)	1.3 E+10 (3.6 E+08)	^{90}Sr	1.4 E–13	6.7 E–05	2.3 E–06
			^{137}Cs	3.9 E–14	1.8 E–05	3.4 E–07
			gross α	1.6 E–15	7.5 E–07	4.4 E–07
			gross β	3.9 E–13	1.8 E–04	NF
					296-B-10 total dose:	3.1 E–06
296-H-212 (CSB; FH; C601)	8,758 (3.66)	4.1 E+09 (1.2 E+08)	^{90}Sr	4.4 E–18	6.1 E–10	2.1 E–11
			^{137}Cs	≤0	0	0
			^{238}Pu	8.9 E–16	1.2 E–07	6.8 E–08
			$^{239/240}$Pu	≤0	0	0
			^{241}Pu	≤0	0	0
			^{241}Am	1.2 E–17	1.6 E–09	8.3 E–10
			gross α	4.3 E–17	5.9 E–09	NF
			gross β	8.7 E–16	1.2 E–07	NF
					296-H-212 total dose:	6.9 E–08
296-P-31 (209-E; FH; E209)	1,059 (0.50)	5.6 E+08 (1.6 E+07)	^{238}Pu	3.7 E–18	6.5 E–11	3.7 E–11
			$^{239/240}$Pu	6.8 E–17	1.2 E–09	7.4 E–10
			^{241}Pu	≤0	0	0
			^{241}Am	1.2 E–17	2.0 E–10	1.0 E–10
			gross α	1.7 E–16	2.9 E–09	NF
			gross β	2.7 E–15	4.6 E–08	1.6 E–09
					296-P-31 total dose:	2.5 E–09
296-P-47 (TF; CH2M HILL; E096)	949 (0.45)	3.1 E+08 (8.6 E+06)	^{90}Sr	≤0	0	0
			^{137}Cs	3.7 E–16	4.4 E–09	8.4 E–11
			^{238}Pu	≤0	0	0
			$^{239/240}$Pu	≤0	0	0
			^{241}Am	≤0	0	0
			gross α	8.6 E–16	1.0 E–08	NF
			gross β	4.7 E–15	5.6 E–08	NF
					296-P-47 total dose:	8.4 E–11
296-P-48 (TF; CH2M HILL; E098)	did not operate					

Table 2-1. Hanford Site Radionuclide Air Emissions from Major Point Sources in 2007
(radiological dose potential of >0.1 mrem/yr EDE to nearest public receptor)[a]

Stack (facility; contractor; EDP Code)[b]	Average operating flow rate,[c] ft^3/min (m^3/s)	Volume, ft^3 (m^3)	Radionuclide or type of radioactivity[d]	Average operating concentration,[e] µCi/mL	Emissions, Ci	EDE to MEI,[f] mrem
200 West Area Major Point Sources						
291-T-1	40,000	2.1 E+10	^{90}Sr	1.6 E–16	1.2 E–07	4.0 E–09
(T Plant; FH; T785)	(18.88)	(6.0 E+08)	^{137}Cs	3.2 E–16	2.4 E–07	4.3 E–09
			^{238}Pu	≤0	0	0
			$^{239/240}$Pu	6.5 E–16	4.9 E–07	2.9 E–07
			^{241}Pu	≤0	0	0
			^{241}Am	5.2 E–17	3.9 E–08	1.9 E–08
			gross α	5.9 E–16	4.4 E–07	NF
			gross β	3.1 E–15	2.3 E–06	NF
					291-T-1 total dose:	3.2 E–07
291-Z-1	290,000	1.5 E+11	^{238}Pu	1.0 E–16	5.1 E–07	2.8 E–07
(PFP; FH; Z810)	(136.86)	(4.3 E+09)	$^{239/240}$Pu	5.0 E–15	2.5 E–05	1.5 E–05
			^{241}Pu	3.9 E–15	1.9 E–05	2.1 E–07
			^{241}Am	1.0 E–15	5.3 E–06	2.6 E–06
			gross α	9.5 E–15	4.7 E–05	NF
			gross β	1.1 E–15	5.6 E–06	1.8 E–07
					291-Z-1 total dose:	1.8 E–05
296-P-43	460	1.1 E+08	^{90}Sr	2.6 E–15	1.1 E–08	3.6 E–10
(TF; CH2M HILL; E045)	(0.22)	(3.0 E+06)	^{137}Cs	≤0	0	0
			^{238}Pu	≤0	0	0
			$^{239/240}$Pu	≤0	0	0
			^{241}Am	6.7 E–16	2.7 E–09	1.3 E–09
			gross α	≤0	0	0
			gross β	4.5 E–15	1.8 E–08	NF
					296-P-43 total dose:	1.7 E–09
296-P-44	470	1.4 E+08	^{90}Sr	≤0	0	0
(TF; CH2M HILL; E046)	(0.22)	(4.0 E+06)	^{137}Cs	≤0	0	0
			^{238}Pu	≤0	0	0
			$^{239/240}$Pu	6.2 E–18	3.4 E–11	2.0 E–11
			^{241}Am	2.0 E–17	1.1 E–10	5.4 E–11
			gross α	1.8 E–17	1.0 E–10	NF
			gross β	1.6 E–15	8.5 E–09	NF
					296-P-44 total dose:	7.4 E–11

Table 2-1. Hanford Site Radionuclide Air Emissions from Major Point Sources in 2007
(radiological dose potential of >0.1 mrem/yr EDE to nearest public receptor)[a]

Stack (facility; contractor; EDP Code)[b]	Average operating flow rate,[c] ft^3/min (m^3/s)	Volume, ft^3 (m^3)	Radionuclide or type of radioactivity[d]	Average operating concentration,[e] µCi/mL	Emissions, Ci	EDE to MEI,[f] mrem
296-S-21	73,429	3.9 E+10	^{90}Sr	≤0	0	0
(TF; CH2M HILL; S289)	(34.65)	(1.1 E+09)	^{137}Cs	≤0	0	0
			^{238}Pu	≤0	0	0
			$^{239/240}$Pu	≤0	0	0
			^{241}Am	≤0	0	0
			gross α	1.2 E–16	1.8 E–07	NF
			gross β	2.4 E–15	3.6 E–06	NF
					296-S-21 total dose:	0
296-W-4	14,476	7.6 E+09	^{90}Sr	≤0	0	0
(WRAP; FH; W123)	(6.83)	(2.2 E+08)	^{137}Cs	≤0	0	0
			^{238}Pu	≤0	0	0
			$^{239/240}$Pu	6.1 E–18	1.8 E–09	1.1 E–09
			^{241}Pu	≤0	0	0
			^{241}Am	1.4 E–17	4.1 E–09	2.0 E–09
			gross α	3.9 E–17	1.2 E–08	NF
			gross β	2.0 E–16	6.0 E–08	NF
					296-W-4 total dose:	3.1 E–09
296-Z-3	3,000	3.4 E+08	^{238}Pu	1.5 E–15	1.6 E–08	8.6 E–09
(PFP; FH; Z813)	(1.42)	(9.5 E+06)	$^{239/240}$Pu	8.4 E–16	8.9 E–09	5.3 E–09
[under CERCLA[g]])			^{241}Pu	≤0	0	0
			^{241}Am	4.8 E–16	5.1 E–09	2.5 E–09
			gross α	4.1 E–15	4.4 E–08	NF
			gross β	7.7 E–15	8.1 E–08	2.7 E–09
					296-Z-3 total dose:	1.9 E–08
296-Z-7	1,113	5.9 E+08	^{238}Pu	≤0	0	0
(PFP; FH; Z818)	(0.53)	(1.7 E+07)	$^{239/240}$Pu	1.7 E–19	3.6 E–12	2.1 E–12
			^{241}Pu	≤0	0	0
			^{241}Am	5.2 E–18	1.1 E–10	5.4 E–11
			gross α	2.2 E–17	4.7 E–10	NF
			gross β	8.8 E–16	1.9 E–08	6.3 E–10
					296-Z-7 total dose:	6.9 E–10

Table 2-1. Hanford Site Radionuclide Air Emissions from Major Point Sources in 2007
(radiological dose potential of >0.1 mrem/yr EDE to nearest public receptor)[a]

Stack (facility; contractor; EDP Code)[b]	Average operating flow rate,[c] ft^3/min (m^3/s)	Volume, ft^3 (m^3)	Radionuclide or type of radioactivity[d]	Average operating concentration,[e] µCi/mL	Emissions, Ci	EDE to MEI,[f] mrem
300 Area Major Point Sources						
EP-324-01-S (324 Building; WCH; F025 [under CERCLA[g]])	63,213 (29.83)	3.3 E+10 (9.4 E+08)	^{90}Sr	≤0	0	0
			^{137}Cs	≤0	0	0
			^{238}Pu	≤0	0	0
			$^{239/240}$Pu	3.7 E–18	4.1 E–09	2.1 E–07
			^{241}Am	2.3 E–18	2.5 E–09	1.0 E–07
			gross α	1.7 E–17	1.8 E–08	NF
			gross β	1.3 E–16	1.4 E–07	NF
					EP-324-01-S total dose:	3.1 E–07
EP-325-01-S (325 Building; PNNL; NA)	140,800 (66.5)	7.40 E+10 (2.1 E+09)	^{3}H (HT)	8.4 E–08	1.76 E+02	2.2 E–02
			^{3}H (HTO)	1.9 E–07	3.99 E+02	1.1 E–01
			^{90}Sr	4.4 E–17	9.2 E–08	2.1 E–07
			^{137}Cs	≤0	0	0
			^{220}Rn	8.7 E–09	1.8 E+01[h]	see Table 3-5
			^{222}Rn	1.1 E–11	2.2 E–02[h]	see Table 3-5
			^{238}Pu	≤0	0	0
			$^{239/240}$Pu	≤0	0	0
			^{241}Pu	≤0	0	0
			^{241}Am	≤0	0	0
			^{243}Am	≤0	0	0
			$^{243/244}$Cm	≤0	0	0
			gross α	2.0 E–18	4.1 E–09	2.1 E–07
			gross β	1.1 E–16	2.3 E–07	5.3 E–07
					EP-325-01-S total dose:	1.3 E–01
EP-327-01-S (327 Building; WCH; F026 [under CERCLA[g]])	36,857 (17.39)	1.9 E+10 (5.5 E+08)	^{90}Sr	≤0	0	0
			^{137}Cs	2.2 E–16	1.4 E–07	1.7 E–07
			^{238}Pu	≤0	0	0
			$^{239/240}$Pu	2.1 E–18	1.4 E–09	7.1 E–08
			^{241}Am	2.1 E–18	1.3 E–09	5.5 E–08
			gross α	1.4 E–16	9.1 E–08	NF
			gross β	1.9 E–15	1.2 E–06	NF
					EP-327-01-S total dose:	3.0 E–07
EP-331-01-V (331 Building; PNNL; NA)	51,900 (24.5)	2.73 E+10 (7.72 E+08)	^{238}Pu	≤0	0	0
			^{241}Pu	≤0	0	0
			^{241}Am	≤0	0	0
			gross α	7.5 E–18	5.8 E–09	3.0 E–07
			gross β	≤0	0	0
					EP-331-01-V total dose:	3.0 E–07

General definitions: ≤0 = analytical result equal to level of laboratory ambient background radioactivity or less than that level, which in practical terms means the radionuclide or type of radioactivity was not detected in the sample of the emission collected; Ci = curie; 1 Ci = 3.7 E+10 becquerels (Bq); ft^3 = cubic feet; HT is tritium, or elemental tritium, in the form of an incondensable gas; HTO is tritiated water vapor, or tritium in the form of condensable water vapor; m^3 = cubic meters; min = minute; mrem = millirem; NA = not applicable; NF = not factored (i.e., if an isotopic result is listed [including zero], the Ci release of the corresponding type of gross radioactivity is in most cases not included in CAP88-PC calculations); s = second; yr = year.

[a] Determining the potential prospective dose impact of each point source necessitated using nearest public receptors, who may differ from the annually determined Hanford Site MEI.

[b] Abbreviations and acronyms in this column are: CERCLA = Comprehensive Environmental Response, Conservation, and Liability Act of 1980; CH2M HILL = CH2M HILL Hanford Group, Inc.; EDP code = electronic data processing code, used in chain-of-custody activities to identify sampling locations; FH = Fluor Hanford; PNNL = Pacific Northwest National Laboratory; PFP = Plutonium Finishing Plant; PUREX = Plutonium-Uranium Extraction; TF = Tank Farms; WCH = Washington Closure Hanford, LLC; WESF = Waste Encapsulation and Storage Facility; WRAP = Waste Receiving and Processing Facility.

[c] Reflects stack flow rate averaged over time of stack operation.

[d] Radionuclides in bold typeface and within a shaded cell identify those required by 40 CFR 61, Subpart H, for mandatory sampling and analysis and as specified in HNF-1974-1, *Radionuclide National Emission Standards for Hazardous Air Pollutants Potential-to-Emit Assessment,* or as specified by facilities.

[e] Reflects concentration averaged over time of stack operation.

[f] EDE for MEI = effective dose equivalent for the maximally exposed individual; for calendar year 2007, the MEI was located near Sagemoor Road, Franklin County, directly across the Columbia River from the Hanford Site 300 Area.

[g] Emissions from this point source are associated with cleanup operations conducted under the authority of CERCLA. Reporting those emissions in Table 2-1 demonstrates compliance with the monitoring requirements of 40 CFR 61, Subpart H, which is a substantive equivalent law (i.e., "applicable, relevant, or appropriate requirement") as defined by CERCLA.

[h] Radon release value conservatively calculated, not actually measured.

Table 2-2. Hanford Site Radionuclide Air Emissions from Minor Point Sources in 2007
(radiological dose potential of ≤0.1 mrem/yr EDE to nearest public receptor)[a]

Stack (facility; contractor; EDP Code)[b]	Average operating flow rate,[c] ft^3/min (m^3/s)	Volume, ft^3 (m^3)	Radionuclide or type of radioactivity	Average operating concentration,[d] µCi/mL	Emissions, Ci	EDE to MEI,[e] mrem
100 Area Minor Point Sources						
105-KE Basin	30,400	1.6 E+10	^{90}Sr	8.5 E–15	4.2 E–06	1.1 E–07
(100-K Area; FH;	(14.35)	(4.5 E+08)	^{238}Pu	1.7 E–15	8.4 E–07	3.9 E–07
Y245, Y246, Y248			$^{239/240}Pu$	1.2 E–14	5.7 E–06	2.9 E–06
[under CERCLA[f]])			^{241}Pu	5.7 E–14	2.8 E–05	2.6 E–07
			^{241}Am	9.4 E–15	4.7 E–06	2.0 E–06
			gross α	2.3 E–14	1.2 E–05	NF
			gross β	9.3 E–14	4.6 E–05	NF
					105-KE Basin total dose:	5.7 E–06
105-KW Basin	22,000	1.2 E+10	^{90}Sr	7.6 E–14	2.7 E–05	7.0 E–07
(100-K Area; FH;	(10.38)	(3.3 E+08)	^{238}Pu	7.6 E–15	2.7 E–06	1.3 E–06
Y234, Y235, Y236			$^{239/240}Pu$	5.5 E–14	2.0 E–05	1.0 E–05
[under CERCLA[f]])			^{241}Pu	1.6 E–13	5.9 E–05	5.4 E–07
			^{241}Am	4.3 E–14	1.5 E–05	6.3 E–06
			gross α	1.1 E–13	3.8 E–05	NF
			gross β	4.9 E–13	1.8 E–04	NF
					105-KW Basin total dose:	1.9 E–05
107-N	7,502	3.9 E+09	gross α	3.9 E–16	5.9 E–08	3.0 E–08
(100 N Area; WCH;	(3.54)	(1.1 E+08)	gross β	5.3 E–15	8.1 E–07	2.1 E–08
Y265 [under CERCLA[f]])					**107-N total dose:**	5.1 E–08
1706-KE	12,000	3.7 E+07	gross α	5.7 E–15	9.7 E–09	4.9 E–09
(100-K Area; FH; Y243)	(5.66)	(1.0 E+06)	gross β	1.1 E–14	1.9 E–08	4.9 E–10
					1706-KE total dose:	5.4 E–09
200 East Area Minor Point Sources						
296-A-10 (PUREX; FH; A550)	did not operate; no plan to resume operation					
296-A-18	1,171	4.5 E+08	gross α	5.4 E–16	9.5 E–09	5.9 E–09
(TF; CH2M HILL; E060)	(0.55)	(1.3 E+07)	gross β	1.5 E–15	2.7 E–08	9.4 E–10
					296-A-18 total dose:	6.8 E–09
296-A-19	1,103	5.8 E+08	gross α	5.4 E–16	1.2 E–08	7.4 E–09
(TF; CH2M HILL; E061)	(0.52)	(1.6 E+07)	gross β	2.0 E–15	4.6 E–08	1.6 E–09
					296-A-19 total dose:	9.0 E–09
296-A-20	1,688	6.8 E+08	gross α	9.2 E–16	2.1 E–08	1.3 E–08
(TF; CH2M HILL; E197)	(0.88)	(1.9 E+07)	gross β	1.9 E–15	4.4 E–08	1.5 E–09
					296-A-20 total dose:	1.5 E–08
296-A-21	14,680	7.7 E+09	gross α	5.3 E–16	1.5 E–07	9.3 E–08
(242-A Evaporator;	(6.93)	(2.2 E+08)	gross β	1.6 E–15	4.4 E–07	1.5 E–08
CH2M HILL; E645)					**296-A-21 total dose:**	1.1 E–07

Table 2-2. Hanford Site Radionuclide Air Emissions from Minor Point Sources in 2007
(radiological dose potential of ≤0.1 mrem/yr EDE to nearest public receptor)[a]

Stack (facility; contractor; EDP Code)[b]	Average operating flow rate,[c] ft^3/min (m^3/s)	Volume, ft^3 (m^3)	Radionuclide or type of radioactivity	Average operating concentration,[d] µCi/mL	Emissions, Ci	EDE to MEI,[e] mrem
296-A-22 (242-A Evaporator; CH2M HILL; E643)	444 (0.21)	1.9 E+08 (5.4 E+06)	^{90}Sr	≤0	0	0
			^{137}Cs	4.1 E–16	2.8 E–09	5.3 E–11
			^{238}Pu	≤0	0	0
			$^{239/240}$Pu	3.3 E–18	2.3 E–11	1.4 E–11
			^{241}Am	1.6 E–19	1.1 E–12	5.7 E–13
			gross α	2.5 E–16	1.7 E–09	NF
			gross β	2.6 E–15	1.8 E–08	NF
					296-A-22 total dose:	6.8 E–11
296-A-26 (TF; CH2M HILL; E297)	did not operate					
296-A-27 (TF; CH2M HILL; E270)	893 (0.42)	4.7 E+08 (1.3 E+07)	gross α	1.7 E–16	4.5 E–09	2.8 E–09
			gross β	2.1 E–15	5.5 E–08	1.9 E–09
					296-A-27 total dose:	4.7 E–09
296-A-28 (TF; CH2M HILL; E272)	4,356 (2.06)	2.3 E+09 (6.5 E+07)	gross α	≤0	0	0
			gross β	9.9 E–16	1.4 E–07	4.9 E–09
					296-A-28 total dose:	4.9 E–08
296-A-29 (TF; CH2M HILL; E901)	710 (0.34)	3.7 E+08 (1.1 E+07)	gross α	1.4 E–16	2.9 E–09	1.8 E–09
			gross β	3.2 E–15	6.4 E–08	2.2 E–09
					296-A-29 total dose:	4.0 E–09
296-A-30 (TF; CH2M HILL; E903)	5,888 (2.78)	2.8 E+09 (8.0 E+07)	gross α	7.3 E–16	1.1 E–07	6.8 E–08
			gross β	2.9 E–15	4.3 E–07	1.5 E–08
					296-A-30 total dose:	8.3 E–08
296-A-40 (TF; CH2M HILL; E013)	767 (0.36)	4.0 E+08 (1.1 E+07)	gross α	1.1 E–16	1.5 E–09	9.3 E–10
			gross β	1.9 E–15	2.7 E–08	9.4 E–10
					296-A-40 total dose:	1.9 E–09
296-A-41 (TF; CH2M HILL; E015)	7,576 (3.58)	3.2 E+09 (9.1 E+07)	gross α	5.2 E–16	5.9 E–08	3.7 E–08
			gross β	1.8 E–15	2.0 E–07	7.0 E–09
					296-A-41 total dose:	4.4 E–08
296-A-43 (TF; CH2M HILL; E148)	870 (0.41)	4.6 E+08 (1.3 E+07)	gross α	≤0	0	0
			gross β	6.2 E–16	1.1 E–08	3.9 E–10
					296-A-43 total dose:	3.9 E–10
296-E-1 (ETF; FH; E036)	51,302 (24.21)	2.7 E+10 (7.6 E+08)	gross α	1.5 E–16	1.6 E–07	9.9 E–08
			gross β	3.8 E–16	4.0 E–07	1.4 E–08
					296-E-1 total dose:	1.1 E–07

Table 2-2. Hanford Site Radionuclide Air Emissions from Minor Point Sources in 2007
(radiological dose potential of ≤0.1 mrem/yr EDE to nearest public receptor)[a]

Stack (facility; contractor; EDP Code)[b]	Average operating flow rate,[c] ft^3/min (m^3/s)	Volume, ft^3 (m^3)	Radionuclide or type of radioactivity	Average operating concentration,[d] µCi/mL	Emissions, Ci	EDE to MEI,[e] mrem
296-P-45 (TF; CH2M HILL; E047)	457 (0.22)	2.9 E+07 (8.2 E+05)	gross α	4.6 E–16	5.1 E–10	3.2 E–10
			gross β	1.9 E–15	2.2 E–09	7.7 E–11
					296-P-45 total dose:	4.0 E–10
200 West Area Minor Point Sources						
291-S-1 (REDOX Plant; FH; S006)	21,901 (10.34)	1.2 E+10 (3.3 E+08)	gross α	1.6 E–15	7.0 E–07	4.1 E–07
			gross β	8.2 E–15	3.7 E–06	1.2 E–07
					291-S-1 total dose:	5.3 E–07
296-P-22 (TF; CH2M HILL; W191)	814 (0.38)	4.3 E+08 (1.2 E+07)	gross α	2.0 E–16	3.0 E–09	1.8 E–09
			gross β	1.1 E–15	1.7 E–08	5.6 E–10
					296-P-22 total dose:	2.4 E–09
296-P-23 (TF; CH2M HILL; W190) and **296-S-25** (TF; CH2M HILL; W145) [stack operation alternates]	1,088 (0.51) and 899 (0.42)	5.4 E+08 (1.5 E+07) [combined total for both stacks]	gross α	8.8 E–16	1.7 E–08	1.0 E–08
			gross β	3.6 E–15	7.0 E–08	2.3 E–09
					296-P-23 and 296-S-25 combined total dose:	1.2 E–08
296-S-15 (TF; CH2M HILL; W111)	did not operate					
296-S-16 (222-S; CH2M HILL; S264)	23 (0.01)	1.2 E+07 (3.4 E+05)	gross α	3.2 E–16	1.5 E–10	8.8 E–11
			gross β	3.4 E–15	1.6 E–09	5.3 E–11
					296-S-16 total dose:	1.4 E–10
296-S-18 (TF; CH2M HILL; W096)	2,210 (1.04)	6.2 E+08 (1.8 E+07)	gross α	5.1 E–16	1.3 E–08	7.7 E–09
			gross β	7.1 E–15	1.8 E–07	5.9 E–09
					296-S-18 total dose:	1.4 E–08
296-T-7 (T Plant; FH; T154)	1,340 (0.63)	7.0 E+08 (2.0 E+07)	^{137}Cs	≤0	0	0
			gross α	≤0	0	0
			gross β	7.4 E–15	2.1 E–07	6.9 E–09
					296-T-7 total dose:	6.9 E–09
296-T-17 (TF; CH2M HILL; W117)	did not operate					
291-U-1 (U Plant; FH; U771	20,726 (9.78)	1.1 E+10 (3.1 E+08)	gross α	≤0	0	0
			gross β	1.9 E–14	8.1 E–06	2.7 E–07
					291-U-1 total dose:	2.7 E–07
296-Z-5 (PFP; FH; Z913)	10,525 (4.97)	5.5 E+09 (1.6 E+08)	gross α	≤0	0	0
			gross β	5.7 E–16	1.2 E–07	4.0 E–09
					296-Z-5 total dose:	4.0 E–09
296-Z-6 (PFP; FH; Z802)	14,000 (6.61)	7.4 E+09 (2.1 E+08)	gross α	1.4 E–16	4.0 E–08	2.4 E–08
			gross β	1.3 E–15	3.8 E–07	1.3 E–08
					296-Z-6 total dose:	3.7 E–08
296-Z-15 (PFP; FH; Z915) [under CERCLA[f]])	1,555 (0.73)	8.2 E+08 (2.3 E+07)	gross α	≤0	0	0
			gross β	≤0	0	0
					296-Z-15 total dose:	0

Table 2-2. Hanford Site Radionuclide Air Emissions from Minor Point Sources in 2007
(radiological dose potential of ≤0.1 mrem/yr EDE to nearest public receptor)[a]

Stack (facility; contractor; EDP Code)[b]	Average operating flow rate,[c] ft^3/min (m^3/s)	Volume, ft^3 (m^3)	Radionuclide or type of radioactivity	Average operating concentration,[d] µCi/mL	Emissions, Ci	EDE to MEI,[e] mrem
300 Area Minor Point Sources						
340-B (340 Complex; FH; F008)	did not operate; locked out, no plan to resume operations					
340-DECON (340 Complex; FH; F009)	7,482 (3.53)	3.9 E+09 (1.1 E+08)	gross α	1.3 E–15	2.0 E–07	1.0 E–05
			gross β	8.8 E–15	1.3 E–06	3.0 E–06
					340-DECON total dose:	1.3 E–05
340-NT-EX (340 Complex; FH; F002)	1,429 (0.67)	7.5 E+08 (2.1 E+07)	gross α	≤0	0	0
			gross β	1.9 E–15	4.7 E–08	1.1 E–07
					340-NT-EX total dose:	1.1 E–07
EP-318-01-S (318 Building; PNNL; NA)	567 (0.28)	2.98 E+08 (8.44 E+06)	gross α	9.1 E–17	7.7 E–10	3.9 E–08
			gross β	6.4 E–16	5.4 E–09	1.2 E–08
					EP-318-01-S total dose:	5.1 E–08
EP-320-01-S (320 Building; PNNL; NA)	28,100 (13.3)	1.48 E+10 (4.18 E+08)	gross α	1.0 E–16	4.2 E–08	2.1 E–06
			gross β	2.2 E–15	9.1 E–07	2.1 E–06
					EP-320-01-S total dose:	4.2 E–06
EP-320-02-S (320 Building; PNNL; NA)	344 (0.16)	1.81 E+08 (5.12 E+06)	gross α	2.5 E–16	1.3 E–09	6.6 E–08
			gross β	2.9 E–15	1.5 E–08	3.5 E–08
					EP-320-02-S total dose:	1.0 E–07
EP-320-04-S (320 Building; PNNL; NA)	344 (0.16)	1.81 E+08 (5.12 E+06)	gross α	5.6 E–16	2.9 E–09	1.5 E–07
			gross β	9.6 E–15	4.9 E–08	1.1 E–07
					EP-320-04-S total dose:	2.6 E–07
EP-323-01-S (323 Building; PNNL; NA)	1,480 (0.70)	5.41 E+08 (1.53 E+07)	gross α	1.1 E–16	1.7 E–09	8.7 E–08
			gross β	9.7 E–16	1.5 E–08	3.5 E–08
					EP-323-01-S total dose:	1.2 E–07
EP-326-01-S (326 Building; PNNL; NA)	48,300 (22.8)	2.54 E+10 (7.19 E+08)	gross α	4.0 E–16	2.9 E–07	1.5 E–05
			gross β	5.6 E–15	4.0 E–06	9.2 E–06
					EP-326-01-S total dose:	2.4 E–05
EP-329-01-S (329 Building; PNNL; NA)	44,600 (21.0)	2.34 E+10 (6.64 E+08)	^{131m}Xe	3.0 E–19	2.0 E–10	2.7 E–16
			^{133}Xe	4.5 E–18	3.0 E–09	1.6 E–14
			^{222}Rn	3.2 E–18	2.1 E–09	see Table 3-5
			gross α	1.1 E–17	7.0 E–09	3.6 E–07
			gross β	2.1 E–17	1.4 E–08	3.2 E–08
					EP-329-01-S total dose:	3.9 E–07
EP-3730-01-V (3730 Building; PNNL; NA)	119 (0.056)	4.51 E+07 (1.28 E+06)	gross α	2.3 E–16	3.0 E–10	1.5 E–08
			gross β	5.4 E–17	6.9 E–11	1.6 E–10
					EP-3730-01-S total dose:	1.5 E–08

Table 2-2. Hanford Site Radionuclide Air Emissions from Minor Point Sources in 2007
(radiological dose potential of ≤0.1 mrem/yr EDE to nearest public receptor)[a]

Stack (facility; contractor; EDP Code)[b]	Average operating flow rate,[c] ft^3/min (m^3/s)	Volume, ft^3 (m^3)	Radionuclide or type of radioactivity	Average operating concentration,[d] µCi/mL	Emissions, Ci	EDE to MEI,[e] mrem
400 Area Minor Point Sources						
437-1-61 (MASF; FH; F019)	15,005 (7.08)	7.9 E+09 (2.2 E+08)	gross α	5.8 E–16	1.8 E–07	8.3 E–07
			gross β	1.8 E–15	5.5 E–07	6.6 E–08
					437-1-61 total dose:	9.0 E–07
437-MN&ST (MASF; FH; F014)	14,304 (6.75)	7.5 E+09 (2.1 E+08)	gross α	7.2 E–16	2.4 E–07	1.1 E–06
			gross β	6.2 E–15	2.0 E–06	2.4 E–07
					437-MN&ST total dose:	1.3 E–06
FFTF-CB-EX (FFTF; FH; F011)	11,850 (5.59)	6.2 E+09 (1.8 E+08)	^{3}H (HTO)	1.2 E–09	2.5 E–01	7.0 E–06
			gross α	1.3 E–15	3.0 E–07	1.4 E–06
			gross β	4.1 E–15	9.8 E–07	1.2 E–07
					FFTF-CB-EX total dose:	8.5 E–06
FFTF-HT-TR (FFTF; FH; F013)	2,891 (1.36)	1.5E+09 (4.3E+07)	gross α	≤0	0	0
			gross β	5.7 E–16	3.3 E–08	4.0 E–09
					FFTF-HT-TR total dose:	4.0 E–09
FFTF-RE-SB (FFTF; FH; F012)	11,720 (5.53)	6.2 E+09 (1.7 E+08)	gross α	7.4 E–16	1.8 E–07	8.3 E–07
			gross β	9.5 E–15	2.3 E–06	2.8 E–07
					FFTF-RE-SB total dose:	1.1 E–06
600 Area Minor Point Sources						
696-W-1 (WSCF; FH; W010)	46,527 (21.96)	2.4 E+10 (6.9 E+08)	gross α	≤0	0	0
			gross β	≤0	0	0
					696-W-1 total dose:	0
696-W-2 (WSCF; FH; W011)	925 (0.44)	4.9 E+08 (1.4 E+07)	gross α	≤0	0	0
			gross β	1.9 E–16	3.5 E–09	1.2 E–10
					696-W-2 total dose:	1.2 E–10

General definitions: ≤0 = analytical result equal to level of laboratory ambient background radioactivity or less than that level, which in practical terms means the radionuclide or type of radioactivity was not detected in the sample of the emission collected; Ci = curie; 1 Ci = 3.7 E+10 becquerels (Bq); ft^3 = cubic feet; HT is tritium, or elemental tritium, in the form of an incondensable gas ; HTO is tritiated water vapor, or tritium in the form of condensable water vapor; m^3 = cubic meters; min = minute; mrem = millirem; NA = not applicable; NF = not factored (i.e., if an isotopic result is listed [including zero], the Ci release of the corresponding type of gross radioactivity is in most cases not included in CAP88-PC calculations); s = second; yr = year.

[a] Determining the potential prospective dose impact of each point source necessitated using nearest public receptors, who may differ from the annually determined Hanford Site MEI.

[b] Abbreviations and acronyms in this column are: CERCLA = Comprehensive Environmental Response, Conservation, and Liability Act of 1980; CH2M HILL = CH2M HILL Hanford Group, Inc.; EDP code = electronic data processing code, used in chain-of-custody activities to identify sampling locations; FFTF = Fast Flux Test Facility; FH = Fluor Hanford; MASF = Maintenance and Storage Facility; PNNL = Pacific Northwest National Laboratory; PFP = Plutonium Finishing Plant; TF = Tanks Farms; WCH = Washington Closure Hanford, LLC; and WSCF = Waste Sampling and Characterization Facility.

[c] Reflects stack flow rate averaged over time of stack operation.

[d] Reflects concentration averaged over time of stack operation.

[e] EDE for MEI = effective dose equivalent for the maximally exposed individual; for calendar year 2007, the MEI was located near Sagemoor Road, Franklin County, directly across the Columbia River from the Hanford Site 300 Area.

[f] Emissions from this point source are associated with cleanup operations conducted under the authority of CERCLA. Reporting those emissions in Table 2-2 demonstrates compliance with the monitoring requirements of 40 CFR 61, Subpart H, which is a substantive equivalent law (i.e., "applicable, relevant, or appropriate requirement") as defined by CERCLA.

Table 2-3. Hanford Site Major Stack Heights and Emission Controls

Stack	Discharge height, ft (m)	Emission control
100 Area Major Point Sources		
105-KW Air Sparging Vent	48 (14.6)	HEPA
296-K-142	90 (27.4)	HEPA
200 East Area Major Point Sources		
291-A-1	200 (61)	HEPA
296-A-42	55 (16.8)	HEPA
296-B-1	90 (27.4)	HEPA
296-B-10	75 (22.9)	HEPA
296-H-212	75 (22.9)	HEPA
296-P-31	32 (9.8)	HEPA
296-P-47	15 (4.6)	HEPA
296-P-48	15 (4.6)	HEPA
200 West Area Major Point Sources		
296-P-43	15 (4.6)	HEPA
296-P-44	15 (4.6)	HEPA
296-P-45*	15 (4.6)	HEPA
296-S-21	38 (11.6)	HEPA
291-T-1	200 (61)	HEPA
296-W-4	47 (14.2)	HEPA
291-Z-1	200 (61)	HEPA
296-Z-3	24 (7.2)	HEPA
296-Z-7	50 (15.2)	HEPA
300 Area Major Point Sources		
EP-324-01-S	150 (46)	HEPA
EP-325-01-S	89 (27.1)	HEPA
EP-327-01-S	42.8 (13.1)	HEPA
EP-331-01-V	62 (18.9)	HEPA

* This stack operated as a minor stack during 2007.

The operational efficiency of HEPA filters is ≥99.95%

Table 2-4. Hanford Site Minor Stack Heights and Emission Controls

Stack	Discharge height, ft (m)	Emission control
100 Area Minor Point Sources		
105-KE Basin	42 (12.8)	none
105-KW Basin	42 (12.8)	none
107-N	27.0 (8.2)	HEPA
1706-KE	25 (7.6)	HEPA
200 East Area Minor Point Sources		
296-A-10	15.0 (4.6)	HEPA
296-A-18	12.5 (3.8)	HEPA
296-A-19	12.9 (3.9)	HEPA
296-A-21	22 (6.7)	HEPA
296-A-22	61 (18.6)	HEPA
296-A-20	15.7 (4.8)	HEPA
296-A-26	27 (8.2)	HEPA
296-A-27	15.8 (4.8)	HEPA
296-A-28	23 (7.0)	HEPA
296-A-29	14.9 (4.5)	HEPA
296-A-30	23 (7.0)	HEPA
296-A-40	13.3 (4.1)	HEPA
296-A-41	29.2 (8.9)	HEPA
296-A-43	35.5 (10.8)	HEPA
296- E–1	51 (15.5)	HEPA
200 West Area Minor Point Sources		
296-P-22	10.2 (3.1)	HEPA
296-P-23	15 (4.6)	HEPA
296-S-15	15 (4.6)	HEPA
296-S-18	22 (6.7)	HEPA
296-S-25	15 (4.6)	HEPA
296-T-17	32 (9.8)	HEPA
291-S-1	200 (61)	sand filter
296-S-16	9.8 (3)	HEPA
296-T-7	28 (8.5)	HEPA
291-U-1	200 (61)	sand filter
296-W-3	25 (7.6)	HEPA
296-Z-5	28 (8.5)	HEPA
296-Z-6	15 (4.5)	HEPA
296-Z-15	42 (12.8)	HEPA
300 Area Minor Point Sources		
340-B	37 (11.3)	HEPA
340-DECON	27 (8.2)	HEPA
340-NT-EX	20 (6.1)	HEPA
EP-318-01-S	29 (8.8)	HEPA
EP-320-01-S	40 (12.1)	HEPA
EP-320-02-S	32 (9.7)	HEPA

Table 2-4. Hanford Site Minor Stack Heights and Emission Controls

Stack	Discharge height, ft (m)	Emission control
EP-320-04-S	26 (7.9)	HEPA
EP-323-01-S	16 (4.9)	HEPA
EP-326-01-S	47.6 (14.5)	HEPA
EP-329-01-S	62.6 (19.1)	HEPA
EP-3730-01-S	19.4 (5.9)	HEPA
400 Area Minor Point Sources		
437-1-61	38.4 (11.7)	HEPA
437-MN&ST	30 (9.1)	HEPA
FFTF-CB-EX	47 (14.3)	none
FFTF-HT-TR	29 (8.8)	none
FFTF-RE-SB	20 (6.1)	none
600 Area Minor Point Sources		
696-W-1	25 (7.6)	HEPA
696-W-2	32 (9.8)	HEPA

Operational efficiencies of HEPA filters are ≥99.95% and of sand filters, ≥98%.

Table 2-5. Distances and Directions from Hanford Site Operational Areas to Receptors at Respective Nearest Residences and Farms[a]

Receptor		Distance (km [mi]) and direction from Hanford Site operational area[b]				
		100 Area	200-E Area	200-W Area	300 Area	400 Area
Offsite residence	Hanford Site MEI[c]	40.6 (25.2) SE	28.3 (17.6) SE	35.1 (21.8) SE	1.4 (0.87) E	10.8 (6.7) SE
	Nearest	8.9 (5.6) NNW	21.2 (13.2) E	13.7 (8.5) W	1.4 (0.87) E	8.6 (5.5) E
	Nearest in prevailing wind	24.2 (15.1) E	21.6 (13.5) ESE	22.0 (13.8) SE	1.4 (0.87) NE	9.1 (5.7) SE
Onsite public receptor	Nearest[d]	26.1 (16.2) SE	13.5 (8.4) SE	20.2 (12.6) ESE	12.3 (7.6) NNW	4.3 (2.7) WNW
	Nearest in prevailing wind	26.1 (16.2) SE	16.7 (10.4) ESE	20.2 (12.6) ESE	14.0 (8.8) NW	4.4 (2.7) NNE
Vegetable-producing farm	Nearest	9.8 (6.1) NW	21.1 (13.1) E	17.7 (11.0) NW	3.2 (2.0) E	10.5 (6.5) ESE
	Nearest in prevailing wind	24.9 (15.5) E	21.1 (13.1) E	29.9 (18.6) SE	4.0 (2.5) NE	12.6 (7.8) SE
Milk-producing farm	Nearest	34.9 (21.7) E	29.1 (18.1) ENE	34.6 (21.5) S	5.8 (3.6) ESE	13.5 (8.3) E
	Nearest in prevailing wind	34.9 (21.7) E	30.6 (19.0) ESE	38.9 (24.2) ESE	9.2 (5.7) NE	15.3 (9.5) SE
Meat-producing farm	Nearest	11.2 (7.0) NNW	20.9 (13.0) WNW	17.7 (11.0) WSW	2.7 (1.7) ESE	12.2 (7.6) SE
	Nearest in prevailing wind	31.4 (19.5) ESE	24.0 (14.9) E	27.0 (16.8) SE	8.0 (5.0) NE	12.2 (7.6) SE

[a] The definition of residence includes dwelling, school, business, or office.

[b] All emission points within an emission Area are assigned a single distance to the nearest receptor; km = kilometer; mi = mile.

[c] A member of the public who lives at a residence near Sagemoor Road, in Franklin County, directly across the Columbia River from the Hanford Site 300 Area.

[d] The nearest onsite receptor is employed at the Laser Interferometer Gravitational Wave Observatory (LIGO). This receptor, who from year to year could be but is not necessarily the MEI, is a member of the public not employed by DOE or its contractors and who works on the Hanford Site at a location to which access is not controlled by DOE. For radiological dose impacts from emissions in 2007, numerous offsite public receptors and onsite public receptors were evaluated. The evaluations determined that an offsite receptor near Sagemoor Road, in Franklin County, received the maximum dose due to air emissions from all Hanford Site sources during 2007. For onsite receptors, two employment locations were evaluated: LIGO and ENCGS.

3.0 POINT SOURCE EMISSION DOSE ASSESSMENTS

3.1 DESCRIPTION OF POINT SOURCE EMISSIONS DOSE MODEL

The year 1990 was the first year this annual report format was required to comply with the Clean Air Act Amendments of 1990, described earlier in 54 Federal Register 16965, December 15, 1989. For 2007, CAP88-PC Version 3 (Clean Air Act Assessment Package – 1988, for Personal Computer; EPA 2007) for the first time was used to determine the compliance status of Hanford Site radionuclide air emissions with the 10 mrem/yr EDE standard of both Subpart H of 40 CFR 61 and of WAC 246-247. Doses from 1990 through 1992 were modeled using CAP88, an early mainframe version of the program. Doses from 1993 through 2006 were modeled using CAP88-PC Version 1 (EPA 1992), a desktop computer version of CAP-88 that relies more on default parameters than does the mainframe version. Some CAP88-PC Version 1 results for 2007 are included in this report for comparing to those results from previous years.

Because the Hanford Site has numerous and widely separated emission points, it is necessary to determine the point at which the maximum dose would be received from the combined air emissions released from all locations. To model the doses from those emissions, each of the five major operational areas is assigned within it a single reference facility having an emission point that typically is the source of maximum emissions from that Area to the Hanford Site MEI. The straight-line distances and directions to the MEI from each of the five reference facilities are used in the dose calculations, which include annual meteorological data (refer to Appendix A). In 2007, those reference facilities were the 105-KE Building in the 100 Areas; the PUREX Facility in the 200 East Area; PFP in the 200 West Area; the 325 Building in the 300 Area; and FFTF in the 400 Area.

For reports from 1990 through 1999, only offsite members of the public had been evaluated for dose. During this period, the annual MEI resided at these locations: from 1990 through 1992, Ringold, in Franklin County, east-southeast of the 200 Areas and northeast of the 300 Area; from 1993 through 1999, near Sagemoor Road, directly east and across the Columbia River from the 300 Area. Starting with the report for 2000, a new category of members of the public was evaluated in determining the MEI: non-DOE employees at work locations within the Hanford Site boundary. Private-sector reindustrialization at the Hanford Site forced a broadening of the MEI definition to include members of the public not employed by DOE and whose workplace is within the boundaries of the Hanford Site yet outside DOE-controlled areas. Under this new definition, the MEI location for 2000 shifted from what would have been the offsite residence near Sagemoor Road to a Washington State University (WSU) laboratory in the 300 Area, north of Richland. In 2001, the location changed to the 313 Building, also in the 300 Area. In early 2002, non-DOE employment at the WSU laboratory and the 313 Building ceased, causing the MEI to shift back to the offsite Sagemoor Road location in 2002 and 2003. For 2004, the MEI location shifted to Ringold, owing mainly to reduced point source emissions of ^{3}H from the 300 Area. For 2005, the MEI location returned to the Sagemoor Road residence, where it has remained through 2007 due to increased ^{3}H point source emissions from the 300 Area.

The principal locations evaluated for the MEI are shown in Figure 3-1. Figure 3-2 displays the MEI doses attributable to radionuclide emissions from Hanford Site point sources from 1990 through 2007.

3.2 SUMMARY OF INPUT PARAMETERS

Dose calculations were performed using established standard parameters for the Hanford Site and its environment (PNL-3777, Rev. 2). Point source emissions data by radionuclide and operational area (refer to Table 3-1) were used in the dose calculations. The calculations used an effective discharge height of 33 ft (10 m) for all release locations other than the 200 Area facilities, which were assumed to have an

effective release height of 292 ft (89 m; DOE/RL-2006-29). In all but one case, emissions reported as gross alpha or gross beta were evaluated as $^{239/240}Pu$ or ^{90}Sr, respectively. The one exception is for gross beta emissions from the 400 Area where, based on facility-specific information, those emissions were modeled as ^{137}Cs.

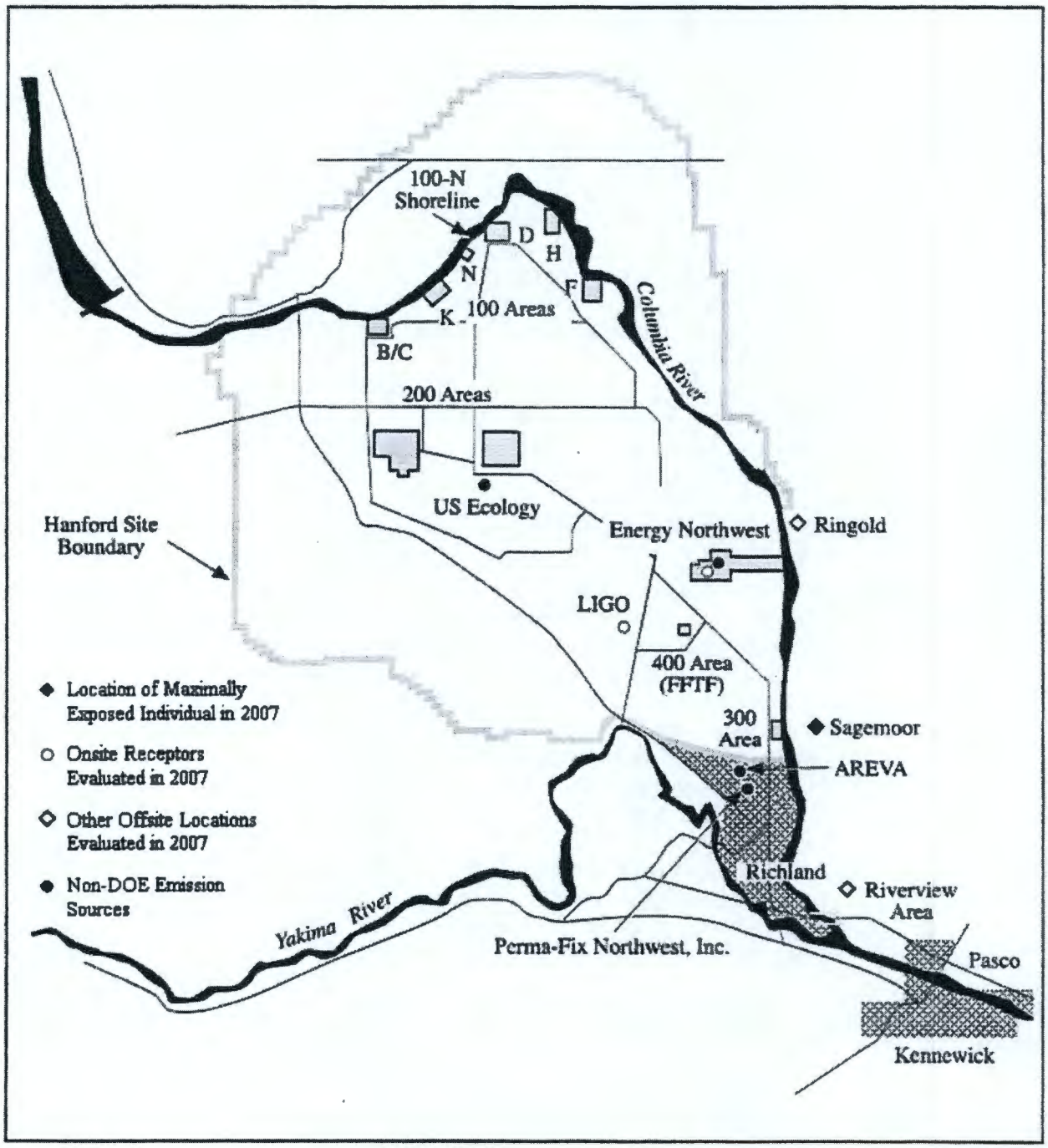

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Figure 3-1. Locations of Hanford Site Maximally Exposed Individual and Other Evaluated Receptor Locations for 2007

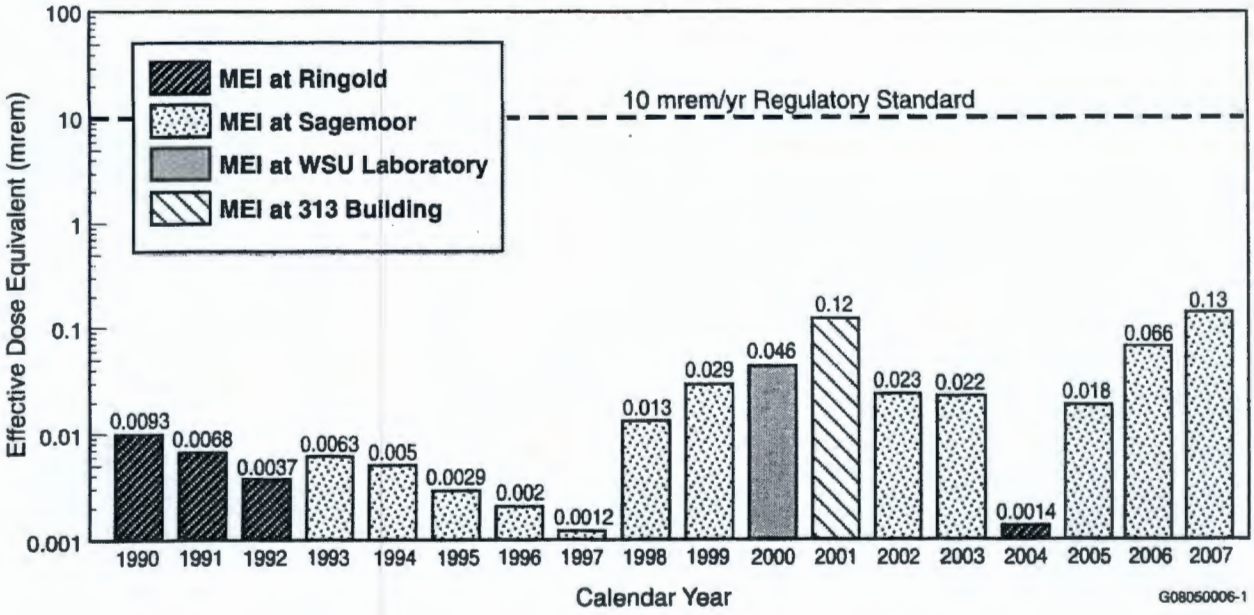

Figure 3-2. Doses to the MEI Due to Point Source Emissions of Radionuclides from the Hanford Site, 1990 through 2007

Radionuclide data used for dose calculations are in Appendix A; all other radionuclide-specific parameters used were default values in CAP88-PC data libraries. Maximum individual exposure and consumption parameters were those determined previously for the Hanford Site. The entire MEI diet was constructed using the "local" food production option in CAP88-PC for ingestion-pathway parameters. For locations within the Hanford Site boundary, the ingestion dose was estimated using average individual parameters for the 80-km (50-mi) assessment area. Radionuclide air concentrations at receptor locations were determined using site-specific meteorological data for each representative release location. Joint-frequency distributions and CAP88-PC wind files were prepared from data collected at weather stations in each of the operational areas and represent the average of hourly data taken during 2007.

3.3 COMPLIANCE ASSESSMENT

3.3.1 40 Code of Federal Regulations 61, Subpart H, Regulatory Standard

The regulatory standard for a maximum dose to any member of the public is 10 mrem/yr EDE. The standard is in 40 CFR 61, Subpart H, and applies to radionuclide air emissions, other than radon, from DOE facilities. For calendar year 2007, the Hanford Site MEI location was near Sagemoor Road, Franklin County, Washington, directly east of the 300 Area. The combined dose to the MEI from routine and nonroutine Hanford Site point source emissions was 0.13 mrem (0.0013 mSv) EDE. The majority of that dose (99.63%) is attributable to ^{3}H point source emissions from the 300 Area (refer to Table 3-2).

Table 3-1. Hanford Site Radionuclide Air Emissions from Point Sources in 2007

Radionuclide	Releases, Ci[a]					
	100 Areas	200 East Area	200 West Area	300 Area	400 Area	Total
^{3}H (as HT)[b]	NM	NM	NM	1.8 E+02	NM	1.8 E+02
^{3}H (as HTO)[c]	NM	NM	NM	4.0 E+02	2.5 E–01	4.0 E+02
^{90}Sr	3.2 E–05[d]	6.9 E–05[d]	2.2 E–05[d]	6.7 E–06[d]	NM	1.3 E–04[d]
^{129}I	NM	1.6 E–03	NM	NM	NM	1.6 E–03
^{131m}Xe	NM	NM	NM	2.0 E–10[e]	NM	2.0 E–10[e]
^{133}Xe	NM	NM	NM	3.0 E–09[e]	NM	3.0 E–09[e]
^{137}Cs	NM	1.9 E–05	2.4 E–07	1.4 E–07	5.9 E–06[f]	2.5 E–05
^{220}Rn	NM	NM	NM	1.8 E+01[e]	NM	1.8 E+01[e]
^{222}Rn	NM	NM	NM	2.2 E–02[e]	NM	2.2 E–02[e]
^{238}Pu	3.6 E–06	1.2 E–07	5.1 E–07	ND	NM	4.2 E–06
$^{239/240}Pu$	2.6 E–05[g]	1.5 E–06[g]	2.6 E–05[g]	5.6 E–07[g]	8.9 E–07[g]	5.5 E–05[g]
^{241}Pu	8.7 E–05	ND	1.9 E–05	ND	NM	1.1 E–04
^{241}Am	2.0 E–05	2.9 E–07	5.3 E–06	3.8 E–09	NM	2.6 E–05
^{243}Am	NM	NM	NM	ND	NM	ND
$^{243/244}Cm$	NM	NM	NM	ND	NM	ND

[a] 1 Ci = 1 curie = 3.7 E+10 becquerels (Bq); ND = not detected (i.e., either the radionuclide was not detected in any sample during the year or the average of all the measurements for that given radionuclide or type of radioactivity made during the year was below background levels); NM = not measured.

[b] HT = tritium in the form of incondensable gas.

[c] HTO = tritium in the form of condensable water vapor.

[d] This release value includes data on gross beta emissions from some stacks.

[e] Calculated release based on inventory and project process.

[f] This release value derives entirely from data on gross beta emissions from 400 Area stacks.

[g] This release value includes data on gross alpha emissions from some stacks, except for those in the 400 Area, the value for which derives entirely from data on gross alpha emissions.

Table 3-2. CAP88-PC Effective Dose Equivalent Estimates for the Maximally Exposed Individual at Sagemoor Road, Resulting from Hanford Site Point Source Radionuclide Air Emissions in 2007

Distances, directions, and effective dose equivalent (mrem) to offsite MEI, by radionuclide and operational area[a]						EDE (40 CFR 61, Subpart H) by radionuclide	
Radionuclide	100 Area 41 km SE	200-E Area 28 km ESE	200-W Area 35 km ESE	300 Area 1.5 km N	400 Area 11 km NE	EDE Total (mrem)	Percent of EDE Total
^{3}H (HT)	NM	NM	NM	2.2 E–02	NM	2.2 E–02	16.399
^{3}H (HTO)	NM	NM	NM	1.1 E–01	7.1 E–06	1.1 E–01	83.354
^{90}Sr	8.2 E–07[b]	2.4 E–06[b]	7.2 E–07[b]	1.5 E–05[b]	NM	1.9 E–06[b]	0.014
^{129}I	NM	2.3 E–04	NM	NM	NM	2.3 E–04	0.174
^{131m}Xe	NM	NM	NM	2.7 E–16	NM	2.7 E–16	<0.001
^{133}Xe	NM	NM	NM	1.6 E–14	NM	1.6 E–14	<0.001
^{137}Cs/Ba	NM	3.6 E–07	4.3 E–09	1.7 E–07	6.9 E–07[c]	1.2 E–06[d]	0.001
^{238}Pu	1.7 E–06	6.9 E–08	2.8 E–07	0	NM	2.0 E–06	0.002
$^{239/240}$Pu	1.3 E–05[e]	9.4 E–07[e]	1.5 E–05[e]	2.8 E–05[e]	4.1 E–06[e]	6.2 E–05[e]	0.046
^{241}Pu	8.0 E–07	0	2.0 E–07	0	NM	1.0 E–06	0.001
^{241}Am	8.5 E–06	1.5 E–07	2.6 E–06	1.6 E–04	NM	1.1 E–05	0.009
^{243}Am	NM	NM	NM	0	NM	0	0
$^{243/244}$Cm	NM	NM	NM	0	NM	0	0
Dose totals	**2.5 E–05**	**2.4 E–04**	**1.9 E–05**	**1.3 E–01**	**1.2 E-05**	**1.3 E–01[f]**	▼
Percent of total dose	**0.019**	**0.177**	**0.014**	**99.781**	**0.009**	► **Percent total: 100**	

[a] 1 mrem = 0.01 mSv; 1 km = 0.621 mi.

[b] This dose estimate includes data on emissions of gross beta, assumed to be ^{90}Sr in dose calculations.

[c] This dose estimate derives entirely from data on FFTF emissions of gross beta, assumed to be ^{137}Cs in dose calculations.

[d] This dose estimate includes data on FFTF emissions of gross beta, assumed to be ^{137}Cs in dose calculations.

[e] This dose estimate includes data on emissions of gross alpha, assumed to be $^{239/240}$Pu in dose calculations for some stacks.

[f] The particulate radionuclide portion of the total point source dose is 2.6 E–04 mrem, or 0.20% of the total.

Table 3-3 shows the contribution to the MEI dose in 2007 from each major stack, grouped by operational area. Table 3-4 ranks each stack by the dose attributable to its emissions compared to the total MEI dose from all point source emissions.

Table 3-3. Doses from Hanford Site Major Point Sources that Operated in 2007

Source identification (contractor)	Effective dose equivalent (mrem)[a]	Percent of dose total[b]
100-K West Area		
296-K-142 (FH)	3.3 E–09	<0.0001
200 East Area		
291-A-1 (FH)	2.3 E–04	0.17
296-A-42 (CH2M HILL)	3.7 E–10	<0.0001
296-B-1 (FH)	3.1 E–09	<0.0001
296-B-10 (FH)	3.1 E–06	0.0023
296-H-212 (FH)	6.9 E–08	<0.0001
296-P-31 (FH)	2.5 E–09	<0.0001
296-P-47 (CH2M HILL)	8.4 E–11	<0.0001
296-P-48 (CH2M HILL)	DNO	<0.0001
200 West Area		
291-T-1 (FH)	3.2 E–07	0.0002
291-Z-1 (FH)	1.8 E–05	0.014
296-P-43 (CH2M HILL)	1.7 E–09	<0.0001
296-P-44 (CH2M HILL)	7.4 E–11	<0.0001
296-S-21 (CH2M HILL)	0	0
296-W-4 (FH)	3.1 E–09	<0.0001
296-Z-3 (FH)	1.9 E–08	<0.0001
296-Z-7 (FH)	6.9 E–10	<0.0001
300 Area		
EP-324-01-S (WCH)	3.1 E–07	0.0002
EP-325-01-S (PNNL)	1.3 E–01	99.63
EP-327-01-S (WCH)	3.0 E–07	0.0002
EP-331-01-V (PNNL)	3.0 E–07	0.0002
Major point source totals ▶	**≈1.3 E–01**	**≈99.82**

[a] 1 mrem = 1.0 E-02 mSv

[b] Of the ≈1.3 E–01 mrem total for all stacks, the portion from minor stacks is ≈8.1 E–05 mrem, or ≈0.06%. Slightly varying totals are due to numerical rounding.

Table 3-4. Ranking of Doses from Hanford Site Stack Radionuclides Emissions by Stack, Calendar Year 2007

Rank	Stack	Major or minor	Contractor	Operating Area	EDE (mrem/yr)[a]	Percent of total dose
1	**EP-325-01-S**	**Major**	PNNL	300	1.3275 E–01[b]	99.753
2	**291-A-1**	**Major**	FH	200 East	2.3 E–04	0.17326
3	105-KW Basin	minor	FH	100-KW	1.9 E–05	0.01426
4	**291-Z-1**	**Major**	FH	200 West	1.8 E–05	0.01351
5	340-DECON	minor	FH	300	1.3 E–05	0.00976
6	EP-326-01-S	minor	PNNL	300	2.4 E–05	0.01801
7	FFTF-CB-EX	minor	FH	400	8.5 E–06	0.00638
8	105-KE Basin	minor	FH	100-KE	5.7 E–06	0.00428
9	EP-320-01-S	minor	PNNL	300	4.2 E–06	0.00315
10	**296-B-10**	**Major**	FH	200 East	3.1 E–06	0.00233
11	437-MN&ST	minor	FH	400	1.3 E–06	0.00098
12	FFTF-RE-SB	minor	FH	400	1.1 E–06	0.00083
13	437-1-61	minor	FH	400	9.0 E–07	0.00068
14	291-S-1	minor	FH	200 West	5.3 E–07	0.00040
15	EP-329-01-S	minor	PNNL	300	3.9 E–07	0.00029
16	**291-T-1**	**Major**	FH	200 West	3.2 E–07	0.00024
17	**EP-324-01-S**	**Major**	WCH	300	3.1 E–07	0.00023
18	**EP-331-01-V**	**Major**	PNNL	300	3.0 E–07	0.00023
18	**EP-327-01-S**	**Major**	WCH	300	3.0 E–07	0.00023
20	291-U-1	minor	FH	200 West	2.7 E–07	0.00020
21	EP-320-04-S	minor	PNNL	300	2.6 E–07	0.00020
22	EP-323-01-S	minor	PNNL	300	1.2 E–07	0.00009
23	296-E-1	minor	FH	200 East	1.1 E–07	0.00008
23	340-NT-EX	minor	FH	300	1.1 E–07	0.00008
23	296-A-21	minor	CH2M HILL	200 East	1.1 E–07	0.00008
26	EP-320-02-S	minor	PNNL	300	1.0 E–07	0.00008
27	296-A-30	minor	CH2M HILL	200 East	8.3 E–08	0.00006
28	**296-H-212**	**Major**	FH	200 East	6.9 E–08	0.00005
29	EP-318-01-S	minor	PNNL	300	5.1 E–08	0.00004
29	107-N	minor	WCH	100-N	5.1 E–08	0.00004
31	296-A-28	minor	CH2M HILL	200 East	4.9 E–08	0.00004
32	296-A-41	minor	CH2M HILL	200 East	4.4 E–08	0.00003
33	296-Z-6	minor	FH	200 West	3.7 E–08	0.00003
34	**296-Z-3**	**Major**	FH	200 West	1.9 E–08	0.00001
35	EP-3730-01-S	minor	PNNL	300	1.5 E–08	0.00001
35	296-A-20	minor	CH2M HILL	200 East	1.5 E–08	0.00001
37	296-S-18	minor	CH2M HILL	200 West	1.4 E–08	0.00001
38	296-S-25 & 296-P-23	minor	CH2M HILL	200 West	1.2 E–08	0.00001
39	296-A-19	minor	CH2M HILL	200 East	9.0 E–09	0.00001

Table 3-4. Ranking of Doses from Hanford Site Stack Radionuclides Emissions by Stack, Calendar Year 2007

Rank	Stack	Major or minor	Contractor	Operating Area	EDE (mrem/yr)[a]	Percent of total dose
40	296-T-7	minor	FH	200 West	6.9 E–09	0.00001
41	296-A-18	minor	CH2M HILL	200 East	6.8 E–09	0.00001
42	1706-KE	minor	FH	100-KE	5.4 E–09	<0.00001
43	296-A-27	minor	CH2M HILL	200 East	4.7 E–09	<0.00001
44	FFTF-HT-TR	minor	FH	400	4.0 E–09	<0.00001
44	296-A-29	minor	CH2M HILL	200 East	4.0 E–09	<0.00001
44	296-Z-5	minor	FH	200 West	4.0 E–09	<0.00001
47	**296-K-142**	**Major**	FH	100-KW	3.3 E–09	<0.00001
48	**296-B-1**	**Major**	FH	200 East	3.1 E–09	<0.00001
48	**296-W-4**	**Major**	FH	200 West	3.1 E–09	<0.00001
50	**296-P-31**	**Major**	FH	200 East	2.5 E–09	<0.00001
51	296-P-22	minor	CH2M HILL	200 East	2.4 E–09	<0.00001
52	296-A-40	minor	CH2M HILL	200 East	1.9 E–09	<0.00001
53	**296-P-43**	**Major**	CH2M HILL	200 West	1.7 E–09	<0.00001
54	**296-P-44**	**Major**	CH2M HILL	200 East	7.4 E–10	<0.00001
55	**296-Z-7**	**Major**	FH	200 West	6.9 E–10	<0.00001
56	296-P-45	minor	CH2M HILL	200 West	4.0 E–10	<0.00001
57	296-A-43	minor	CH2M HILL	200 East	3.9 E–10	<0.00001
58	**296-A-42**	**Major**	CH2M HILL	200 East	3.7 E–10	<0.00001
59	296-S-16	minor	CH2M HILL	200 West	1.4 E–10	<0.00001
60	696-W-2	minor	FH	600	1.2 E–10	<0.00001
61	**296-P-47**	**Major**	CH2M HILL	200 East	8.4 E–11	<0.00001
62	296-A-22	minor	CH2M HILL	200 East	6.8 E–11	<0.00001
63	296-S-21	minor	CH2M HILL	200 West	0	0
63	296-Z-15	minor	FH	200 West	0	0
63	696-W-1	minor	FH	600	0	0
NA	296-A-10	minor	FH	200 East	DNO	NA
NA	296-A-26	minor	FH	200 East	DNO	NA
NA	**296-P-48**	**Major**	CH2M HILL	200 East	DNO	NA
NA	296-S-15	minor	CH2M HILL	200 West	DNO	NA
NA	296-T-17	minor	CH2M HILL	200 West	DNO	NA
NA	296-W-3	minor	FH	200 West	DNO	NA
NA	340-B BLDG	minor	FH	300	DNO	NA
				Totals[c] ▶	**≈1.3 E–01**	**≈100**

[a] EDE = effective dose equivalent; 1 mrem = 1.0 E–02 mSv

[b] Extra decimal places are displayed for this stack because in comparison to all of stacks it comprises the largest percentage of the total dose.

[c] Slight differences in totals due to rounding.

DNO = did not operate; NA = not applicable.

3.3.2 Washington Administrative Code 246-247

For Hanford Site radionuclide air emissions, Washington state in WAC 246-247-040(1) has adopted the federal dose standard of 10 mrem/yr EDE found in 40 CFR 61 Subpart H. In addition to the maximum dose attributable to radionuclides emitted from point sources, WAC 246-247-040(6) state requires that the dose to the MEI also include doses attributable to fugitive emissions, radon (refer to Section 3.6.3), and to nonroutine events (refer to Section 3.5). Sampling data from ambient air samplers stationed at the perimeter of the Hanford Site were used to estimate emissions from fugitive sources. The reportable fugitive emission dose was calculated for the MEI near Sagemoor Road because that is the location of the MEI for emissions from point sources (refer to Section 4 for a further discussion on the basis for this). The MEI doses from the calculated releases of two radon isotopes are discussed in Section 3.6.3 and shown in Table 3-5; the release values are based on conservative engineering estimates. Several instances of nonroutine emissions occurred, but these emissions had no measurable contribution to the cumulative emissions from the Hanford Site. Thus, the total dose to the MEI in 2007 at the Sagemoor Road location from all Hanford Site radionuclide emissions, including routine emissions from point sources, fugitive sources, and radon, as well as nonroutine emissions was 0.14 mrem (0.0014 mSv) EDE. This total dose is the sum of doses from Hanford Site point sources (i.e., 0.13 mrem [0.0013 mSv] EDE), fugitive sources (i.e., 3.9 E–03 mrem [3.9 E–05 mSv] EDE), and radon sources (i.e., 4.6 E–03 mrem [4.6 E–05 mSv]).*

3.4 METEOROLOGICAL DATA

Radionuclide air emissions disperse once they enter the atmosphere. Atmospheric dispersion models predict the degree of dilution and the magnitude of resulting air concentrations at downwind locations. Site-specific measurements of the occurrence frequencies for wind speed, wind direction, and atmospheric stability are used in the models. The dispersion models yield annual average dispersion factors, in units of seconds per cubic meter (s/m^3). Combining these factors with annual average release rates yields predictions of average radionuclide air concentrations for the year. Meteorological data for 2007 are presented in Appendix A as joint frequency of wind speed, wind direction, and stability category for stations located at the 100, 200, 300, and 400 Areas.

3.5 NONROUTINE RELEASES OF RADIONUCLIDES TO THE ATMOSPHERE

Several instances of presumably radioactive nonroutine emissions occurred in 2007. The most notable occurred on July 27, 2007, when approximately 85 gallons of radioactive tank waste from the 241-S-102 Tank, in the 200 West Area, spilled onto the ground in the vicinity of the 241-S-102 retrieval pump discharge. At the time of the incident, a new retrieval pump was in use, which had clogged. In an attempt to unclog the pump, it was run in reverse, which created back pressure that forced waste into a water line that supplied water to the pump. The waste leaked from the water supply line to the ground. The spill was eventually cleaned up, and no measurable increases in radiological concentrations were detected in samples collected by nearby onsite ambient air monitors and by additional ambient air monitors placed close to the spilled waste.

Any contributions these emissions may have had to the cumulative emissions from the Hanford Site were not discernibly measurable near the locations of known or presumed emissions nor at ambient air monitoring stations farther afield.

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* Version 3 of CAP88-PC was used to calculate all MEI doses for 2007. Version 1 had been used from 1993 through 2006. For purposes of comparison, listed next are the same types of MEI doses for 2007 as calculated using Version 1: point sources: 0.15 mrem (0.0015 mSv) EDE); fugitive sources: 0.023 mrem (2.3 E–04 mSv) EDE); and radon sources: 1.2 E–03 mrem (1.2 E–05 mSv) EDE, for a total of 0.17 mrem (0.0017 mSv) EDE.

3.6 ADDITIONAL COMPLIANCE INFORMATION

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

The portions of the Hanford Site MEI dose attributable to individual point sources as listed in Section 2.0 are appropriate for use in demonstrating the compliance of abated stack emissions with applicable terms of the Hanford Site Air Operating Permit (AOP), FF-01, and any underlying Notice of Construction (NOC) approvals.

3.6.2 Construction Projects and Modifications Exempted from 40 CFR 61.96

No exemptions of the approval process under 40 CFR 61.96 were granted in 2007. In 1992, the EPA determined that some emission units at the Hanford Site were out of compliance with requirements in 40 CFR 61, Subpart H. As a result, a NESHAP Federal Facilities Compliance Agreement (FFCA) was made between RL and EPA Region 10. In 1994, EPA stated it would not grant any exemptions until all FFCA milestones were completed, which occurred by the end of 2005. Notwithstanding that achievement, extenuating circumstances involving the designation status of two stacks caused EPA to continue requiring its approval for all construction or modification projects, including those with a radiological dose potential of less than 0.1 mrem EDE per year.

3.6.3 Radon-220 and Radon-222 Emissions

Radon-220 and Rn-222 were emitted from the 325 Building via major stack EP-325-01-S. Radon-222 was also emitted from the 329 Building via minor stack EP-329-01-S. The annual releases of those radon isotopes and respective doses are shown in Table 3-5. The release values are bounding engineering estimates, not derived from actual effluent sample measurements. Radon is exempted from consideration in determining compliance with the dose standard of Subpart H of 40 CFR 61 yet is encompassed by state regulations, as in WAC-246-247-040(6), which states that "All emissions of radionuclides . . . are subject to the standards of this section . . . ." For 2007, the total dose from these two radon isotopes did not substantially increase the total dose from point and fugitive sources of radionuclide emissions from the Hanford Site.

Table3-5. Emissions of ^{220}Rn and ^{222}Rn
from the 325 and 329 Buildings, 300 Area, in 2007

Stack (facility; contractor)[b]	Radionuclide	Emissions, Ci	EDE to MEI,[a] mrem
EP-325-01-S (325 Building; PNNL)	^{220}Rn	1.83 E+01	4.6 E–03
	^{222}Rn	2.23 E–02	9.2 E–05
EP-329-01-S (329 Building; PNNL)	^{222}Rn	2.10 E–09	8.7 E–12
		Total	4.6 E–03

[a] EDE = effective dose equivalent; MEI = maximally exposed individual, which in this case resides near Sagemoor Road, Franklin County, directly east of the 300 Area.

4.0 FUGITIVE SOURCES OF EMISSIONS

The Clean Air Act Amendments of 1990, promulgated in 54 Federal Register 16965, December 15, 1989, amended NESHAP regulations (i.e., 40 CFR 61, Subpart H) to govern emissions of radionuclides from DOE facilities and the resulting radiological doses to members of the public. A dose standard of 10 mrem/yr EDE was imposed, to which compliance is expected for radionuclide emissions emanating from point and fugitive sources. Measuring and/or modeling these emissions is fundamental to demonstrating compliance with the standard.

Measuring emissions from point sources is generally a prescriptive process, using well-defined technical methods, as described in 40 CFR 61 Subpart H, or alternatives approved by EPA. Subpart H monitoring methods, however, are not intended for nor amenable to measuring fugitive emissions. To address this shortcoming, EPA and DOE developed a Memorandum of Understanding (MOU) (DOE, 1995) between their agencies. A principal agreement in this MOU was that the Subpart H dose standard applies not only to the radiological effects from point source emissions but from fugitive emissions as well. A further aspect of this agreement is that DOE facilities nationwide were to develop methods for evaluating fugitive emissions. Before the MOU was published, the Hanford Site had developed such a method, and thus has been in compliance with that condition in the MOU since its inception.

With respect to dose effects from fugitive emissions, WDOH regulations are consistent with the MOU, as evidenced by WAC 246-247-010(2), which states that the Subpart H dose standard applies to "point sources, nonpoint sources, and fugitive emissions." But WAC246-247-030(12) acknowledges that fugitive emissions "are not feasible to directly measure and quantify." This admission underscores the technical difficulties and inherent complexities in estimating fugitive emissions and their dose effects. Despite such challenges, the Hanford Site method affords a defensible and conservative estimate of fugitive radionuclide emissions and resulting doses, which are reported annually, both individually and in combination with the maximum dose from point source emissions, radon doses, and, as warranted, the doses from nonroutine airborne releases. Summing the doses from all of these radiological sources of emissions assures a comprehensive compliance determination against the Subpart H dose standard.

Beginning in 1991, the Hanford Site has annually apprised EPA of its methods for estimating fugitive emissions and modeling the resulting doses to a member of the public. An EPA-funded guidance document on methods to estimate fugitive emissions (EPA, 2004) is available. The Hanford Site method is summarized, along with methods used at other DOE sites. The guidance document does not pass judgment on the methods, instead leaving individual sites free to choose a method most suitable to their unique operations, locations, and configurations. To date, neither EPA nor WDOH has approved methods for DOE to estimate cumulative fugitive radioactive emissions and associated doses for the Hanford Site.

> Note: For purposes of this report (i.e., DOE/RL-2008-03), the term *fugitive emissions* refers to any potential source of radioactive material that is not actively monitored at the point of release. Such sources have been defined in various EPA and WDOH regulations as "fugitive," "diffuse," or "non-point" sources. EPA defines *fugitive emissions* as "those emissions which could not reasonably pass through a stack, vent, or other functionally equivalent opening" (40 CFR 70.2). WDOH similarly defines fugitive emissions, but with a significant qualification, which has been underlined: "'Fugitive emissions' means radioactive air emissions which do not and could not reasonably pass through a stack, vent, or other functionally equivalent structure, and which are not feasible to directly measure and quantify" (WAC 246-247-030(12)). The WAC provides no definition of "non-point" sources; thus, such sources are assumed to be equivalent to diffuse sources as defined in DOE/EH-0173T: "Diffuse Source is a source or sources of radioactive contaminants (emissions) released into the atmosphere that do not have a defined point (origin) of

release (i.e., non-point source). Such sources are also known as area sources." The methods used at Hanford are not dependent on the regulatory distinctions among these types of sources for estimating fugitive emissions and their resulting contributions to the total dose from airborne radionuclides.

In general, fugitive sources of radioactive emissions are sources not actively ventilated, are not sealed to prevent the escape of volatile or resuspended radioactive material to the ambient air, and are not amenable to routine sampling in a controlled manner as stacks commonly are. Examples of sources of fugitive radioactive emissions are passively ventilated tank vents, vented containers, outdoor surface contamination areas, cracks between cover blocks, decommissioned buildings, etc. Emissions released from buildings to the ambient air via passive ventilation systems are also considered fugitive because they lack a measurable flow. Emissions from fugitive sources are monitored by the Hanford Site Surface Environmental Surveillance Program and the Near-Facility Monitoring Program, as described in Section 4.1. These emissions mix with ambient air, which may also have added to it emissions from point sources. Fugitive emission sources in and around Hanford Site facilities are described in Section 4.3. That section also describes the monitoring program and use of monitoring data for characterizing fugitive emissions and the estimated maximum EDE to the public attributable to those emissions.

Currently, all nuclear material production facilities at the Hanford Site have been shut down or placed in a surveillance-and-maintenance mode. Only waste minimization, stabilization processes, research activities, environmental remediation, and decontamination and decommissioning (D&D) continue. In the past, when the Hanford Site was operating at or near full capacity, point source emissions were easily detected. Now, however, radioactive materials released from point sources have in large part diminished to background levels found in the ambient environment. Therefore, the contribution from fugitive emissions has become a larger percentage of total emissions from the Hanford Site, even though fugitive emissions have thus far remained relatively small and constant.

The standard approach for assessing offsite doses from forced ventilation exhaust points is by applying atmospheric transport models to emissions measured at the facility stack. Assessing offsite doses from fugitive emissions, however, is not as straightforward. It is complicated by the difficulties of quantifying those emissions from potential sources. Methods for quantifying fugitive emissions are still being developed, an effort complicated by factors such as 1) the difficulty in accurately quantifying air flow from the source, 2) the greater complexity in the influences from meteorological conditions, and 3) distinguishing radionuclides released from fugitive sources from preexisting low concentrations of radionuclides in ambient air.

Passively ventilated point sources, breather vents and other openings on tanks, vaults, vented containers, and other structures are potential conduits of radioactive emissions. Airborne radionuclides inside vented structures can be released through passive air exchanges, typically caused by changes in atmospheric pressure and temperature. It is difficult, however, to accurately assess radionuclide releases that might occur under such conditions, particularly when a vent opening is irregularly shaped or when multiple openings are in close proximity. This difficulty in accurately and readily quantifying passively ventilated emissions is the main reason why these sources are not routinely sampled using conventional sampling methods. However, low emissions can be verified using other approved means such as smears, non-destructive analysis, occupational continuous air monitors, and direct radiation measurement using hand-held instruments. As an alternative to routine record sampling, estimates of radionuclides discharged as fugitive emissions from such sources are made based on data collected from a network of ambient air samplers around the downwind perimeter of the Hanford Site. Fugitive radionuclide releases estimates are then calculated using these data. Section 4.2 contains the dose and release estimates and resulting doses for Hanford Site fugitive emissions in 2007.

For this report, doses have been calculated for emissions from both actively ventilated point sources and fugitive sources. Dose results for each type of release are presented separately, in addition to the totals for all sources of radioactive emissions. The historical data displayed in Figure 4-1 sharply illustrates the impacts distant nuclear events in the world had on regional concentrations of airborne radioactivity, measured by the Hanford Site Surface Environmental Surveillance Program. The ambient air concentrations from sample locations at the Hanford Site perimeter are seen to differ little from concentrations measured at locations distant from the Hanford Site.

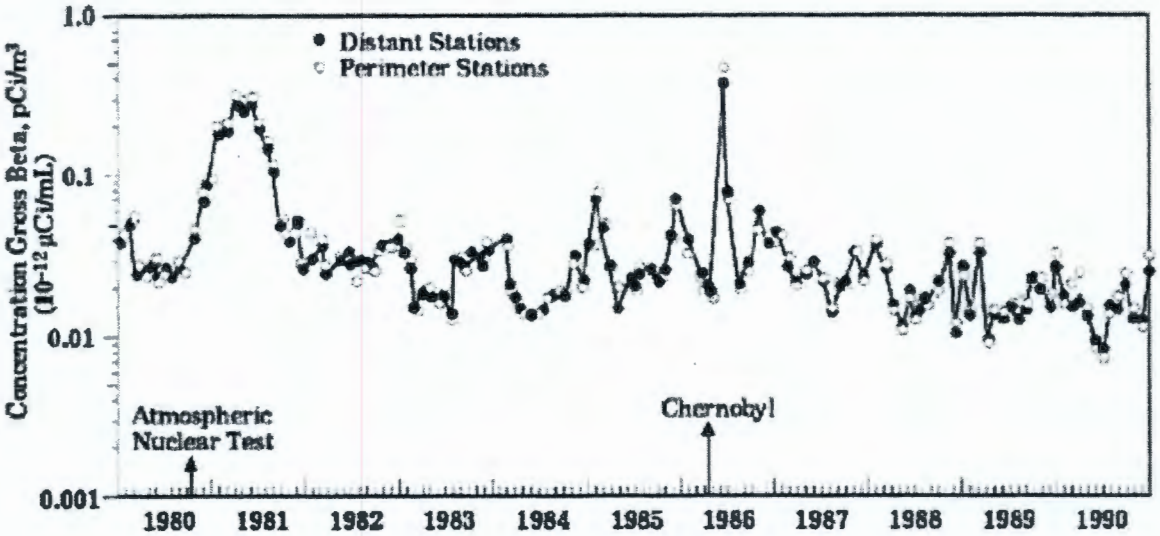

Figure 4-1. Historical Impact on Gross Beta Radioactivity in Hanford Site Ambient Air Samples, 1979 through 1990 (PNL-7346)

4.1 FUGITIVE EMISSIONS MONITORING

At the Hanford Site, two programs, the Near-Facility Environmental Monitoring Program and the Surface Environmental Surveillance Program, monitor radionuclides in the environment at locations on and off the Hanford Site. Further program information is presented in the remainder of this section.

4.1.1 Near-Facility Environmental Monitoring

Near-facility environmental monitoring is defined as monitoring done near facilities that have potentially dispersible radioactivity. Monitoring locations are associated mostly with major nuclear facilities and waste storage or disposal facilities such as container storage, burial grounds, underground tanks (i.e., Tank Farms), ponds, cribs, trenches, and ditches.

Routine monitoring activities include the sampling and monitoring of ambient air, surface contamination, external radiation doses, soil, vegetation, and animals. Samples are collected from known or expected effluent transport pathways, which are generally downwind of potential or actual airborne releases and downgradient of liquid discharges. Ambient air sampling is the primary method used in monitoring fugitive emissions, with other media samples possibly useful as secondary indicators.

In 2007, airborne radioactivity was sampled by a network of 101 ambient air samplers operated as continuously as possible at locations near facilities, as shown in the following list:

Number of Samplers	Location
7	100-B/C Areas
4	100-D Area
5	100-F Area
12	100-K Area
3	100-N Area
48	200 Areas
3	Environmental Restoration Disposal Facility
12	300 Area
4	400 Area (operated by PNNL)
2	Wye Barricade
1	Yakima Barricade

Figure 4-2 identifies the general locations of the ambient air samplers used for near-facility monitoring. The station at the Wye Barricade is collocated with samplers operated by the PNNL Surface Environmental Surveillance Project and WDOH. Four other stations, one each at 100-KE; ERDF; Integrated Disposal Facility (IDF), in the 200 East Area; and C Tank Farms, in the 200 East Area, have WDOH samplers collocated with them. Additional samplers are also used to support specific environmental remediation tasks. Ambient air samplers are primarily located at or near (within about 1,600 ft [500 m]) sites and facilities having the potential for or history of environmental releases. Particulate air samples are analyzed for gross alpha activity, gross beta activity, gamma-emitting isotopes, ^{90}Sr, uranium isotopes (^{234}U, ^{235}U, and ^{238}U), and plutonium isotopes (^{238}Pu and $^{239/240}$Pu). Gamma-emitting isotopes reported over the years include ^{60}Co, ^{106}Ru, ^{125}Sb, ^{134}Cs, ^{137}Cs, ^{154}Eu, and ^{155}Eu. Samples collected at CSB and the 100-K and 100-N Areas are also analyzed for ^{241}Am and/or ^{241}Pu. More detailed descriptions of these monitoring programs can be found in the *Hanford Site Environmental Report for Calendar Year 2007* (PNNL-17603) and the *Hanford Site Near-Facility Environmental Monitoring Data Report for Calendar Year 2007* (PNNL-17603, APP. 2, 2008).

4.1.2 Surface Environmental Surveillance

Surface environmental surveillance encompasses sampling and analyzing for radiological contaminants at locations in four surveillance zones on and off the Hanford Site. The first surveillance zone extends from the near-facility monitoring locations to the Hanford Site perimeter. The second zone consists of a series of perimeter sampling stations near or just inside the Hanford Site boundary and along State Highway 240. The third zone consists of nearby community sampling locations within a 50-mi (80-km) radius of the Hanford Site. The fourth zone (i.e., background locations) currently consists of a single distant community location upwind of the Hanford Site and considered unaffected by its operations.

Routine surveillance activities include the sampling and monitoring of air, surface water, groundwater, food and farm products, fish and wildlife, soil and vegetation, and external radiation. Like the near-facility monitoring program, ambient air sampling is the primary method used in monitoring fugitive emissions.

The air surveillance network consists of 42 sampling stations, of which 23 are onsite, 11 at the Hanford Site perimeter, 7 in nearby communities, and 1 in a distant community considered a background location. This program routinely monitors for radioactive vapors, gases, and aerosols. Water vapor, gas, and liquid aerosol sampling and analysis are performed for ^{3}H and ^{129}I at selected locations.

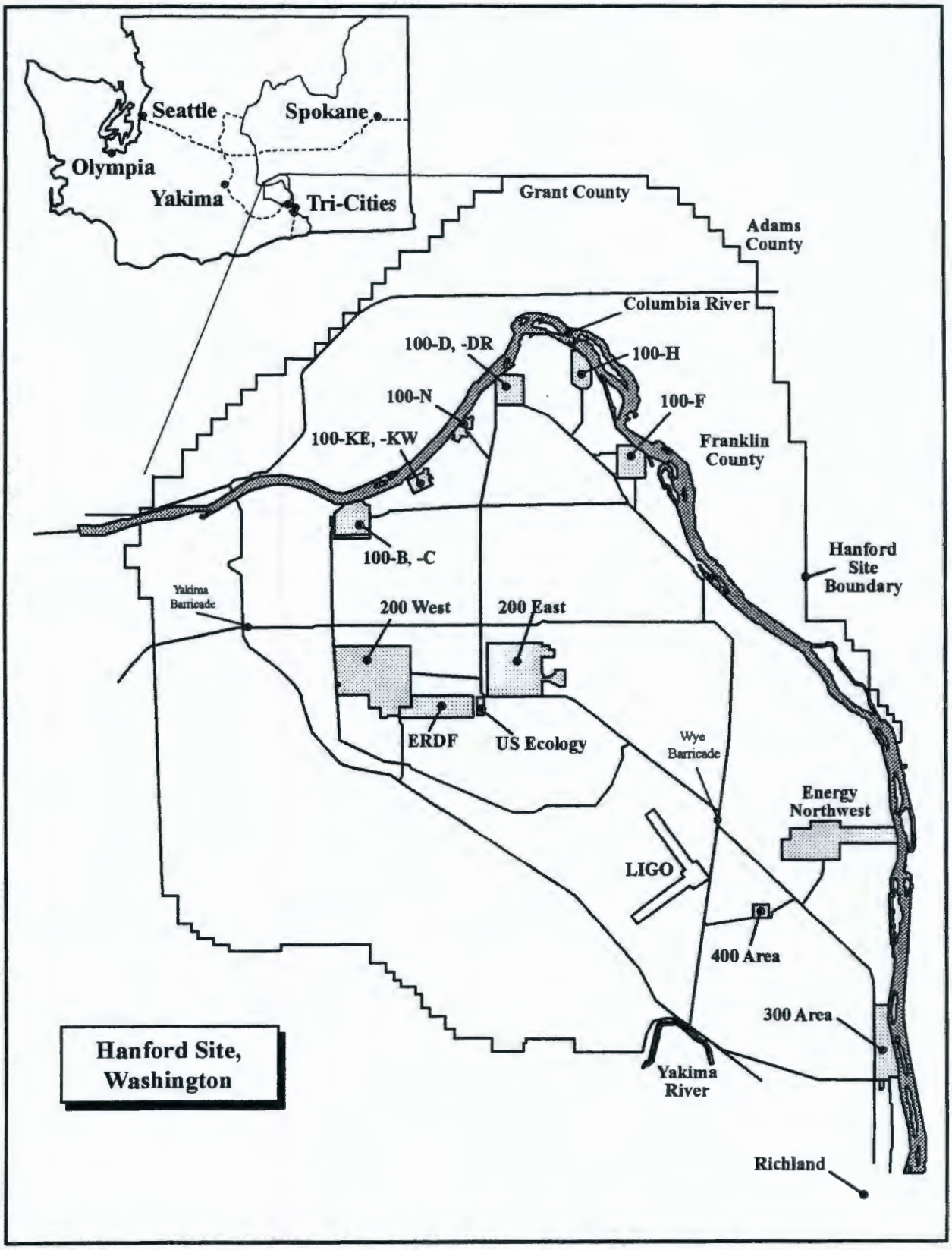

Figure 4-2. Near-Facility Ambient Air Sampling General Locations

Airborne particulate radionuclides at all sampling stations are sampled and analyzed. Particulate air samples are routinely analyzed for gross alpha activity, gross beta activity, gamma-emitting isotopes, ^{90}Sr, uranium isotopes (^{234}U, ^{235}U, and ^{238}U), and plutonium isotopes (^{238}Pu and $^{239/240}Pu$). Gamma-emitting isotope concentrations reported in 2007 include ^{60}Co and ^{137}Cs. Figure 4-3 depicts the locations of the ambient air samplers in the Surface Environmental Surveillance Project. A more detailed description of this program can be found in the *Hanford Site Environmental Report for Calendar Year 2007* (PNNL-17603).

4.2 ESTIMATED DOSES FROM FUGITIVE EMISSIONS

Potential releases from fugitive sources and the resulting dose to an offsite member of the public were estimated using ambient air monitoring data from environmental surveillance air sampling locations along the Hanford Site perimeter. Data from 12 selected perimeter and nearby community locations were used in the assessment of fugitive emissions in 2007 (refer to Figure 4-3, sampling locations 24–31, 33, and 35–38 [samples from locations 37 and 38 were analyzed together as unified composites]).

4.2.1 Dose Assessment Method

The method currently used to estimate emissions from fugitive sources at the Hanford Site, and the subsequent dose to a maximally exposed member of the public, is based on measured ambient air concentrations at the site perimeter. Contributions from monitored stack emissions and background radioactivity are subtracted from ambient air concentrations measured for each radionuclide. If the difference is positive, the result is attributed to fugitive sources. From the adjusted ambient air concentrations, CAP88-PC is used to back-calculate fugitive releases in curies per year, conservatively assumed to emanate from a single, centralized location in the 200 West Area, an assumption that yields the largest release estimate. This is an indirect method for estimating fugitive emissions, but is subject to less uncertainty in estimating dose to a member of the public because it uses actual monitoring data from the site perimeter where members of the public could be located. This method is also far more cost effective than estimating fugitive emissions from the resuspension of particulate radionuclides from over 1,000 potential fugitive emission sources at the Hanford Site. A document was recently published that not only details the method and procedures used to estimate Hanford Site radiological doses to the MEI from both radioactive point source and fugitive source emissions but also offers a brief history of relevant federal and state regulations and agency agreements (refer to *Methods for Calculating Doses to Demonstrate Compliance with Air Pathway Radiation Dose Standards at the Hanford Site*, DOE/RL-2007-53). This document evolved out of several DOE discussions with EPA and WDOH on the topic of the Hanford Site MEI. WDOH personnel participated in the review phase of the document and accepted the manner in which their resulting comments had been incorporated into it.

Current information on the extent and characteristics of onsite soil contamination is insufficient to use radionuclide resuspension estimates in conjunction with transport and dose modeling for many potential sources of fugitive emissions. The ambient air sampling results consisted of measured air concentrations for radionuclides that could be released from Hanford Site operations and fugitive sources. Radionuclides routinely assayed in ambient air samples include ^{3}H, ^{60}Co, ^{90}Sr, ^{129}I, ^{137}Cs, ^{234}U, ^{235}U, ^{238}U, ^{238}Pu, and $^{239/240}Pu$ (*Hanford Site Environmental Report for Calendar Year 2007* [PNNL-17603]).

Using the CAP88-PC atmospheric dispersion modeling code, radionuclide air concentrations resulting from monitored stack emissions at Hanford Site facilities and other nearby non-DOE sources were calculated for each of the 12 selected perimeter and nearby community sampling locations. These

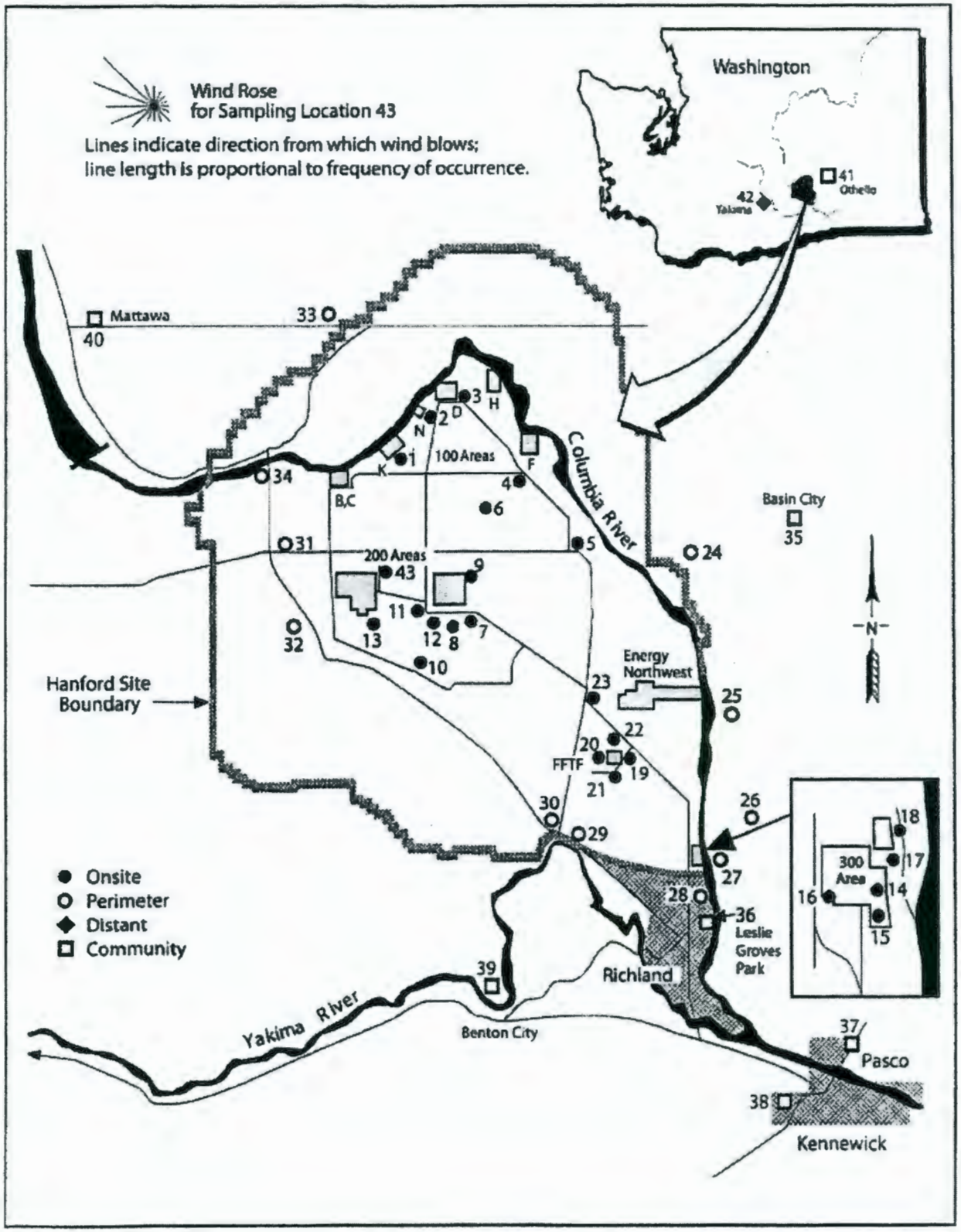

Figure 4-3. Environmental Surveillance Ambient Air Sampling Locations

modeled airborne radionuclide concentrations attributable to the stack emissions were subtracted from the ambient monitoring results. Average regional background concentrations for each radionuclide were calculated from the air sample results obtained at the distant community sampling station in Yakima, outside the 80-km (50-mile) radius and historically upwind from Hanford Site sources. The average background concentration at that station was also subtracted from the ambient monitoring results at the Hanford Site perimeter stations. The net air concentrations at the site perimeter, adjusted to account for monitored emission sources and background concentrations, are assumed to be the contribution of emissions from fugitive sources.

Hypothetical releases of radionuclides from fugitive sources are estimated using the net perimeter air concentrations attributable to fugitive emissions and by performing a back-calculation using CAP88-PC. The 200 West Area near the center of the Hanford Site is assumed to be the source of all fugitive emissions. This assumption results in a conservatively high estimate of releases and doses from all fugitive sources. The average of the estimated emissions for each perimeter monitoring station is then used with CAP88-PC to estimate the dose at the Hanford Site perimeter. Table 4-1 displays results from the perimeter monitoring location having the highest estimated dose from fugitive emissions, as well as the dose at the location of the member of the public who received the highest dose from monitored point source emissions. A combined dose to a member of the public comprising the highest dose from monitored point source emissions and the dose at that location from estimated fugitive source emissions is reported and evaluated for compliance with the 10 mrem/year standard in 40 CFR Part 61, Subpart H.

4.2.2 Results of Dose Assessment

During 2007, the measured annual average ambient air concentrations of ^{137}Cs, ^{238}Pu, and total uranium (modeled as ^{234}U) at the perimeter and nearby community sampling locations were assessed to be greater than the combined contributions of these analytes from stack releases and background. Thus, calculating the net fugitive air concentrations for these isotopes resulted in positive values. Calculating the net fugitive air concentrations for all other isotopes resulted in negative values. All of the net air concentrations, both positive and negative, for each radionuclide were used in back-calculating fugitive releases from the 200 West Area.

The fugitive source releases shown in Table 4-1 represent the average of the individual release estimates for each radionuclide, calculated from net air concentrations at the perimeter and nearby community locations. The average radionuclide release rates in the table are based on estimated releases for all stations at which that radionuclide was sampled, whether the air concentrations at those locations indicated a net positive or negative fugitive source release. When the resulting average release estimate in Table 4-1 is less than zero for an individual radionuclide, the air concentrations for that radionuclide at the perimeter stations were smaller than the combined concentrations attributable to stack emissions and regional background. Those estimated averaged fugitive releases were used to calculate the dose at potential onsite and offsite MEI locations, as well as at each of the perimeter ambient air sampling stations. (Note: If the average release estimate for a particular radionuclide was less than zero, fugitive sources were considered as not contributory to the total dose at the receptor locations. The dose estimate for that nuclide was set to zero before combining the contributions of all radionuclides to obtain the total dose at each location. In such cases, it is unlikely that fugitive sources contributed to the offsite measured concentrations of those radionuclides.)

As shown in Table 4-1, the highest estimated dose in 2007 from fugitive source emissions was at the Prosser Barricade sampling station, which is within the Hanford Site boundary and not a residence or business, etc. Also in Table 4-1 is the fugitive source dose for the Sagemoor Road location, where the highest MEI dose from point source emissions was in 2007. The hypothetical mean doses from fugitive emissions to an individual at Sagemoor Road and to a hypothetical receptor at the Prosser Barricade are

3.9 E–03 mrem (3.9 E–05 mSv) EDE and 6.4 E–03 mrem (6.4 E–05 mSv) EDE, respectively. The doses at the other sampling stations and potential MEI locations were lower than those at the Prosser Barricade location. (For comparison purposes, the corresponding doses from fugitive sources estimated using CAP88-PC v1 were 2.3 E–02 mrem [2.3 E–04 mSv] EDE and 5.8 E–02 mrem [5.8 E–04 mSv] EDE at the Sagemoor and LIGO locations, respectively.)

Table 4-1. Estimated Hanford Site Fugitive Emissions and Resulting Effective Dose Equivalents for 2007[a]

Radionuclide[b]	Estimated fugitive emissions from 200 Areas (Ci)[c]	Location	
		Estimated dose to MEI at Sagemoor (mrem)[d]	Estimated dose at Prosser Barricade (mrem)[e]
^{3}H	–7.2 E+03	0	0
^{60}Co	–1.9 E–01	0	0
^{90}Sr	–1.2 E–02	0	0
$^{137}Cs/^{137m}Ba$	5.2 E–02	1.5 E–03	2.6 E–03
^{129}I	NA[e]	–	–
U Total	2.2 E–02	1.8 E–03	3.0 E–03
^{238}Pu	5.1 E–04	5.3 E–04	8.8 E–04
^{239}Pu	–8.4 E–05	0	0
	Total ▶	3.9 E–03	6.4 E–03

[a] Hanford Site stack emissions, background radioactivity, and emissions from Perma-Fix Northwest, Inc., AREVA Federal Services LLC, and the Energy Northwest Columbia Generating Station have been subtracted from these fugitive emissions estimates, which may contain releases from other non-DOE nuclear facilities. Negative values for releases of a radionuclide indicate that air concentrations at the site perimeter are lower than the combined air concentrations expected from natural background and monitored stack releases.

[b] Not all radionuclides listed were evaluated at every sampling station.

[c] 1 Ci = 3.7 E+10 Bq. Emissions from fugitive sources are assumed to originate in the Hanford Site 200 Areas and have a release height of 1 m. The 300 Area also has potential sources for the resuspension of uranium from soil, along with naturally occurring uranium isotopes found throughout the area. Uranium releases were modeled as if the total inventory were from the 200 Areas, because it was not possible to determine the source of uranium isotopes detected at offsite sample stations.

[d] 1 mrem = 1.0 E–02 mSv; these doses are based on air monitoring results for sample stations at the site perimeter. Radionuclides with negative releases are assumed to have a zero dose.

[e] The highest estimated dose from fugitive emissions was at the Prosser Barricade, a location with no full-time occupancy by a member of the public, which disqualifies it for consideration as a possible MEI location.

[f] Samples for ^{129}I were collected but had not been analyzed in time for publication of this report, due to lack of analytical capability to process the samples.

For 2007, the combined dose from point and fugitive sources of emissions to the Sagemoor Road offsite MEI was 0.14 mrem (0.0014 mSv) EDE, which is significantly below the federal and state 10 mrem/yr standard. The MEI dose derived from 0.13 mrem (0.0013 mSv) EDE from point source emissions and 3.9 E–03 mrem (3.9 E–05 mSv) EDE from fugitive emissions. (For purposes of comparison, the

corresponding total doses estimated using CAP88-PC v1 for point and fugitive sources combined were 0.17 mrem [0.0017 mSv] EDE in 2007 and 0.10 mrem [0.0010 mSv] EDE in 2006.)

For purposes of demonstrating compliance with the NESHAP dose standard, the dose is reported for a member of the public at the location that receives the maximum dose from point source emissions, combined with the dose from fugitive source emissions at that same location. The estimated maximum dose from fugitive source emissions is also reported separately if the location differs from that of the MEI who receives the highest dose from point source emissions. However, the maximum dose from fugitive source emissions is not used to determine the location of the Hanford MEI for compliance purposes. The reason is three-fold. First, regardless of the size difference between doses from point source emissions and from fugitive source emissions, the method used to calculate the dose from point source emissions is given primacy because it is agency-approved and based on more realistic measurements, whereas the method used to calculate the fugitive emission dose is based on a hypothetical source location, is intentionally conservative, and has not been officially approved by EPA or WDOH, although both agencies have been cognizant of it since its inception. Second, the fugitive-dose method centers on a single hypothetical point of origin that was chosen to maximize the estimated fugitive emissions, which adds to the conservative nature of the method. In contrast, the point-source method reflects actual emissions because it is largely based on measured emission from facilities in five different geographical operating zones across the Hanford Site. Third, the location that receives the highest fugitive-source dose is within the Hanford Site boundary. The dose estimate for that location assumes full-time occupancy and local food production, although a member of the public would not have full-time unrestricted access to the area and no crops are grown onsite. Those assumptions typically result in a higher dose than other potential MEI locations that are not within the Hanford site boundary and which are more distant from the hypothetical fugitive source in the 200 West Area.

In addition to the sitewide fugitive emissions estimates, fugitive tritium emissions from two sources during 2007 were estimated to determine their contribution to the public radiological dose. Tritium emissions from the 100-K Spent Fuel Storage Basins were estimated as less than 2 Ci/yr (7.4 E+10 Bq/yr), and those from the 200 Area Tank Farms were estimated as less than 6 Ci/yr (2 E+11 Bq/yr). Emissions from both sources were assumed to be in the form of tritiated water.

For 2007, the resulting dose to the offsite MEI from estimated tritium emissions was 1.2 E–05 mrem (1.2 E–07 mSv) EDE from the 100-K Basins and 6.5 E–05 mrem (6.5 E–07 mSv) EDE from the 200 Area Tank Farms. The dose from these sources was much lower than the dose from monitored point source emissions and did not substantially increase the total dose to an offsite receptor.

4.2.3 Estimate of Uncertainty in Dose Assessment

To estimate uncertainty in the dose estimates, the reported air concentrations for 2007 at the Byers Landing and Leslie Groves perimeter sampling stations and at the distant community station in Yakima were used to estimate the mean and 95% confidence intervals for each location. The analysis used the uncorrected air concentrations at the reference locations, including contributions from monitored point source releases at DOE facilities, sources other than DOE facilities, fugitive sources, and regional background. The Byers Landing and Leslie Groves stations were selected for this analysis because they were closest to the Hanford Site MEI and were perimeter stations at which all radionuclides were evaluated. The distant offsite and upwind Yakima location is assumed to represent regional background levels of radionuclides in the ambient air.

The uncertainty calculation was performed using the GENII-S computer code (SAND91-0561A) to produce a stochastic analysis of the environmental radiation doses. The raw values of the measured air concentrations were input as basic concentrations to define an empirical distribution for each

radionuclide. The code used a Latin hypercube sampling routine to select random values for each radionuclide concentration in 300 trials to obtain the dose distribution for each location. The values of parameters other than the radionuclide air concentrations were those recommended for use at the Hanford Site (PNL-3777, Rev. 2) and were not varied as part of this analysis. Therefore, the uncertainties reported in this section reflect only variability in the air sampling data.

The estimated mean dose at the Byers Landing station was 6.2 E–02 mrem (6.2 E–04 mSv) for artificially produced radionuclides sampled at that location, with a 95% confidence interval of 2.9 E–02 mrem (2.9 E–04 mSv) to 9.8 E–02 mrem (9.8 E–04 mSv). The corresponding result for the station at Leslie Groves was 1.2 E–01 mrem (1.2 E–03 mSv) with 95% confidence limits of 3.3 E–02 mrem (3.3 E–04 mSv) to 2.3 E–01 mrem (2.3 E–03 mSv). The result for the distant community monitoring station was 3.5 E–02 mrem (3.5 E–04 mSv) with 95% confidence limits of 3.3 E–03 mrem (3.3 E–05 mSv) to 8.6E–02 mrem (8.6 E–04 mSv). The mean dose estimates and the upper and lower 95% confidence limits were higher at some site perimeter stations than at the distant community station, although the ranges for all stations overlap. The maximum estimated dose at perimeter stations was comparable to that calculated for stack emissions and fugitive sources combined; therefore, the 95% confidence interval for the dose from all sources would be expected to be similar at those locations.

4.2.4 Discussion of Bias in Dose Assessment

It should be noted that the release estimates for fugitive sources in Table 4-1 were obtained using CAP88-PC, which incorporates a continuous-release Gaussian-plume dispersion model. Releases from fugitive sources would be expected to occur primarily under conditions that are very different from the annual average assumptions used by CAP88-PC. This is particularly true for emissions that are a function of wind speed, such as resuspension of contaminated soil and evaporation from ponds. Because release rates from such sources are greatest under conditions that favor atmospheric dispersion, use of an annual average continuous release model to back-calculate the release quantities might introduce a significant bias into these estimates. The dose estimates for sources of this type might also be affected by seasonal variation in the resuspension rates caused by the prevalence of strong winds during certain seasons of the year. If those seasonal episodes occur primarily during times when crop production is minimal, some of the exposure pathways incorporated into the CAP88-PC code (direct deposition on human and animal food crops, for example) would not be applicable. The release and dose estimates reported for fugitive sources in this evaluation should therefore be viewed as approximations whose accuracy is limited by a number of factors inherent in the sampling and modeling process.

4.3 FUGITIVE EMISSION SOURCES

The Hanford Site consists of 586 mi^2 (1,518 km^2) of semiarid shrub-steppe land, of which approximately 6% (about 32 mi^2 [83 km^2], or 20,000 acres [8,090 ha]) has been disturbed and/or actively used. This 6% of land is divided into large operational and support areas: the 100, 200 East, 200 West, 300, 400, and 600 Areas.

Almost all point and fugitive sources of radionuclide emissions are located in the five operational Areas (i.e., 100, 200 East, 200 West, 300, and 400 Areas). For dose modeling purposes, sources outside those operational areas are combined with sources within the nearest operational area. Most point source emissions are measured directly, but at a few facilities they are conservatively calculated from process knowledge. Emissions from fugitive sources are estimated using sample results from a network of environmental surveillance monitoring systems located along the Hanford Site perimeter and at several receptor locations.

The Hanford Site was acquired in 1943 and dedicated to producing plutonium for national defense and managing the resulting production wastes. Restoring the Hanford Site environment is the new mission that has largely supplanted the previous operational objectives for national defense. The environmental restoration effort will entail activities such as decontaminating and decommissioning over 100 facilities and cleaning up and restoring about 1,500 waste sites. Until the restoration and cleanup work is completed, radioactive emissions may be released from hundreds of fugitive sources, in addition to monitored point sources.

Besides both measuring and modeling point source emissions to determine public doses, environmental surveillance is conducted. Environmental and food-chain pathways are monitored near facilities emitting radionuclides from either point sources or fugitive sources.

The environmental pathways for all air emissions from the Hanford Site are monitored using a stratified sampling approach. Samples are collected and radiation measured according to four surveillance areas. These areas extend from main onsite operational areas to offsite regions (PNNL-16623).

The first area begins near the operating facilities and ends at the Hanford Site perimeter. Fugitive emissions generally will be most concentrated and easier to detect in this area before diluting further as they drift offsite.

The second surveillance area is a series of sampling stations that surround the Hanford Site near its perimeter. Because a person could live as close to the Hanford Site as some of these stations, their data represent the maximum exposures for a member of the public. Therefore, ambient air sampling data from the perimeter locations most closely reflect the actual impacts of radionuclide air emissions from point sources and fugitive sources at the Hanford Site.

The third surveillance area encompasses nearby and distant communities within a 50-mi (80-km) radius of the center of the Hanford Site but beyond its boundaries. Surveillance is conducted in communities to provide measurements at those locations where the most people are potentially exposed. This surveillance ensures radionuclide levels are well below standards established to protect the public health.

Finally, the fourth surveillance area comprises distant locations at which background concentrations are measured. These concentrations are compared with onsite, perimeter, and community locations to indicate the effects of Hanford Site activities. Background locations are essentially unaffected by Hanford Site emissions but contain similar levels of radioactivity originating naturally and from nuclear-testing fallout.

The goal of environmental surveillance at the Hanford Site is to verify compliance with DOE, EPA, and WDOH radiological dose standards for public protection. This goal is accomplished by measuring radionuclides and consequent exposure in the onsite and offsite environment. The environmental surveillance criteria are derived from 1) the collected environmental surveillance data on radionuclides and doses, 2) applicable regulations other than DOE Orders, 3) DOE Order 5400.5, and 4) the DOE *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE/EH-0173T). The surveillance program (refer to *Hanford Site Environmental Surveillance Data Report for Calendar Year 2007* [PNNL-17603, APP. 1, 2008]) was established on these criteria and the pathway analyses that provide information on radionuclides and media contributing to human dose. Experience from Hanford Site environmental surveillance activities and studies conducted over the past 45 years has built an invaluable technical repository of information for planning and data interpretation.

4.3.1 Description of Fugitive Emission Sources

The presently identified actual or potential sources of fugitive radionuclide emissions to the environment at the Hanford Site are described in this section. Among the sources that could release radioactive fugitive emissions are several types of waste handling and disposal facilities such as cribs, ponds, ditches, trenches, retention basins, valve pits, French drains, reverse wells, tanks, vented containers, and burial grounds. Over 1,000 of these types of sources have been identified, of which more than 95% are inactive (DOE/RL-88-30). Facilities that are operating, on standby, or inactive can also be sources of radioactive fugitive emissions. These following activities can also cause the release of radioactive fugitive emissions: deactivation, decontamination, decommissioning, and demolition of facilities; characterization of waste sites and areas; and cleanup of inactive waste sites. Each waste site or facility usually has one or more features or characteristics that could contribute to the release of fugitive emissions. The features may be passive vents, risers, equipment and personnel access doors, and exhausters, whereas characteristics may include an undetected leak, unburied waste, or an absence of intrusion barriers. Rates of fugitive emissions could be influenced by a variety of environmental conditions, such as: 1) changing atmospheric pressures, 2) wind speed, 3) erosion, 4) evaporation, 5) percolation, 6) biotic intrusion, or 7) wind-caused particle resuspension. Range fires present another cause of fugitive emissions, by way of smoke from burned material that contained radioactive particles and the resultant loss of vegetative cover, which had served to retard the resuspension of surface soil contaminants.

The general types of sites and facilities and their potential primary sources of fugitive emissions are briefly described in the following sections.

4.3.1.1 Crib

Low-level liquid waste was discharged to cribs, which are subsurface systems similar to sanitary drain fields that allow the liquid component of the waste to percolate into the soil. The natural properties of the soil are used to remove radioactive material from the effluent water through filtration, ion-exchange, and precipitation reactions.

Many cribs are vented to the atmosphere through vents and pipe risers. Some cribs, however, have had vents and pipe risers either blanked or removed. Those engineered structures promote the downward flow of liquids disposed of in cribs but also provide pathways to the surface and atmosphere. Secondary causes of fugitive emissions include erosion and uptake and intrusion by biota, followed by wind-caused particle resuspension.

4.3.1.2 Ditch

A ditch is an open, unlined excavation used for disposing of liquid effluents or transporting liquid effluents to ponds for disposal. Most ditches, however, have been filled with soil. Fugitive emissions from ditches occur primarily from wind-caused particle resuspension, vegetative uptake, biota intrusion, and erosion.

4.3.1.3 Trench

Early disposal practices included disposing of liquid effluents into unlined trenches and over time filling the structures with soil. These trenches were mostly replaced by cribs such as the BC-cribs. Fugitive emissions from trenches are primarily caused by erosion, uptake and intrusion by biota, followed by wind-caused particle resuspension.

4.3.1.4 Retention Basin

Similar to trenches, retention basins generally were lined with concrete and used to hold liquid before routing it to ditches or ponds. Fugitive emissions from retention basins are caused primarily by wind-caused particle resuspension.

4.3.1.5 Diversion Box

A diversion box is usually an underground concrete structure formed around a junction of transfer lines carrying liquid effluent. When diversion boxes are accessed for operations or maintenance, radioactively contaminated material might be released in the form of fugitive emissions.

4.3.1.6 Valve Pit

A valve pit is similar in structure to a diversion box, but contains piping valves. When valve pits are accessed for maintenance or operations, radioactively contaminated material might be released in the form of fugitive emissions.

4.3.1.7 French Drain and Reverse Well

A French drain is a rock-filled encasement inserted in the ground. A reverse well is an ordinary well used for mixing liquid waste with groundwater. These subsurface systems were used to dispose of potentially contaminated liquid waste by promoting percolation into the soil. The natural filtration properties of the soil removed radioactive material from effluent water. Fugitive emissions from French drains and reverse wells might occur through erosion or uptake and intrusion by biota, followed by wind-caused particle resuspension.

4.3.1.8 Tank

A tank generally is a large reinforced metal structure that receives liquid effluent for storage. Examples are double-shell tanks (DSTs) and single-shell tanks (SSTs). Pathways for fugitive emissions from tanks include passively ventilated point sources and inactive exhausters open to the atmosphere. Transport mechanisms for these emissions include deposition and subsequent particle resuspension.

4.3.1.9 Burial Ground

Burial grounds are trenches in which contaminated solid waste is buried. Waste packaging procedures and burial practices used depend on the type of waste. Fugitive emissions occur at burial grounds through direct release to the atmosphere before the waste is buried, but could occur after burial by way of erosion, vegetative uptake, biota intrusion, and wind-caused particle resuspension.

4.3.1.10 Deactivation, Decontamination, Decommissioning, and Demolition Activities

Deactivation, decontamination, decommissioning, and demolition activities are conducted to minimize the potential release or spread of contamination from facilities and equipment. Deactivation activities are intended to remove facility systems and/or areas from operational service to make them ready for the facility transition phase in which facilities are either converted to another use or placed in a permanent shutdown condition. Activities could include removal of fuel; draining and/or de-energizing of systems; removal of accessible stored radioactive and hazardous material; and other actions that place the facility systems and/or areas in a safe and stable condition. Deactivation reduces the risk to the public and the

environment until the ultimate disposition of each facility is decided and implemented, and allows the surveillance and maintenance program to be conducted more cost effectively.

Decontamination primarily consists of physically removing contaminants, but can also include fixing contaminants in place, to the extent they are not smearable, to prevent their mobility during demolition. Methods might include washing with water, scraping, sandblasting, or fixing the contamination in place by painting, applying asphalt, etc. Demolition involves destroying and removing the structure and might include excavating its foundation. In some cases, contaminated material might be exposed to the atmosphere, but proper planning and controls should minimize these exposures. Monitors around demolition sites are used to measure or indicate the effectiveness of controls.

4.3.1.11 Waste Site Characterization and Cleanup Activities

Characterization is performed to determine the extent of contamination. Cleanup activities are conducted to minimize the potential release or spread of contamination from inactive waste sites. Contaminated soils and structures are excavated and transported to ERDF for disposal. Contaminated materials are exposed to the atmosphere during excavation and disposal activities. Proper planning and controls such as water sprays and fixatives are used to minimize the potential for airborne emissions. The waste sites are backfilled after excavation and the disposed material is covered with soil.

4.3.1.12 Outdoor Radioactive Surface Contamination Areas

All of the following outdoor radioactive surface contamination areas are routinely surveyed: burial grounds, cribs, trenches, retention basins, and identified unplanned release sites. The surveys are performed at least annually, but more frequently when needed. The areal magnitude of outdoor surface contamination varies. The magnitude is not fixed because of continuing efforts to clean, stabilize, or remediate known contaminated areas while new areas of contamination are continuing to be identified. Newly identified contamination could result because of preexisting contamination having migrated, by way of wind or biological intrusion, to previously uncontaminated areas or because the radiological screening criteria have become more stringent.

Contaminated areas are posted as Radiologically Controlled Area, Soil Contamination Area, or Underground Radioactive Material Area. Radiologically controlled areas are areas having a potential for an individual to receive an annual dose of up to 100 mrem. Soil contamination areas have more widespread contamination, and can have a potential for an individual to receive an annual dose of more than 100 mrem. Underground Radioactive Material Area signs mark cribs, burial grounds, covered trenches, and ponds, but not underground plumes that extend away from these sites. If an area has soil contamination and underground contamination, such as a surface contaminated crib, both postings will be used. The general location, by area, and the approximate area of soil contamination and underground contamination are shown in Table 4-2. Fugitive emissions from areas of soil contamination are primarily caused by erosion, plant uptake, biota intrusion, and wind-caused particle resuspension.

4.3.1.13 Structures with Radioactive Contamination

Structures having indoor contamination and not actively ventilated through a point source could be sources for fugitive emissions. Many structures control fugitive emissions with ventilation systems and contamination control practices. Ventilation systems generally help maintain a negative indoor air pressure and can significantly reduce airborne contaminants from leaving the building by use of pollution abatement systems. Many structures with ventilation systems discharge air to the atmosphere via an emission control device, typically a HEPA filter. Facilities having a potential to emit radioactive contaminants and have actively ventilated and filtered point sources that are routinely sampled are not

considered a source of fugitive emissions. This type of facility has the potential, though lesser in extent, than facilities not equipped with active ventilation systems but with a comparable source term. The Hanford Site has many old structures with radioactive contamination and no building ventilation. Contaminants can sometimes migrate outdoors via human entry and exit. Also, contaminants can migrate outdoors via passive ventilation or animal intrusion because these structures often have cracks and gaps that serve as pathways to the outdoors. Once the contaminants are transported outdoors, they can become airborne by wind-caused resuspension.

Table 4-2. Soil and Underground Contamination Areas at the Hanford Site in 2007

Hanford Site operational area	Soil contamination areas,[a] acres (hectares)	Underground radioactive material areas,[b] acres (hectares)
100 Areas	17 (7)	322 (131)
200 Areas[c]	242 (98)	902 (365)
300 Area (north)	0	104 (42)
400 Area	0	0
600 Area[d]	8,594 (3,478)	136 (55)
Total	8,853 (3,593)	1,464 (593)

[a] Includes areas posted as "Contamination/Soil Contamination" or as "Radiologically Controlled" and areas that had both radioactive material and contamination/soil contamination.

[b] Includes areas with only underground contamination.

[c] Includes Tank Farms.

[d] Includes BC-controlled area, Environmental Restoration Disposal Facility, and waste disposal facilities outside the 200 East Area and 200 West Area boundaries.

4.3.2 Description of Specific Fugitive Emission Sources

This section contains brief descriptions of the identified sources of fugitive emissions at the Hanford Site.

4.3.2.1 100 Areas Inactive Reactor Sites

The inactive reactor sites in the 100 Areas include the 100-B/C Area, 100-D Area, 100-F Area, 100-H Area, 100-K Area, and 100-N Area. The reactors are currently under surveillance and maintenance until the long-term disposition of these reactors is determined. Activities were conducted at several of the reactors to demolish ancillary facilities and to place the reactors in interim safe storage (ISS) pending final disposition. The potential sources for fugitive emissions include personnel and equipment passing through access doors during surveillance and maintenance; inactive exhaust vents and risers; ISS activities; ancillary facility decontamination and demolition; remedial actions; and characterization activities. The N Springs (i.e., a stretch of Columbia River shoreline below the retired 1301-N Crib) remains a source of low-level contamination (primarily ^{90}Sr) that seeps into the Columbia River. Other means of fugitive emissions include erosion, uptake or intrusion of biota, and wind-caused resuspension.

4.3.2.2 100-K Area Basins

Two identical reactors are located in the 100-K Area, one reactor in the 100-KE Area and the other in the 100-KW Area. The reactors and their support facilities were constructed between 1952 and 1954, beginning service in 1955. The 100-KW Area reactor ceased operating in 1970 and the 100-KE reactor in 1971.

The fuel storage basins within the 105-KE and 105-KW Buildings were modified years ago to store N Reactor irradiated fuel. Storing of this fuel began in 1975 at the 105-KE Basin and in 1981 at the 105-KW Basin. In 1989, shipments of fuel from N Reactor to the Basins ceased. The last of the fuel from both basins was removed in 2007. Fuel from the basins was packaged into Multi-Pack Canister Overpacks (MCOs). The MCOs were shipped to CVDF where the fuel is dried. After that, the MCOs, containing the fuel, were shipped to CSB in the 200 East for storage.

The primary radionuclides that could be included in fugitive emissions from the 100-K Basins include ^{3}H, ^{90}Sr, ^{137}Cs, ^{238}Pu, $^{239/240}Pu$, ^{241}Pu, and ^{241}Am. The potential release points for fugitive emissions include personnel and equipment access doors, which are normally closed.

4.3.2.3 200 Area Facilities and Sites

Active and inactive facilities and sites in the 200 Areas are potential sources for fugitive emissions. Activities in the facilities or on the sites include surveillance and maintenance, decontamination and decommissioning, and stabilization. Erosion, vegetative uptake, wind, and biota intrusion can also induce fugitive emissions at these locations.

4.3.2.4 Plutonium-Uranium Extraction Facility

The PUREX Facility is located in the 200 East Area. The main building, 202-A, is a heavily shielded, reinforced concrete structure known as a canyon. This building contains the main equipment that was used in the PUREX process of chemically separating and purifying actinides from the irradiated nuclear fuel.

Radionuclides primarily associated with the PUREX Plant include ^{90}Sr, ^{106}Ru, ^{129}I, ^{137}Cs, ^{238}Pu, $^{239/240}Pu$, ^{241}Pu, and ^{241}Am. Potential fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.5 Uranium-Trioxide Plant

The UO_3 Plant, located in the 200 West Area, produced UO_3 powder by calcining uranyl nitrate solutions from the PUREX Plant. The UO_3 powder was loaded into hoppers for shipment offsite.

Uranium was formerly the potential primary source of radioactive fugitive emissions from the UO_3 Plant. Since the UO_3 Plant was deactivated, only small amounts of UO_3 remain, located primarily inside of equipment. The noble gases radon and thoron remain as the only source of fugitive emissions. Potential fugitive emission release points include access doors, all of which are restricted and controlled.

4.3.2.6 Reduction-Oxidation Plant

REDOX is also located in the 200 West Area. It used methyl isobutyl ketone as a solvent to remove both plutonium and uranium from dissolved fuel rods solutions.

Radionuclides primarily associated with REDOX include ^{90}Sr, ^{106}Ru, ^{129}I, ^{137}Cs, ^{238}Pu, $^{239/240}Pu$, ^{241}Pu, and ^{241}Am. Potential fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.7 Plutonium Finishing Plant

PFP is located in the 200 West Area. It was designed to recover, stabilize, and store plutonium. Recovered plutonium nitrate and plutonium nitrate solutions received from the PUREX Plant were reduced to plutonium dioxide. The reduction process stabilized the plutonium into the state best suited for long-term storage. The current PFP mission does not include producing finished plutonium metal but rather maintaining a safe and compliant facility, storing Special Nuclear Materials safely and securely, stabilizing nuclear materials for long-term storage, and clean-up activities.

Radionuclides primarily associated with PFP include $^{239/240}Pu$, ^{241}Pu, and ^{241}Am. Potential fugitive emission release points from PFP include access doors, passively ventilated waste drain line vents, and the inlet-exhaust ventilation system.

4.3.2.7.1 234-5Z Building

The 234-5Z Building is often referred to as PFP, Dash 5, or the 234-5 Building. The basement of the 234-5Z Building mostly consists of pipe tunnels carrying drain piping. The first floor houses the following: 1) two former plutonium processing lines (Remote Mechanical A and Remote Mechanical C Lines) and their control rooms, 2) stabilization and repackaging gloveboxes, 3) plutonium storage vaults, and 4) the plutonium nitrate feed load-in/load-out, blending, and storage facilities.

Radionuclides primarily associated with the 234-5Z Building include $^{239/240}Pu$ and ^{241}Am. Potential fugitive release points include access doors, passively ventilated waste drain line vents, and the inlet-exhaust ventilation system.

4.3.2.7.2 236-Z Building

The 236-Z Building, also called the Plutonium Reclamation Facility, is located south of the southeastern corner of the 234-5Z Building and connected to it by the 242-Z Building. The building air exhausts through the 291-Z-1 stack.

Radionuclides primarily associated with the 236-Z Building include $^{239/240}Pu$ and ^{241}Am. Potential fugitive release points include access doors and the inlet-exhaust ventilation system.

4.3.2.7.3 232-Z Building

The 232-Z Building is the Waste Incinerator Facility, which was operated from the 1960s until 1972 when it was shut down. CERCLA deactivation activities commenced in 2005 and were completed in May 2006. Demolition of the building along with the 296-Z-14 stack was completed in July.

Radionuclides primarily associated with the 232-Z Building include $^{239/240}Pu$ and ^{241}Am. The remaining potential fugitive emission release point is the stabilized building slab.

4.3.2.7.4 241-Z Building

The 241-Z Building is a below-grade reinforced concrete structure with a pre-engineered corrugated metal enclosure over the top that provides weather protection. The below-grade structure consists of five separate ventilated cells, each containing a stainless-steel tank of approximately 17,000-liter capacity. In addition, the second cell from the west end, the D-7 cell, houses a 700-liter overflow tank. These tanks had been used to accumulate the liquid waste generated during PFP complex operations. The tanks and the vault portion of the 241-Z Building were ventilated by the 296-Z-3 Stack. Waste was received in the tanks through underground piping. The pH of the waste was adjusted before being transferred to the DST System at Tank Farms. The last waste was transferred out at the end of 2004, and the system has been isolated from PFP processes and from Tank Farms. The 241-Z completed closure activities and commenced CERCLA above-grade deactivation activities in 2006. Demolition of the above-grade building along with the 296-Z-3 stack was completed in June 2007.

Radionuclides primarily associated with the 241-Z Building include $^{239/240}$Pu and ^{241}Am. Potential fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.7.5 242-Z Building

The 242-Z Building houses abandoned waste treatment process equipment once used to recover americium. This facility was permanently shut down after a process upset in 1976 spread contamination and caused irreparable equipment damage inside. The structural integrity of the facility was not compromised, however. The facility was decontaminated extensively before being placed in layaway pending decommissioning work. The 242-Z Building shares the main ventilation system of the 234-5Z and 236-Z Buildings, exhausting its building air through the 291-Z-1 Stack.

Radionuclides primarily associated with the 242-Z Building include $^{239/240}$Pu and ^{241}Am. Potential fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.7.6 243-Z Building

The 243-Z Building is the Low-Level Waste Treatment Facility, which receives very low-activity wastewater (VLAW) from various PFP operations. The VLAW is treated and then routed to the TEDF. Building air is exhausted through the CERCLA-regulated 296-Z-15 Stack.

Radionuclides primarily associated with the 243-Z Building include $^{239/240}$Pu and ^{241}Am. Potential fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.7.7 2736-Z and 2736-ZA Buildings

The 2736-Z Building is the primary plutonium storage facility for special nuclear material. The 2736-ZA Building provides ventilation for the 2736-Z Building, emissions from which are exhausted through the 296-Z-6 Stack located on the roof of the 2736-ZA Building.

Radionuclides primarily associated with the 2736-Z Building include $^{239/240}$Pu and ^{241}Am. Potential fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.7.8 2736-ZB Building

The 2736-ZB Building has a shipping area and receiving area that can both accommodate a maximum of 100 shipping containers, each of which is about the size of a 55-gal (210-L) drum. Adequate spacing is

provided between containers to meet criticality prevention requirements, personnel exposure specifications, and corridor access standards to emergency staging areas. The two areas are separated by a wall. The capability to weld inner and outer cans has been added to this building. Exhaust associated with shipping and receiving activities and can-welding operations is ventilated through the 296-Z-5 stack. In addition, the capability to thermally stabilize plutonium-bearing materials in muffle furnaces and repackaging of materials has been added to this building, with associated emissions exhausted through the 296-Z-7 stack.

Radionuclides primarily associated with the 2736-ZB Building include $^{239/240}$Pu and ^{241}Am. Potential fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.8 T Plant Complex

Originally, the T Plant Complex, then known just as T Plant, was a fuel separations facility using the bismuth-phosphate process. Now the complex is used primarily for repackaging transuranic (TRU) and transuranic mixed waste for eventual shipment to the Waste Isolation Pilot Plant (aka WIPP) near Carlsbad, New Mexico. Other waste activities include cleaning radioactively contaminated equipment and storing, treating, sampling, and verifying waste.

The T Plant Complex is located in the 200 West Area. Buildings, structures, or special facilities in the Complex are the 221-T Building (Canyon, Head-End, and Railroad Tunnel); the 2706-T, 2706-TA, and 2706-TB Buildings; the 214-T Storage Building; storage modules; and outdoor treatment and storage pads. Other ancillary structures, buildings, and areas include the 271-T administration building, 291-T-1 stack, 221-TA Buildings, and 211-T Area.

Decontamination processes, storage, and treatment are conducted in the 221-T Building and 2706-T Building and other locations within the T Plant Complex boundary. The 221-T Building Head-End is used for waste processing activities (e.g., treatment and storage). The 271-T Building and other support structures provide office space to staff supporting T Plant operations.

Radioactive decontamination, treatment, and storage activities are performed on the canyon deck, process cells, railroad tunnel, and head-end. The canyon area consists of 37 cells and one railroad tunnel door. The railroad tunnel, used for transporting equipment, waste, etc., into and out of the canyon, enters the plant at cell 2L. A motor-driven rolling steel door provides railroad tunnel access. Primary radionuclides associated with T Plant include ^{90}Sr, ^{137}Cs, and $^{239/240}$Pu. Potential fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.8.1 2706-T Building

The 2706-T Building is a ground-level structure constructed of prefabricated steel. Two openings on its west end are fitted with roll-up metal doors that allow access to the pit area. Treatment, storage, and low-level radioactive decontamination activities can be performed over this pit.

Radionuclides primarily associated with the 2706-T Building include ^{90}Sr, ^{137}Cs, $^{239/240}$Pu, and ^{241}Am. Potential fugitive emission release points include access doors, the inlet-exhaust ventilation system, and an outdoor storage area.

4.3.2.8.2 221-T Building — Head-End Operations

The 221-T Building head-end consists of a canyon area extending from the basement floor to the roof. This canyon area has several deck levels and a parapet wall. Four floor levels adjacent to the canyon

house include 1) an electrical switchgear room, 2) a chemistry laboratory, 3) office areas, 4) a change room, 5) a lunch room, 6) a control room, 7) an instrument shop, 8) a maintenance shop, and 9) storage areas.

Radionuclides primarily associated with 221-T Head-End Operations include ^{90}Sr, ^{137}Cs, and $^{239/240}Pu$. Potential fugitive emission release points include access doors and inlet-exhaust ventilation system.

4.3.2.8.3 221-T Building — Pressurized-Water Reactor Fuel Assembly Storage

Canyon cell 2R was modified to include a fuel pool for storing 72 pressurized-water reactor (PWR) Core 2 blanket fuel assemblies, used in the Shippingport Reactor. By the end of September 2004, those fuel assemblies had all been removed from the pool and shipped to the Canister Storage Building (CSB).

The 221-T Building galleries are maintained at atmospheric pressure, while the 221-T Building canyon area is kept at a negative pressure with respect to other connected ventilated spaces. A primary design feature of these systems is to ensure that potentially contaminated canyon air is completely separate from the clean air in the 221-T Building galleries and the 271-T Building, which is the office space connected to the 221-T Building.

The 271-T Building is adjacent to the 221-T Building. While most of this building is used for office space, portions are used by T Plant Complex Operations.

Radionuclides primarily associated with 221-T-PWR Fuel Assembly Storage include ^{90}Sr, ^{137}Cs, and $^{239/240}Pu$. Potential fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.9 B Plant Complex

Currently, the B Plant Complex is deactivated and all production activities have ceased. It was originally designed to chemically process spent nuclear fuels. Radiological containment and confinement features were incorporated in the various facilities and support systems to prevent exposure of plant personnel and the general public to excessive radiation. The plant was then modified to separate strontium and cesium from the fission product waste stream following plutonium and uranium recovery from irradiated reactor fuels in the PUREX Plant. The recovered purified and concentrated strontium and cesium solutions were then transferred to WESF for conversion to solid compounds, encapsulation, and interim storage. After strontium and cesium removal, the remaining waste was transferred from B Plant to the Tank Farms.

B Plant consists of the 221-B Processing Building and the 271-B Service and Office Building. The 221-B Process Building and its attached 271-B Service Building were constructed in 1943.

Radionuclides primarily associated with B Plant include ^{90}Sr and ^{137}Cs. Potential fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.10 Waste Encapsulation and Storage Facility

WESF, or the 225-B Building, is an operating facility used to ensure safe storage and management of the cesium and strontium capsules. Construction of WESF was completed in 1974.

Radionuclides primarily associated with WESF include ^{90}Sr and ^{137}Cs. Potential fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.11 200 Area Interim Storage Area (at CSB)

The 200 Area Interim Storage Area (ISA) is located adjacent to CSB. The ISA is designed to receive non-defense reactor spent nuclear fuel (SNF) from various locations at the Hanford Site for consolidated interim storage. The SNF intended for relocating to the ISA included SNF from FFTF, the Neutron Radiography Facility, and light-water reactors whose fuel has been transferred to USDOE for research. The ISA is periodically monitored by means of hand-held radiation-detection instruments used to check for the presence of radiological contamination on swipes collected on the outer surfaces of containers holding SNF.

4.3.2.12 222-S Laboratory Complex

The 222-S Laboratory Complex is located near the southeast corner of the 200 West Area. The facility is composed of the main laboratory complex (222-S) and a number of ancillary buildings and structures.

4.3.2.12.1 222-S Laboratory

The 222-S Laboratory is a two-story, aboveground building with a subterranean service level. This building is divided into laboratory support spaces, office spaces, a multi-curie wing, a hot cell addition, and supplemental service areas. The building is designed with its own waste disposal facility, decontamination facility, fire protection and alarm system, ventilation system, and radiation monitoring systems.

The 222-S Laboratory Annex houses the maintenance shop, instrument shop, and the counting room filter building.

Radionuclides primarily associated with the 222-S Laboratory include ^{90}Sr, ^{137}Cs, and $^{239/240}Pu$. Potential fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.12.2 222-SA Laboratory

The 222-SA Laboratory is a five-wide modular building located southeast of the 222-S Laboratory. Part of this laboratory prepares nonradioactive standards for 222-S and other Hanford Site laboratories. The other section of the laboratory is used for cold-process development work and standards preparation. The 222-SA Laboratory only has the potential for nonradioactive fugitive emissions.

4.3.2.12.3 2716-S Storage Building

The 2716-S Storage Building, located south of the 222-S Laboratory, is partitioned off for the storage of acids and bases. It provides both long- and short-term storage capability for laboratory materials and contains no radioactive materials.

4.3.2.12.4 207-SL Retention Basin

The 207-SL Retention Basin acts as a temporary holding facility for nonradioactive, nonhazardous liquid effluents before they are transferred via a cross-site pipeline to the Treated Effluent Disposal Facility, located in the 200 East Area. Transfers are also done by means of tanker truck, which transports basin water to the Liquid Effluent Retention Facility if the wastewater does not meet TEDF acceptance criteria.

The basin is a covered, below-grade concrete structure, directly northeast of the 222-S Building. Two 25,000-gal (95,000-L) compartments allow batch collection, sampling, and discharge of the wastewater.

Three 20,000-gal (75,708-L) storage tanks were added in 1994 to improve waste transfer and storage capabilities. Wastewater from the laboratory, normally free of radioactive and hazardous chemical contamination, is routed to the 207-SL Retention Basin. Nonradioactive, nonhazardous wastewater from the nearby package boiler is also discharged to the basin.

Radionuclides primarily associated with the 207-SL Retention Basin include ^{90}Sr, ^{137}Cs, and $^{239/240}Pu$. Potential fugitive release points include access doors and seams in the basin cover blocks.

4.3.2.12.5 219-S Waste Handling Facility

The 219-S Waste Handling Facility collects liquid waste generated by the 222-S Laboratory operations that is contaminated radioactively and/or with hazardous chemicals. Potential fugitive release points include access doors in the enclosure facility over the vaults. This facility consists of two below-grade vaults (A and B, also called cells) containing three stainless steel tanks, a Transite[1] building, the pipe trench and operating gallery, and an attached concrete-walled sample gallery. Tanks TK-101 and TK-102 are in vault A and tanks TK-103 and TK-104 are in vault B. Tank TK-103 is no longer in service.

Radionuclides primarily associated with the 219-S Waste Handling Facility include ^{90}Sr, ^{137}Cs, and $^{239/240}Pu$. Potential fugitive release points include access doors and seams in the vault enclosure.

4.3.2.12.6 222-SB Filter Building

The 222-SB Filter Building, located south of the 222-S Building, houses 96 HEPA filters, which provide final filtration for the 222-S Laboratory. Under normal operation of the ventilation system, three electrically powered fans exhaust air from the 222-S Laboratory. Exhaust air leaves the 222-S Building through the 296-S-21 stack. In the event one of the primary exhaust fans fails to operate, emergency diesel-powered ventilation is provided for and exhausted through the 222-SE Filter Building.

Radionuclides primarily associated with the 222-SB Filter Building include ^{90}Sr, ^{137}Cs, and $^{239/240}Pu$. Potential fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.12.7 222-SC Filter Building

The 222-SC Filter Building, located north of the 222-S Laboratory, contains the second and third stage HEPA filtration for hot cells 1-A, 1-E-1, 1-E-2, 1-F, and 11-A-1 through 11-A-6. The hot cells in rooms 1-A, 1-E, 1-E, 1-F, and 11-A are serviced by the main building supply and exhaust ventilation. The 222-SC Filter Building houses five parallel pairs of HEPA filters, which provide filtration to hot cell exhaust air before it enters the main exhaust plenum and final filtering in the 222-SB or 222-SE Filter Buildings. A total of three stages of HEPA filtration are provided for the hot cell ventilation exhaust.

4.3.2.12.8 222-SE Filter Building

The 222-SE Filter Building, located south of the 222-S Building, houses 56 HEPA filters. This building provides redundant backup filtering capabilities for the 222-S Laboratory exhaust.

Radionuclides primarily associated with the 222-SE Filter Building include ^{90}Sr, ^{137}Cs, and $^{239/240}Pu$. Potential fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.12.9 218-W-7 Dry Waste Burial Vault

The 218-W-7 Dry Waste Burial Vault is located 40 ft (11.3 m) southeast of 222-S. This underground concrete vault was removed from service around 1960. It was used primarily for disposal of plutonium-contaminated hood waste generated by the 222-S Laboratory. Access to the tank is through a locked hatchway.

[1] A product of BNZ Materials, Inc.

The radionuclide primarily associated with the 218-W-7 Dry Waste Burial Vault is $^{239/240}Pu$. A locked access hatchway is the only potential release point for fugitive emissions.

4.3.2.12.9 218-W-7 Dry Waste Burial Vault

The 218-W-7 Dry Waste Burial Vault is located 40 ft (11.3 m) southeast of 222-S. This underground concrete vault was removed from service around 1960. It was used primarily for disposal of plutonium-contaminated hood waste generated by the 222-S Laboratory. Access to the tank is through a locked hatchway.

The radionuclide primarily associated with the 218-W-7 Dry Waste Burial Vault is $^{239/240}Pu$. A locked access hatchway is the only potential release point for fugitive emissions.

4.3.2.13 Waste Verification and Sampling Facility

The Waste Verification and Sampling Facility (213-W Building) is located in the 200 West Area. The 213-W Building is adjacent to the 272-WA Building (the Operations Support Building) at the 218-W-5 Burial Grounds at the west end of the 200 West Area. The primary function or process associated with this facility is the verification of waste drums received from waste generators. Because of limited use, it was transferred to the 200 West Tank Farms in 1995.

Radionuclides primarily associated with the 213-W Building include low levels of ^{90}Sr and ^{137}Cs. Potential fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.14 Waste Receiving and Processing Facility

WRAP, initially constructed and operational in 1997, has expanded to a group of structures on the west side of the 200 West Area adjacent to CWC. It is used for examining, assaying, characterizing, and repackaging principally TRU waste destined for disposal at the Waste Isolation Pilot Plant in Carlsbad, New Mexico. Some rooms in the building are dedicated to mechanical, electrical, heating, ventilating, and cooling systems, as well as to administrative areas.

4.3.2.15 Central Waste Complex

CWC is a group of structures located on the west side of the 200 West Area exclusion zone, consisting of the Flammable and Alkali Metal Waste Storage Modules; Waste Storage Buildings; Waste Storage Pad; outdoor storage areas; and Waste Receiving and Staging Area. The primary function or process associated with the CWC is the receipt and storage of radioactive and mixed waste. The CWC has the potential to generate radioactive and/or hazardous chemical emissions and radioactive and/or hazardous chemical liquid effluent.

Radionuclides associated with the CWC are from a wide group of mixed-fission, mixed-waste, and TRU radionuclides. Potential fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.15.1 Flammable and Alkali Metal Waste Storage Modules

The Flammable and Alkali Waste Storage Modules are pre-engineered structures. The size and weight of the storage modules vary, depending on the manufacturer. As a result, no set standard exists for every module. The front, back, and side walls of all of these modules are constructed of 10-guage steel and coated inside with chemical-resistant epoxy paint or have a corrosion-resistant covering. All roofs are constructed of 12-gauge steel. All modules have a vented catch sump under their storage floors. Each sump has a capacity of 400 to 2,000 gal (1,500 to 7,600 L). Water supply presently is not provided but could be if necessary. Under no circumstances would water be provided to the Alkali Metal Waste Storage Modules.

4.3.2.15.2 2401-W Waste Storage Building

The 2401-W Waste Storage Building is a pre-engineered steel structure for housing dangerous, mixed, radioactive, and/or Toxic Substances Control Act (TSCA) waste. It is 50 ft (15.2 m) wide by 80 ft (24.4 m) long by 20 ft (6.1 m) high. It is maintained at atmospheric pressure, and heating and cooling are not required for its operations.

4.3.2.15.3 2402-W Buildings

The 2402-W Buildings are pre-engineered steel structures for housing dangerous, mixed, radioactive, and/or TSCA waste. They are 50 ft (15.2 m) wide by 80 ft (24.4 m) long by 20 ft (6.1 m) high. They are maintained at atmospheric pressure, and heating and cooling are not required for their operations.

4.3.2.15.4 2403-WA through 2403-WC Waste Storage Buildings

These buildings are pre-engineered steel structures for housing dangerous, mixed, radioactive, and/or TSCA waste. They are 170 ft (51.8 m) wide by 200 ft (61 m) long by 20 ft (6.1 m) high and are maintained at atmospheric pressure. Heating and cooling are not required for their operations.

4.3.2.15.5 2403-WD Waste Storage Building

This building is a pre-engineered steel structure for housing dangerous, mixed, radioactive, and/or TSCA waste. It is170 ft (51.8 m) wide by 275 ft (99 m) long by 20 ft (6.1 m) high. It is maintained at atmospheric pressure, and heating and cooling are not required for its operations.

4.3.2.15.6 Waste Receiving and Staging Area

This area is an asphalt pad approximately 61 m long and 46 m wide, and is used for container handling and staging of waste destined for various storage buildings.

4.3.2.15.7 2404-W Waste Storage Buildings

The 2404-W Buildings are pre-engineered steel structures for housing dangerous, mixed, radioactive, and/or TSCA waste. They are 121.2 ft (37 m) wide by 180.4 ft (55 m) long by 20 ft (6.1 m) high and maintained at atmospheric pressure. Heating and cooling are not required.

4.3.2.15.8 Waste Storage Pad

The waste storage pad is approximately 90 ft (27.4 m) by 100 ft (30.5 m) with a 6 in. (15.2 cm) curb and has an access ramp and rainwater collection-and-removal system.

4.3.2.16 Tank Farms

Liquid waste from chemical processing operations containing high concentrations of radionuclides is stored on an interim basis in underground tanks. The Hanford Site Tank Farms contain 177 tanks (149 SSTs and 28 DSTs) with capacities ranging from 50,000 to 1.2 million gal (190,000 to 4.5 million L). Since 1967, newly generated liquid waste has been stored in DSTs. The SSTs are no longer receiving waste.

The location of all the Tank Farms is the 200 East and 200 West Areas. Both DSTs and SSTs are present in these areas. Tank Farms in the 200 East Area include the A, AX, B, BX, BY, C (SSTs), AN, AZ, AY, AP, and AW (DSTs). Those in the 200 West Area are the S, SX, T, TX, TY, U (SSTs) and the SY (DST).

Hanford Site Tank Farms comprise transfer routes, diversion boxes, storage vaults, double-contained receiver tanks (DCRT), and evaporators.

A system of underground pipes is used to transfer wastes from the 200 West Area DSTs to the 200 East Area DSTs, as well as between the DSTs and from the DSTs to treatment and storage units in the 200 East Area. Underground and "at-grade" pipe systems are used to transfer waste from SSTs into the DSTs.

Radionuclides currently analyzed for in sampled emissions from the Tank Farms include ^{90}Sr, ^{125}Sb, ^{129}I, ^{137}Cs, $^{239/240}Pu$, and ^{241}Am. Fugitive emission release locations may include vents, risers, access hole covers, inlet-exhaust ventilation systems, diversion boxes, transfer lines, and storage vaults.

4.3.2.16.1 Double-Shell Waste Tanks

The DSTs are of two different types. The first type has a capacity of one million to 1.2 million gal (3.79 million to 4.54 million L) and is used for long-term storage of high-activity mixed waste. Twenty-four 1.2-million-gal (4.5-million-L) DSTs and four 1.0-million-gal (3.8-million-L) DSTs have been built. For efficiency during construction and operation, these tanks were grouped into six Tank Farms.

The second type of DST is smaller, with storage capacities ranging from 800 to 45,000 gal (3,028 to 170,370 L). These tanks were used primarily for lag storage of waste before transfer to the larger tanks or to other facilities. These smaller tanks are called DCRTs.

The first type of DSTs was fabricated as three concentric tanks with an annular area between the inner primary steel tank and the outer secondary steel tank. A concrete tank encloses the secondary tank and the roof of the primary tank. A DST tank farm consists of 2 to 8 tanks. The second type of DSTs consists of a steel tank situated within a concrete vault. The vault also provides an annular-type space around the tank. Ancillary equipment also is present, such as transfer lines, valve pits, diversion boxes, and tank-farm piping. Fugitive emissions can occur from the ancillary equipment and from the DST primary tanks and annuli if the powered ventilation is not operating.

4.3.2.17 242-A Evaporator

The 242-A Evaporator complex is located in the 200 East Area. The 242-A Building contains the evaporator vessel and supporting process equipment. Separate ventilation systems are used for the evaporator vessel and the building. Radioactive emissions are monitored at the stack of each ventilation system.

Radionuclides currently analyzed for in sampled emissions from 242-A include ^{90}Sr, ^{129}I, ^{137}Cs, $^{239/240}Pu$, and ^{241}Am. Potential fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.18 242-S Evaporator

The 242-S Evaporator, currently inactive, is located in the 200 West Area. It consists of an evaporator vessel, supporting process equipment, and control area. The building ventilation exhausts filtered building air. Potential fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.19 242-T Evaporator

The 242-T Evaporator, currently inactive, is located in the 200 West Area. The 242-T Evaporator Facility is divided into a processing area and a control area. The process area includes the 242-T Building, the 242-TA Vault, and 242-TB Ventilation Building. The control area is contained in the metal building adjacent to the east wall of the 242-T Building. Potential fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.20 Grout Treatment Facility

GTF combined low-level radioactive liquid waste with a cement mixture that was pumped into disposal vaults. GTF was placed in cold standby in 1993.

Radioactive constituents primarily associated with GTF include ^{90}Sr, ^{137}Cs, and other low-level radioactive waste from the Tank Farms. Potential fugitive emission release modes include vents, risers, and the inlet-exhaust ventilation system.

4.3.2.21 Low-Level Burial Grounds and Environmental Restoration Disposal Facility

The LLBG is an active land-based unit consisting of eight burial grounds located in the 200 East and 200 West Areas. The 218-E-10 and 2128-E-12B Burial Grounds are in the 200 East Area. The 218-W-3A, 218-W-3AE, 218-W-4B, 218-W-4C, 218-W-5, and 218-W-6 Burial Grounds are in the 200 West Area. The LLBG are of various sizes and depths of lined and unlined disposal trenches. The lined trenches have leachate collection and removal systems.

The following provides a brief description of waste disposed of in the LLBG. An electronic database is maintained that documents each waste receipt, type of waste, and disposal location. Waste disposal in unlined trenches ceased in calendar year 2003. The only trenches that continue to receive waste are trench 94, used for defueled Naval reactor compartments, in burial ground 218-E-12B and trenches 31 and 34, used for mixed waste, in burial ground 218-W-5.

4.3.2.21.1 Burial Ground 218-W-3A

Burial Ground 218-W-3A is approximately 50 acres (20.4 hectares) in size and began receiving waste in 1970. Examples of waste received in this burial ground include ion-exchange resins, failed equipment, tanks, pumps, ovens, agitators, heaters, hoods, jumpers, vehicles, accessories, retrievable TRU waste, and post-August 19, 1987-RCRA and state-only designated mixed waste.

4.3.2.21.2 Burial Ground 218-W-3AE

The 218-W-3AE Burial Ground is approximately 49 acres (20 hectares) in size and began receiving waste in 1981. Examples of waste received in this burial ground include rags, paper, rubber gloves, disposable supplies, broken tools, and post-August 19, 1987-RCRA and state-only designated mixed waste.

4.3.2.21.3 Burial Ground 218-W-4B

The 218-W-4B Burial Ground is approximately 8.6 acres (3.5 hectares) in size and began receiving waste in 1968. Examples of waste received in this burial ground include rags, paper, rubber gloves, disposable supplies, broken tools, and retrievable TRU waste.

4.3.2.21.4 Burial Ground 218-W-4C

The 218-W-4C Burial Ground is approximately 49 acres (20 hectares) in size and began receiving waste in 1978. Examples of waste received in this burial ground include contaminated soil, decommissioned pumps, pressure vessels, post-August 19, 1987-RCRA and state-only designated waste, and retrievable TRU waste.

4.3.2.21.5 Burial Ground 218-W-5

The 218-W-5 Burial Ground is approximately 92 acres (37.2 hectares) in size and began receiving waste in 1986. Examples of waste placed in this burial ground include rags, paper, rubber gloves, disposable supplies, broken tools, and post-August 19, 1987-RCRA and state-only designated waste. It currently contains double-lined mixed-waste trenches (trenches 31 and 34). Trenches 31 and 34 also are designated for greater-than-90-day container storage. Waste to be placed in trenches 31 and 34 for storage purposes predominately will be macro-encapsulated long-length contaminated equipment and other containerized waste that has been treated to meet Land Disposal Restriction (LDR) requirements. Adjacent to the double-lined mixed-waste trenches are leachate collection tanks. Examples of waste to be placed in the double-lined mixed-waste trenches include mixed waste that has been treated to meet LDR requirements (including bulk waste), macro-encapsulated long-length contaminated equipment, etc.

4.3.2.21.6 Burial Ground 218-W-6

The 218-W-6 Burial Ground is approximately 40 acres (16 hectares) in size and has not received any waste.

4.3.2.21.7 Burial Ground 218-E-10

The 218-E-10 Burial Ground is approximately 89 acres (36 hectares) in size and began receiving waste in 1960. Examples of waste located there are failed equipment, rags, paper, rubber gloves, disposable supplies, broken tools, and post-August 19, 1987-RCRA and state-only designated mixed waste.

4.3.2.21.8 Burial Ground 218-E-12B

Burial Ground 218-E-12B is approximately 168 acres (68 hectares) in size and began receiving wastes in 1967. Examples of waste placed in the burial ground include defueled reactor compartments (trench 94), low-level waste, and retrievable TRU waste.

4.3.2.22 Environmental Restoration Disposal Facility

ERDF opened in July 1996 and received waste from Environmental Restoration activities across the Hanford Site. The ERDF consists of cells equipped with a double liner and leachate collection and recovery system that meets the requirements for hazardous waste landfills under RCRA. The ERDF is authorized under a CERCLA record of decision and can only receive waste from actions conducted on the Hanford Site. An interim cover of soil is placed over the cells until the final closure cover is constructed.

4.3.2.23 300 Area Fuel Supply Facility

The buildings previously associated with the 300 Area Fuel Supply Shutdown Facility have been demolished. The associated inactive waste transfer system will be addressed under the CERCLA action for the 300-FF-2 Operable Unit.

4.3.2.24 340 Complex

The 340 Complex is located in the 300 Area near the Columbia River. The 340 Complex was constructed primarily to collect, store, and transport radioactive liquid wastes from 300 Area facilities. Waste was sent from the 324, 325, 326, 327, and 329 Buildings to the Radioactive Liquid Waste System until its valves were closed and most lines cut and capped at their sources. Direct shipments of containers or tankers were also received at the 340 Facility and added to the vault tanks. The 340 Complex also includes the 300 Area Retention Process Sewer, which collects process wastewater with the potential to become radioactively contaminated. This waste stream is monitored for radioactive materials and then accumulated in the 307 Basins before being transferred to the 300 Area Treated Effluent Disposal Facility (TEDF) for treatment.

Uranium, ^{60}Co, ^{90}Sr, ^{137}Cs, ^{238}Pu, $^{239/240}Pu$, and ^{241}Am are the most significant radionuclides potentially present at the 340 Complex. Potential fugitive emission release points include access doors, the inlet-exhaust ventilation system, and the 307 Retention Basin.

4.3.2.24.1 340-A Building

The 340-A Building houses six aboveground storage tanks, which provided temporary storage of radioactive liquid waste. The 340-NT-EX Stack powered exhaust system provides airborne ventilation to the now empty storage tanks, and the 340-A Building air is passively ventilated to the atmosphere via a roof air vent.

Smearable radiological contamination resulting from leakage of radioactive liquid waste from the storage tanks has been detected in the 340-A Building. The radionuclides with the most significant dose impact include ^{90}Sr, ^{137}Cs, ^{238}Pu, $^{239/240}Pu$, and ^{241}Am, which could potentially be present in fugitive emissions from the facility.

4.3.2.24.2 340-B East Building

The 340-B East Building served as a railroad car load-out facility. This facility housed railroad cars during the transfer of radioactive liquid wastes from the 340 vault tanks.

The 340-B East Building exhaust system is currently not operated, thus the building is not maintained at negative pressure. Consequently, fugitive emissions can potentially occur. Potential fugitive emission release points at the 340-B East Building include personnel and equipment access doors. The radionuclides with the largest dose impact that potentially could be released as fugitive emissions include ^{90}Sr, ^{137}Cs, ^{238}Pu, $^{239/240}Pu$, and ^{241}Am.

4.3.2.24.3 340 Vault

The 340 Vault houses two 15,000-gal (57,000-L) radioactive mixed tanks that accumulated mixed waste for shipment to the 200 Area TSD facilities. The 340 Vault, the vault tanks, and the associated piping system are ventilated through the 340-NT-EX stack. Smearable and fixed contamination resulting from tank overfills and maintenance activities are documented in facility records.

4.3.2.24.4 Retention Process Sewer

The Retention Process Sewer consists of a plumbing system, a liquid waste retention/storage system, and a monitoring system. The plumbing system consists of underground single-walled pipes and unsealed manholes that transport liquid waste from the generating facilities to the liquid waste retention/storage system. The retention system consists of four lined and connected open-top concrete basins, which are also known as the 307 Retention Basins. Each basin has a holding capacity of approximately 25,000 gal (95,000 L). The monitoring system uses in-line gamma radiation detectors to monitor radiation levels in the liquids of the Retention Process Sewer. The gamma detectors are used to divert potentially contaminated wastewater to one of the 307 Basins for further evaluation. If contamination is detected above specified action levels, the wastewater can be filtered to meet acceptance levels of the 300 Area TEDF, or if necessary trucked to the 200 Area for treatment and disposal.

4.3.2.25 361 Building

The 361 Building is a pre-cast concrete portable equipment shelter that is permanently located in the southwest corner of the 300 Area. Sampling equipment is installed to sample atmospheric gases, some of which may be radioactive. Periodically, radioactive xenon and/or radon calibration gas is used to confirm operability of the equipment. The building has no active ventilation or exhaust point.

4.3.2.26 Fast Flux Test Facility

FFTF is a 400-megawatt-thermal, sodium-cooled, fast-neutron-flux reactor designed specifically for irradiation testing of nuclear reactor fuels and materials for liquid-metal, fast-breeder reactors. The reactor is currently shut down.

Radionuclides primarily associated with FFTF include ^{3}H and ^{137}Cs. The potential primary fugitive emission release points include the personnel and equipment access doors and the inlet-exhaust ventilation system.

4.3.2.27 Waste Sampling and Characterization Facility Ancillary Facilities

4.3.2.27.1 6265A Building

The Solid Waste Storage Area (6265A Building) is an open-sided, outdoor, 90-Day Accumulation Area used for temporary storage of drums or other low-level radioactive waste packages.

4.3.2.27.2 6266A Building

The Contaminated Liquid Retention Vault (6266A Building) contains two 3,785-liter polyethylene tanks in a common concrete vault. The tanks were designed to receive low-level inorganic, radiologically contaminated liquid waste or sample excess from the analytical laboratory. The liquid is transferred to an approved disposal facility on the Hanford Site using a portable tank truck. This building also provides temporary storage of drums or other low-level radioactive waste packages.

4.3.2.27.3 6267 Building

The Environmental Sample Archive Building (6267 Building) provides for controlled storage, indexing, categorizing, and retrieval of low-level radiological samples. Storage is provided for up to 2,500 samples requiring refrigerated storage and up to 11,500 samples requiring ambient storage. This building also provides for temporary storage of drums and other low-level radioactive waste packages.

4.3.2.27.4 6268 Building

The Sample Equipment Cleaning Facility (6268 Building) provides cleaning for the various tools used for collecting samples from the field. The tools are scrubbed and given solvent and acid baths to clean residual chemicals. No radioactive materials are allowed in this building. Administrative controls are in place to prevent any radioactive materials from entering the building.

4.3.2.27.5 6269 Building

The Mobile Laboratory Storage Facility (6269 Building) houses up to five mobile laboratories and provides protection from adverse weather conditions for the instrumentation and computers contained inside the laboratories. This area also contains calibration laboratory instrumentation used in the mobile laboratories and a sample preparation area for adding chemical buffers and preservatives to sample containers. The building also provides temporary storage of drums or other low-level radioactive waste packages.

4.3.2.27.6 6270 Building

The Environmental Data/Remedial Tracking System Facility (6270 Building) provides accommodations for computerized records data processing to retain records of sample inventories, tracking data, and sample analysis data. This facility is nonradioactive and is used primarily to house administrative personnel.

4.3.2.28 Purgewater Storage Tanks

Purgewater Modutanks, located in the 600 Area but near the 200 Areas, store and treat groundwater purged from Hanford wells. The tanks, each with a one-million-gallon capacity, are located aboveground, double-lined, and open to the atmosphere.

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5.0 SUPPLEMENTAL INFORMATION

This section has supplemental information related to Hanford Site radionuclide air emissions in 2007 and consists of the following:

- Population dose estimate
- Compliance status with Subparts Q and T of 40 CFR 61
- Radionuclide emission estimates and periodic confirmatory measurement information related to Notices of Construction (NOCs)
- Ambient air sampling measurements
- Quality assurance (QA) program status of compliance with 40 CFR 61, Appendix B, Method 114.

5.1 POPULATION DOSE ESTIMATE

The estimated regional population radiation dose (i.e., the collective effective dose equivalent [EDE]) from Hanford Site air emissions in 2007 was calculated using the GENII computer code (PNL-6584). This population consisted of approximately 486,000 people residing within a 50-mi (80-km) radius of the Hanford Meteorology Station, which is located near the center of the Hanford Site (PNNL-14428). The population within 50 mi (80 km) of sources in the 300 Area, which account for over 90% of the collective dose from air pathways, is about 350,000. Pathways evaluated for population exposure to releases of radionuclides from the Hanford Site to the atmosphere include inhalation, air submersion, ground-shine, and consumption of food. Population exposure to radionuclide air emissions was determined using values of population-weighted atmospheric dispersion factors for distance and each compass sector.

The collective EDE for 2007 from radionuclide air emissions was 0.72 person-rem (0.0072 person-Sv). Radionuclide releases from the Hanford Site to surface water added 0.20 person-rem (0.0020 person-Sv). Therefore, the total population dose in 2007 from both airborne and liquid-borne radionuclides originating from the Hanford Site was 0.92 person-rem (0.0092 person-Sv).

5.2 COMPLIANCE STATUS WITH 40 CFR 61, SUBPARTS Q AND T

In 40 CFR 61, Subpart Q, "National Emission Standards for Radon Emissions From Department of Energy Facilities," paragraph 61.190 states that the provisions of Subpart Q apply to the design and operation of all storage and disposal facilities for radium-bearing material that emit ^{222}Rn to the air. Paragraph 61.191(b) states that a source means any building, structure, pile, impoundment, or area used for interim storage or disposal that is or contains waste material containing radium in sufficient concentration to emit ^{222}Rn in excess of a standard of 20 pCi/m^2/s. The known quantities of ^{226}Ra (the immediate precursor to ^{222}Rn) stored at the Hanford Site were evaluated and found to decay to ^{222}Rn at a rate below the standard.

Activities at the Hanford Site were evaluated for compliance with 40 CFR 61 Subpart T, "National Emissions Standards for Radon Emissions From the Disposal of Uranium Mill Tailings." In paragraph 61.220, "Designation of Facilities," owners and operators of such facilities are subject to the provisions in Subpart T: those whose sites were used for the disposal of tailings and that managed residual radioactive material or uranium byproduct materials during and following the processing of uranium ores and that are listed in or designated by the Secretary of Energy under Title I of the Uranium

Mill Tailings Control Act of 1978 or regulated under Title II of that act. Since no uranium milling and uranium-ore processing activities are conducted at the Hanford Site, Subpart T does not apply.

5.3 EMISSION ESTIMATES AND PERIODIC CONFIRMATORY MEASUREMENT DATA FOR NOTICES OF CONSTRUCTION

This section contains emission estimates and periodic confirmatory measurement data as required by NOCs and other regulatory agreements.

5.3.1 Sitewide Notices of Construction for Portable Exhausters

This section contains information on portable exhausters covered by sitewide NOCs. Portable exhausters are referenced in *Radioactive Air Emissions Notice of Construction Portable/Temporary Radioactive Air Emission Units* (DOE/RL-96-75, Rev. 2) and in *Radioactive Air Emissions Notice of Construction for HEPA Filtered Vacuum Radioactive Air Emission Units* (DOE/RL-97-50, Rev. 2), which require that the estimated emissions from these units be summarized in this document. The information in Tables 5-1 and 5-2 fulfills that requirement.

When yearly documentation demonstrates that the handling limits for the emission units have not been exceeded, the estimated emissions are considered to be equal to or less than the values provided in the respective NOC.

Table 5-1. Emission Estimates for Portable/Temporary Radioactive Air Emission Units in 2007.

Unit Type	Radionuclide	Annual estimated emissions, Ci
Type I Units	^{137}Cs	3.53 E–07[a]
Type II Units	did not operate	
Type III Units	did not operate	

1 Ci = 1 curie = 3.7 E+10 becquerels (Bq)

[a] Emissions in 2007 were summarized by calculating a ratio of the total hours of operation during that year (45.1 hr/8,760 hr/yr) to the annual abated release limit (i.e., 6.86 E-05 Ci/yr) in the PTRAEU Notice of Construction (DOE/RL-95-75) to obtain emissions represented by the hours of operation.

Table 5-2. HEPA-Filtered Vacuum Usage for 2007.

Facility	Area	Alpha possession quantity NOC limit, Ci	Beta-gamma possession quantity NOC limit, Ci	Alpha possession quantity in 2007, Ci	Beta-gamma possession quantity in 2007, Ci	Estimated Actual Emissions, Ci	
						Alpha	Beta-gamma
272-S	200-W	7.70 E–03	3.88 E–01	<9.0 E–12	<4.5 E–10	<4.50 E–15	<2.3 E–13
CWC	200-W	7.70 E–03	3.88 E–01	1.77 E–07	2.67 E–05	8.85 E–11	1.34 E–08
ETF	200-E	4.57 E–03	2.30 E–01	<2.2 E–09	<1.1 E–07	<1.1 E–12	<5.5 E–11

1 Ci = 1 curie = 3.7 E+10 becquerels (Bq).

CWC = Central Waste Complex; ETF = Effluent Treatment Facility

5.3.2 Miscellaneous Periodic Confirmatory Emission Measurements

Table 5-3 shows information that confirms low emissions, as verified by results from nondestructive analysis of HEPA filters.

Table 5-3. Nondestructive Analysis Results for 2007.

Location	Filtration	Analysis date	Radionuclide	Ci
296-S-23 Stack	HEPA	May 10, 2007	^{137}Cs	1.7 E–07
Guzzler	HEPA	no analysis in 2007	NA	NA

1 Ci = 1 curie = 3.7 E+10 becquerels (Bq); HEPA = high-efficiency particulate air.
NA = not applicable

Table 5-4 shows information that confirms low emissions, as verified by results from destructive analysis of a K Basins Closure Project HEPA filter.

Table 5-4. K Basins Closure Project Destructive Analysis Results for 2007.

Stack (Location; EDP code)	Filter medium	Radionuclides or type of radioactivity	Activity, pCi
105-KW Air Sparging Vent (105-KW Basin; Y249)	HEPA	^{90}Sr	5.1 E+00
		$^{239/240}Pu$	3.7 E–01
		^{241}Am	6.2 E–01
		gross α	3.5 E+00
		gross β	3.8 E+01

ND = not detected; HEPA = high-efficiency particulate air.
1 Ci = 1 curie = 3.7 E+10 becquerels (Bq).

5.3.3 Periodic Confirmatory Measurements on Notice of Construction Sources

This section identifies NOCs active in 2007 that were potential sources of radionuclide emissions. As part of the approval process for these NOCs, potential maximum emission levels were calculated based on descriptions of work proposed at the sources. The calculated levels would cause negligible dose impacts, and the sources are not usually amenable to conventional gaseous-extraction, or record sampling. As a consequence, WDOH has approved a variety of alternative measurement methods, defined below, by which to periodically confirm that NOC sources generate only low emissions of radionuclides.

Information on active NOCs and their corresponding methods of periodic confirmatory measurements (PCMs) are summarized in Table 5-5. The NOCs listed are consistent with the database maintained for the Hanford Site Air Operating Permit; PCM details are kept on file.

In the far right-hand column of Table 5-5, "Y" stands for "yes," "N" for "no," and "NA" for "not applicable" (which also means that no activities were conducted under the respective NOC). All "Y" entries are qualified by a superscripted numeral. The superscripted numerals correspond to the PCM verification methods used, which are:

1A — stack monitoring; see Table 2-1 for the stack cited*
1B — stack monitoring; see Table 2-2 for the stack cited*
2 — dose-rate surveys and/or surface smears
3 — continuous air monitor (CAM) data
4 — ambient air monitoring near sources
5 — nondestructive analysis (NDA) of HEPA filters; see Table 5-3, if applicable
6 — based on methods and/or factors in WAC 246-247-030(21)(a) or 40 CFR 61 Appendix D or on an alternate method approved by WDOH in, for example, an NOC
7 — destructive analysis of HEPA filters.

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* Using this PCM method, airborne radionuclides originating from an NOC source are by design drawn into a stack ventilation system and sampled as part of the cumulative emission exhausted via that stack.

In some cases, the PCM verification method cited in Table 5-5 is followed by a parenthetical reference to a stack or to another table within this report, which presents the respective PCM verification information or data.

Table 5-5. Periodic Confirmatory Measurements on Notice of Construction Emission Sources in 2007.

Location (AOP Emission Point)	Project	Permit ID	Issue Date	Low emissions verified? (Y, N, or NA)[a]
		BNI		
Waste Treatment and Immobilization Plant (200 Area Diffuse/Fugitive, Guzzler)	Excavation Activities for the Building of Temporary Construction Facilities and Main Facilities (DOH NOC ID 672)	AIR 06-1032	10/5/06	Y[2]; Y[4] (Table 5-6)
Waste Treatment and Immobilization Plant (HV-C2, HV-S1, HV-S2, HV-S3A, HV-S3B, HV-S4, IHLW-S1)	Construction of WTP High Level Waste Vitrification Plant Rev. 4 (DOH NOC ID 625)	AIR 06-401	4/4/06	NA
Waste Treatment and Immobilization Plant (LB-C2, LB-S1, LB-S2)	Construction of WTP Laboratory Rev. 4 (DOH NOC ID 626)	AIR 06-402	4/4/06	NA
Waste Treatment and Immobilization Plant (LV-C2, LV-S1, LV-S2, LV-S3)	Construction of WTP Low Activity Waste Vitrification Plant Rev. 4 (DOH NOC ID 627)	AIR 06-403 (obsoleted 6/8/07)	4/4/06	NA
	Construction of the WTP LAW Vitrification Plant, Rev. 4A (DOH NOC ID 627)	AIR 07-601	6/8/07	
Waste Treatment and Immobilization Plant (PT-C2, PT-S1, PT-S2, PT-S3, PT-S4)	Construction of WTP Pretreatment Plant Rev. 4 (DOH NOC ID 628)	AIR 06-404	4/4/06	NA
		CH2M HILL		
222-S Laboratory (200W S-296S021-001)	Hot Cell Expansion (DOH NOC ID 637)	AIR 06-1005 (obsoleted10/30/07)	10/5/06	Y[1A] (296-S-21 in Table 2-1)
	Hot Cell Expansion (DOH NOC ID 637)	AIR 07-1021	10/30/07	
242-A Evaporator (200E P-242A-002)	Operation of the 242-A Evaporator (DOH NOC ID 651)	AIR 06-1016	10/5/06	Y[1B] (296-A-22 in Table 2-2)
241-AN Tank Farm (200 Area Diffuse/Fugitive)	241-AN Tank Farm Installation and Operation of a New Ventilation System (DOH NOC ID 692)	AIR 06-1046	10/5/06	Y[2]; Y[4] (Table 5-6)
241-AN Tank Farm (200E P-296AN-001)	Installation and Operation of a Waste Retrieval System in Tanks 241-AN-101, -102, -103, -104, -105, -106, -107 (DOH NOC ID 668)	AIR 06-1028	10/5/06	Y[1B] (296-A-29 in Table 2-2)
241-AN & 241-AW Tank Farms (200E P-296A044-001, 200E P-296A045-001, 200E P-296A046-001, 200E P-296A047-001)	Operation of New Ventilation systems in the AN and AW Tank Farms (DOH NOC ID 706)	AIR 06-1060	10/5/06	NA
241-AW Tank Farm (200 Area Diffuse/Fugitive)	Installation and Operation of a New Ventilation System (DOH NOC ID 693)	AIR 06-1047	10/5/06	Y[2]; Y[4] (Table 5-6)
241-AP Tank Farm (200E P-296AP-001)	Installation and Operation of Waste Retrieval System in Tanks 241-AP-102 and 241-AP-104 (DOH NOC ID 666)	AIR 06-1027	10/5/06	Y[1B] (296-A-40 in Table 2-2)

Table 5-5. Periodic Confirmatory Measurements on Notice of Construction Emission Sources in 2007.

Location (AOP Emission Point)	Project	Permit ID	Issue Date	Low emissions verified? (Y, N, or NA)[a]
241-AY/AZ Tank Farm (200E P-296A042-001)	241-AY and 241-AZ Ventilation Upgrades (DOH NOC ID 653)	AIR 06-1018	10/5/06	Y^{1A} (296-A-42 in Table 2-1)
241-AZ Tank Farm (200 Area Diffuse/Fugitive, 200E P-296A042-001, Guzzler)	Installation and Operation of a Waste Retrieval System in 241-AY-101, -102, 241-AZ-101, -102 (DOH NOC ID 714)	AIR 06-1064	10/5/06	Y^{1A} (296-A-42 in Table 2-1); Y^2; Y^4 (Table 5-6)
241-AZ Tank Farm (200E P-296A020-001)	241-AZ Tank Farm Annulus Exhauster Operation (DOH NOC ID 671)	AIR 06-1031	10/5/06	Y^{1B} (296-A-20 in Table 2-2)
241-C Tank Farm (200 Area Diffuse/Fugitive, 200 W-296P048-001)	241-C-200 Series Tanks Retrieval (DOH NOC ID 698)	AIR 06-1052	10/5/06	Y^{1A} (296-P-48 in Table 2-1); Y^2; Y^4 (Table 5-6)
241-C-106 Tank (200 Area Diffuse/Fugitive, 200E W-296P047-001)	Liquid Pumping and Enhanced Sluicing Rev. 6 (DOH NOC ID 683)	AIR 06-1038	10/5/06	Y^{1A} (296-P-47 in Table 2-1); Y^2; Y^4 (Table 5-6)
241-ER-311 Catch Tank (200 Area Diffuse/Fugitive, 200 W-296P045-001, 200E P-241ER311-001)	Removal of Liquid from Catch Tank 241-ER-311 (DOH NOC ID 718)	AIR 06-1066 (obsoleted 10/30/07)	10/5/06	Y^{1B} (296-P-45 in Table 2-2); Y^4 (Table 5-6)
		AIR 07-1020	10/30/07	
241-S Tank Farm (200 Area Diffuse/Fugitive, 200W P-241S102-001, 200 W-241P044-001)	Installation and Operation of a Waste Retrieval System in Tank 241-S-102 (DOH NOC ID 694)	AIR 06-1048 (obsoleted 5/18/07)	10/5/06	Y^{1A} (296-P-44 in Table 2-1); Y^2; Y^4 (Table 5-6)
		AIR 07-505	5/18/07	
241-S-112 Tank (200 Area Diffuse/Fugitive, 200W P-241S112-001, 200 P-296P043-001)	Installation and Operation of a Waste Retrieval System in Tank 241-S-112 (DOH NOC ID 686)	AIR 06-1041	10/5/06	Y^{1A} (296-P-43 in Table 2-1); Y^2; Y^4 (Table 5-6)
241-UX-302A (200W P-241UX302A-001, 200W P-241U301B-001, 200E P-241AZ154-001)	Installation and Operation of Breather Filter on Tanks 241-UX-302A, 241-AZ-154, and 241-U-301B (DOH NOC ID 659)	AIR 06-1022	10/5/06	Y^2
244 DCRTs Isolation and Closure (200 Area Diffuse/Fugitive, 200E P-244A-002, 200E P-244BX-002, 200W P-244S-002, 200W P-244TX-002, 200E P-244A-003, 200E P-244BX-003, 200W P-244S-003, P-244TX-003)	Isolation and Closure of Stacks 296-A-25, 296-B-28, 296-S-22, and 296-T-18 (DOH NOC ID 697)	AIR 06-1051	10/5/06	Y^2; Y^4 (Table 5-6)
244-CR DCRT (200 Area Diffuse/Fugitive, 200E P-244CR-002, 200E W-296P47-001, Guzzler,)	244-CR Vault Isolation and Interim Stabilization (DOH NOC ID 685)	AIR 06-1040	10/5/06	Y^4 (Table 5-6); NA (Table 5-3)
Tank Farms (200 Area Diffuse/Fugitive)	Tank Farms Decontamination Trailer (DOH NOC ID 695)	AIR 06-1049	10/5/06	Y^2; Y^4 (Table 5-6)
	Vapor Sampling of Miscellaneous Underground Units with No Known Path of Ventilation (DOH NOC ID 674)	AIR 06-1034	10/5/06	

Table 5-5. Periodic Confirmatory Measurements on Notice of Construction Emission Sources in 2007.

Location (AOP Emission Point)	Project	Permit ID	Issue Date	Low emissions verified? (Y, N, or NA)[a]
Tank Farms (200 Area Diffuse and Fugitive-TF, PTRAEU)	Categorical Tank Farm Facility Entry and Surveillance (DOH NOC ID 673)	AIR 06-1033	10/5/06	Y[2]; Y[4] (Table 5-6); Y[6] (Table 5-1)
Tank Farms, Bulk Vit Demo (200 Area Diffuse/Fugitive, Bulk Vit Demo Exhauster)	Supplemental Treatment Test and Demonstration Facility (DOH NOC ID 705)	AIR 06-1059	10/5/06	Y[2]; Y[4] (Table 5-6)
Tank Farms, Integrated Disposal Facility (200 Area Diffuse/Fugitive)	Operation of the Integrated Disposal Facility (DOH NOC ID 713)	AIR 06-1063	10/5/06	Y[4] (Table 5-6)
Tank Farms, Guzzler (Guzzler at Tank Farms)	Guzzler Excavation and Backfilling Activities in Support of the 200 East Area A Farm Complex (DOH NOC ID 647)	AIR 06-1012	10/5/06	NA (Table 5-3)
Tank Farms, Project E-525 (200 Area Diffuse/Fugitive, 200E P-241AZ301-001)	Double Shell Tanks Transfer System Modifications (DOH NOC ID 688)	AIR 06-1043	10/5/06	Y[2]; Y[4] (Table 5-6)
Tank Farms, Project W-314 (200 Area Diffuse/Fugitive, PTRAEU, Guzzler)	Tank Farms Restoration and Safe Operations (Project W-314) (DOH NOC ID 689)	AIR 06-1044	10/5/06	Y[4] (Table 5-6); Y[6] (Table 5-1); NA (Table 5-3)
Tank Farms, Retrieval Project (200 Area Diffuse/Fugitive, Guzzler)	Categorical Tank Farm Facility Waste Retrieval and Closure Phase I, Site Preparation and System Installation (DOH NOC ID 702)	AIR 06-1056	10/5/06	Y[2]; Y[4] (Table 5-6) NA (Table 5-3)
Tank Farms, Retrieval Project (200 W-296P047-001, 200 W-296P048-001, 200 Area Diffuse/Fugitive)	Categorical Tank Farm Facility Waste Retrieval and Closure Phase II, Waste Retrieval Operations (DOH NOC ID 703)	AIR 06-1057 (obsoleted 3/9/07)	10/5/06	Y[1A] (296-P-47, 296-P-48 in Table 2-1); Y[2]; Y[5]; Y[4] (Table 5-6)
	Categorical Tank Farm Facility Waste Retrieval and Closure: Phase II, Waste Retrieval Operations (DOH NOC ID 703)	AIR 07-305	3/23/07	
Tank Farms, Vadose Zone (200 Area Diffuse/Fugitive, Air Rotary Drilling, Air Hammer Drilling)	Vadose Zone Characterization (DOH NOC ID 635)	AIR 06-1003	10/5/06	Y[2]; Y[4] (Table 5-6)
FH				
200 Area (200 Area Diffuse/Fugitive, CS&I, and Central Plateau)	Cleaning Radiologically Contaminated Vehicles (DOH NOC ID 715)	AIR 06-1065	10/5/06	Y[2]; Y[4] (Table 5-6)
	Characterization and Stabilization Activities on the Central Plateau (DOH NOC ID 699)	AIR 06-1053	10/5/06	Y[2]; Y[4], (Table 5-6)
200 Area (200 Area Diffuse/Fugitive, PTRAEU, HEPA Vac, Guzzler)	Roof Replacement Activities on the Central Plateau (DOH NOC ID 670)	AIR 06-1030	10/5/06	Y[2]; Y[5]; Y[4] (Table 5-6); NA (Table 5-3)
200 Area Interim Storage Area at the CSB (200 Area ISA)	Construction and Operation of the 200 Area Interim Storage Area at the CSB (DOH NOC ID 650)	AIR 06-1015	10/5/06	Y[2]

Table 5-5. Periodic Confirmatory Measurements on Notice of Construction Emission Sources in 2007.

Location (AOP Emission Point)	Project	Permit ID	Issue Date	Low emissions verified? (Y, N, or NA)[a]
200 Area Effluent Treatment Facility (200E P-2025E ETF, 200 Area Diffuse/Fugitive) **200 Area Liquid Effluent Retention Facility** (200E P-242AL42-001, 200E P-242AL43-001, 200E P-242AL44-001)	Operation of LERF and 200 Area ETF (DOH NOC ID 690)	AIR 06-1045	10/5/06	Y[1B] (296-E-1 in Table 2-2); Y[4] (Table 5-6)
Effluent Treatment Facility (200E P-296E002-001)	Approval to Construct the Solidification Treatment Unit (STU) (DOH NOC ID 676)	AIR 07-402	4/13/07	NA
340-A Building (300 P-340NTEX-001)	Operation of the 340 Waste Storage Facility (DOH NOC ID 704)	AIR 06-1058	10/5/06	Y[1B] (340-NT-EX)
B Plant (200E P-296B001-001)	Operation of the 296-B-1 Emission Unit (DOH NOC ID 645)	AIR 06-1010	10/5/06	Y[1A] (296-B-1 in Table 2-1)
Canister Storage Building (200E P-296H212-001)	Construction and Operation of the Canister Storage Building (DOH NOC ID 652)	AIR 06-1017	10/5/06	Y[1A] (296-H-212); Y[3]; Y[4] (Table 5-6)
Central Waste Complex (200W J-CWC 001, 200W W-PORTEX 011)	Central Waste Complex Operations (DOH NOC ID 654)	AIR 06-1019	10/5/06	Y[2]; Y[3] (W130); Y[4] (Table 5-6)
Cold Vacuum Drying Facility (100K P-296K142 001)	Construction and Operation of the Cold Vacuum Drying Facility (DOH NOC ID 643)	AIR 06-1009	10/5/06	Y[1A] (296-K-142 in Table 2-1)
Decontamination Trailers (200 Area Diffuse/Fugitive, 200 Decon Trailer (Intermittent Powered Exhaust), 200 Decon Trailer (Collection Tank Vents)	200/600 Areas Facilities Support Decontamination Trailer (Intermittent Power Exhaust) (DOH NOC ID 678)	AIR 07-1102	11/15/2007	Y[2]; Y[4] (Table 5-6)
FFTF (400 Area Diffuse/Fugitive Emissions, 400 P-437MN&ST-001, 400 P-FFTFHTTR-001, 400 P-FFTFCBEX-001, 400 P-437-002)	Sodium Residuals Removal and Other Deactivation Activities (DOH NOC ID 646)	AIR 06-1011	10/5/06	Y[1B] (437-MN&ST, FFTF-HT-TR, FFTF-CB-EX, FFTF-RE-SB, 437-1-61 in Table 2-2); Y[2]; Y[4] (Table 5-8)
FFTF Sodium Storage Facility (400 Sodium Storage Facility)	Construction and Operation of the Sodium Storage Facility (DOH NOC ID 639)	AIR 06-1007	10/5/06	Y[2]; Y[4] (Table 5-8)
Low Level Burial Grounds (200 Area Diffuse/Fugitive, HEPA Vac, Drum Venting System, Drum Venting Passive)	Operation of the Transuranic Waste Retrieval Project (DOH NOC ID 700)	AIR 06-1054 (obsoleted 3/15/07)	10/5/06	Y[2]; Y[4] (Table 5-6); Y[6] (Table 5-2)
	Operation of the Transuranic Waste Retrieval Project (DOH NOC ID 719)	AIR 07-307 (obsoleted 10/19/07)	3/23/07	
		AIR 07-1012	10/22/07	

Table 5-5. Periodic Confirmatory Measurements on Notice of Construction Emission Sources in 2007.

Location (AOP Emission Point)	Project	Permit ID	Issue Date	Low emissions verified? (Y, N, or NA)[a]
Low Level Burial Grounds (200W P-Trench31 001, 200W P-Trench34 001)	LLBG Mixed Waste Disposal, Trench 31 and 34 Leachate Collection and Storage Tank (DOH NOC ID 662)	AIR 06-1023	10/5/06	Y[2]
Plutonium Finishing Plant (200 Area Diffuse/Fugitive, Concrete Containers, 200W P-291Z001-001, 200W P-296Z005-001, 200W P-296Z006-001, 200W P-296Z007-001)	Transition of the Plutonium Finishing Plant Complex (DOH NOC ID 655)	AIR 06-1020	10/5/06	Y[2]; Y[3]; Y[4] (Table 5-6); Y[1A] (291-Z-1, 296-Z-7 in Table 2-1); Y[1B] (296-Z-5, 296-Z-6 in Table 2-2)
PUREX Storage Tunnels (200E P-296A010-001)	Reactivation of PUREX Storage Tunnel Number 2 (DOH NOC ID 665)	AIR 06-1026	10/5/06	NA (296-A-10 in Table 2-2)
Purgewater Storage and Treatment Facility (200 J-NONPOINT 012)	Purgewater Storage and Treatment Facility, Purgewater Modutanks (DOH NOC ID 636)	AIR 06-1004	10/5/06	Y[4] (Table 5-6)
T Plant Complex (200W P-291T001-001, 200 Area Diffuse/Fugitive, PTRAEU)	Consolidated T Plant Operations (DOH NOC ID 711)	AIR 06-1062 (obsoleted 3/15/07)	10/5/06	Y[1A] (291-T-1); Y[2]; Y[5]; Y[4] (Table 5-6)
		AIR 07-306	3/23/07	
T Plant Complex (200W P-296T007-001, 200 Area Diffuse/Fugitive)	Operation of the 2706-T Building (DOH NOC ID 648)	AIR 06-1013	10/5/06	Y[1B] (296-T-7); Y[4] (Table 5-6)
Waste Encapsulation and Storage Facility (200E P-296B010-001)	WESF Liquid Low Level Radioactive Liquid Removal from Tank 100 (DOH NOC ID 649)	AIR 06-1014	10/5/06	Y[1A] (296-B-10 in Table 2-1)
Waste Receiving and Processing Facility (200W P-296W004 001, 200 Area Diffuse/Fugitive)	Construction and Operation of the Waste Receiving and Processing Facility (DOH NOC ID 638)	AIR 06-1006 (obsoleted 3/29/07)	10/5/06	Y[1A] (296-W-4 in Table 2-1); Y[4] (Table 5-6)
		AIR 07-308	3/29/07	
WRAP Head Space Gas Sampling (HSGS) Facility (200W S-MO444-001)	WRAP Head Space Gas Sampling (HSGS) Analysis (DOH NOC ID 656)	AIR 07-304	3/23/2007	Y[6]
Waste Sampling and Characterization Facility (600 S-6266-001, 600 S-6266-002, 600 J NONPOINT Source)	Use of Portable Tanks and Revised Source Term at WSCF (DOH NOC ID 669) Use of Portable Tanks and Revised Source Term at WSCF (DOH NOC ID 669)	AIR 06-1029 AIR 06-1029	10/5/06 10/5/06	Y[1B] (696-W-1, 696-W-2 in Table 2-2); Y[2]; Y[4] (Table 5-6)
PNNL				
318 Building (300 EP-318-01-S)	Calibration and Development Activities in the Radiological Calibrations Laboratory (318 Building) (DOH NOC ID 681)	AIR 06-1037	10/5/06	Y[1B] (EP-318-01-S in Table 2-2)
325 Building (300 EP-325-01-S)	Radiological Processing Laboratory (325 Building) (DOH NOC ID 687)	AIR 06-1042	10/5/06	Y[1A] (EP-325-01-S in Table 2-1)

Table 5-5. Periodic Confirmatory Measurements on Notice of Construction Emission Sources in 2007.

Location (AOP Emission Point)	Project	Permit ID	Issue Date	Low emissions verified? (Y, N, or NA)[a]
326 Building (300 EP-326-01-S)	Research Activities in the Material Sciences Laboratory (326 Building) (DOH NOC ID 677)	AIR 06-1036	10/5/06	Y[1B] (EP-326-01-S in Table 2-2)
329 Building (300 EP-329-01-S)	Research Activities in the Chemical Sciences Laboratory (329 Building) (DOH NOC ID 701)	AIR 06-1055	10/5/06	Y[1B] (EP-329-01-S in Table 2-2)
331 Building (300 EP-331-01-V)	Research Activities in the Life Sciences Laboratory - I (331 Building) (DOH NOC ID 710)	AIR 06-1061	10/5/06	Y[1A] (EP-331-01-V in Table 2-1)
361 Building (300 EP-361-01-V)	Operation of the 361 Building in Testing Equipment Operability Utilizing Radioxenon (DOH NOC ID 657)	AIR 07-503	5/16/07	Y[6]
WCH				
300 Area (300 Area Diffuse/Fugitive)	300 Area Excavation Activities (DOH NOC ID 684)	AIR 06-1039	10/5/06	NA
Sitewide				
Sitewide HEPA Vacs (200 W-PORTEX 007)	HEPA Filtered Vacuum Radioactive Air Emission Units (DOH NOC ID 663)	AIR 06-1024	10/5/06	Y[2]; Y[5]; Y[6] (Table 5-2)
Sitewide Guzzler (Sitewide Guzzler)	Categorical Guzzler Vacuum Excavation System for Radiologically Limited Activities on the Hanford Site (DOH NOC ID 658)	AIR 06-1021	10/5/06	NA (Table 5-3)
Sitewide PTRAEU (PTRAEU)	Portable/Temporary Radionuclide Airborne Emissions Units (DOH NOC ID 664)	AIR 06-1025	10/5/06	Y[2]; Y[6] (Table 5-1)
Sitewide Tanker Truck (Tanker Truck Transfers)	Tanker Truck Loading of Radioactive Contaminated Waste Water (DOH NOC ID 696)	AIR 06-1050	10/5/06	Y[2]
Sitewide Vented Containers (Vented Containers)	Sitewide Vented Container Storage (DOH NOC ID 641)	AIR 06-1008 (obsoleted 7/2/07)	10/5/06	Y[4] (Table 5-6)
		AIR 07-701	7/2/07	

5.4 AMBIENT AIR SAMPLING MEASUREMENTS

The near-facility monitoring (NFM) program comprises a comprehensive network of monitoring locations near facilities and projects at the Hanford Site. The program monitors soil, vegetation, and ambient air that may contain radionuclides dispersed there by onsite activities. It also uses thermoluminescent dosimeters to measure ambient dose rates. Emissions from many NOC activities are not measured directly at the source, as are emissions from forcibly ventilated stacks. Frequently, NOC activities are temporary and not conducted within the confines of structures having ventilation systems equipped with sampling or monitoring equipment. Hence, assessing emissions from these activities is not nearly as straightforward as is measuring stack emissions.

WDOH requires that emissions from NOC activities be measured periodically to confirm whether or not they are low. A variety of measurement data are used in this confirmation process, including those from the NFM program, dose-rate surveys, surface smears, CAM sampling, and both NDA and destructive analysis, especially of HEPA filters. Further confirmation methods are allowed, provided they are first approved by WDOH.

Summarized in Table 5-6 are the analytical data measured from ambient air samples collected during 2007, organized by general emission unit, which for regulatory purposes is construed as equivalent to an operations Area such as the 100, 200, 300, 400, or 600 Area. Radionuclides with concentrations that fell below analytical detection limits in both the first and second half of the semi-annual composite samples or the quarterly composite samples were not listed in the table.

Several RCC projects have requirements for annually reporting ambient air monitoring data obtained from samples collected at PNNL air monitoring stations. The PNNL stations in proximity to these projects are as follows: PNNL station "Yakima Barricade" is used for the 100-B/C, 100-F, and 100-KR-1 Field Remediation Projects; PNNL station "Wye Barricade" is used for the 100-F Field Remediation Project; PNNL station "200 West SE" is used for the ERDF Project; and PNNL stations "300 Trench," "300 NE," "300 Area South Gate," "300 Area Southwest," and "300 Water Intake" are used for the 300-FF-2 Remediation Project and the 300 Area Demolition Project. Air monitoring data related to these locations are in Table 5-7.

PNNL also compiles ambient air monitoring data from samples collected near the 400 Area. Those data are presented in Table 5-8.

The following definitions apply to abbreviations and units of measure used in Tables 5-6 through 5-8:

- EDP = Electronic Data Processing (these alpha-numeric codes, such as "N464," serve as sampler location identifiers)
- "1st half," "2nd," "1st quarter," and so on refer to standard fractional periods of the calendar year
- 1 Ci = 1 curie = 3.7 E+10 becquerels (Bq)
- pCi = picocurie = E–12 Ci
- m^3 = cubic meter pC/m^3 = picocuries per cubic meter (pCi = E–12 curies)
- NA = not applicable (because up to 26 samples were analyzed each half year and up to 13 a quarter, but this table shows only a single isotopic result obtained for that period)
- ND = not detected (i.e., result less than zero, less than its overall analytical error, or no peak detected)

Table 5-6. Hanford Site Near-Facility Monitoring Air Sampling Results for 2007.

100 Area

100-B/C Field Remediation Project					
EDP code	**Radionuclide or type of radioactivity**	**Concentration, pCi/m^3**			
		1st half	**2nd half**	**Average**	**Maximum**
N464	gross α	NA	NA	1.1 E–03	2.2 E–03
	gross β	NA	NA	1.5 E–02	4.3 E–02
	^{234}U	ND	5.1 E–05	5.1 E–05	5.1 E–05
	^{235}U	ND	1.7 E–05	1.7 E–05	1.7 E–05
	^{238}U	4.8 E–06	2.2 E–05	1.3 E–05	2.2 E–05
N465	gross α	NA	NA	1.4 E–03	2.9 E–03
	gross β	NA	NA	1.6 E–02	4.7 E–02
	^{234}U	1.2 E–05	6.7 E–05	4.0 E–05	6.7 E–05
	^{238}U	8.1 E–06	ND	8.1 E–06	8.1 E–06
N466	gross α	NA	NA	1.3 E–03	3.4 E–03
	gross β	NA	NA	1.7 E–02	4.3 E–02
	^{234}U	7.7 E–06	1.6 E–05	1.2 E–05	1.6 E–05
	^{235}U	ND	4.3 E–06	4.3 E–06	4.3 E–06
	^{238}U	7.7 E–06	1.2 E–05	1.0 E–05	1.2 E–05
	$^{239/240}$Pu	ND	4.9 E–06	4.9 E–06	4.9 E–06
N496	gross α	NA	NA	1.1 E–03	2.8 E–03
	gross β	NA	NA	1.8 E–02	4.5 E–02
	^{234}U	1.0 E–05	1.3 E–05	1.2 E–06	1.3 E–05
	^{238}U	ND	9.4 E–06	9.4 E–06	9.4 E–06
	$^{239/240}$Pu	4.8 E–06	ND	4.8 E–06	4.8 E–06
N497	gross α	NA	NA	1.2 E–03	3.3 E–03
	gross β	NA	NA	1.6 E–02	4.8 E–02
	^{234}U	1.0 E–05	1.6 E–05	1.3 E–05	1.6 E–05
	^{238}U	9.7 E–06	7.1 E–06	8.4 E–06	9.7 E–06
	$^{239/240}$Pu	ND	4.7 E–06	4.7 E–06	4.7 E–06

100-D Field Remediation Project					
EDP code	Radionuclide or type of radioactivity	Concentration, pCi/m^3			
		1st half	2nd half	Average	Maximum
N467	gross α	NA	NA	1.2 E–03	2.4 E–03
	gross β	NA	NA	1.5 E–02	3.1 E–02
	^{234}U	1.3 E–05	1.3 E–05	1.3 E–05	1.3 E–05
	^{238}U	ND	6.4 E–06	6.4 E–06	6.4 E–06
N468	gross α	NA	NA	9.7 E–04	1.8 E–03
	gross β	NA	NA	1.3 E–02	3.0 E–02
	^{234}U	ND	1.4 E–05	1.4 E–05	1.4 E–05
	^{238}U	ND	8.2 E–06	8.2 E–06	8.2 E–06
N514	gross α	NA	NA	1.1 E–03	1.8 E–03
	gross β	NA	NA	1.3 E–02	2.8 E–02
	^{106}Ru	ND	9.4 E–04	9.4 E–04	9.4 E–04
	^{234}U	ND	1.4 E–05	1.4 E–05	1.4 E–05
	^{238}U	1.5 E–05	1.1 E–05	1.3 E–05	1.5 E–05
N515	gross α	NA	NA	1.1 E–03	1.7 E–03
	gross β	NA	NA	1.5 E–02	3.0 E–02
	^{90}Sr	2.9 E–04	ND	2.9 E–04	2.9 E–04
	^{234}U	1.2 E–05	1.8 E–05	1.5 E–05	1.8 E–05
	^{235}U	ND	6.2 E–06	6.2 E–06	6.2 E–06
	^{238}U	8.2 E–06	1.4 E–05	1.1 E–05	1.4 E–05

100-K Basins Closure Project					
EDP code	Radionuclide or type of radioactivity	Concentration, pCi/m^3			
		1st half	2nd half	Average	Maximum
N401	gross α	NA	NA	1.3 E–03	2.3 E–03
	gross β	NA	NA	1.6 E–02	4.4 E–02
	^{234}U	7.9 E–06	1.3 E–05	1.0 E–05	1.3 E–05
	^{238}U	4.3 E–06	1.5 E–05	9.4 E–06	1.5 E–05
	^{241}Am	1.6 E–05	1.1 E–05	1.3 E–05	1.6 E–05
N402	gross α	NA	NA	1.3 E–03	2.4 E–03
	gross β	NA	NA	1.6 E–02	4.1 E–02
	^{234}U	1.0 E–05	1.6 E–05	1.3 E–05	1.6 E–05
	^{238}U	9.7 E–06	ND	9.7 E–06	9.7 E–06
	^{241}Am	1.3 E–05	ND	1.3 E–05	1.3 E–05
N403	gross α	NA	NA	1.4 E–03	2.9 E–03
	gross β	NA	NA	1.8 E–02	3.8 E–02
	^{137}Cs	1.7 E–04	ND	1.7 E–04	1.7 E–04
	^{234}U	ND	1.8 E–05	1.8 E–05	1.8 E–05
	^{238}U	8.0 E–06	1.0 E–05	9.2 E–06	1.0 E–05
	^{241}Am	1.2 E–05	7.9 E–06	9.9 E–06	1.2E–05
N404	gross α	NA	NA	1.5 E–03	2.6 E–03
	gross β	NA	NA	1.6 E–02	3.5 E–02
	^{234}U	ND	2.2 E–05	2.2 E–05	2.2 E–05
	^{238}U	ND	1.0 E–05	1.0 E–05	1.0 E–05
	$^{239/240}$Pu	ND	1.1 E–05	1.1 E–05	1.1 E–05
	^{241}Am	1.9 E–05	8.2 E–06	1.3 E–05	1.9 E–05
N476	gross α	NA	NA	1.2 E–03	2.4 E–03
	gross β	NA	NA	1.8 E–02	4.8 E–02
	^{234}U	ND	1.3 E–05	1.3 E–05	1.3 E–05
	^{238}U	4.3 E–06	7.2 E–06	5.7 E–06	7.2 E–06
	^{241}Am	1.6 E–05	6.1 E–06	1.1 E–05	1.6 E–05
N477	gross α	NA	NA	1.3 E–03	3.0 E–03
	gross β	NA	NA	1.8 E–02	4.7 E–02
	^{137}Cs	ND	1.2 E–04	1.2 E–04	1.2 E–04
	^{234}U	1.1 E–05	9.3 E–06	1.0 E–05	1.1 E–05
	^{238}U	8.4 E–06	9.9 E–06	9.0 E–06	9.9 E–06
	$^{239/240}$Pu	1.8 E–05	1.5 E–05	1.4 E–05	1.8 E–05
	^{241}Am	2.0 E–05	1.4 E–05	1.6 E–05	2.0 E–05

100-K Basins Closure Project					
EDP code	Radionuclide or type of radioactivity	Concentration, pCi/m^3			
		1st half	2nd half	Average	Maximum
N478	gross α	NA	NA	1.5 E–03	5.1 E–03
	gross β	NA	NA	2.0 E–02	7.9 E–02
	^{234}U	9.9 E–06	1.6 E–05	1.3 E–05	1.6 E–05
	^{238}U	5.0 E–06	7.2 E–06	6.1 E–06	7.2 E–06
	^{241}Am	1.1 E–05	8.8 E–06	9.7 E–06	1.1 E–05
N479	gross α	NA	NA	1.4 E–03	2.3 E–03
	gross β	NA	NA	1.7 E–02	4.3 E–02
	^{234}U	7.0 E–06	9.8 E–06	8.4 E–06	9.8 E–06
	^{238}U	7.0 E–06	7.4 E–06	7.2 E–06	7.4 E–06
	^{241}Am	1.7 E–05	1.2 E–05	1.4 E–05	1.7 E–05

118-K-1 Field Remediation Project					
EDP code	Radionuclide or type of radioactivity	Concentration, pCi/m^3			
		1st half	2nd half	Average	Maximum
N403	gross α	NA	NA	1.3 E–03	2.9 E–03
	gross β	NA	NA	1.8 E–02	3.8 E–02
	^{137}Cs	1.7 E–04	ND	1.7 E–04	1.7 E–04
	^{234}U	ND	1.8 E–05	1.8 E–05	1.8 E–05
	^{238}U	8.0 E–06	1.0 E–05	9.2 E–06	1.0 E–05
	^{241}Am	1.2 E–05	7.9 E–06	9.9 E–06	1.2 E–05
N534	gross α	NA	NA	1.2 E–03	2.4 E–03
	gross β	NA	NA	1.6 E–02	4.1 E–02
	^{234}U	1.5 E–05	1.2 E–05	1.4 E–05	1.5 E–05
	^{238}U	ND	1.0 E–05	1.0 E–05	1.0 E–05
	^{238}Pu	ND	5.7 E–06	5.7 E–06	5.7 E–06
N535	gross α	NA	NA	1.2 E–03	2.5 E–03
	gross β	NA	NA	1.5 E–02	3.9 E–02
	^{137}Cs	6.6 E–04	ND	6.6 E–04	6.6 E–04
	^{234}U	8.5 E–06	1.7 E–05	1.3 E–05	1.7 E–05
	^{238}U	9.3 E–06	1.5 E–05	1.2 E–05	1.5 E–05
	$^{239/240}$Pu	4.5 E–05	ND	4.5 E–05	4.5 E–05

100-N D4 and Field Remediation Projects					
EDP code	Radionuclide or type of radioactivity	Concentration, pCi/m^3			
		1st half	2nd half	Average	Maximum
N102	gross α	NA	NA	1.3 E–03	3.3 E–03
	gross β	NA	NA	1.6 E–02	3.4 E–02
	^{234}U	7.5 E–06	1.4 E–05	1.1 E–05	1.4 E–05
	^{235}U	4.6 E–06	ND	4.6 E–06	4.6 E–06
	^{238}U	5.8 E–06	9.1 E–06	7.5 E–06	9.1 E–06
	$^{239/240}$Pu	ND	3.3 E–06	3.3 E–06	3.3 E–06
N103	gross α	NA	NA	1.3 E–03	3.0 E–03
	gross β	NA	NA	1.6 E–02	4.3 E–02
	^{234}U	8.3 E–06	2.0 E–05	1.4 E–05	2.0 E–05
	^{238}U	ND	1.7 E–05	1.7 E–05	1.7 E–05
N106	gross α	NA	NA	1.3 E–03	2.8 E–03
	gross β	NA	NA	1.5 E–02	3.4 E–02
	^{234}U	5.2 E–06	2.0 E–05	1.2 E–05	2.0 E–05
	^{238}U	9.6 E–06	1.2 E–05	1.1 E–06	1.2 E–05
	$^{239/240}$Pu	6.8 E–06	ND	6.8 E–06	6.8 E–06

100-F Field Remediation Project					
EDP code	Radionuclide or type of radioactivity	Concentration, pCi/m^3			
		1st half	2nd half	Average	Maximum
N519	gross α	NA	NA	1.3 E–03	2.6 E–03
	gross β	NA	NA	1.7 E–02	4.0 E–02
	^{234}U	8.5 E–06	1.4 E–05	1.1 E–05	1.4 E–05
	^{238}U	7.1 E–06	9.2 E–06	8.2 E–06	9.2 E–06
N520	gross α	NA	NA	1.1 E–03	2.2 E–03
	gross β	NA	NA	1.6 E–02	4.7 E–02
	^{234}U	8.7 E–06	1.7 E–05	1.3 E–05	1.7 E–05
	^{235}U	ND	3.5 E–06	3.5 E–06	3.5 E–06
	^{238}U	ND	7.0 E–06	7.0 E–06	7.0 E–06

100-F Field Remediation Project					
EDP code	Radionuclide or type of radioactivity	Concentration, pCi/m^3			
		1st half	2nd half	Average	Maximum
N521	gross α	NA	NA	1.4 E–03	3.6 E–03
	gross β	NA	NA	1.7 E–02	5.6 E–02
	^{234}U	7.6 E–06	1.7 E–05	1.2 E–05	1.7 E–05
	^{235}U	5.0 E–06	ND	5.0 E–06	5.0 E–06
	^{238}U	1.1 E–05	9.6 E–06	1.0 E–05	1.1 E–05
N552	gross α	NA	NA	1.3 E–03	3.0 E–03
	gross β	NA	NA	1.7 E–02	3.9 E–02
	^{234}U	1.0 E–05	1.6 E–05	1.3 E–05	1.8 E–05
	^{238}U	ND	1.8 E–05	1.8 E–05	1.8 E–05
N553	gross α	NA	NA	1.3 E–03	2.5 E–03
	gross β	NA	NA	1.6 E–02	4.5 E–02
	^{234}U	1.5 E–05	1.8 E–05	1.6 E–05	1.8 E–05
	^{238}U	9.2 E–06	9.7 E–06	9.4 E–06	9.7 E–06

200 Areas

200 East Area					
EDP code	Radionuclide or type of radioactivity	Concentration, pCi/m^3			
		1st half	2nd half	Average	Maximum
N019	gross α	NA	NA	1.7 E–03	5.0 E–03
	gross β	NA	NA	1.8 E–02	3.9 E–02
	^{234}U	ND	1.5 E–05	1.5 E–05	1.5 E–05
	^{235}U	ND	3.6 E–06	3.6 E–06	3.6 E–06
	^{238}U	8.4 E–06	7.3 E–06	7.9 E–06	8.4 E–06
	$^{239/240}Pu$	ND	3.6 E–06	3.6 E–06	3.6 E–06
N158	gross α	NA	NA	1.3 E–03	2.6 E–03
	gross β	NA	NA	1.6 E–02	3.8 E–02
	^{234}U	ND	8.6 E–06	1.1 E–05	1.4 E–05
	^{235}U	4.4 E–06	ND	4.4 E–06	4.4 E–06
N498	gross α	NA	NA	1.3 E–03	3.0 E–03
	gross β	NA	NA	1.7 E–02	5.7 E–02
	^{234}U	9.7 E–06	1.8 E–05	1.4 E–05	1.8 E–05
	^{238}U	ND	1.4 E–05	1.4 E–05	1.4 E–05
N499	gross α	NA	NA	1.2 E–03	3.1 E–03
	gross β	NA	NA	1.6 E–02	4.9 E–02
	^{234}U	1.3 E–05	1.4 E–05	1.4 E–05	1.4 E–05
	^{238}U	ND	4.8 E–06	4.8 E–06	4.8 E–06
N532	gross α	NA	NA	1.2 E–03	2.9 E–03
	gross β	NA	NA	1.7 E–02	5.8 E–02
	^{234}U	2.0 E–05	1.5 E–05	1.7 E–05	2.0 E–05
	^{235}U	ND	5.2 E–06	5.2 E–06	5.2 E–06
	^{238}U	7.5 E–06	9.0 E–06	8.2 E–06	9.0 E–06
	$^{239/240}Pu$	3.5 E–06	ND	3.5 E–06	3.5 E–06
N559	gross α	NA	NA	1.1 E–03	3.0 E–03
	gross β	NA	NA	1.7 E–02	5.4 E–02
	^{234}U	1.2 E–05	1.0 E–05	1.1 E–05	1.2 E–05
	^{235}U	5.7 E–06	ND	5.7 E–06	5.7 E–06
	^{238}U	ND	6.8 E–06	6.8 E–06	6.8 E–06
N957	gross α	NA	NA	1.3 E–03	3.5 E–03
	gross β	NA	NA	1.5 E–02	3.6 E–02
	^{137}Cs	1.4 E–04	ND	1.4 E–04	1.4 E–04
	^{234}U	1.8 E–05	1.3 E–05	1.6 E–05	1.8 E–05
	^{238}U	9.9 E–06	6.1 E–06	8.0 E–06	9.9 E–06

200 East Area					
EDP code	Radionuclide or type of radioactivity	Concentration, pCi/m^3			
		1st half	2nd half	Average	Maximum
N967	gross α	NA	NA	1.3 E–03	2.4 E–03
	gross β	NA	NA	1.6 E–02	4.6 E–02
	^{90}Sr	ND	4.7 E–04	4.7 E–04	4.7 E–04
	^{234}U	7.9 E–06	8.9 E–06	8.4 E–06	8.9 E–06
	^{235}U	5.2 E–06	ND	5.2 E–06	5.2 E–06
	^{238}U	6.3 E–06	8.1 E–06	7.2 E–06	8.1 E–06
N968	gross α	NA	NA	1.2 E–03	2.6 E–03
	gross β	NA	NA	1.5 E–02	4.0 E–02
	^{234}U	1.6 E–05	1.3 E–05	1.4 E–05	1.6 E–05
	^{238}U	8.0 E–06	6.7 E–06	7.3 E–06	8.0 E–06
N969	gross α	NA	NA	1.2 E–03	2.3 E–03
	gross β	NA	NA	1.6 E–02	4.6 E–02
	^{234}U	8.2 E–06	1.0 E–05	9.1 E–06	1.0 E–05
	^{238}U	4.1 E–06	5.0 E–06	4.5 E–06	5.0 E–06
N970	gross α	NA	NA	1.3 E–03	2.4 E–03
	gross β	NA	NA	1.5 E–02	4.4 E–02
	^{137}Cs	1.4 E–04	ND	1.4 E–04	1.4 E–04
	^{234}U	1.0 E–05	1.0 E–05	1.0 E–05	1.0 E–05
	^{235}U	ND	4.6 E–06	4.6 E–06	4.6 E–06
	^{238}U	4.0 E–06	4.9 E–06	4.5 E–06	4.9 E–06
N972	gross α	NA	NA	1.2 E–03	3.3 E–03
	gross β	NA	NA	1.7 E–02	5.8 E–02
	^{234}U	3.6 E–06	1.2 E–05	8.0 E–06	1.2 E–05
	^{238}U	4.3 E–06	7.5 E–06	5.9 E–06	7.5 E–06
N973	gross α	NA	NA	1.1 E–03	2.6 E–03
	gross β	NA	NA	1.6 E–02	4.1 E–02
	^{234}U	5.5 E–06	1.2 E–05	8.8 E–06	1.2 E–05
	^{238}U	4.1 E–06	ND	4.1 E–06	4.1 E–06
N976	gross α	NA	NA	1.3 E–03	2.4 E–03
	gross β	NA	NA	1.5 E–02	3.7 E–02
	^{234}U	2.1 E–05	1.6 E–05	1.9 E–05	2.1 E–05
	^{235}U	5.0 E–06	ND	5.0 E–06	5.0 E–06
	^{238}U	1.2 E–05	1.4 E–05	1.3 E–05	1.4 E–05

200 East Area					
EDP code	Radionuclide or type of radioactivity	Concentration, pCi/m^3			
		1st half	2nd half	Average	Maximum
N977	gross α	NA	NA	1.1 E–03	2.9 E–03
	gross β	NA	NA	1.6 E–02	4.0 E–02
	^{234}U	1.5 E–05	1.1 E–05	1.3 E–05	1.5 E–05
	^{238}U	ND	1.1 E–05	1.1 E–05	1.1 E–05
	$^{239/240}$Pu	3.0 E–06	ND	3.0 E–06	3.0 E–06
N978	gross α	NA	NA	1.3 E–03	2.1 E–03
	gross β	NA	NA	1.5 E–02	4.4 E–02
	^{234}U	9.2 E–06	1.4 E–05	1.1 E–05	1.4 E–05
	^{235}U	ND	3.7 E–06	3.7 E–06	3.7 E–06
	^{238}U	6.7 E–06	1.1 E–05	8.8 E–06	1.1 E–05
N984	gross α	NA	NA	1.2 E–03	2.4 E–03
	gross β	NA	NA	1.6 E–02	4.6 E–02
	^{137}Cs	4.9 E–04	1.5 E–04	3.2 E–04	4.9 E–04
	^{234}U	7.4 E–06	2.3 E–05	1.5 E–05	2.3 E–05
	^{235}U	5.4 E–06	5.7 E–06	5.5 E–06	5.7 E–06
	^{238}U	6.6 E–06	6.7 E–06	6.6 E–06	6.7 E–06
	$^{239/240}$Pu	ND	9.3 E–06	9.3 E–06	9.3 E–06
N985	gross α	NA	NA	1.4 E–03	3.7 E–03
	gross β	NA	NA	1.5 E–02	4.6 E–02
	^{137}Cs	ND	1.2 E–04	1.2 E–04	1.2 E–04
	^{234}U	1.4 E–05	1.9 E–05	1.6 E–05	1.9 E–05
	^{238}U	8.7 E–06	1.1 E–05	9.6 E–06	1.1 E–05
N999	gross α	NA	NA	1.3 E–03	2.2 E–03
	gross β	NA	NA	1.5 E–02	5.2 E–02
	^{234}U	1.5 E–05	9.1 E–06	1.2 E–05	1.5 E–05
	^{235}U	ND	5.4 E–06	5.4 E–06	5.4 E–06
	^{238}U	1.2 E–05	1.5 E–05	1.3 E–05	1.5 E–05

Canister Storage Building (200 East Area)					
EDP code	Radionuclide or type of radioactivity	Concentration, pCi/m^3			
		1st half	2nd half	Average	Maximum
N480	gross α	NA	NA	1.2 E–03	2.9 E–03
	gross β	NA	NA	1.5 E–02	4.6 E–02
	^{234}U	1.1 E–05	1.3 E–05	1.2 E–05	1.3 E–05
	^{238}U	1.2 E–05	1.1 E–05	1.1 E–06	1.2 E–05
	^{241}Am	ND	5.9 E–06	5.9 E–06	5.9 E–06
N481	gross α	NA	NA	1.2 E–03	2.9 E–03
	gross β	NA	NA	1.7 E–02	5.2 E–02
	^{234}U	1.0 E–05	1.3 E–05	1.2 E–05	1.3 E–05
	^{238}U	7.6 E–06	1.1 E–05	9.1 E–06	1.1 E–05
	^{241}Am	8.0 E–06	9.0 E–06	8.5 E–06	9.0 E–06

200 West Area					
EDP code	Radionuclide or type of radioactivity	Concentration, pCi/m^3			
		1st half	2nd half	Average	Maximum
N155	gross α	NA	NA	1.1 E–03	2.0 E–03
	gross β	NA	NA	1.6 E–02	3.6 E–02
	^{137}Cs	ND	9.9 E–05	9.9 E–05	9.9 E–05
	^{234}U	7.5 E–06	1.1 E–05	9.0 E–06	1.1 E–05
	^{235}U	4.9 E–06	ND	4.9 E–06	4.9 E–06
	^{238}U	6.7 E–06	9.9 E–06	8.3 E–06	9.9 E–06
	$^{239/240}$Pu	5.3 E–06	8.2 E–06	8.2 E–06	8.2 E–06
N161	gross α	NA	NA	1.1 E–03	1.9 E–03
	gross β	NA	NA	1.5 E–02	3.5 E–02
	^{137}Cs	1.3 E–04	ND	1.3 E–04	1.3 E–04
	^{234}U	ND	8.7 E–06	8.7 E–06	8.7 E–06
	$^{239/240}$Pu	ND	9.8 E–06	9.8 E–06	9.8 E–06
N165	gross α	NA	NA	1.6 E–03	2.9 E–03
	gross β	NA	NA	1.4 E–02	3.9 E–02
	^{234}U	ND	2.4 E–05	2.4 E–05	2.4 E–05
	^{238}U	ND	1.0 E–05	1.0 E–05	1.0 E–05
	$^{239/240}$Pu	7.1 E–04	5.2 E–04	6.1 E–04	7.1 E–04

200 West Area					
EDP code	Radionuclide or type of radioactivity	Concentration, pCi/m^3			
		1st half	2nd half	Average	Maximum
N168	gross α	NA	NA	1.4 E–03	5.0 E–03
	gross β	NA	NA	1.7 E–02	7.4 E–02
	^{234}U	1.6 E–05	1.6 E–05	1.6 E–05	1.6 E–05
	^{238}U	1.2 E–05	1.6 E–05	1.4 E–05	1.6 E–05
	$^{239/240}$Pu	ND	1.9 E–05	1.9 E–05	1.9 E–05
N200	gross α	NA	NA	1.4 E–03	6.5 E–03
	gross β	NA	NA	1.5 E–02	3.8 E–02
	^{234}U	1.2 E–05	ND	1.2 E–05	1.6 E–05
	^{238}U	5.5 E–06	1.4 E–05	9.6 E–06	1.4 E–05
N304	gross α	NA	NA	1.2 E–03	3.0 E–03
	gross β	NA	NA	1.5 E–02	3.7 E–02
	^{234}U	1.2 E–05	7.3 E–06	9.5 E–06	1.2 E–05
	^{235}U	ND	4.3 E–06	4.3 E–06	4.3 E–06
	^{238}U	9.5 E–06	7.3 E–06	8.4 E–06	9.5 E–06
	$^{239/240}$Pu	ND	1.5 E–05	1.5 E–05	1.5 E–05
N433	gross α	NA	NA	1.5 E–03	3.6 E–03
	gross β	NA	NA	1.6 E–02	4.7 E–02
	^{137}Cs	3.0 E–04	ND	3.0 E–04	3.0 E–04
	^{234}U	1.3 E–05	1.6 E–05	1.5 E–05	1.6 E–05
	^{235}U	ND	5.1 E–06	5.1 E–06	5.1 E–06
	^{238}U	1.0 E–05	1.6 E–05	1.3 E–05	1.6 E–05
	$^{239/240}$Pu	3.4 E–05	5.8 E–06	2.0 E–05	3.4 E–05
N441	gross α	NA	NA	1.3 E–03	2.8 E–03
	gross β	NA	NA	1.6 E–02	3.8 E–02
	^{234}U	ND	1.3 E–05	1.3 E–05	1.3 E–05
	^{238}U	ND	8.2 E–06	8.2 E–06	8.2 E–06
	$^{239/240}$Pu	ND	1.3 E–05	1.3 E–05	1.3 E–05
N442	gross α	NA	5.1 E–06	1.4 E–03	2.6 E–03
	gross β	NA	1.6 E–05	1.7 E–02	4.0 E–02
	^{234}U	1.0 E–05	1.6 E–05	1.3 E–05	1.6 E–05
	^{238}U	7.1 E–06	9.4 E–06	8.2 E–06	9.4 E–06

200 West Area					
EDP code	Radionuclide or type of radioactivity	Concentration, pCi/m^3			
		1st half	2nd half	Average	Maximum
N449	gross α	NA	NA	1.1 E–03	2.9 E–03
	gross β	NA	NA	1.5 E–02	4.0 E–02
	^{234}U	8.1 E–06	1.8 E–05	1.3 E–05	1.8 E–05
	^{238}U	8.9 E–06	1.3 E–05	1.1 E–05	1.3 E–05
N456	gross α	NA	NA	1.4 E–03	4.0 E–03
	gross β	NA	NA	1.8 E–02	5.3 E–02
	^{234}U	ND	1.4 E–05	1.4 E–05	1.4 E–05
	^{235}U	ND	3.4 E–06	3.4 E–06	3.4 E–06
	^{238}U	ND	6.9 E–06	6.9 E–06	6.9 E–06
N457	gross α	NA	NA	1.2 E–03	2.6 E–03
	gross β	NA	NA	1.6 E–02	4.6 E–02
	^{234}U	1.5 E–05	1.5 E–05	1.5 E–05	1.5 E–05
	^{238}U	ND	4.4 E–06	4.4 E–06	4.4 E–06
	^{238}U	1.2 E–05	ND	1.2 E–05	1.2 E–05
N554	gross α	NA	NA	1.2 E–03	3.9 E–03
	gross β	NA	NA	1.6 E–02	5.2 E–02
	^{234}U	1.4 E–05	1.9 E–05	1.7 E–05	1.9 E–05
	^{235}U	5.4 E–06	ND	5.4 E–06	5.4 E–06
	^{238}U	1.2 E–05	1.0 E–05	1.1 E–05	1.2 E–05
	$^{239/240}$Pu	ND	6.7 E–06	6.7 E–06	6.7 E–06
N555	gross α	NA	NA	1.2 E–03	2.6 E–03
	gross β	NA	NA	1.6 E–02	5.0 E–02
	^{234}U	2.2 E–05	2.0 E–05	2.1 E–05	2.2 E–05
	^{235}U	ND	7.2 E–06	7.2 E–06	7.2 E–06
	^{238}U	1.0 E–05	1.5 E–05	1.3 E–05	1.5 E–05
	$^{239/240}$Pu	1.0 E–05	8.6 E–06	9.3 E–06	1.0 E–05
N956	gross α	NA	NA	1.2 E–03	2.3 E–03
	gross β	NA	NA	1.6 E–02	4.9 E–02
	^{234}U	8.4 E–06	1.6 E–05	1.2 E–05	1.6 E–05
	^{235}U	ND	4.0 E–06	4.0 E–06	4.0 E–06
	^{238}U	5.0 E–06	7.4 E–06	6.2 E–06	7.4 E–06
N963	gross α	NA	NA	1.2 E–03	2.6 E–03
	gross β	NA	NA	1.5 E–02	3.5 E–02
	^{234}U	6.0 E–06	1.4 E–05	9.8 E–06	1.4 E–05
	^{238}U	3.8 E–06	7.8 E–06	5.8 E–06	7.8 E–06
	$^{239/240}$Pu	6.4 E–06	4.9 E–06	5.6 E–06	6.4 E–06

200 West Area					
EDP code	Radionuclide or type of radioactivity	Concentration, pCi/m^3			
		1st half	2nd half	Average	Maximum
N964	gross α	NA	NA	1.2 E–03	3.0 E–03
	gross β	NA	NA	1.6 E–02	3.8 E–02
	^{234}U	6.3 E–06	1.8 E–05	1.2 E–05	1.8 E–05
	^{238}U	3.9 E–06	7.5 E–06	5.7 E–06	7.5 E–06
N965	gross α	NA	NA	1.4 E–03	4.0 E–03
	gross β	NA	NA	1.5 E–02	3.9 E–02
	^{234}U	8.6 E–06	2.0 E–05	1.4 E–05	2.0 E–05
	^{238}U	5.7 E–06	5.4 E–06	5.6 E–06	5.7 E–06
N966	gross α	NA	NA	1.2 E–03	2.5 E–03
	gross β	NA	NA	1.6 E–02	4.4 E–02
	^{234}U	1.4 E–05	1.4 E–05	1.4 E–05	1.4 E–05
	^{238}U	ND	1.2 E–05	1.2 E–05	1.2 E–05
N974	gross α	NA	NA	1.3 E–03	2.6 E–03
	gross β	NA	NA	1.6 E–02	4.3 E–02
	^{234}U	7.1 E–06	1.5 E–05	1.1 E–05	1.5 E–05
	^{238}U	6.3 E–05	7.7 E–06	7.0 E–06	7.7 E–06
N975	gross α	NA	NA	1.4 E–03	4.5 E–03
	gross β	NA	NA	1.7 E–02	5.1 E–02
	^{234}U	1.6 E–05	1.5 E–05	1.5 E–05	1.6 E–05
	^{238}U	1.3 E–05	1.3 E–05	1.3 E–05	1.3 E–05
	$^{239/240}$Pu	2.2 E–05	3.1 E–05	2.6 E–05	3.1 E–05
N987	gross α	NA	NA	1.3 E–03	3.0 E–03
	gross β	NA	NA	1.6 E–02	3.9 E–02
	^{234}U	ND	2.2 E–05	2.2 E–05	2.2 E–05
	^{235}U	ND	4.1 E–06	4.1 E–06	4.1 E–06
	^{238}U	7.8 E–06	1.3 E–05	1.1 E–05	1.3 E–05
N994	gross α	NA	NA	1.1 E–03	1.9 E–03
	gross β	NA	NA	1.4 E–02	4.0 E–02
	^{234}U	8.2 E–06	1.6 E–05	1.2 E–05	1.6 E–05
	^{238}U	6.5 E–06	ND	6.5 E–06	6.5 E–06
	$^{239/240}$Pu	ND	7.8 E–06	7.8 E–06	7.8 E–06

Environmental Restoration Disposal Facility					
EDP code	Radionuclide or type of radioactivity	Concentration, pCi/m^3			
		1st half	2nd half	Average	Maximum
N482	gross α	NA	NA	1.4 E–03	4.7 E–03
	gross β	NA	NA	1.5 E–02	4.5 E–02
	^{90}Sr	ND	6.7 E–04	6.7 E–04	6.7 E–04
	^{234}U	1.9 E–05	1.3 E–05	1.6 E–05	1.9 E–05
	^{235}U	5.2 E–06	ND	5.2 E–06	5.2 E–06
	^{238}U	1.5 E–05	2.0 E–05	1.8 E–05	2.0 E–05
N517	gross α	NA	NA	1.3 E–03	3.7 E–03
	gross β	NA	NA	1.4 E–02	3.5 E–02
	^{234}U	1.7 E–05	2.2 E–05	1.9 E–05	2.2 E–05
	^{235}U	ND	4.3 E–06	4.3 E–06	4.3 E–06
	^{238}U	1.4 E–05	2.1 E–05	1.7 E–05	2.1 E–05
N518	gross α	NA	NA	1.1 E–03	2.3 E–03
	gross β	NA	NA	1.4 E–02	4.7 E–02
	^{234}U	3.2 E–05	2.4 E–05	2.8 E–05	3.2 E–05
	^{238}U	2.7 E–05	2.2 E–05	2.4 E–05	2.7 E–05
N963	gross α	NA	NA	1.2 E–03	2.6 E–03
	gross β	NA	NA	1.5 E–02	4.1 E–02
	^{234}U	6.0 E–06	1.4 E–05	9.8 E–06	1.4 E–05
	^{238}U	3.8 E–06	7.8 E–06	5.8 E–06	7.8 E–06
	$^{239/240}$Pu	6.4 E–06	4.8 E–06	5.6 E–06	6.4 E–06

200-UW-1 Demolition Project (200 West Area)					
EDP code	Radionuclide or type of radioactivity	Concentration, pCi/m^3			
		1st half	2nd half	Average	Maximum
N168	gro-ss α	NA	NA	1.4 E–03	5.0 E–03
	gross β	NA	NA	1.7 E–02	7.4 E–02
	^{234}U	1.6 E–05	1.6 E–05	1.6 E–05	1.6 E–05
	^{238}U	1.2 E–05	1.6 E–05	1.4 E–05	1.6 E–05
	$^{239/240}$Pu	ND	1.9 E–05	1.9 E–05	1.9 E–05
N550	gross α	NA	NA	1.4 E–03	3.7 E–03
	gross β	NA	NA	1.6 E–02	4.7 E–02
	^{137}Cs	ND	1.2 E–04	1.2 E–04	1.2 E–04
	^{234}U	6.0 E–05	2.7 E–05	4.3 E–05	6.0 E–05
	^{235}U	7.9 E–06	ND	7.9 E–06	7.9 E–06
	^{238}U	4.7 E–05	2.2 E–05	3.5 E–05	4.7 E–05
	$^{239/240}$Pu	1.3 E–05	3.5 E–06	8.2 E–06	1.3 E–05
N956	gross α	NA	NA	1.2 E–03	2.3 E–03
	gross β	NA	NA	1.6 E–02	4.9 E–02
	^{234}U	8.4 E–06	1.6 E–05	1.2 E–05	1.6 E–05
	^{235}U	ND	4.0 E–06	4.0 E–06	4.0 E–06
	^{238}U	5.0 E–06	7.4 E–06	6.2 E–06	7.4 E–06
N963	gross α	NA	NA	1.2 E–03	2.2 E–03
	gross β	NA	NA	1.5 E–02	3.5 E–02
	^{234}U	6.0 E–06	1.4 E–05	9.8 E–06	1.4 E–05
	^{235}U	3.8 E–06	7.8 E–06	5.8 E–06	7.8 E–06
	$^{239/240}$Pu	6.4 E–06	4.9 E–06	5.6 E–06	6.4 E–06

200-N Demolition Project (200 North Area)					
EDP code	Radionuclide or type of radioactivity	Concentration, pCi/m^3			
		1st half	2nd half	Average	Maximum
N563	gross α	NA	NA	1.3 E–03	3.0 E–03
	gross β	NA	NA	1.1 E–02	1.6 E–02
	^{234}U	1.8 E–05	1.8 E–05	1.8 E–05	1.8 E–05
	^{235}U	ND	8.3 E–06	8.3 E–06	8.3 E–06
	^{238}U	1.4 E–05	ND	1.4 E–05	1.4 E–05
	^{238}Pu	ND	7.7 E–06	7.7 E–06	7.7 E–06
N564	gross α	NA	NA	1.1 E–03	3.7 E–03
	gross β	NA	NA	1.1 E–02	2.0 E–02
	^{60}Co	ND	2.5 E–04	2.5 E–04	2.5 E–04
	^{234}U	9.7 E–06	1.6 E–05	1.3 E–05	1.6 E–05
	^{235}U	6.4 E–06	ND	6.4 E–06	6.4 E–06
	^{238}U	1.7 E–05	9.5 E–06	1.3 E–05	1.7 E–05

300 Area

300-FF-2 Field Remediation Project					
EDP code	Radionuclide or type of radioactivity	Concentration, pCi/m^3			
		1st half	2nd half	Average	Maximum
N130	gross α	NA	NA	1.2 E–03	2.5 E–03
	gross β	NA	NA	1.6 E–02	3.7 E–02
	^{234}U	8.1 E–06	1.3 E–05	1.0 E–05	1.3 E–05
	^{238}U	ND	1.1 E–05	1.1 E–05	1.1 E–05
N527	gross α	NA	NA	1.2 E–03	1.9 E–03
	gross β	NA	NA	1.7 E–02	3.1 E–02
	^{234}U	ND	1.6 E–05	1.6 E–05	1.6 E–05
	^{238}U	ND	1.3 E–05	1.3 E–05	1.3 E–05
N537	gross α	NA	NA	1.2 E–03	2.6 E–03
	gross β	NA	NA	1.7 E–02	4.7 E–02
	^{234}U	1.2 E–05	1.1 E–05	1.2 E–05	1.2 E–05
	^{238}U	ND	1.7 E–05	1.7 E–05	1.7 E–05

300-FF-2 Field Remediation Project					
EDP code	Radionuclide or type of radioactivity	Concentration, pCi/m^3			
		1st half	2nd half	Average	Maximum
N538	gross α	NA	NA	1.4 E–03	2.4 E–03
	gross β	NA	NA	1.7 E–02	4.8 E–02
	^{234}U	1.6 E–05	2.6 E–05	2.1 E–05	2.6 E–05
	^{235}U	ND	5.3 E–06	5.3 E–06	5.3 E–06
	^{238}U	1.2 E–05	1.5 E–05	1.3 E–05	1.5 E–05
N539	gross α	NA	NA	1.2 E–03	3.4 E–03
	gross β	NA	NA	1.8 E–02	5.0 E–02
	^{234}U	1.4 E–05	1.4 E–05	1.4 E–05	1.4 E–05
	^{238}U	1.1 E–05	8.3 E–06	9.4 E–06	1.1 E–05
N540	gross α	NA	NA	1.3 E–03	4.0 E–03
	gross β	NA	NA	1.8 E–02	5.0 E–02
	^{234}U	1.3 E–05	2.3 E–05	1.8 E–05	2.3 E–05
	^{235}U	ND	8.2 E–06	8.2 E–06	8.2 E–06
	^{238}U	5.4 E–06	1.5 E–05	1.0 E–05	1.5 E–05

300 Area Decontamination and Demolition Project							
EDP code	Radionuclide or type of radioactivity	Concentration, pCi/m3					
		1st quarter	2nd quarter	3rd quarter	4th quarter	Average	Maximum
N557	gross α	NA	NA	NA	NA	1.2 E–03	3.3 E–03
	gross β	NA	NA	NA	NA	1.8 E–02	4.7 E–02
	^{234}U	1.8 E–05	2.3 E–05	4.0 E–05	1.9 E–05	2.5 E–05	4.0 E–05
	^{238}U	7.6 E–06	ND	ND	ND	7.6 E–06	7.6 E–06
	^{238}Pu	1.8 E–05	1.5 E–05	2.1 E–05	ND	1.8 E–05	2.1 E–05

600 Area

Wye Barricade (600 Area)					
EDP code	Radionuclide or type of radioactivity	Concentration, pCi/m^3			
		1st half	2nd half	Average	Maximum
N981	gross α	NA	NA	1.1 E–03	2.1 E–03
	gross β	NA	NA	1.6 E–02	4.2 E–02
	^{234}U	ND	1.1 E–05	1.1 E–05	1.1 E–05
	^{238}U	4.7 E–06	6.3 E–06	5.5 E–06	6.3 E–06

100, 200, 300, and 600 Areas

Table 5-7. Pacific Northwest National Laboratory Supplemental Air Data for Environmental Restoration Contract Projects during 2007

Location (EDP code)	Radionuclide or type of radioactivity	Concentration, pCi/m^3	
		Average	Maximum
N914 (100-B)	^{3}H	2.8 E+00	5.3 E+00
N915 (100-B SE)	^{3}H	2.2 E+00	5.1 E+00
N917 (E100K – 118-K-1 Project)	^{3}H	8.4 E+00	5.3 E+01
N900 (100-K Area)	gross α	8.9 E–04	1.9 E–03
	gross β	1.7 E–02	7.2 E–02
	^{3}H	2.7 E+00	6.6 E+00
N901 (200-W SE)	gross α	7.5 E–04	1.6 E–03
	gross β	1.6 E–02	4.8 E–02
	^{234}U	1.9 E–05	1.9 E–05
	^{238}U	1.9 E–05	2.6 E–05
	$^{239/240}Pu$	1.1 E–05	1.1 E–05
N902 (300 NE)	gross α	7.9 E–04	1.6 E–03
	gross β	1.7 E–02	5.1 E–02
	^{3}H	8.7 E+00	1.4 E+01
	^{40}K	2.8 E–02	2.8 E–02
	^{234}U	2.3 E–05	2.3 E–05
	^{238}U	2.6 E–05	3.3 E–05
N903 (300 South Gate and 300 Area Composite)	gross α	7.9 E–04	1.7 E–03
	gross β	1.7 E–02	4.6 E–02
	^{3}H	8.6 E+00	2.1 E+01
	^{234}U	2.9 E–05	2.9 E–05
	^{238}U	2.5 E–05	3.2 E–05
	$^{239/240}Pu$	1.9 E–06	1.9 E–06
N904 (300 Trench)	gross α	6.7 E–04	1.3 E–03
	gross β	1.6 E–02	4.8 E–02
	^{3}H	8.5 E+00	1.7 E+01
	^{234}U	4.3 E–05	4.3 E–05
	^{238}U	3.2 E–05	3.8 E–05
	$^{239/240}Pu$	4.1 E–06	4.1 E–06
N905 (300 Water Intake)	gross α	7.0 E–04	1.8 E–03
	gross β	1.6 E–02	4.7 E–02
	^{3}H	5.3 E+00	1.5 E+01
N918 (300 South West)	gross α	8.9 E–04	2.2 E–03
	gross β	1.8 E–02	5.3 E–02
	^{3}H	1.2 E+01	2.9 E+01

Table 5-7. Pacific Northwest National Laboratory Supplemental Air Data for Environmental Restoration Contract Projects during 2007

Location (EDP code)	Radionuclide or type of radioactivity	Concentration, pCi/m^3	
		Average	Maximum
N906 (WYE Barricade)	gross α	7.3 E–04	1.3 E–03
	gross β	1.4 E–02	4.6 E–02
	^{234}U	3.1 E–05	3.1 E–05
	^{238}U	1.5 E–05	2.3 E–05
N907 (Yakima Barricade)	gross α	7.6 E–04	1.2 E–03
	gross β	1.5 E–02	3.6 E–02

400 Area

Table 5-8. Pacific Northwest National Laboratory Supplemental Air Data for the Fast Flux Test Facility during 2007

Location (EDP code)	Radionuclide or type of radioactivity	Concentration, pCi/m^3	
		Average	Maximum
N910 (400 E)	gross α	7.7 E–04	1.9 E–03
	gross β	1.5 E–02	4.9 E–02
	^{3}H	4.4 E+00	1.5 E+01
N911 (400 N)	gross α	8.5 E–04	2.2 E–03
	gross β	1.7 E–02	5.3 E–02
N912 (400 S)	gross α	8.4 E–04	1.7 E–03
	gross β	1.6 E–02	5.0 E–02
N913 (400 W)	gross α	8.0 E–04	1.2 E–03
	gross β	1.6 E–02	5.3 E–02

5.5 QUALITY ASSURANCE PROGRAM COMPLIANCE STATUS

Air emissions data reported in this document reflect the product of many quality assurance (QA) activities concerned with the collecting, handling, analyzing, validating, and reporting of samples and the resultant analytical data. These activities are identified in the quality assurance plans cited below. In addition, point-by-point comparisons of the major point source monitoring systems and laboratory methods to the quality assurance criteria of 40 CFR 61, Appendix B, Method 114, are detailed in the appropriate QA plan, below. PNNL was not required to perform point-by-point comparisons because their major stacks had been upgraded to full compliance status.

- EM-QA-1 Rev. 5. 2005. *Effluent Management Quality Assurance Plan.* Pacific Northwest National Laboratory, Richland, Washington.
- ENV-1-1.15. 2006. *Quality Assurance Project Plan for Radiological Air Emissions Monitoring,* Section 6.1. Washington Closure Hanford, LLC, Richland, Washington.
- ETD-001, Rev. 7. 2005. *Quality Assurance Project Plan for the Hanford Site Surface Environmental Surveillance and the Drinking Water Monitoring Project.* Pacific Northwest National Laboratory, Richland, Washington.
- HNF-EP-0528, Rev. 7. 2006. *NESHAP Quality Assurance Project Plan for Radioactive Air Emissions.* Fluor Hanford, Richland, Washington.
- HNF-EP-0538, Rev. 10. 2006. *Near-Facility Environmental Monitoring Quality Assurance Project Plan.* Fluor Hanford, Richland, Washington.
- HNF-SD-CP-QAPP-017, Rev. 8. 2006. *Waste Sampling and Characterization Facility Quality Assurance Plan.* Fluor Hanford, Richland, Washington.
- RPP-QAPP-004. 2001. *NESHAP Quality Assurance Program Plan for Tank Farm Contractor Radionuclide Air Emissions.* CH2M HILL Hanford Group, Inc., Richland, Washington.

The effluent monitoring quality assurance programs described by the above plans are based upon one or more of the following documents:

- 10 CFR 830, *Nuclear Safety Management.*
- 40 CFR 61, Appendix B, "Method 114 — Test Methods for Measuring Radionuclide Emissions from Stationary Sources."
- ASME NQA-1, *Quality Assurance Requirements for Nuclear Facility Applications, 2000 Edition.*
- DOE O 414.1C, *Quality Assurance,* "Contractor Requirements Document."
- DOE 450.1, *Environmental Protection Program.*
- DOE Order 5400.5, *Radiation Protection of the Public and the Environment.*
- DOE/EH-0173T, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance,* (DOE 1991).
- *EPA Requirements for Quality Assurance Project Plans* (QA/R-5).

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6.0 REFERENCES

10 CFR 830, *Nuclear Safety Management.*

40 CFR 61, *National Emission Standards for Hazardous Air Pollutants* (NESHAP), Subpart H, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities."

ASME. 2000. *Quality Assurance Requirements for Nuclear Facility Applications, 2000 Edition.* NQA-1, New York.

DOE. 1995. Letter, Raymond Berube, U.S. DOE, to E. Ramona Travato, U.S. EPA, "Memorandum of Understanding Between the U.S. Environmental Protection Agency and the U.S. Department of Energy Concerning the Clean Air Act Emission Standards for Radionuclides 40 CFR Part 61 Including Subparts H, I, Q & T," May 16, 1995. U.S. Department of Energy and U.S. Environmental Protection Agency, Washington, D.C.

DOE Order 231.1, *Environment, Safety and Health Reporting,* U.S. Department of Energy, Washington, D.C.

DOE Order 414.1C, *Quality Assurance,* "Contractor Requirements Document," U.S. Department of Energy-Richland Operations Office, Richland, Washington.

DOE Order 450.1, *Environmental Protection Program,* U.S. Department of Energy, Washington, D.C.

DOE Order 5400.5, *Radiation Protection of the Public and the Environment,* U.S. Department of Energy, Washington, D.C.

DOE/EH-0173T. 1991. *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*, U.S. Department of Energy, Washington D.C.

DOE/RL-88-30, Rev. 15. 2006. *Hanford Site Waste Management Units Report,* U.S. Department of Energy-Richland Operations Office, Richland, Washington.

DOE/RL-97-50, Rev. 2. 1999. *Radioactive Air Emissions Notice of Construction for HEPA Filtered Vacuum Radioactive Air Emission Units,"* U.S. Department of Energy-Richland Operations Office, Richland, Washington.

DOE/RL-97-75, Rev. 2. 1999. *Radioactive Air Emissions Notice of Construction Portable/Temporary Radioactive Air Emission Units,"* U.S. Department of Energy-Richland Operations Office, Richland, Washington.

DOE/RL-2006-29. 2006. *Calculating Potential-to-Emit Radiological Releases and Doses.* U.S. Department of Energy-Richland Operations Office, Richland, Washington.

DOE/RL-2007-53. 2008. *Methods for Calculating Doses to Demonstrate Compliance with Air Pathway Radiation Dose Standards at the Hanford Site*, U.S. Department of Energy-Richland Operations Office, Richland, Washington.

Ecology. 2006. *Hanford Site Air Operating Permit 00-05-06, Renewal 1.* Washington State Department of Ecology, Olympia, Washington.

Ecology. 2006. *Department of Energy Hanford Site Air Emissions License #FF-01.* AIR 06-1067. Washington State Department of Ecology, Olympia, Washington.

EPA. 1992. *User's Guide for CAP88-PC, Version 1.0.* EPA 402-B-92-001. U.S. Environmental Protection Agency, Office of Radiation Programs, Las Vegas, Nevada.

EPA. 2007. *CAP88-PC Version 3.0 User Guide.* U.S. Environmental Protection Agency, Office of Radiation and Indoor Air, Washington, D.C.

EPA. 2004. *Methods for Estimating Fugitive Air Emissions of Radionuclides from Diffuse Sources at DOE Facilities.* U.S. Environmental Protection Agency, Office of Radiation and Indoor Air, Washington, D.C.

EPA QA/R-5. 2001. *EPA Requirements for Quality Assurance Project Plans,* U.S. Environmental Protection Agency, Washington, D.C.

HNF-1974-1. 2002. *Radionuclide National Emission Standards for Hazardous Air Pollutants Potential-to-Emit Assessment.* Fluor Hanford, Inc., Richland, Washington.

PNL-3777, Rev. 2. 1993. *Recommended Environmental Dose Calculation Methods and Hanford-Specific Parameters*, Pacific Northwest Laboratory, Richland, Washington.

PNNL-6415, Rev. 18. 2007. *Hanford Site National Environmental Policy Act (NEPA) Characterization*, Pacific Northwest National Laboratory, Richland, Washington.

PNL-6584. 1988. *GENII — The Hanford Environmental Radiation Dosimetry Software System*, Vols. 1-3. Pacific Northwest Laboratory, Richland, Washington.

PNL-7346. 1990. *Hanford Site Environmental Report for Calendar Year 1989.* Pacific Northwest Laboratory, Richland, Washington.

PNNL-14428. 2004. *Hanford Area 2000 Population.* Pacific Northwest National Laboratory, Richland, Washington.

PNNL-17603. 2008. *Hanford Site Environmental Report for Calendar Year 2007.* Pacific Northwest National Laboratory, Richland, Washington.

PNNL-17603 APP. 1. 2008. *Hanford Site Environmental Surveillance Data Report for Calendar Year 2007.* Pacific Northwest National Laboratory, Richland, Washington.

PNNL-17603, APP. 2. 2008. *Hanford Site Near-Facility Environmental Monitoring Data Report for Calendar Year 2007.* Pacific Northwest National Laboratory, Richland, Washington.

SAND91-0561A. 1991. *User's Guide for GENII-S: A Code for Statistical and Deterministic Simulations of Radiation Doses to Humans from Radionuclides in the Environment.* Sandia National Laboratories, Albuquerque, New Mexico.

WAC 246-247, "Radiation Protection — Air Emissions."

APPENDIX A

DOSE MODELING AND METEOROLOGICAL DATA

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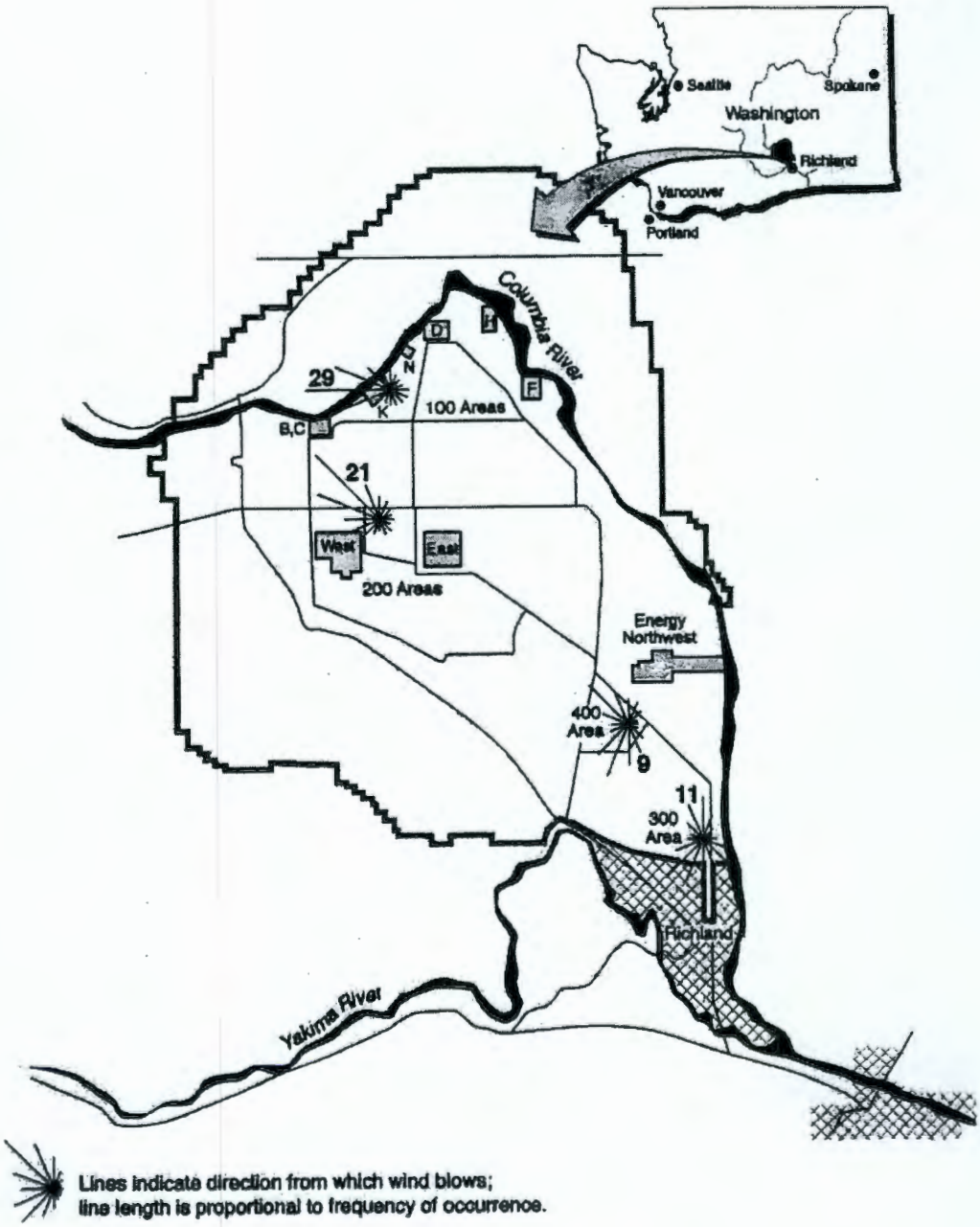

Figure A-1. Meteorological Stations and Wind Roses in 2007.

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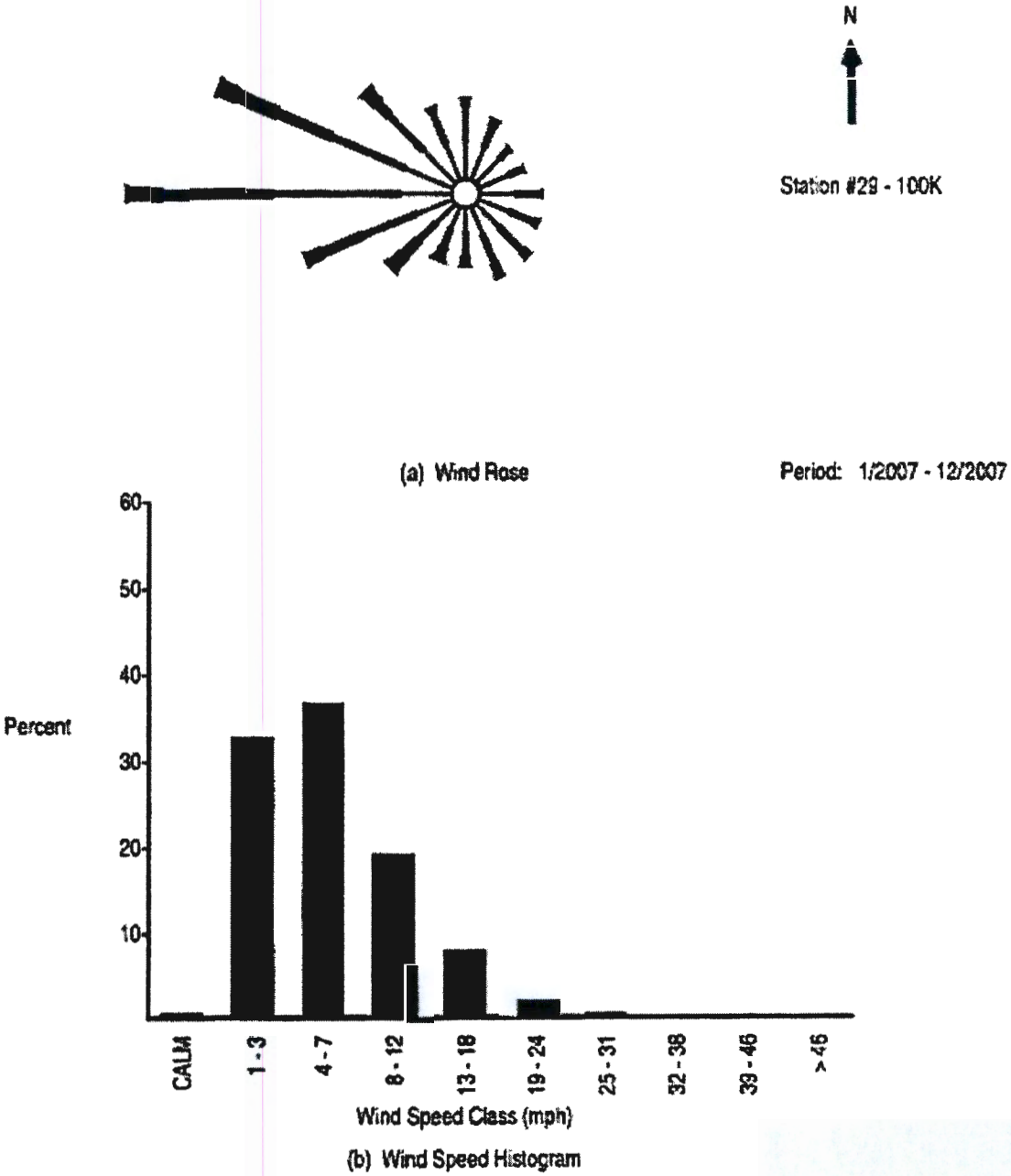

Figure A-2. 100-K Area Wind Rose and Histogram.

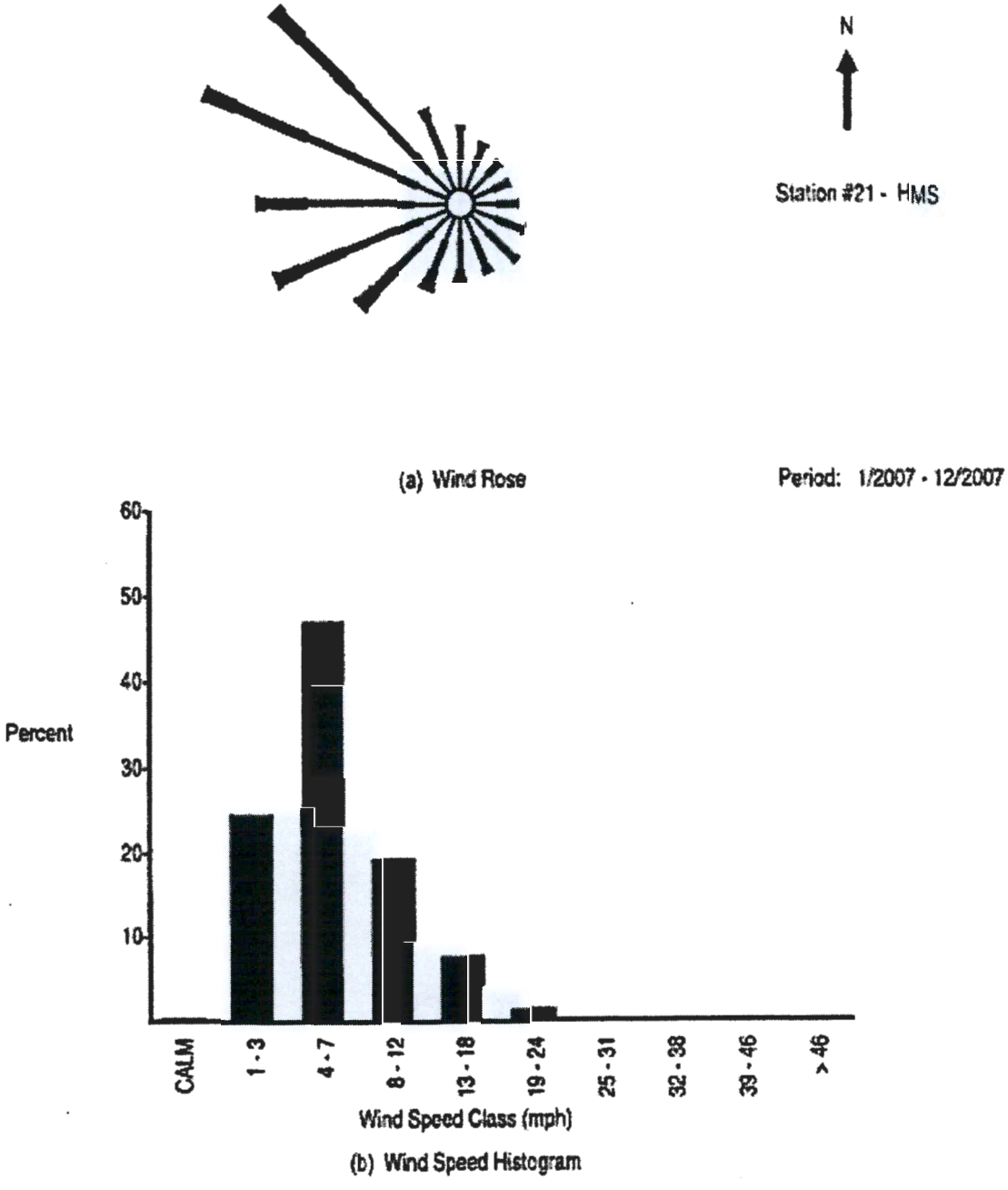

Figure A-3. 200 Area Wind Rose and Histogram.

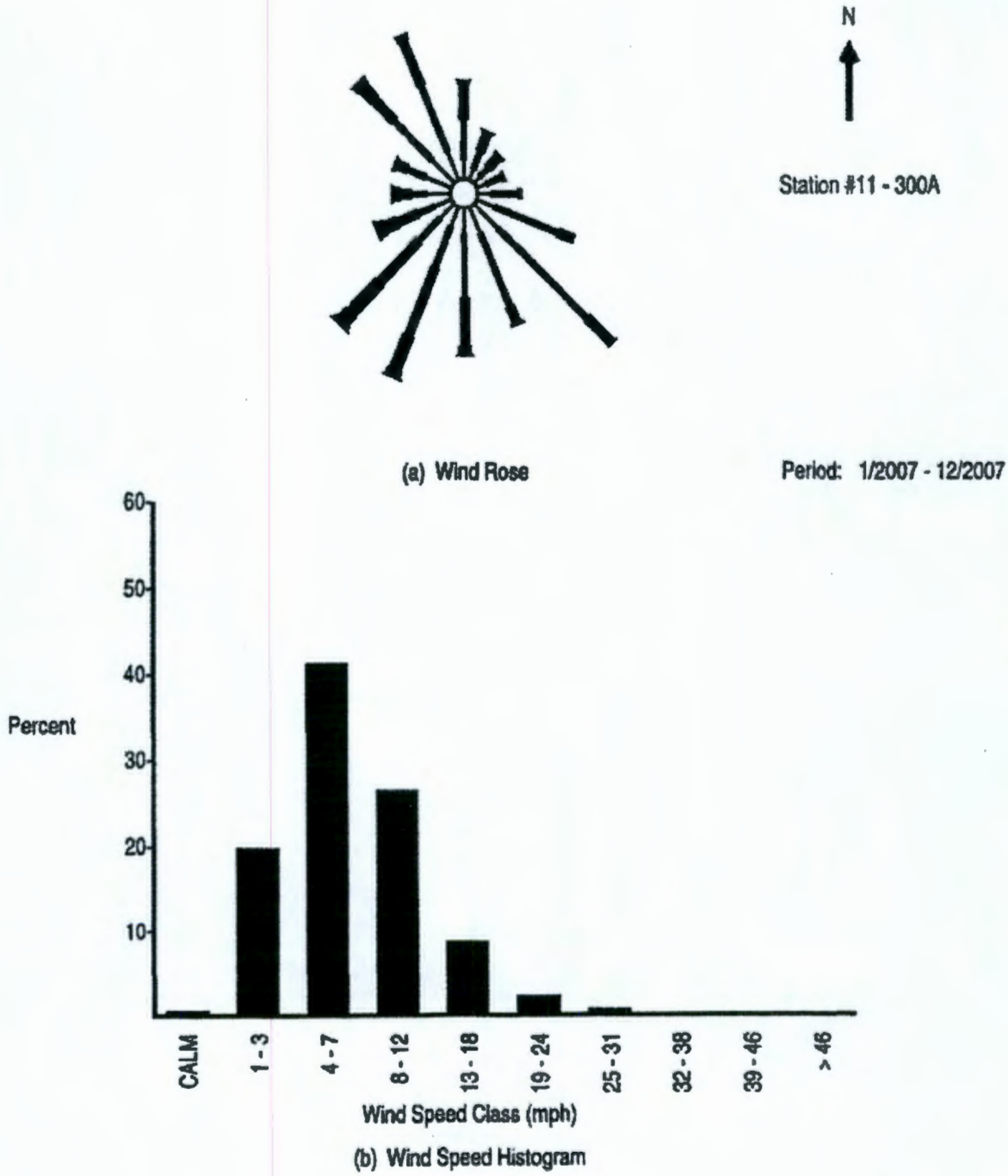

Figure A-5. 300 Area Wind Rose and Histogram.

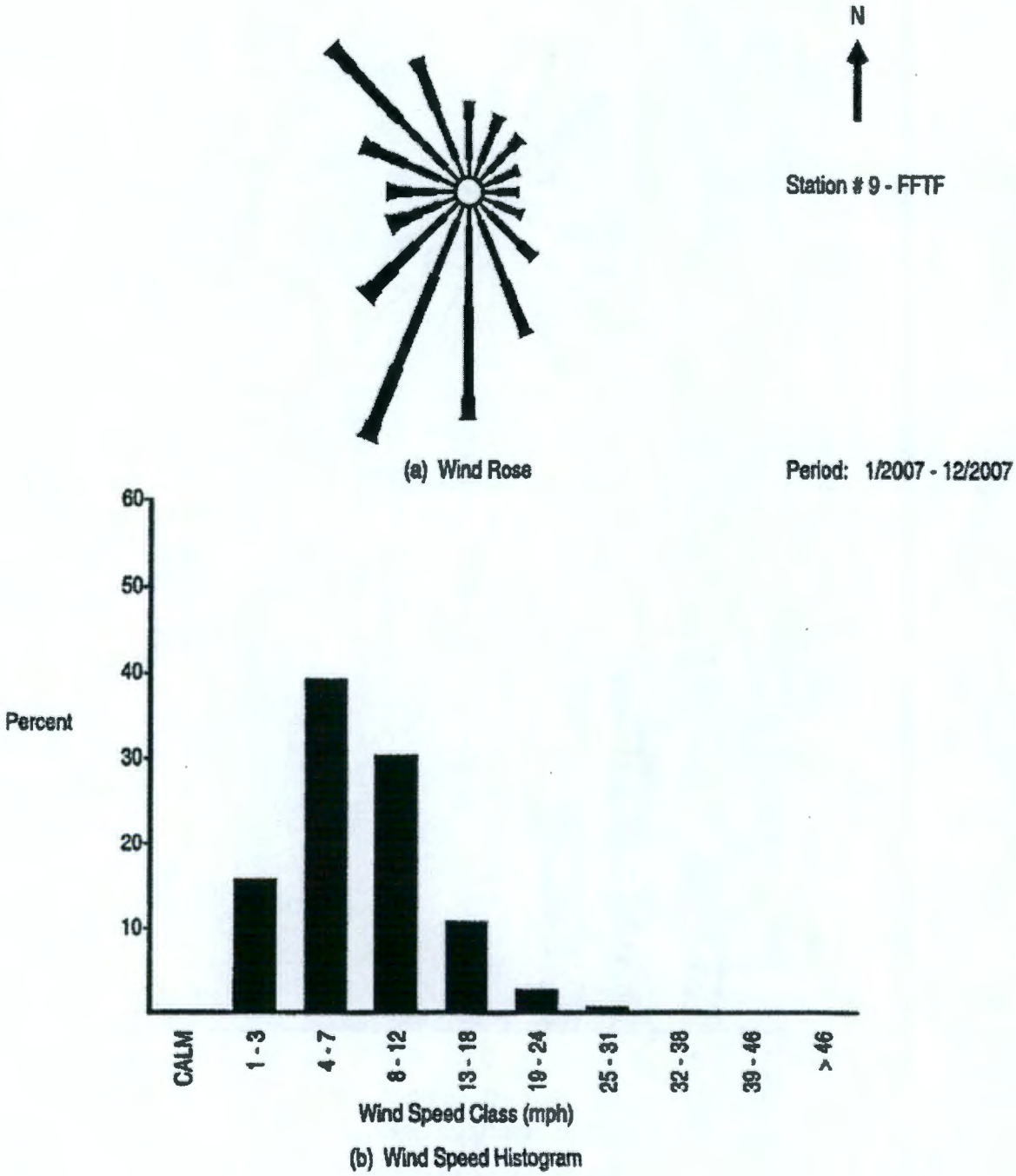

Figure A-6. 400 Area Wind Rose and Histogram.

Table A-1. Annual Average Joint Frequency during 2007 (as percent of time) of Wind Speed, Stability Class, and Direction for the 100-K Area (Station 29) at the 10–Meter Level

Wind Speed (m/sec)	Stability Class	Wind direction toward:																Total
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	
0.89	A	0.15	0.03	0.05	0.05	0.01	0.03	0.08	0.05	0.04	0.02	0.04	0.04	0.06	0.08	0.04	0.10	0.87
	B	0.18	0.09	0.05	0.08	0.06	0.04	0.05	0.05	0.03	0.03	0.09	0.13	0.12	0.17	0.18	0.22	1.57
	C	0.22	0.15	0.12	0.12	0.08	0.15	0.07	0.06	0.03	0.04	0.03	0.06	0.08	0.21	0.25	0.20	1.87
	D	0.53	0.55	0.58	0.42	0.54	0.52	0.51	0.34	0.34	0.18	0.24	0.23	0.49	0.65	0.84	0.60	7.56
	E	0.49	0.60	0.56	0.62	0.57	0.46	0.48	0.47	0.40	0.55	0.44	0.58	0.71	0.49	0.54	0.41	8.37
	F	0.44	0.49	0.54	0.49	0.59	0.49	0.52	0.58	0.46	0.44	0.55	0.93	1.06	1.01	0.68	0.57	9.84
	G	0.12	0.11	0.12	0.13	0.23	0.25	0.19	0.22	0.15	0.10	0.23	0.23	0.48	0.39	0.21	0.12	3.28
	Total	**2.13**	**2.02**	**2.02**	**1.91**	**2.08**	**1.94**	**1.90**	**1.77**	**1.45**	**1.36**	**1.62**	**2.20**	**3.00**	**3.00**	**2.74**	**2.22**	**33.36**
2.65	A	0.75	0.30	0.17	0.10	0.07	0.09	0.22	0.21	0.08	0.08	0.12	0.19	0.35	0.36	0.55	0.50	4.14
	B	0.40	0.20	0.08	0.09	0.10	0.12	0.07	0.12	0.13	0.11	0.11	0.18	0.29	0.44	0.41	0.44	3.29
	C	0.23	0.21	0.04	0.09	0.21	0.16	0.11	0.16	0.06	0.04	0.07	0.12	0.33	0.36	0.21	0.16	2.56
	D	0.34	0.37	0.26	0.27	0.45	0.51	0.64	0.46	0.23	0.14	0.18	0.45	1.09	1.08	0.59	0.41	7.47
	E	0.23	0.15	0.13	0.30	0.53	0.40	0.49	0.44	0.49	0.53	0.53	1.10	3.00	1.40	0.55	0.26	10.53
	F	0.08	0.05	0.05	0.11	0.19	0.27	0.36	0.36	0.35	0.26	0.37	1.02	1.87	0.87	0.41	0.18	6.80
	G	0.01	0.01	0.00	0.05	0.08	0.08	0.12	0.07	0.07	0.01	0.06	0.42	0.70	0.23	0.05	0.00	1.96
	Total	**2.04**	**1.29**	**0.73**	**1.01**	**1.63**	**1.63**	**2.01**	**1.82**	**1.41**	**1.17**	**1.44**	**3.48**	**7.63**	**4.74**	**2.77**	**1.95**	**36.75**
4.70	A	0.22	0.20	0.13	0.01	0.03	0.06	0.06	0.03	0.04	0.03	0.12	0.28	0.35	0.42	0.27	0.10	2.35
	B	0.02	0.07	0.01	0.00	0.04	0.09	0.04	0.03	0.04	0.04	0.10	0.15	0.34	0.26	0.10	0.04	1.37
	C	0.05	0.04	0.01	0.04	0.04	0.07	0.04	0.06	0.02	0.01	0.08	0.13	0.23	0.16	0.07	0.07	1.12
	D	0.07	0.02	0.01	0.01	0.05	0.08	0.15	0.20	0.17	0.15	0.25	0.42	1.01	0.67	0.19	0.03	3.48
	E	0.06	0.06	0.00	0.01	0.00	0.05	0.23	0.35	0.22	0.25	0.60	1.07	3.48	1.71	0.24	0.05	8.38
	F	0.03	0.01	0.00	0.00	0.01	0.01	0.05	0.17	0.04	0.03	0.03	0.47	0.92	0.29	0.05	0.04	2.15
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.01	0.00	0.01	0.10	0.19	0.01	0.01	0.00	0.36
	Total	**0.45**	**0.40**	**0.16**	**0.07**	**0.17**	**0.36**	**0.57**	**0.87**	**0.54**	**0.51**	**1.19**	**2.62**	**6.52**	**3.52**	**0.93**	**0.33**	**19.21**

Table A-1. Annual Average Joint Frequency during 2007 (as percent of time) of Wind Speed, Stability Class, and Direction for the 100-K Area (Station 29) at the 10–Meter Level

Wind Speed (m/sec)	Stability Class	Wind direction toward:																Total
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	
7.15	A	0.01	0.06	0.00	0.00	0.00	0.00	0.00	0.03	0.02	0.01	0.16	0.27	0.14	0.39	0.25	0.06	1.40
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.02	0.04	0.11	0.09	0.13	0.09	0.01	0.50
	C	0.02	0.01	0.00	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.04	0.07	0.12	0.21	0.14	0.00	0.64
	D	0.04	0.04	0.00	0.00	0.00	0.00	0.02	0.05	0.03	0.06	0.37	0.24	0.45	0.71	0.26	0.01	2.28
	E	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.04	0.06	0.14	0.22	0.22	1.13	1.04	0.08	0.00	2.96
	F	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.07	0.05	0.01	0.00	0.18
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.10**	**0.12**	**0.00**	**0.01**	**0.00**	**0.02**	**0.03**	**0.13**	**0.11**	**0.23**	**0.84**	**0.93**	**2.00**	**2.53**	**0.83**	**0.08**	**7.96**
9.80	A	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.03	0.05	0.23	0.11	0.00	0.44
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.01	0.10	0.02	0.00	0.20
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.00	0.05	0.03	0.00	0.12
	D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.15	0.09	0.07	0.39	0.06	0.00	0.81
	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.09	0.01	0.10	0.32	0.03	0.00	0.64
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.00**	**0.00**	**0.14**	**0.28**	**0.21**	**0.23**	**1.10**	**0.25**	**0.00**	**2.22**
12.70	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.06	0.01	0.00	0.08
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.02
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.03	0.00	0.00	0.04
	D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.01	0.13	0.01	0.00	0.18
	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.02	0.00	0.00	0.00	0.00	0.08
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.06**	**0.03**	**0.03**	**0.02**	**0.24**	**0.02**	**0.00**	**0.40**

Table A-1. Annual Average Joint Frequency during 2007 (as percent of time) of Wind Speed, Stability Class, and Direction for the 100-K Area (Station 29) at the 10–Meter Level

Wind Speed (m/sec)	Stability Class	Wind direction toward:																Total
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	
15.60	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
19.00	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Total	A	1.13	0.59	0.35	0.16	0.11	0.18	0.37	0.32	0.18	0.14	0.45	0.81	0.96	1.54	1.23	0.76	9.28
	B	0.60	0.36	0.14	0.17	0.20	0.25	0.16	0.21	0.20	0.20	0.36	0.62	0.85	1.12	0.80	0.71	6.95
	C	0.52	0.41	0.17	0.25	0.33	0.40	0.23	0.28	0.11	0.09	0.23	0.42	0.76	1.02	0.70	0.43	6.35
	D	0.98	0.98	0.85	0.70	1.04	1.11	1.32	1.05	0.77	0.58	1.22	1.43	3.12	3.63	1.95	1.05	21.78
	E	0.79	0.82	0.69	0.94	1.10	0.91	1.20	1.30	1.17	1.62	1.88	3.00	8.42	4.96	1.44	0.72	30.96
	F	0.57	0.55	0.59	0.60	0.79	0.77	0.93	1.11	0.85	0.73	0.96	2.44	3.92	2.23	1.15	0.79	18.98
	G	0.13	0.12	0.12	0.18	0.31	0.33	0.31	0.32	0.23	0.11	0.30	0.75	1.37	0.63	0.27	0.12	5.60
	Total	**4.72**	**3.83**	**2.91**	**3.00**	**3.88**	**3.95**	**4.52**	**4.59**	**3.51**	**3.47**	**5.40**	**9.47**	**19.40**	**15.13**	**7.54**	**4.58**	**99.90**

Table A-2. Annual Average Joint Frequency during 2007 (as percent of time) of Wind Speed, Stability Class, and Direction for the 200 Area Meteorology Station (Station 21) at the 10–Meter Level

Wind speed (m/sec)	Stability class	Wind direction toward:																Total
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	
0.89	A	0.08	0.07	0.08	0.03	0.05	0.08	0.02	0.03	0.06	0.06	0.04	0.06	0.03	0.06	0.02	0.06	0.83
	B	0.12	0.11	0.16	0.21	0.15	0.07	0.07	0.04	0.04	0.07	0.07	0.06	0.07	0.08	0.04	0.06	1.42
	C	0.13	0.2	0.2	0.08	0.13	0.14	0.09	0.04	0.06	0.11	0.05	0.07	0.04	0.07	0.07	0.07	1.55
	D	0.62	0.55	0.54	0.54	0.44	0.48	0.51	0.51	0.31	0.22	0.26	0.31	0.34	0.46	0.54	0.7	7.33
	E	0.28	0.31	0.32	0.25	0.32	0.42	0.45	0.34	0.3	0.5	0.56	0.62	0.59	0.66	0.55	0.39	6.86
	F	0.27	0.21	0.15	0.17	0.15	0.17	0.28	0.27	0.45	0.44	0.49	0.44	0.74	0.56	0.44	0.26	5.49
	G	0.07	0.06	0.05	0.05	0.08	0.11	0.08	0.09	0.07	0.12	0.12	0.09	0.12	0.04	0.15	0.11	1.41
	Total	**1.57**	**1.51**	**1.50**	**1.33**	**1.32**	**1.47**	**1.50**	**1.32**	**1.29**	**1.52**	**1.59**	**1.65**	**1.93**	**1.93**	**1.81**	**1.65**	**24.89**
2.65	A	0.17	0.14	0.12	0.03	0.02	0.05	0.07	0.04	0.01	0.09	0.51	0.44	0.11	0.29	0.64	0.23	2.96
	B	0.04	0.01	0.00	0.02	0.02	0.03	0.05	0.02	0.03	0.03	0.11	0.23	0.05	0.12	0.32	0.05	1.13
	C	0.02	0.00	0.00	0.05	0.02	0.02	0.01	0.01	0.03	0.04	0.08	0.13	0.09	0.19	0.34	0.06	1.09
	D	0.03	0.04	0.00	0.00	0.03	0.02	0.05	0.10	0.13	0.17	0.38	0.70	0.45	1.04	0.89	0.08	4.11
	E	0.03	0.00	0.00	0.01	0.01	0.01	0.05	0.16	0.11	0.35	0.69	1.15	1.62	2.78	1.67	0.05	8.69
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.14	0.01	0.04	0.14	0.20	0.23	0.27	0.05	1.11
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.05	0.01	0.05	0.09	0.00	0.21
	Total	**0.29**	**0.19**	**0.12**	**0.11**	**0.10**	**0.13**	**0.23**	**0.37**	**0.45**	**0.69**	**1.81**	**2.84**	**2.53**	**4.70**	**4.22**	**0.52**	**19.30**
4.70	A	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.15	0.26	0.05	0.17	0.41	0.04	1.12
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.10	0.15	0.03	0.10	0.12	0.00	0.51
	C	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.09	0.14	0.03	0.05	0.15	0.01	0.50
	D	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.10	0.39	0.43	0.20	0.58	0.70	0.01	2.49
	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.14	0.35	0.27	0.35	0.25	0.90	0.50	0.00	2.81
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.02	0.02	0.00	0.01	0.00	0.06
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.02**	**0.02**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.05**	**0.23**	**0.49**	**1.00**	**1.35**	**0.58**	**1.80**	**1.89**	**0.06**	**7.49**

Table A-2. Annual Average Joint Frequency during 2007 (as percent of time) of Wind Speed, Stability Class, and Direction for the 200 Area Meteorology Station (Station 21) at the 10–Meter Level

Wind speed (m/sec)	Stability class	Wind direction toward:																Total
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	
7.15	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.07	0.00	0.01	0.13	0.00	0.22
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.00	0.01	0.05	0.00	0.12
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.05	0.00	0.07
	D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.07	0.13	0.07	0.00	0.08	0.11	0.00	0.47
	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.13	0.03	0.07	0.01	0.08	0.16	0.00	0.51
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.04**	**0.20**	**0.20**	**0.26**	**0.01**	**0.18**	**0.50**	**0.00**	**1.39**
9.80	A	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.03	0.05	0.23	0.11	0.00	0.44
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.01	0.10	0.02	0.00	0.20
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.00	0.05	0.03	0.00	0.12
	D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.15	0.09	0.07	0.39	0.06	0.00	0.81
	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.09	0.01	0.10	0.32	0.03	0.00	0.64
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.00**	**0.00**	**0.14**	**0.28**	**0.21**	**0.23**	**1.10**	**0.25**	**0.00**	**2.22**
12.70	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.03
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.03
	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.02
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.04**	**0.03**	**0.01**	**0.00**	**0.00**	**0.00**	**0.08**

Table A-2. Annual Average Joint Frequency during 2007 (as percent of time) of Wind Speed, Stability Class, and Direction for the 200 Area Meteorology Station (Station 21) at the 10–Meter Level

Wind speed (m/sec)	Stability class	Wind direction toward:																Total
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	
15.60	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
19.00	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Total	A	0.25	0.22	0.20	0.06	0.07	0.13	0.10	0.07	0.08	0.17	0.72	0.88	0.25	0.76	1.31	0.33	5.60
	B	0.16	0.12	0.16	0.23	0.17	0.10	0.12	0.06	0.08	0.10	0.32	0.53	0.16	0.41	0.55	0.11	3.38
	C	0.16	0.21	0.20	0.13	0.15	0.16	0.10	0.05	0.09	0.16	0.24	0.38	0.16	0.36	0.64	0.14	3.33
	D	0.66	0.59	0.54	0.54	0.47	0.50	0.56	0.61	0.52	0.61	1.34	1.60	1.06	2.55	2.30	0.79	15.24
	E	0.31	0.31	0.32	0.26	0.33	0.43	0.50	0.55	0.58	1.42	1.65	2.21	2.57	4.74	2.91	0.44	19.53
	F	0.27	0.21	0.15	0.17	0.15	0.17	0.28	0.30	0.59	0.46	0.53	0.60	0.96	0.80	0.72	0.31	6.67
	G	0.07	0.06	0.05	0.05	0.08	0.11	0.08	0.10	0.07	0.12	0.12	0.14	0.13	0.09	0.24	0.11	1.62
	Total	**1.88**	**1.72**	**1.62**	**1.44**	**1.42**	**1.60**	**1.74**	**1.74**	**2.01**	**3.04**	**4.92**	**6.34**	**5.29**	**9.71**	**8.67**	**2.23**	**55.37**

Table A-3. Annual Average Joint Frequency during 2007 (as percent of time) of Wind Speed, Stability Class, and Direction for the 200 Area Meteorology Station (Station 21) at the 89–Meter Level

Wind speed (m/sec)	Stability class	Wind direction toward:																Total
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	
0.89	A	0.07	0.01	0.02	0.04	0.03	0	0.01	0	0.03	0.05	0.04	0.02	0.01	0.01	0.04	0.03	0.41
	B	0.03	0.07	0.07	0.07	0.07	0.03	0.04	0.03	0.06	0	0.03	0.05	0.03	0.07	0.03	0.03	0.71
	C	0.07	0.1	0.09	0.06	0.06	0.12	0.1	0.04	0.04	0.04	0.03	0.04	0	0.02	0.06	0.04	0.91
	D	0.43	0.36	0.41	0.36	0.43	0.39	0.53	0.35	0.22	0.14	0.15	0.17	0.37	0.24	0.43	0.38	5.36
	E	0.26	0.17	0.12	0.16	0.17	0.19	0.27	0.23	0.15	0.11	0.1	0.13	0.16	0.1	0.23	0.22	2.77
	F	0.14	0.17	0.09	0.14	0.16	0.16	0.26	0.32	0.18	0.14	0.23	0.18	0.22	0.15	0.27	0.19	3.00
	G	0.07	0.03	0.03	0.03	0.05	0.07	0.06	0.09	0.05	0.07	0.11	0.03	0.03	0.03	0.04	0.06	0.85
	Total	**1.07**	**0.91**	**0.83**	**0.86**	**0.97**	**0.96**	**1.27**	**1.06**	**0.73**	**0.55**	**0.69**	**0.62**	**0.82**	**0.62**	**1.10**	**0.95**	**14.01**
2.65	A	0.26	0.34	0.2	0.21	0.3	0.39	0.39	0.22	0.17	0.12	0.15	0.06	0.04	0.09	0.1	0.17	3.21
	B	0.42	0.25	0.26	0.23	0.26	0.26	0.27	0.15	0.15	0.19	0.21	0.09	0.12	0.09	0.19	0.33	3.47
	C	0.3	0.2	0.15	0.19	0.18	0.19	0.18	0.13	0.18	0.18	0.15	0.17	0.11	0.2	0.23	0.33	3.07
	D	0.63	0.29	0.25	0.27	0.27	0.4	0.51	0.32	0.26	0.13	0.16	0.19	0.24	0.57	1.03	0.82	6.34
	E	0.54	0.26	0.12	0.18	0.28	0.33	0.29	0.23	0.15	0.13	0.14	0.27	0.44	0.55	0.78	0.68	5.37
	F	0.36	0.12	0.09	0.12	0.13	0.14	0.19	0.21	0.13	0.18	0.13	0.3	0.6	0.58	0.68	0.66	4.62
	G	0.08	0.01	0.05	0.01	0.02	0.01	0.07	0.09	0.08	0.09	0.11	0.17	0.31	0.35	0.18	0.09	1.72
	Total	**2.59**	**1.47**	**1.12**	**1.21**	**1.44**	**1.72**	**1.90**	**1.35**	**1.12**	**1.02**	**1.05**	**1.25**	**1.86**	**2.43**	**3.19**	**3.08**	**27.80**
4.70	A	0.33	0.31	0.14	0.08	0.03	0.09	0.09	0.09	0.02	0.13	0.35	0.20	0.04	0.09	0.32	0.32	2.63
	B	0.09	0.08	0.04	0.06	0.06	0.04	0.04	0.03	0.11	0.10	0.19	0.11	0.03	0.12	0.31	0.21	1.62
	C	0.08	0.03	0.02	0.05	0.02	0.02	0.02	0.03	0.05	0.05	0.12	0.07	0.05	0.14	0.27	0.22	1.24
	D	0.10	0.07	0.05	0.02	0.10	0.10	0.06	0.14	0.14	0.10	0.14	0.18	0.17	0.43	1.10	0.52	3.42
	E	0.21	0.08	0.03	0.05	0.06	0.05	0.11	0.16	0.17	0.19	0.27	0.26	0.57	1.07	1.73	0.57	5.58
	F	0.19	0.07	0.02	0.01	0.01	0.09	0.04	0.16	0.09	0.10	0.14	0.41	0.79	1.38	1.62	0.72	5.84
	G	0.10	0.01	0.00	0.00	0.00	0.00	0.00	0.06	0.02	0.01	0.04	0.11	0.21	0.38	0.50	0.27	1.71
	Total	**1.10**	**0.65**	**0.30**	**0.27**	**0.28**	**0.39**	**0.36**	**0.67**	**0.60**	**0.68**	**1.25**	**1.34**	**1.86**	**3.61**	**5.85**	**2.83**	**22.04**

Table A-3. Annual Average Joint Frequency during 2007 (as percent of time) of Wind Speed, Stability Class, and Direction for the 200 Area Meteorology Station (Station 21) at the 89–Meter Level

Wind speed (m/sec)	Stability class	Wind direction toward:																Total
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	
7.15	A	0.02	0.09	0.02	0.02	0.01	0.00	0.02	0.03	0.01	0.03	0.45	0.31	0.07	0.26	0.49	0.09	1.92
	B	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.12	0.17	0.04	0.01	0.18	0.01	0.58
	C	0.01	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.01	0.01	0.07	0.15	0.03	0.09	0.15	0.04	0.59
	D	0.02	0.02	0.00	0.00	0.00	0.01	0.00	0.07	0.07	0.17	0.20	0.41	0.23	0.34	0.63	0.09	2.26
	E	0.06	0.05	0.00	0.02	0.01	0.01	0.02	0.10	0.10	0.20	0.46	0.68	1.09	2.18	1.95	0.28	7.21
	F	0.11	0.04	0.01	0.00	0.01	0.00	0.00	0.05	0.05	0.02	0.05	0.14	0.50	1.10	1.88	0.48	4.44
	G	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.03	0.02	0.01	0.03	0.04	0.21	0.12	0.48	0.29	1.27
	Total	**0.26**	**0.21**	**0.03**	**0.05**	**0.05**	**0.02**	**0.04**	**0.28**	**0.28**	**0.46**	**1.38**	**1.90**	**2.17**	**4.10**	**5.76**	**1.28**	**18.27**
9.80	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.11	0.16	0.03	0.03	0.25	0.05	0.65
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.05	0.11	0.01	0.05	0.12	0.00	0.35
	C	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.10	0.03	0.02	0.12	0.01	0.35
	D	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.10	0.27	0.45	0.19	0.51	0.44	0.03	2.07
	E	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.05	0.08	0.14	0.44	0.60	0.59	1.72	1.63	0.04	5.32
	F	0.03	0.00	0.00	0.01	0.00	0.00	0.01	0.03	0.02	0.00	0.01	0.08	0.10	0.22	0.42	0.03	0.96
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.04	0.02	0.09
	Total	**0.08**	**0.04**	**0.00**	**0.02**	**0.01**	**0.00**	**0.01**	**0.08**	**0.13**	**0.26**	**0.95**	**1.50**	**0.96**	**2.55**	**3.02**	**0.18**	**9.79**
12.70	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.03	0.01	0.03	0.19	0.00	0.32
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.05	0.01	0.04	0.03	0.00	0.19
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04	0.04	0.00	0.00	0.08	0.00	0.17
	D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.07	0.28	0.17	0.05	0.35	0.63	0.00	1.59
	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.12	0.16	0.38	0.37	0.13	0.85	1.13	0.02	3.17
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.01	0.02	0.00	0.04	0.00	0.00	0.10
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.16**	**0.27**	**0.83**	**0.68**	**0.20**	**1.31**	**2.06**	**0.02**	**5.54**

Table A-3. Annual Average Joint Frequency during 2007 (as percent of time) of Wind Speed, Stability Class, and Direction for the 200 Area Meteorology Station (Station 21) at the 89–Meter Level

Wind speed (m/sec)	Stability class	Wind direction toward:																Total
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	
15.60	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.06	0.01	0.00	0.03	0.00	0.11
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.04
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.00	0.03
	D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.07	0.17	0.10	0.01	0.09	0.26	0.00	0.71
	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.23	0.12	0.13	0.06	0.23	0.30	0.00	1.09
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.03**	**0.31**	**0.31**	**0.30**	**0.08**	**0.32**	**0.64**	**0.00**	**1.99**
19.00	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.07	0.00	0.00	0.00	0.00	0.00	0.09
	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.14	0.08	0.06	0.02	0.01	0.10	0.00	0.42
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.16**	**0.15**	**0.07**	**0.03**	**0.01**	**0.10**	**0.00**	**0.53**
Total	A	0.68	0.75	0.38	0.35	0.37	0.48	0.51	0.34	0.24	0.34	1.17	0.85	0.21	0.51	1.42	0.66	9.26
	B	0.55	0.40	0.37	0.36	0.39	0.33	0.35	0.21	0.34	0.32	0.66	0.59	0.24	0.38	0.89	0.58	6.96
	C	0.47	0.34	0.26	0.31	0.28	0.33	0.30	0.20	0.28	0.29	0.47	0.57	0.22	0.47	0.93	0.64	6.36
	D	1.21	0.77	0.71	0.65	0.80	0.90	1.10	0.88	0.76	0.80	1.44	1.67	1.26	2.53	4.52	1.84	21.84
	E	1.08	0.56	0.27	0.42	0.53	0.58	0.69	0.78	0.80	1.30	1.99	2.50	3.06	6.71	7.85	1.81	30.93
	F	0.83	0.40	0.21	0.28	0.31	0.39	0.50	0.77	0.47	0.48	0.57	1.13	2.22	3.47	4.87	2.08	18.98
	G	0.28	0.06	0.08	0.04	0.07	0.08	0.13	0.27	0.17	0.18	0.31	0.35	0.77	0.88	1.24	0.73	5.64
	Total	**5.10**	**3.28**	**2.28**	**2.41**	**2.75**	**3.09**	**3.58**	**3.45**	**3.06**	**3.71**	**6.61**	**7.66**	**7.98**	**14.95**	**21.72**	**8.34**	**99.97**

Table A-4. Annual Average Joint Frequency during 2007 (as percent of time) of Wind Speed, Stability Class, and Direction for the 300 Area (Station 11) at the 10–Meter Level

Wind speed (m/sec)	Stability class	Wind direction toward:																Total
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	
0.89	A	0.07	0.01	0.02	0.04	0.03	0	0.01	0	0.03	0.05	0.04	0.02	0.01	0.01	0.04	0.03	0.41
	B	0.03	0.07	0.07	0.07	0.07	0.03	0.04	0.03	0.06	0	0.03	0.05	0.03	0.07	0.03	0.03	0.71
	C	0.07	0.1	0.09	0.06	0.06	0.12	0.1	0.04	0.04	0.04	0.03	0.04	0	0.02	0.06	0.04	0.91
	D	0.43	0.36	0.41	0.36	0.43	0.39	0.53	0.35	0.22	0.14	0.15	0.17	0.37	0.24	0.43	0.38	5.36
	E	0.26	0.17	0.12	0.16	0.17	0.19	0.27	0.23	0.15	0.11	0.1	0.13	0.16	0.1	0.23	0.22	2.77
	F	0.14	0.17	0.09	0.14	0.16	0.16	0.26	0.32	0.18	0.14	0.23	0.18	0.22	0.15	0.27	0.19	3.00
	G	0.07	0.03	0.03	0.03	0.05	0.07	0.06	0.09	0.05	0.07	0.11	0.03	0.03	0.03	0.04	0.06	0.85
	Total	**1.07**	**0.91**	**0.83**	**0.86**	**0.97**	**0.96**	**1.27**	**1.06**	**0.73**	**0.55**	**0.69**	**0.62**	**0.82**	**0.62**	**1.10**	**0.95**	**14.01**
2.65	A	0.26	0.34	0.2	0.21	0.3	0.39	0.39	0.22	0.17	0.12	0.15	0.06	0.04	0.09	0.1	0.17	3.21
	B	0.42	0.25	0.26	0.23	0.26	0.26	0.27	0.15	0.15	0.19	0.21	0.09	0.12	0.09	0.19	0.33	3.47
	C	0.3	0.2	0.15	0.19	0.18	0.19	0.18	0.13	0.18	0.18	0.15	0.17	0.11	0.2	0.23	0.33	3.07
	D	0.63	0.29	0.25	0.27	0.27	0.4	0.51	0.32	0.26	0.13	0.16	0.19	0.24	0.57	1.03	0.82	6.34
	E	0.54	0.26	0.12	0.18	0.28	0.33	0.29	0.23	0.15	0.13	0.14	0.27	0.44	0.55	0.78	0.68	5.37
	F	0.36	0.12	0.09	0.12	0.13	0.14	0.19	0.21	0.13	0.18	0.13	0.3	0.6	0.58	0.68	0.66	4.62
	G	0.08	0.01	0.05	0.01	0.02	0.01	0.07	0.09	0.08	0.09	0.11	0.17	0.31	0.35	0.18	0.09	1.72
	Total	**2.59**	**1.47**	**1.12**	**1.21**	**1.44**	**1.72**	**1.90**	**1.35**	**1.12**	**1.02**	**1.05**	**1.25**	**1.86**	**2.43**	**3.19**	**3.08**	**27.80**
4.70	A	0.33	0.31	0.14	0.08	0.03	0.09	0.09	0.09	0.02	0.13	0.35	0.20	0.04	0.09	0.32	0.32	2.63
	B	0.09	0.08	0.04	0.06	0.06	0.04	0.04	0.03	0.11	0.10	0.19	0.11	0.03	0.12	0.31	0.21	1.62
	C	0.08	0.03	0.02	0.05	0.02	0.02	0.02	0.03	0.05	0.05	0.12	0.07	0.05	0.14	0.27	0.22	1.24
	D	0.10	0.07	0.05	0.02	0.10	0.10	0.06	0.14	0.14	0.10	0.14	0.18	0.17	0.43	1.10	0.52	3.42
	E	0.21	0.08	0.03	0.05	0.06	0.05	0.11	0.16	0.17	0.19	0.27	0.26	0.57	1.07	1.73	0.57	5.58
	F	0.19	0.07	0.02	0.01	0.01	0.09	0.04	0.16	0.09	0.10	0.14	0.41	0.79	1.38	1.62	0.72	5.84
	G	0.10	0.01	0.00	0.00	0.00	0.00	0.00	0.06	0.02	0.01	0.04	0.11	0.21	0.38	0.50	0.27	1.71
	Total	**1.10**	**0.65**	**0.30**	**0.27**	**0.28**	**0.39**	**0.36**	**0.67**	**0.60**	**0.68**	**1.25**	**1.34**	**1.86**	**3.61**	**5.85**	**2.83**	**22.04**

Table A-4. Annual Average Joint Frequency during 2007 (as percent of time) of Wind Speed, Stability Class, and Direction for the 300 Area (Station 11) at the 10–Meter Level

Wind speed (m/sec)	Stability class	Wind direction toward:																Total
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	
7.15	A	0.02	0.09	0.02	0.02	0.01	0.00	0.02	0.03	0.01	0.03	0.45	0.31	0.07	0.26	0.49	0.09	1.92
	B	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.12	0.17	0.04	0.01	0.18	0.01	0.58
	C	0.01	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.01	0.01	0.07	0.15	0.03	0.09	0.15	0.04	0.59
	D	0.02	0.02	0.00	0.00	0.00	0.01	0.00	0.07	0.07	0.17	0.20	0.41	0.23	0.34	0.63	0.09	2.26
	E	0.06	0.05	0.00	0.02	0.01	0.01	0.02	0.10	0.10	0.20	0.46	0.68	1.09	2.18	1.95	0.28	7.21
	F	0.11	0.04	0.01	0.00	0.01	0.00	0.00	0.05	0.05	0.02	0.05	0.14	0.50	1.10	1.88	0.48	4.44
	G	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.03	0.02	0.01	0.03	0.04	0.21	0.12	0.48	0.29	1.27
	Total	**0.26**	**0.21**	**0.03**	**0.05**	**0.05**	**0.02**	**0.04**	**0.28**	**0.28**	**0.46**	**1.38**	**1.90**	**2.17**	**4.10**	**5.76**	**1.28**	**18.27**
9.80	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.11	0.16	0.03	0.03	0.25	0.05	0.65
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.05	0.11	0.01	0.05	0.12	0.00	0.35
	C	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.10	0.03	0.02	0.12	0.01	0.35
	D	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.10	0.27	0.45	0.19	0.51	0.44	0.03	2.07
	E	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.05	0.08	0.14	0.44	0.60	0.59	1.72	1.63	0.04	5.32
	F	0.03	0.00	0.00	0.01	0.00	0.00	0.01	0.03	0.02	0.00	0.01	0.08	0.10	0.22	0.42	0.03	0.96
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.04	0.02	0.09
	Total	**0.08**	**0.04**	**0.00**	**0.02**	**0.01**	**0.00**	**0.01**	**0.08**	**0.13**	**0.26**	**0.95**	**1.50**	**0.96**	**2.55**	**3.02**	**0.18**	**9.79**
12.70	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.03	0.01	0.03	0.19	0.00	0.32
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.05	0.01	0.04	0.03	0.00	0.19
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04	0.04	0.00	0.00	0.08	0.00	0.17
	D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.07	0.28	0.17	0.05	0.35	0.63	0.00	1.59
	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.12	0.16	0.38	0.37	0.13	0.85	1.13	0.02	3.17
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.01	0.02	0.00	0.04	0.00	0.00	0.10
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.16**	**0.27**	**0.83**	**0.68**	**0.20**	**1.31**	**2.06**	**0.02**	**5.54**

Table A-4. Annual Average Joint Frequency during 2007 (as percent of time) of Wind Speed, Stability Class, and Direction for the 300 Area (Station 11) at the 10–Meter Level

Wind speed (m/sec)	Stability class	Wind direction toward:																Total
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	
15.60	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.06	0.01	0.00	0.03	0.00	0.11
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.04
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.00	0.03
	D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.07	0.17	0.10	0.01	0.09	0.26	0.00	0.71
	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.23	0.12	0.13	0.06	0.23	0.30	0.00	1.09
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.03**	**0.31**	**0.31**	**0.30**	**0.08**	**0.32**	**0.64**	**0.00**	**1.99**
19.00	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.07	0.00	0.00	0.00	0.00	0.00	0.09
	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.14	0.08	0.06	0.02	0.01	0.10	0.00	0.42
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.16**	**0.15**	**0.07**	**0.03**	**0.01**	**0.10**	**0.00**	**0.53**
Total	A	0.68	0.75	0.38	0.35	0.37	0.48	0.51	0.34	0.24	0.34	1.17	0.85	0.21	0.51	1.42	0.66	9.26
	B	0.55	0.40	0.37	0.36	0.39	0.33	0.35	0.21	0.34	0.32	0.66	0.59	0.24	0.38	0.89	0.58	6.96
	C	0.47	0.34	0.26	0.31	0.28	0.33	0.30	0.20	0.28	0.29	0.47	0.57	0.22	0.47	0.93	0.64	6.36
	D	1.21	0.77	0.71	0.65	0.80	0.90	1.10	0.88	0.76	0.80	1.44	1.67	1.26	2.53	4.52	1.84	21.84
	E	1.08	0.56	0.27	0.42	0.53	0.58	0.69	0.78	0.80	1.30	1.99	2.50	3.06	6.71	7.85	1.81	30.93
	F	0.83	0.40	0.21	0.28	0.31	0.39	0.50	0.77	0.47	0.48	0.57	1.13	2.22	3.47	4.87	2.08	18.98
	G	0.28	0.06	0.08	0.04	0.07	0.08	0.13	0.27	0.17	0.18	0.31	0.35	0.77	0.88	1.24	0.73	5.64
	Total	**5.10**	**3.28**	**2.28**	**2.41**	**2.75**	**3.09**	**3.58**	**3.45**	**3.06**	**3.71**	**6.61**	**7.66**	**7.98**	**14.95**	**21.72**	**8.34**	**99.97**

Table A-5. Annual Average Joint Frequency during 2007 (as percent of time) of Wind Speed, Stability Class, and Direction for the 400 Area (Station 9) at the 10–Meter Level

Wind speed (m/sec)	Stability class	Wind direction toward:																Total
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	
0.89	A	0.02	0.02	0.03	0.03	0.04	0.06	0.04	0.02	0.01	0.02	0.04	0.01	0.06	0.02	0.00	0.05	0.47
	B	0.04	0.01	0.03	0.07	0.04	0.06	0.04	0.03	0.04	0.02	0.03	0.05	0.03	0.02	0.04	0.04	0.59
	C	0.05	0.03	0.04	0.07	0.07	0.04	0.07	0.08	0.05	0.03	0.05	0.04	0.04	0.02	0.01	0.01	0.70
	D	0.27	0.46	0.29	0.25	0.2	0.26	0.31	0.3	0.3	0.29	0.24	0.16	0.22	0.31	0.25	0.32	4.43
	E	0.21	0.21	0.17	0.19	0.2	0.22	0.22	0.3	0.33	0.2	0.27	0.44	0.39	0.3	0.48	0.29	4.42
	F	0.29	0.22	0.21	0.17	0.26	0.18	0.12	0.18	0.37	0.32	0.42	0.3	0.3	0.31	0.27	0.39	4.31
	G	0.11	0.04	0.05	0.03	0.01	0.03	0.07	0.07	0.09	0.1	0.11	0.06	0.09	0.08	0.07	0.07	1.08
	Total	**0.99**	**0.99**	**0.82**	**0.81**	**0.82**	**0.85**	**0.87**	**0.98**	**1.19**	**0.98**	**1.16**	**1.06**	**1.13**	**1.06**	**1.12**	**1.17**	**16.00**
2.65	A	0.08	0.2	0.24	0.24	0.2	0.31	0.26	0.31	0.49	0.25	0.22	0.08	0.07	0.08	0.11	0.11	3.25
	B	0.17	0.2	0.15	0.16	0.18	0.21	0.29	0.22	0.38	0.33	0.22	0.03	0.03	0.04	0.05	0.12	2.78
	C	0.26	0.15	0.17	0.11	0.18	0.1	0.12	0.14	0.36	0.28	0.07	0.05	0.04	0.02	0.1	0.17	2.32
	D	0.59	0.29	0.29	0.33	0.25	0.25	0.56	0.77	0.76	0.37	0.27	0.15	0.24	0.58	0.87	0.82	7.39
	E	0.57	0.43	0.42	0.24	0.26	0.43	0.82	1.32	1.09	1.19	1.02	0.59	0.63	0.93	1.56	1.11	12.61
	F	0.52	0.64	0.48	0.21	0.09	0.23	0.48	0.86	1.15	0.8	0.53	0.26	0.32	0.45	0.93	0.56	8.51
	G	0.16	0.08	0.14	0.03	0.05	0.05	0.07	0.2	0.41	0.26	0.13	0.08	0.09	0.07	0.22	0.3	2.34
	Total	**2.35**	**1.99**	**1.89**	**1.32**	**1.21**	**1.58**	**2.60**	**3.82**	**4.64**	**3.48**	**2.46**	**1.24**	**1.42**	**2.17**	**3.84**	**3.19**	**39.20**
4.70	A	0.15	0.22	0.37	0.14	0.06	0.06	0.08	0.13	0.44	0.84	0.30	0.15	0.17	0.14	0.14	0.06	3.45
	B	0.18	0.08	0.05	0.02	0.02	0.07	0.11	0.12	0.53	0.71	0.23	0.05	0.06	0.05	0.09	0.09	2.46
	C	0.15	0.06	0.05	0.04	0.02	0.01	0.06	0.15	0.48	0.59	0.18	0.04	0.03	0.03	0.13	0.14	2.16
	D	0.21	0.16	0.04	0.04	0.03	0.05	0.19	0.40	0.99	0.99	0.30	0.21	0.27	0.41	0.82	0.53	5.64
	E	0.12	0.10	0.06	0.00	0.01	0.03	0.30	0.98	1.51	1.42	0.51	0.37	0.37	1.00	1.82	0.72	9.32
	F	0.16	0.10	0.06	0.00	0.00	0.00	0.26	0.96	1.01	0.97	0.28	0.09	0.08	0.09	0.83	0.51	5.40
	G	0.07	0.03	0.04	0.00	0.00	0.00	0.16	0.41	0.33	0.22	0.02	0.00	0.00	0.02	0.28	0.33	1.91
	Total	**1.04**	**0.75**	**0.67**	**0.24**	**0.14**	**0.22**	**1.16**	**3.15**	**5.29**	**5.74**	**1.82**	**0.91**	**0.98**	**1.74**	**4.11**	**2.38**	**30.34**

Table A-5. Annual Average Joint Frequency during 2007 (as percent of time) of Wind Speed, Stability Class, and Direction for the 400 Area (Station 9) at the 10–Meter Level

Wind speed (m/sec)	Stability class	Wind direction toward:																Total
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	
7.15	A	0.01	0.14	0.08	0.00	0.00	0.00	0.02	0.02	0.06	0.49	0.38	0.13	0.08	0.04	0.07	0.12	1.64
	B	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.26	0.20	0.10	0.03	0.02	0.05	0.01	0.79
	C	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.37	0.14	0.03	0.03	0.06	0.09	0.04	0.86
	D	0.02	0.00	0.03	0.00	0.00	0.00	0.00	0.04	0.33	0.98	0.36	0.17	0.13	0.25	0.53	0.17	3.01
	E	0.00	0.00	0.02	0.00	0.00	0.01	0.04	0.07	0.47	1.02	0.39	0.15	0.10	0.45	0.55	0.12	3.39
	F	0.00	0.00	0.00	0.02	0.00	0.00	0.01	0.09	0.18	0.36	0.03	0.01	0.00	0.00	0.02	0.00	0.72
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.06	0.08	0.06	0.02	0.00	0.00	0.00	0.01	0.02	0.27
	Total	**0.04**	**0.17**	**0.13**	**0.02**	**0.00**	**0.01**	**0.09**	**0.28**	**1.30**	**3.54**	**1.52**	**0.59**	**0.37**	**0.82**	**1.32**	**0.48**	**10.68**
9.80	A	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.09	0.06	0.03	0.03	0.02	0.02	0.37
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.06	0.08	0.03	0.00	0.06	0.00	0.27
	C	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.06	0.07	0.06	0.01	0.03	0.01	0.01	0.29
	D	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.25	0.15	0.09	0.06	0.08	0.23	0.10	1.00
	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04	0.32	0.14	0.05	0.02	0.11	0.11	0.03	0.83
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.03
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.02
	Total	**0.01**	**0.03**	**0.02**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.08**	**0.80**	**0.52**	**0.35**	**0.15**	**0.25**	**0.43**	**0.16**	**2.81**
12.70	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.08	0.00	0.00	0.00	0.00	0.11
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.02	0.01	0.00	0.00	0.00	0.07
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.02
	D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.14	0.02	0.01	0.00	0.03	0.00	0.27
	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.07	0.01	0.01	0.02	0.00	0.00	0.23
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.03
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.21**	**0.29**	**0.14**	**0.03**	**0.02**	**0.04**	**0.00**	**0.73**

Table A-5. Annual Average Joint Frequency during 2007 (as percent of time) of Wind Speed, Stability Class, and Direction for the 400 Area (Station 9) at the 10–Meter Level

Wind speed (m/sec)	Stability class	Wind direction toward:																Total
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	
15.60	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.05	0.00	0.00	0.00	0.00	0.00	0.08
	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.01	0.00	0.00	0.00	0.00	0.08
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.06**	**0.10**	**0.01**	**0.00**	**0.00**	**0.00**	**0.00**	**0.17**
19.00	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**
Total	A	0.27	0.58	0.72	0.41	0.30	0.43	0.40	0.48	1.00	1.71	1.06	0.51	0.41	0.31	0.34	0.36	9.29
	B	0.39	0.31	0.23	0.25	0.24	0.34	0.44	0.37	1.05	1.36	0.78	0.33	0.19	0.13	0.29	0.26	6.96
	C	0.47	0.26	0.27	0.22	0.27	0.15	0.25	0.37	0.99	1.34	0.52	0.22	0.15	0.16	0.35	0.37	6.36
	D	1.09	0.93	0.66	0.62	0.48	0.56	1.06	1.51	2.39	2.98	1.51	0.80	0.93	1.63	2.73	1.94	21.82
	E	0.90	0.74	0.67	0.43	0.47	0.69	1.38	2.68	3.44	4.29	2.46	1.62	1.52	2.81	4.52	2.27	30.89
	F	0.97	0.96	0.75	0.40	0.35	0.41	0.87	2.09	2.72	2.48	1.26	0.68	0.70	0.85	2.05	1.46	19.00
	G	0.34	0.15	0.23	0.06	0.06	0.08	0.32	0.74	0.91	0.65	0.29	0.14	0.18	0.17	0.58	0.72	5.62
	Total	**4.43**	**3.93**	**3.53**	**2.39**	**2.17**	**2.66**	**4.72**	**8.24**	**12.50**	**14.81**	**7.88**	**4.30**	**4.08**	**6.06**	**10.86**	**7.38**	**99.94**

Table A-6. Radionuclide Data on Clearance Class, Particle Size, Scavenging Coefficient, and Deposition Velocity Used for CAP88-PC Dose Calculations at the Hanford Site, 2007.

Radionuclide	Clearance class	Particle size (μm)	Scavenging Coefficient (per second)	Deposition Velocity (m/s)
^{3}H (vapor)	V	0	0	0
^{3}H (elemental)	G	0	0	0
^{60}Co	M	1.0	1.60 E-06	1.80 E-03
^{90}Sr	M	1.0	1.60 E-06	1.80 E-03
^{129}I	F	1.0	1.60 E-06	3.50 E-02
^{131m}Xe	G	0	0	0
^{133}Xe	G	0	0	0
^{137}Cs	F	1.0	1.60 E-06	1.80 E-03
^{137m}Ba	M	1.0	1.60 E-06	1.80 E-03
^{220}Rn	G	0	0	0
^{222}Rn	G	0	0	0
^{238}Pu	M	1.0	1.60 E-06	1.80 E-03
^{239}Pu	M	1.0	1.60 E-06	1.80 E-03
^{241}Pu	M	1.0	1.60 E-06	1.80 E-03
^{241}Am	M	1.0	1.60 E-06	1.80 E-03
^{243}Am	M	1.0	1.60 E-06	1.80 E-03
^{243}Cm	M	1.0	1.60 E-06	1.80 E-03

Table A-7. Radionuclide Data on Decay Constant and Transfer Coefficient Used for CAP88-PC Dose Calculations at the Hanford Site, 2007.

Radionuclide	Decay constant (per day)			Transfer coefficient	
	Radioactive	Surface	Water	Milk[1]	Meat[2]
^{3}H (vapor)	1.54 E–04	5.48 E–05	0	0	0
^{3}H (elemental)	1.54 E–04	5.48 E–05	0	0	0
^{60}Co	3.60 E–04	5.48 E–05	0	2.00 E–03	3.00 E–02
^{90}Sr	6.52 E–05	5.48 E–05	0	2.00 E–03	1.00 E–02
^{129}I	1.21 E–10	5.48 E–05	0	1.00 E–02	4.00 E–02
^{131m}Xe	5.82 E–02	5.48 E–05	0	0	0
^{133}Xe	1.32 E–01	5.48 E–05	0	0	0
^{137}Cs	6.32 E–05	5.48 E–05	0	1.00 E–02	5.00 E–02
^{137m}Ba	3.91 E+02	5.48 E–05	0	5.00 E–04	2.00 E–04
^{220}Rn	1.08 E+03	5.48 E–05	0	0	0
^{222}Rn	1.81 E–01	5.48 E–05	0	0	0
^{234}U	7.76 E–09	5.48 E–05	0	4.00 E–04	4.00 E–04
^{238}Pu	2.16 E–05	5.48 E–05	0	1.00 E–06	1.00 E–04
^{239}Pu	7.88 E–08	5.48 E–05	0	1.00 E–06	1.00 E–04
^{241}Pu	1.32 E–04	5.48 E–05	0	1.00 E–06	1.00 E–04
^{241}Am	4.39 E–06	5.48 E–05	0	2.00 E–06	5.00 E–05
^{243}Am	2.57 E–07	5.48 E–05	0	2.00 E–06	5.00 E–05
^{243}Cm	6.66 E–05	5.48 E–05	0	2.00 E–06	2.00 E–05

[1] Fraction of animal's daily intake of nuclide that appears in each liter of milk, in days/L.

[2] Fraction of animal's daily intake of nuclide that appears in each kg of meat, in days/kg.

Table A-8. Radionuclide Data on Concentration Uptake Factor and Gastric Intestinal Uptake Fraction Used for CAP88-PC Dose Calculations at the Hanford Site, 2007.

Radionuclide	Concentration uptake factor		GI uptake fraction	
	Forage[1]	Edible[2]	Inhalation	Ingestion
^{3}H (vapor)	0	0	1.00 E+00	1.00 E+00
^{3}H (elemental)	0	0	1.00 E+00	1.00 E+00
^{60}Co	2.00 E+00	8.00 E–02	1.00 E–01	1.00 E–01
^{90}Sr	4.00 E+00	3.00 E–01	3.00 E–01	3.00 E–01
^{129}I	1.00 E–01	2.00 E–02	1.00 E+00	1.00 E+00
^{131m}Xe	0	0	0	0
^{133}Xe	0	0	0	0
^{137}Cs	1.00 E+02	1.00 E–02	2.00 E–01	2.00 E–01
^{137m}Ba	1.00 E–01	1.00 E–02	2.00 E–01	2.00 E–01
^{220}Rn	0	0	0	0
^{222}Rn	0	0	0	0
^{238}U	1.00 E–01	2.00 E–03	2.00 E–02	2.00 E–02
^{238}Pu	1.00 E–01	1.00 E–03	5.00 E–04	5.00 E–04
^{239}Pu	1.00 E–01	1.00 E–03	5.00 E–04	5.00 E–04
^{241}Pu	1.00 E–01	1.00 E–03	5.00 E–04	5.00 E–04
^{241}Am	1.00 E–01	1.00 E–03	5.00 E–04	5.00 E–04
^{243}Am	1.00 E–01	1.00 E–03	5.00 E–04	5.00 E–04
^{243}Cm	5.50 E–03	1.07 E–04	1.00 E–03	1.00 E–03

GI = gastric intestinal

[1] Concentration factor for uptake of nuclide from soil for pasture and forage, in pCi/kg dry weight per pCi/kg dry soil.

[2] Concentration factor for uptake of nuclide from soil by edible parts of crops, in pCi/kg wet weight per pCi/kg dry soil.

Table A-9. Exposure and Consumption Data for the Hanford Site.

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

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

VALUES FOR RADIONUCLIDE-INDEPENDENT VARIABLES

HUMAN INHALATION RATE (cm^2/hr) = 9.70 E+05

SOIL PARAMETERS
Effective surface density, kg/sq m, dry weight
(assumes 15-cm plow layer) = 2.24 E+02

BUILDUP TIMES
For activity in soil (yr) = 5.00 E+01
For radionuclides deposited on ground/water (d) = 365

DELAY TIMES
Ingestion of pasture grass by animals (hr) = 0.00 E+00
Ingestion of stored feed by animals (hr) = 2.40 E+03
Ingestion of leafy vegetables by man (hr) = 2.40 E+01
Ingestion of produce by man (hours) = 1.20 E+02
Transport time from animal feed-milk-man (d) = 2.00 E+00
Time from slaughter to consumption (d) = 1.50 E+01

WEATHERING
Removal rate constant for physical loss (per hr) = 3.00 E–03

CROP EXPOSURE DURATION
Pasture grass (hr) = 7.20 E+02
Crops/leafy vegetables (hr) = 2.16 E+03

AGRICULTURAL PRODUCTIVITY
Grass-cow-milk-man pathway (kg/m^2) = 3.00 E–01
Produce/leafy veg for human consumption (kg/m^2) = 2.00 E+00

FALLOUT INTERCEPTION FRACTIONS
Vegetables = 2.50 E–01
Pasture = 2.50 E–01

GRAZING PARAMETERS
Fraction of year animals graze on pasture = 7.50 E–01
Fraction of daily feed that is pasture grass when animal grazes on pasture = 1.00 E+00

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

Table A-9. Exposure and Consumption Data for the Hanford Site. (cont)

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

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

DECONTAMINATION
Fraction of radioactivity retained after washing
or leafy vegetables and produce = 1.00 E+00

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

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

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

HUMAN FOOD UTILIZATION FACTORS
Produce ingestion (kg/yr) = 2.20 E+02
Milk ingestion (L/yr) = 2.70 E+02
Meat ingestion (kg/yr) = 9.80 E+01
Leafy vegetable ingestion (kg/yr) = 3.00 E+01

SWIMMING PARAMETERS
Fraction of time spent swimming = 1.00 E–02
Dilution factor for water (cm) = 1.00 E+00

Table A-10. Hanford Site Meteorological Data — General Site Information.

HEIGHT OF LID
LIDAI = 1,000 m

RAINFALL RATE
RR = 15.9 cm/yr

AVERAGE AIR TEMPERATURE
A = 12.0 °C (53.6 °F; 285.2 °K)

SURFACE ROUGHNESS LENGTH
0 = 0.010 m

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

STABILITY E	0.073
STABILITY F	0.109
STABILITY G	0.146

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APPENDIX B

ERRATUM: REPORTING THE 296-P-31 STACK AS A MINOR EMISSION UNIT IN THE 2006 RADIONUCLIDE AIR EMISSIONS REPORT

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ERRATUM: 296-P-31 STACK REPORTED AS A MINOR EMISSION UNIT IN THE 2006 RADIONUCLIDE AIR EMISSIONS REPORT

The 296-P-31 Stack, of the 209-E Facility in the 200 East Area, was categorized as a major emission unit in the revision to the *Department of Energy Hanford Site Air Emissions License #FF-01* (FF-01) approved in October 2006. However, the stack operating, emission, and dose data were listed in Table 2-2 of the *Radionuclide Air Emissions Report for the Hanford Site, Calendar 2006,* DOE/RL-2007-01. Table 2-2 lists "minor" stacks having a potential radiological dose of less than or equal to 0.1 mrem/yr effective dose equivalent to a maximally exposed individual member of the public, whereas Table 2-1 lists "major" stacks having a potential radiological dose of greater than 0.1 mrem/yr EDE. Potential doses are calculated based on the discharge of stack emissions that would result if all pollution control equipment did not exist but the facility operations were otherwise normal.

Uncertainty regarding the approved monitoring qualification status of the 209-E Stack in 2006 contributed to a reasoned decision to list the stack in Table 2-2. In letter AIR-07-1206, dated December 14, 2007, the Washington State Department of Health (WDOH) objected to this listing, stating that as such it was "misreported as being a minor emissions unit (<0.1 mrem/yr PTE)." Following discussions between WDOH and DOE-RL, the two agencies reached an agreement on this matter in early 2008. The agreement was described in letter 08-SED-0090, from D. A. Brockman, DOE-RL to P. J. Martell, WDOH, "Response to Letter AIR 07-1202 — Clarification of Stack 296-P-31 Listing in CY 2006 Radionuclide Air Emissions Report. Specifically, the DOE-RL letter pledged that "an erratum will state that 296-P-31 was categorized as a major emission unit in the latest DOE Hanford Site Radioactive Air Emission FF-01 License (FF-01). In past years, WDOH has accepted errata in subsequent radionuclide air emissions reports as a suitable means for documenting corrections and/or clarifications to reports already published." This Appendix B erratum satisfies the DOE-RL pledge to acknowledge the WDOH categorization of the 296-P-31 stack as a major point source emission unit in 2006 as well as the misreporting identified by WDOH, as discussed above. In this 2007 report, the 296-P-31 stack is listed in Table 2-1, in accordance with its categorization in the FF-01 and its monitoring method approved for a major stack.

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