DOE/RL-2000-37

Radionuclide Air Emissions Report for the Hanford Site, Calendar Year 1999

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

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

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

INFORMATION CLEARANCE FORM

A. Information Category

- ☐ Abstract
- ☐ Journal Article
- ☐ Summary
- ☐ Internet
- ☐ Visual Aid
- ☐ Software
- ☐ Full Paper
- ☒ Report
- ☐ Other _____

B. Document Number DOE/RL-2000-37

C. Title
Radionuclide Air Emissions Report for the Hanford Site, Calendar Year 1999

D. Internet Address

E. Required Information

1. Is document potentially Classified? ☒ No ☐ Yes (MANDATORY)
   Manager's Signature Required
   If Yes _____ ☒ No ☐ Yes Classified
   ADC Signature Required
2. Internal Review Required? ☒ No ☐ Yes
   If Yes, Document Signatures Below
   Counsel _____
   Program _____
3. References in the Information are Applied Technology ☒ No ☐ Yes
   Export Controlled Information ☒ No ☐ Yes

4. Does Information Contain the Following: (MANDATORY)
   a. New or Novel (Patentable) Subject Matter? ☒ No ☐ Yes
      If "Yes", Disclosure No.: _____
   b. Information Received in Confidence, Such as Proprietary and/or Inventions? ☒ No ☐ Yes If "Yes", Affix Appropriate Legends/Notices.
   c. Copyrights? ☒ No ☐ Yes If "Yes", Attach Permission.
   d. Trademarks? ☒ No ☐ Yes If "Yes", Identify in Document.
5. Is Information requiring submission to OSTI? ☐ No ☒ Yes
   If Yes UC-702 and B&R-EW3130010
6. Release Level? ☒ Public ☐ Limited
7. Charge Code 100019/CA40 HMWM 0251

F. Complete for a Journal Article

1. Title of Journal

G. Complete for a Presentation

1. Title for Conference or Meeting _____
2. Group Sponsoring _____
3. Date of Conference _____
4. City/State _____
5. Will Information be Published in Proceedings? ☐ No ☐ Yes
6. Will Material be Handed Out? ☐ No ☐ Yes

H. Author/Requestor
D. J. Rokkan
(Print and Sign)

Responsible Manager
L. P. Diediker
(Print and Sign)

I. Reviewers

	Yes	Print	Signature	Public Y/N (If N, complete J)
General Counsel	☒	R. Southworth		(Y) / N
Office of External Affairs	☐			Y / N
DOE-RL	☒	P. J. Krupin		(Y) / N
Other	☐			Y / N
Other	☐			Y / N

J. If Information Includes Sensitive Information and is not to be released to the Public indicate category below.

- ☐ Applied Technology
- ☐ Personal/Private
- ☐ Proprietary
- ☐ Business-Sensitive
- ☐ Predecisional
- ☐ UCNI
- ☐ Protected CRADA
- ☐ Export Controlled
- ☐ Procurement-Sensitive
- ☐ Patentable
- ☐ Other (Specify) _____

Information Clearance Approval
APPROVED FOR RELEASE OFFICIAL DOCUMENT CW Date 6/30/00

K. If Additional Comments, Please Attach Separate Sheet

A-6001-401 (02/98)

DOE/RL-2000-37
UC-702

Radionuclide Air Emissions Report for the Hanford Site, Calendar Year 1999

D. J. Rokkan
Fluor Hanford, Inc.

K. Rhoads
Pacific Northwest National Laboratory

Date Published
June 2000

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

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

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

Chris Willingham 6/30/00
Release Approval Date

RADIONUCLIDE AIR EMISSIONS REPORT FOR THE HANFORD SITE, CALENDAR YEAR 1999

ABSTRACT

This report documents radionuclide air emissions from the U.S. Department of Energy (DOE) Hanford Site in 1999 and the resulting effective dose equivalent to the maximally exposed individual (MEI) member of the public. The report has been prepared in accordance with 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 with the Washington Administrative Code (WAC) Chapter 246-247,* Radiation Protection–Air Emissions.

The federal regulations in Subpart H of 40 CFR 61 require the measurement and reporting of radionuclides emitted from U.S. Department of Energy (DOE) facilities and the resulting offsite dose from those emissions. A standard of 10 mrem/yr effective dose equivalent (EDE) is imposed on them. The EDE to the MEI due to routine emissions in 1999 from Hanford Site point sources was 0.029 mrem (2.9 E-04 mSv), which is less than 0.3 percent of the federal standard.

WAC 246-247 requires the reporting of radionuclide emissions from all Hanford Site sources, during routine as well as nonroutine operations. The state has adopted the 40 CFR 61 standard of 10 mrem/yr EDE into their regulations. The state further requires that the EDE to the MEI be calculated not only from point source emissions but also from diffuse and fugitive sources of emissions. The EDE from diffuse and fugitive emissions at the Hanford Site in 1999 was 0.039 mrem (3.9 E-04 mSv) EDE. The total dose from point sources and from diffuse and fugitive sources of radionuclide emissions during all operating conditions in 1999 was 0.068 mrem (6.8 E-04 mSv) EDE, which is less than 0.7 percent of the state standard.

Mr. Paul J. Krupin, of the DOE Richland Operations Office, may be contacted by telephone at (509) 372-1112 or e-mail at Paul_J_Krupin@rl.gov for further information concerning this document.

This page intentionally left blank.

CONTENTS

FIGURES

TABLES

GLOSSARY

224-T TRUSAF	224-T Transuranic Waste Storage and Assay Facility
AMU	aqueous make-up
BHI	Bechtel Hanford, Inc.
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
CHG	CH2M HILL Hanford Group, Inc.
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
DST	double-shell tank
EDE	effective dose equivalent
EDP	electronic data processing
EMSL	Environmental Molecular Science Laboratory
EPA	U.S. Environmental Protection Agency
ERC	Environmental Restoration Contract
ERDF	Environmental Restoration Disposal Facility
ETF	200 Area Effluent Treatment Facility
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 vapor
HVAC	heating, ventilation, and air conditioning
ISS	interim safe storage
MASF	Maintenance and Storage Facility
MEI	maximally exposed individual
MW	mixed waste
NESHAP	National Emission Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
NOC	notice of construction
PFP	Plutonium Finishing Plant
PNNL	Pacific Northwest National Laboratory
PRF	Plutonium Reclamation Facility
PTRAEU	portable temporary air emission unit
PUREX	plutonium-uranium extraction
QA	quality assurance
RCRA	*Resource Conservation and Recovery Act*
REDOX	reduction-oxidation
RMCS	rotary mode core sampler

GLOSSARY (cont)

RPP	River Protection Project
RSB	Reactor Service Building
SNM	special nuclear materials
SST	single-shell tank
TRIGA	Test Reactor and Isotope Production by General Atomics
TRU	transuranic
UO_3 Plant	Uranium-TriOxide Plant
WAC	Washington Administrative Code
WESF	Waste Encapsulation and Storage Facility
WHC	Westinghouse Hanford Company
WDOH	Washington State Department of Health
WIPP	Waste Isolation Pilot Plant
WNP-2	Energy Northwest Nuclear Plant 2
WRAP	Waste Receiving and Processing Facility
WSCF	Waste Sampling and Characterization Facility

1.0 INTRODUCTION

This report documents radionuclide air emissions from the U.S. Department of Energy (DOE) Hanford Site (Hanford) in 1999, and the resulting effective dose equivalent (EDE) to the maximally exposed individual (MEI) member of the public. The report has been prepared in accordance 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." This report has also been prepared in accordance with the reporting requirements of the Washington Administrative Code (WAC) Chapter 246-247, *Radiation Protection—Air Emissions.*

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 12) and the *Hanford Site Climatological Summary 1999, with Historical Data* (PNNL 13117).

1.1.1 Historical Background

The federal government acquired the Hanford Site in 1943 on which to construct and operate facilities for use in the atomic weapons program that 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, two DOE Offices manage the programs at the Hanford Site. They are the DOE Richland Operations Office (DOE-RL) and the DOE Office of River Protection (DOE-ORP).

1.1.2 Major Areas, Facilities, and Activities

Five major operating areas at the Hanford Site generated radionuclide air emissions in 1999: the 100, 200 East, 200 West, 300, and 400 Areas (refer to Figure 1-1). The 100 Areas have the two 100-K Spent Fuel Storage Basins and nine deactivated production reactors and their support facilities, all located near the Columbia River. The 200 Areas are on a plateau about 21.5 mi (34.7 km) northwest of the city of Richland, and close to 7 mi (11.3 km) from the Columbia River. Facilities in the 200 East Area include the Plutonium Uranium-Extraction (PUREX) Facility, B Plant Complex, Waste Encapsulation and Storage Facility (WESF), 242-A Evaporator, 200 Areas Effluent Treatment Facility, and Single-Shell and Double-Shell Tank Farms. Facilities in the 200 West Area include the Plutonium Finishing Plant (PFP), Uranium-TriOxide (UO_3) Plant, Single-Shell and Double-Shell Tank Farms, T Plant Complex, U Plant, Reduction-Oxidation Plant (REDOX), 222-S Laboratory, Waste Sampling and Characterization Facility (WSCF), Central Waste Complex (CWC), Waste Receiving and Processing (WRAP) Facility, and Low-Level Burial Grounds (LLBG). The 300 Area, adjacent to the north end of the City of Richland, has research and development laboratories and the deactivated N Reactor Fuel Fabrication Facilities. The 400 Area has the Fast Flux Test Facility (FFTF), approximately 8 mi (12.9 km) north-northwest of the City of Richland.

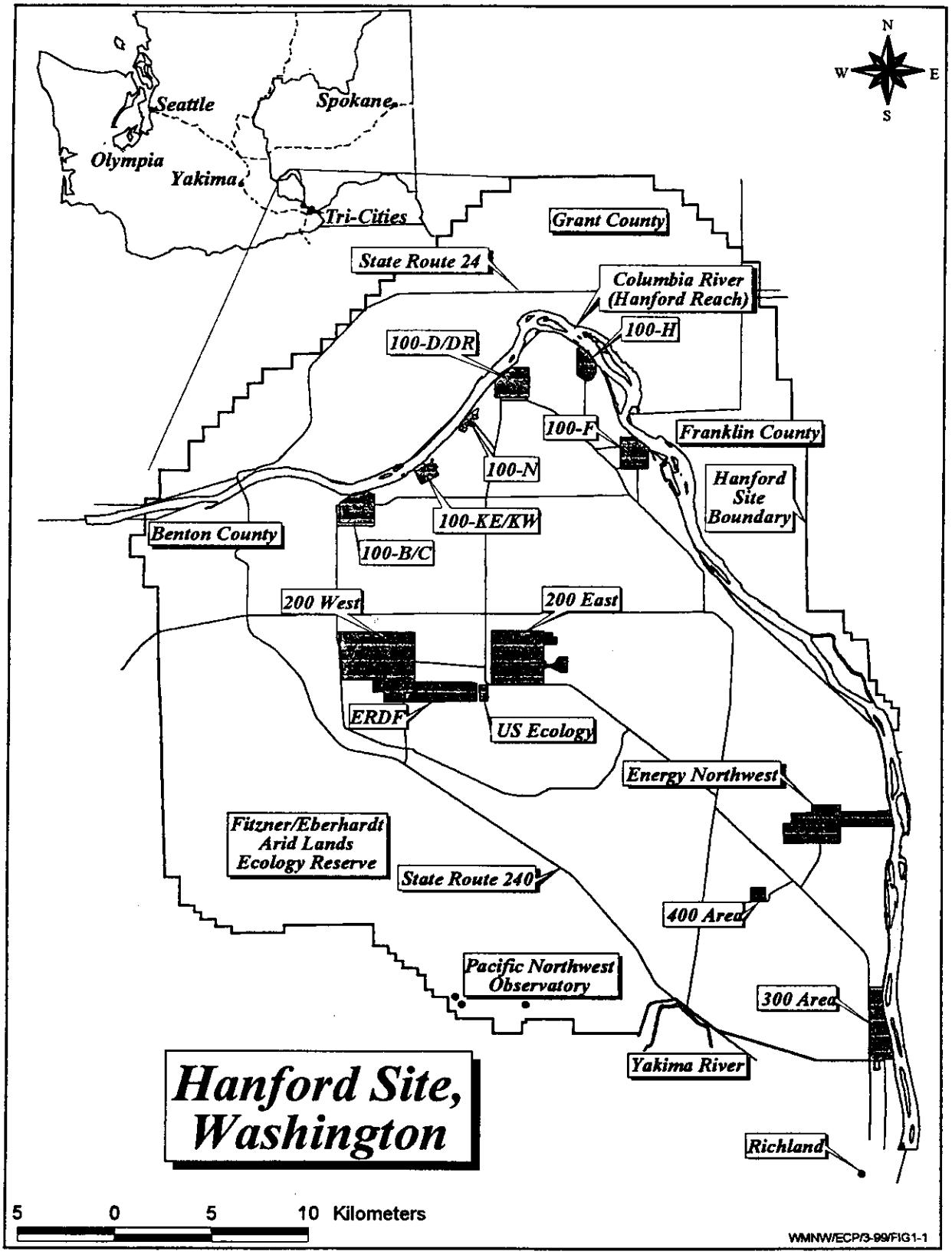


Figure 1-1. Hanford Site Map.

The 600 Area has WSCF, just east of the 200 West Area main entrance, and other facilities not in major operating areas (i.e., 100, 200, 300, and 400 Areas).

Major events in 1999 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 from inactive waste sites was excavated, transported, and disposed of at the 200 Area Environmental Restoration Disposal Facility (ERDF). Activities were conducted to place several of the reactors in interim safe storage (ISS) pending final disposition.

- Decontamination and decommissioning activities were conducted at the 100-D/DR Areas, 100-F Area, and the 233-S Facility (part of REDOX).

- The 3020 Environmental Molecular Science Laboratory (EMSL) operated in 1999. EMSL is a national focal point for molecular science research with an emphasis on long-term environmental management mission at the Hanford Site.

- 200 Area Effluent Treatment Facility (ETF) operated in 1999, processing mixed aqueous waste streams.

- The 242-A Evaporator did not operate in 1999.

- The 222-S Laboratory operated in 1999, continuing its tank waste characterization efforts.

- WSCF operated in 1999, analyzing effluent and environmental samples.

- PFP Laboratory development testing was conducted on plutonium solutions. Plutonium storage vault activities consisted of moving considerable quantities of special nuclear material (SNM) to facilitate implementation of International Atomic Energy Agency safeguards on one of the storage vaults. Clean-out activities were also conducted in the 232-Z Incinerator Building.

- The two 100-K Spent Fuel Storage Basins continued storing irradiated fuel removed from N Reactor, with work continuing toward transferring this fuel to permanent dry storage location in the 200 Areas.

- The 340 Complex operated in 1999, shipping liquid waste to the 200 Areas.

- The 3745 Building exhaust system (EP-3745-01-S) was shut down on July 26, 1999, and the system deregistered on October 29, 1999.

- FFTF did not operate in 1999. In December 1993, DOE put FFTF into a radiologically and industrially safe shutdown condition. Pending decisions about possible future missions for FFTF, further shutdown activities were put on hold in 1996, a status that remained unchanged through 1999.

DOE contractors at the Hanford Site are identified as follows, along with their management responsibilities and facilities they oversee that have or have had radionuclide air emissions:

- **Battelle Memorial Institute.** Manages the Pacific Northwest National Laboratory (PNNL) for DOE and DOE-RL. 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.

- **Bechtel Hanford, Inc.** Manages the Environmental Restoration Contract (ERC) for DOE-RL. BHI has responsibility for the surveillance and maintenance of inactive past-practice waste sites and inactive facilities; remediation of past-practice waste sites and contaminated groundwater; closure of Resource Conservation and Recovery Act land-based treatment, storage, and disposal units; overall Hanford Site groundwater project management and sitewide drilling management; facility transitions; and decontamination and decommissioning of facilities.

- **Fluor Hanford.** Manages the Project Hanford Management Contract (PHMC) for DOE-RL. FH has responsibility for facilities such as PFP, FFTF, CWC, LLBG, 222-S Laboratory, WSCF, T Plant Complex, 224-T TRUSAF Building, PUREX Facility, B Plant Complex, and 100-K Area Spent Fuel Storage Basins. FH monitors liquid effluents and air emissions, performs environmental surveillance near DOE facilities managed by BHI, CHG, and FH. FH also provides Hanford Site support services, such as fire protection, central stores, distribution of electrical power, and generation of steam heat and power.

The DOE-ORP 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.

- **CH2M HILL Hanford Group, Inc.** Manages the River Protection Project (RPP) for DOE-ORP. CHG 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 the contractor chosen by DOE to vitrify the waste into a glasslike substance for permanent disposal. CHG will continue to be responsible for storage of the treated waste until permanent disposal facilities are available.

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 WNP-2 reactor and office buildings, located near the Columbia River, several kilometers north of the 300 Area and east of the 400 Area, 3) the radioanalytical laboratory immediately south of the 300 Area operated by Quanterra, a subsidiary of IT Analytical Services, 4) the Siemens Nuclear Power Corporation fuel fabrication facility, which is immediately adjacent to the southern boundary of the Hanford Site, 5) Allied Technology Group, adjacent to the east side of the Siemens facility, 6) Interstate Nuclear Services, located 1 mi (1.6 km) south of the southern boundary of the Hanford Site, and 7) Battelle's non-DOE research laboratories in north Richland. Emissions from these privately owned facilities are not included in this report because these 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 the certified sections (i.e., Sections 1.0, 2.0, and 3.0) of this report if it met the following four criteria during 1999: 1) required continuous monitoring or periodic confirmatory measurements in accordance with 40 CFR 61, Subpart H, and with WAC 246-247, 2) was registered with the Washington Department of Health (WDOH), 3) normally or potentially emitted 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.

Emissions from other radionuclide air emission sources are reported in Sections 4.0 and 5.3. Emissions from these sources were estimated or verified using methods approved by the U.S. Environmental Protection Agency (EPA) and WDOH.

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 in the interest of brevity, *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 more than 200,000 ft^3/min (94 m^3/s). Stacks vary in design from horizontal to vertical, rectangular to cylindrical, actively to passively ventilated, and permanent to portable.

The following methods were used singularly or in combination to remove radioactive constituents from most stack emissions during 1999: 1) high-efficiency particulate air (HEPA) filters, 2) sand filters, 3) deep-bed fiberglass filters, 4) fiberglass prefilters, 5) charcoal absorbers and 6) water scrubbers. 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. Point sources of radionuclide air emissions at facilities in the 100-K Area and 100-N Area are described briefly and shown in Figures 1-2 and 1-3, respectively.

1.2.2.1 100-K East and West Areas

These areas contain two retired reactors awaiting decommissioning, two water-filled storage basins storing irradiated nuclear fuel, and radiological analysis laboratories.

- **105-KE.** This point source consists of three powered vents exhausting unfiltered air from the spent fuel storage basin in the 105-KE Building. Emissions were sampled using three record samplers to collect particulate radionuclides.

- **105-KW.** This point source consists of four powered vents exhausting unfiltered air from the spent fuel storage basin in the 105-KW Building. Emissions were sampled using three record samplers to collect particulate radionuclides.

- **1706-KE.** This stack exhausted filtered air from the 1706-KE Laboratory. Emissions were sampled using a record sampler to collect particulate radionuclides.

1.2.2.2 100-N Area

The reactor area contains two emission units.

- **RCF-1-EX.** This stack exhausted filtered air from a hood in the radiological counting facility housed in the H0-64-4230 trailer. Emissions were periodically sampled using a record sampler to collect particulate radionuclides.

- **RCF-2-EX.** This stack exhausted filtered air from a hood in the radiological counting facility housed in the MO-423 trailer. Emissions were periodically sampled using a record sampler to collect particulate radionuclides.

1.2.3 200 East Area Facilities

The 200 East Area contains facilities for chemical separations, reprocessing, and waste handling and disposal. Radionuclide air emission discharge points in the 200 East Area are shown in Figure 1-4. The majority of radionuclides discharged from the 200 Areas are in particulate form. PUREX Plant, B Plant, and related Tank Farm and evaporator facilities discharge gaseous radionuclides and volatile forms of radionuclides, specifically ^{3}H, ^{106}Ru, ^{125}Sb, and ^{129}I.

1.2.3.1 Plutonium-Uranium Extraction Facility

The PUREX Facility was deactivated in June 1997.

- **291-A-1.** This stack exhausted filtered air from the canyon ventilation system (cells A to M) and vessel and condenser vents. Emissions were sampled using record samplers to collect particulate and volatile radionuclides.

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 ^{137}Cs and ^{90}Sr from high-level liquid waste. The main canyon building, 221-B, contains radioactive contamination (from many production campaigns) that must be properly managed. The B Plant Complex, excluding WESF, was deactivated in 1998.

- **296-B-1.** This is the new B Plant main stack, which started up July 22, 1998. It 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. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-B-2.** This stack began operation September 3, 1998. It passively ventilates emissions that pass through the isolated, retired HEPA filters of the closed 291-B-1 stack. The 296-B-2 stack was not record sampled, but instead had periodic confirmatory measurements (i.e., nondestructive analyses) performed on its HEPA filters to verify that its emission levels were low (for results, refer to Table 5-4).

1.2.3.3 Waste Encapsulation and Storage Facility

At the Waste Encapsulation and Storage Facility (WESF) ^{90}Sr and ^{137}Cs from waste separations material were converted to solid strontium fluoride and cesium chloride. These new forms of cesium and strontium 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 stack exhausted filtered air from the 225-B Building. Emissions were sampled using a record sampler to collect particulate radionuclides.

1.2.3.4 244-AR and 244-CR Vaults

The 244-AR and 244-CR vaults are retention facilities used during transfers of high-level radioactive liquid waste from Tank Farms.

- **296-A-12**. This stack did not operate in 1999, and was closed and deregistered as of October 29, 1999. When it was used, it exhausted filtered air from the 244-AR Vault vessel ventilation system.

- **296-A-13**. This stack did not operate in 1999. When in use, it exhausts filtered air from the 244-AR Vault canyon and cells, and emissions are sampled using a record sampler to collect particulate radionuclides.

- **296-C-5**. This stack exhausted filtered air from the 244-CR Vault Cell and vessel ventilation system. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-P-32**. This stack (actually, a portable exhauster) did not operate in 1999. It was connected to the 244-AR Vault vessel ventilation system to replace the 296-A-12 stack (closed and deregistered as of October 29, 1999). The 296-P-32 stack provides better emissions control and sampling systems than does the 296-A-12, and when operated, emissions are sampled using a record sampler to collect particulate radionuclides.

1.2.3.5 200 East Area Tank Farms

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

- **296-A-17 (and 296-P-26)**. These stacks were shut down on March 20, 1998, and replaced by the new 296-A-42 stack. They had exhausted filtered, incondensable vapors from waste storage tanks in the 241-AY and -AZ Tank Farms. The 296-P-26 stack served as the backup exhauster for the 296-A-17 stack.

- **296-C-6**. This stack exhausted filtered air from the 241-C-106 Tank Sluicing ventilation. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-A-18**. This stack did not operate in 1999. When in use, it exhausts filtered air from the 241-AY-101 tank annulus, and emissions are sampled using a record sampler to collect particulate radionuclides.

- **296-A-19**. This stack exhausted filtered air from the 241-AY-102 tank annulus. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-A-20**. This stack did not operate in 1999. When in use, it exhausts filtered air from the 241-AZ-101 and -102 tank annuli, and emissions are sampled using a record sampler to collect particulate radionuclides.

- **296-A-25**. This stack exhausted filtered air from the catch tank at the 244-A lift station. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-A-26**. This stack exhausted filtered air from the waste unloading room and sump tank at the 204-AR Waste Unloading Station. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-A-27**. This stack exhausted filtered air from all 241-AW tanks. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-A-28**. This stack exhausted filtered air from all tank annuli in the 241-AW Tank Farm. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-A-29**. This stack exhausted filtered air from all 241-AN tanks. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-A-30**. This stack exhausted filtered air from all tank annuli in the 241-AN Tank Farm. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-A-40**. This stack exhausted filtered air from all 241-AP tanks. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-A-41**. This stack exhausted filtered air from all tank annuli in the 241-AP Tank Farm. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-A-42**. This new stack began operation on March 20, 1998, replacing the 296-A-17 and 296-P-26 stacks. It exhausted filtered vapors from waste storage tanks in the 241-AY and 241-AZ Tank Farms. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-A-43**. This new stack began operation on March 20, 1998, and exhausted filtered air from the 702-AZ Building. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-B-28**. This stack exhausted filtered air from the 244-BX saltwell receiver tank and annulus. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-P-16**. This stack exhausted filtered air from the 241-C-105 and -106 tanks. The 241-C-104 tank is also vented by this stack, since it is connected to the 241-C-105 tank with an underground cascade line. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-P-33 and 296-P-34**. These emission points are portable exhausters for the rotary mode core samplers. These emission sources exhausted filtered air from waste tanks that were core sampled. Emissions were sampled using a record sampler to collect particulate radionuclides.

1.2.3.6 242-A Evaporator

The 242-A Evaporator did not operate in 1999. When used, it removes the majority of water from liquid mixed waste, leaving a slurry that is pumped back to the Tank Farms.

- **296-A-21**. This stack exhausted filtered air from the 242-A Building. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-A-22**. This stack exhausted filtered air from the 242-A Evaporator vessel ventilation system. Emissions were sampled using a record sampler to collect particulate radionuclides.

1.2.3.7 200 Area Effluent Treatment Facility

The Effluent Treatment Facility (ETF) treats mixed aqueous waste streams prior to their disposal at the State-Approved Land Disposal Site, a.k.a. the 616-A crib.

- **296-E-1**. This stack exhausted filtered air from the 2025-E Building and ETF processing vents. Emissions were sampled using a record sampler to collect particulate radionuclides.

1.2.3.8 209-E Critical Mass Laboratory

This facility originally was used for testing critical mass configurations. Currently, a portion of the building is being used for office space; the laboratory sectors are inactive.

- **296-P-31** (formerly 209-E). This stack exhausted filtered building ventilation air from the 209-E Facility. Emissions were sampled using a record sampler to collect particulate radionuclides.

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. The radionuclide air emission discharge points in the 200 West Area are shown in Figure 1-5.

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, vessel ventilation system, and treated dissolver offgas system. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-S-2**. This stack exhausted filtered air from the REDOX north and south sample galleries, plutonium load-out hood, and product removal cage. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-S-7W and 296-S-7E**. These stacks were built to exhaust filtered air from the 233-S Facility, which was being decommissioned in 1999. The 296-S-7W was the primary exhaust stack, with 296-S-7E serving as the backup. Due to decommissioning activities, emissions that normally would have been exhausted through 296-S-7W were exhausted through the 296-P-35 portable exhauster. For tracking purposes, this portable exhauster was also identified as 296-S-7W. Emissions were sampled using a record sampler to collect particulate radionuclides.

1.2.4.2 T Plant Complex

The T Plant Complex consists of two main structures: the 221-T Building and the 2706 Facility. The 221-T Building is one of the original fuel-processing facilities. The last fuel processed there was in 1956. The 221-T and the 2706 Facility 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 is decontaminated in both structures.

- **291-T-1**. This stack exhausted filtered air from the 221-T canyon and process ventilation system. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-T-7**. This stack exhausted HEPA-filtered air from the 2706-T and 2706-TA Buildings while decontamination activities are being performed or when other activities create a potential for increased airborne radionuclide contamination; otherwise, the stack does not operate. Emissions were sampled using a record sampler to collect particulate radionuclides.

1.2.4.3 224-T TRUSAF Building

The 224-T TRUSAF (Transuranic Waste Storage and Assay Facility) Building was originally used to purify plutonium nitrate by the lanthanum-fluoride process. After the bismuth-phosphate plants were phased out, the lanthanum-fluoride process was no longer needed, leaving the building without a mission until the early 1970s. At that time, the building was modified to store plutonium scrap in liquid and solid forms. In 1984, it was selected to house the transuranic (TRU) waste storage and assay operation, in which TRU waste containers were nondestructively tested and stored, to be used in future shipments to the Waste Isolation Pilot Plant (WIPP). By September 1998, all stored TRU wastes were removed from the 224-T TRUSAF Building and nondestructive examination and nondestructive assay operations terminated.

- **296-T-11**. This stack exhausted filtered air from the ventilation system through the east part of the plenum. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-T-12**. This stack exhausted filtered air from the ventilation system through the west part of the plenum. Emissions were sampled using a record sampler to collect particulate radionuclides.

1.2.4.4 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. In 1999, characterization activities were conducted at U Plant in support of the Canyon Disposition Initiative. Otherwise, U Plant is a retired facility with a few offices and shops still in use.

- **291-U-1**. This stack exhausted filtered air from the U Plant and 221-U canyon ventilation system. Emissions were sampled using a record sampler to collect particulate radionuclides.

1.2.4.5 Plutonium Finishing Plant

PFP was constructed to produce plutonium metal from recovered nitrate and 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 stabilize and store the established inventory of plutonium compounds.

- **291-Z-1**. This stack exhausted filtered air from the 234-5Z, 236-Z, and 242-Z Buildings. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-Z-3**. This stack exhausted filtered air from the 241-Z vault sump and vessel ventilation system. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-Z-5**. This stack exhausted filtered air from 2736-ZB Building, used for shipping and receiving. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-Z-6**. This stack exhausted filtered air from the 2736-Z Building and its plutonium storage vault ventilation system. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-Z-14**. This stack exhausted filtered air from the 232-Z Incinerator Building. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-Z-15.** This stack exhausted filtered air from the 243-Z Low-Level Waste Treatment Facility. Emissions were sampled using a record sampler to collect particulate radionuclides.

1.2.4.6 200 West Area Tank Farms

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

- **296-P-22.** This stack exhausted filtered air from annuli in the 241-SY-101, -102, and -103 tanks. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-P-23 (and 296-P-28).** This stack exhausted filtered air from the 241-SY-101, -102, and -103 tanks. The 296-P-28 stack serves as the backup to the 296-P-23 stack. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-S-15.** This stack exhausted filtered air from the 241-SX-101 through -112 and 241-SX-114 tanks. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-S-22.** This stack exhausted filtered air from the 244-S saltwell receiver tank and annulus. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-T-18.** This stack exhausted filtered air from the 244-TX saltwell receiver tank and annulus. Emissions were sampled using a record sampler to collect particulate radionuclides.

1.2.4.7 200 West Area Evaporators

Two evaporators are in the 200 West Area: the 242-S Evaporator-Crystallizer Building and the 242-T Evaporator-Crystallizer Building. They 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. The 242-S Evaporator-Crystallizer Building has not operated since the early 1980s. The 242-T Evaporator-Crystallizer Building was deactivated and has been inoperable since 1986.

- **296-S-18.** This stack exhausted filtered air from the 242-S Evaporator-Crystallizer Building. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-T-17.** This stack exhausted filtered air from the 242-T Evaporator-Crystallizer Building and cold-cell ventilation system. Emissions were sampled using a record sampler to collect particulate radionuclides.

1.2.4.8 222-S Laboratory

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

- **296-S-16.** This stack exhausted filtered air from the 219-S Building and waste tanks. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **296-S-21.** This stack exhausted filtered air from 222-S Laboratory hoods, gloveboxes, hot-cells, and the room ventilation system. Emissions were sampled using a record sampler to collect particulate radionuclides.

1.2.4.9 Waste Verification and Sampling Facility

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

- **296-W-3.** This stack did not operate in 1999. When in use, it exhausts filtered air from the 213-W Building, and emissions are sampled using a record sampler to collect particulate radionuclides.

1.2.4.10 Waste Receiving and Processing Facility

WRAP is used for examining, assaying, characterizing, and repackaging wastes, principally TRU waste.

- **296-W-4.** Emissions were monitored with an alpha-beta continuous air monitor (CAM) and sampled using a record sampler to collect particulate radionuclides.

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. Emission points in the 300 Area are shown in Figure 1-6.

1.2.5.1 305-B Hazardous Waste Storage Building

The 305-B Building is used to receive, store, and prepare shipments of dangerous waste and mixed waste generated by Hanford Site research and development programs.

- **EP-305B-01-S.** This stack exhausted air from a filtered process hood. The exhaust is sampled for particulate radionuclides.

1.2.5.2 306-W Materials Development Laboratory

The building contains shops and laboratory facilities for metal-working and ceramic studies.

- **EP-306W-03-V.** This vent exhausted filtered building ventilation air. The exhaust is sampled for particulate radionuclides.

1.2.5.3 309 Plutonium Recycle Test Reactor

The containment dome and support areas of this building once housed the Plutonium Recycle Test Reactor (PRTR). In 1962, the Plutonium Recycle Critical Facility (PRCF) was added to support the PRTR operations. By 1975, the PRTR had been deactivated, all reactor fuel removed from the building, and the fuel storage basin decontaminated. In the mid 1980s, an extensive clean-out effort removed most of the process equipment and vessels. The ground level of the containment dome is currently being used as an assembly shop and the remainder of the building as office space.

- **309-PRTR.** This emission point ventilates this former PRTR facility. Surveys are taken to periodically confirm low emissions.

1.2.5.4 340 Complex

The 340 Complex houses the liquid mixed waste and solid waste handling operations for the 300 Area. The 340-A Building contains six aboveground storage tanks for liquid mixed waste. The west side of the

340-B Building is a storage area for nonradioactive and radioactive solid waste. The 340 Vault houses two accumulation tanks for radioactive liquid wastes.

- **340-NT-EX.** This stack exhausted filtered air from the 340 Building vault, the 340 Building vault tanks, the 340-A Building waste tanks, and the associated piping system. Emission were sampled using a record sampler to collect particulate radionuclides.

- **340-B-BLDG.** This stack exhausted filtered air from the 340-B East Building. The stack exhaust system operates when rail cars are housed within the facility. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **340-DECON.** This stack did not operate in 1999.

1.2.5.5 318 Radiological Calibrations Laboratory

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

- **EP-318-01-S.** This stack exhausted emissions from only a single unfiltered fume hood. Emissions were sampled using a record sampler to collect particulate radionuclides.

1.2.5.6 320 Analytical and Nuclear Research Laboratory

The building contains environmental radiochemistry laboratories.

- **EP-320-01-S.** This stack exhausted filtered building ventilation air. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **EP-320-02-S.** This stack exhausted emissions from filtered chemistry hoods. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **EP-320-03-S.** This stack exhausted emissions from filtered chemistry hoods. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **EP-320-04-S.** This stack exhausted emissions from filtered chemistry hoods. Emissions were sampled using a record sampler to collect particulate radionuclides.

1.2.5.7 323 Mechanical Properties Laboratory

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

- **EP-323-01-S.** This stack exhausted filtered building ventilation air. Emissions were sampled using a record sampler to collect particulate radionuclides.

1.2.5.8 324 Waste Technology Engineering Laboratory

The building contains laboratories for performing chemical and process development activities.

- **EP-324-01-S.** This stack exhausted filtered building air. Emissions were sampled using record samplers to collect particulate radionuclides as well as tritium in two forms: HT (i.e., elemental tritium, an incondensable gas) and HTO (i.e., tritiated, condensable water vapor).

1.2.5.9 325 Radiochemical Processing Laboratory

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

- **EP-325-01-S.** This stack exhausted filtered building air. Emissions were sampled using a record particulate sampler and a tritium (both HT and HTO) sampler.

1.2.5.10 326 Materials Sciences Laboratory

The building contains laboratories and equipment for studies of metallurgical, chemical, and physical behavior of reactor components and fuel materials.

- **EP-326-01-S.** This stack exhausted filtered building air. Emissions were sampled using a record sampler to collect particulate radionuclides.

1.2.5.11 327 Post-Irradiation Testing Laboratory

The building contains hot-cells for examining and testing irradiated materials.

- **EP-327-01-S.** This stack exhausted filtered building air. Emissions were sampled using a record particulate sampler and a tritium (both HT and HTO) sampler.

- **EP-327-02-V.** This roof vent exhausted filtered air from the decontamination cell. Emissions were sampled using a record sampler to collect particulate radionuclides.

1.2.5.12 329 Chemical Sciences Laboratory

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

- **EP-329-01-S.** This stack exhausted filtered building ventilation air. Emissions were sampled using a record sampler to collect particulate radionuclides.

1.2.5.13 331 Life Sciences Laboratory

The building contains areas for biological and ecological research studies.

- **EP-331-01-V.** This stack exhausted filtered and unfiltered building ventilation air. Emissions were sampled using a record sampler to collect particulate radionuclides.

1.2.5.14 331-G Interim Tissue Repository

The building provides research capabilities for conducting radioactive tracer studies using animals, biota, vegetation, and soils.

- **EP-331G-01-S.** This stack exhausted HEPA-filtered building air. Its annual emissions were estimated using methods from 40 CFR 61, Appendix D (refer to Section 5.3.2, Table 5-3).

- **EP-331G-02-S.** This stack exhausted HEPA-filtered building air. Its annual emissions were estimated using methods from 40 CFR 61, Appendix D (refer to Section 5.3.2, Table 5-3).

1.2.5.15 3020 Environmental Molecular Science Laboratory

EMSL contains basic, multidisciplinary research programs involving chemical, biological, materials, and computational sciences. Research and development activities are undertaken at EMSL to advance the understanding of molecular sciences and to apply the information gained to a broad spectrum of environmental restoration and waste management missions. (The description of the EMSL was placed in this section since this facility lies near the southern perimeter of the 300 Area; for dose modeling purposes, EMSL emissions also regarded as emanating from the 300 Area [refer to Figure 1-7 for the single EMSL emission point].)

- **EP-3020-01-S.** This stack exhausted filtered building ventilation air. Emissions were sampled using a record sampler to collect particulate radionuclides.

1.2.5.16 3720 Environmental Sciences Laboratory

The building contains laboratories for multidisciplinary research in the areas of materials characterization, waste management, and environmental restoration.

- **EP-3720-01-S.** This stack exhausted filtered building air. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **EP-3720-02-S.** This stack has not operated since August 1996. It exhausted filtered building air from the north-annex low-level radiochemistry laboratories. When operating, emissions were sampled using a record sampler to collect particulate radionuclides.

- **EP-3720-03-S.** This stack exhausted filtered building air from the south-end laboratories. This region of the building contains a counting room and low-level radiochemistry laboratories. Emissions were sampled using a record sampler to collect particulate radionuclides.

1.2.5.17 3730 Gamma Irradiation Facility

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

- **EP-3730-01-S.** This stack exhausted filtered building ventilation air. Emissions were sampled using a record sampler to collect particulate radionuclides.

1.2.5.18 3745 Radiological Calibrations and Standards Facility

The building contains a counting laboratory used to analyze samples in support of an occupational health physics program.

- **EP-3745-01-S.** This stack exhausted filtered building ventilation air. Emissions were sampled using a record sampler to collect particulate radionuclides. This emission point was deregistered on October 29, 1999.

1.2.6 400 Area Facilities

The 400 Area consists of the FFTF, the Maintenance and Storage Facility (MASF), and the Fuels Materials Examination Facility (FMEF). Emission points in the 400 Area are shown in Figure 1-8.

1.2.6.1 Fast Flux Test Facility

The Fast Flux Test Facility (FFTF), located in the 400 Area, is a 400-megawatt thermal, sodium-cooled, low-pressure, high-temperature reactor plant, which had been used for irradiation testing of breeder reactor fuels and materials.

- **FFTF-RE-SB.** This stack, located in the Lower Reactor Service Building (RSB), exhausted unfiltered air from the lower level of the RSB. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **FFTF-CB-EX.** This stack, also referred to as the Combined Exhaust, exhausted ordinarily unfiltered air from the reactor containment and gases from the argon processing system. Standby particulate filters are automatically dampered into the system if airborne radioactive particulate concentrations exceed administrative limits. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **FFTF-HT-TR.** This 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 automatically dampered into the system if airborne radioactive particulate concentrations exceed administrative limits. Emissions were sampled using record samplers to collect particulate radionuclides and tritium in the form of tritiated water vapor, also called HTO.

1.2.6.2 Maintenance and Storage Facility

The 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 sodium film removal, decontamination, repair, and storage of non-fueled components and hardware for FFTF.

- **437-MN&ST.** This stack exhausted filtered air from MASF. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **437-1-61.** This stack exhausted filtered air from MASF. Emissions were sampled using a record sampler to collect particulate radionuclides.

1.2.7 600 Area Facilities

In the 600 Area, the Waste Sampling and Characterization Facility (WSCF) emits or has the potential to emit radionuclides. For dose modeling purposes, WSCF was regarded as in the 200 West Area because of its close proximity to the main entrance to that Area. Hence, WSCF is shown in Figure 1-5.

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 stack exhausted filtered air from the analytical laboratory, on the main floor of the 6266 Building. Emissions were sampled using a record sampler to collect particulate radionuclides.

- **696-W-2.** This stack exhausted filtered air from the Nuclear Spectroscopy Laboratory (NSL) in the 6266 Building. Emissions were sampled using a record sampler to collect particulate radionuclides.

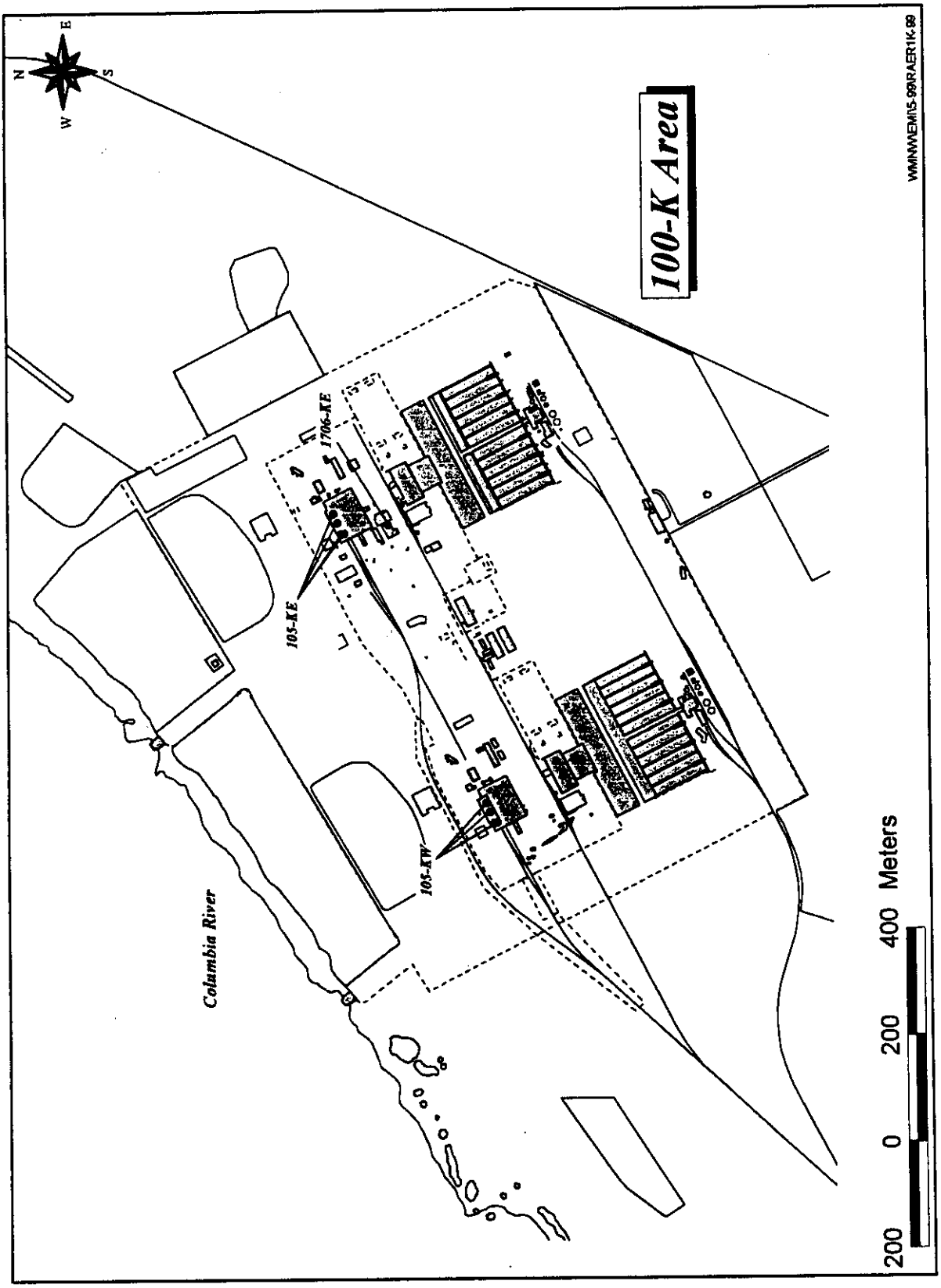


Figure 1-2. 100-K Area Emission Point Sources.

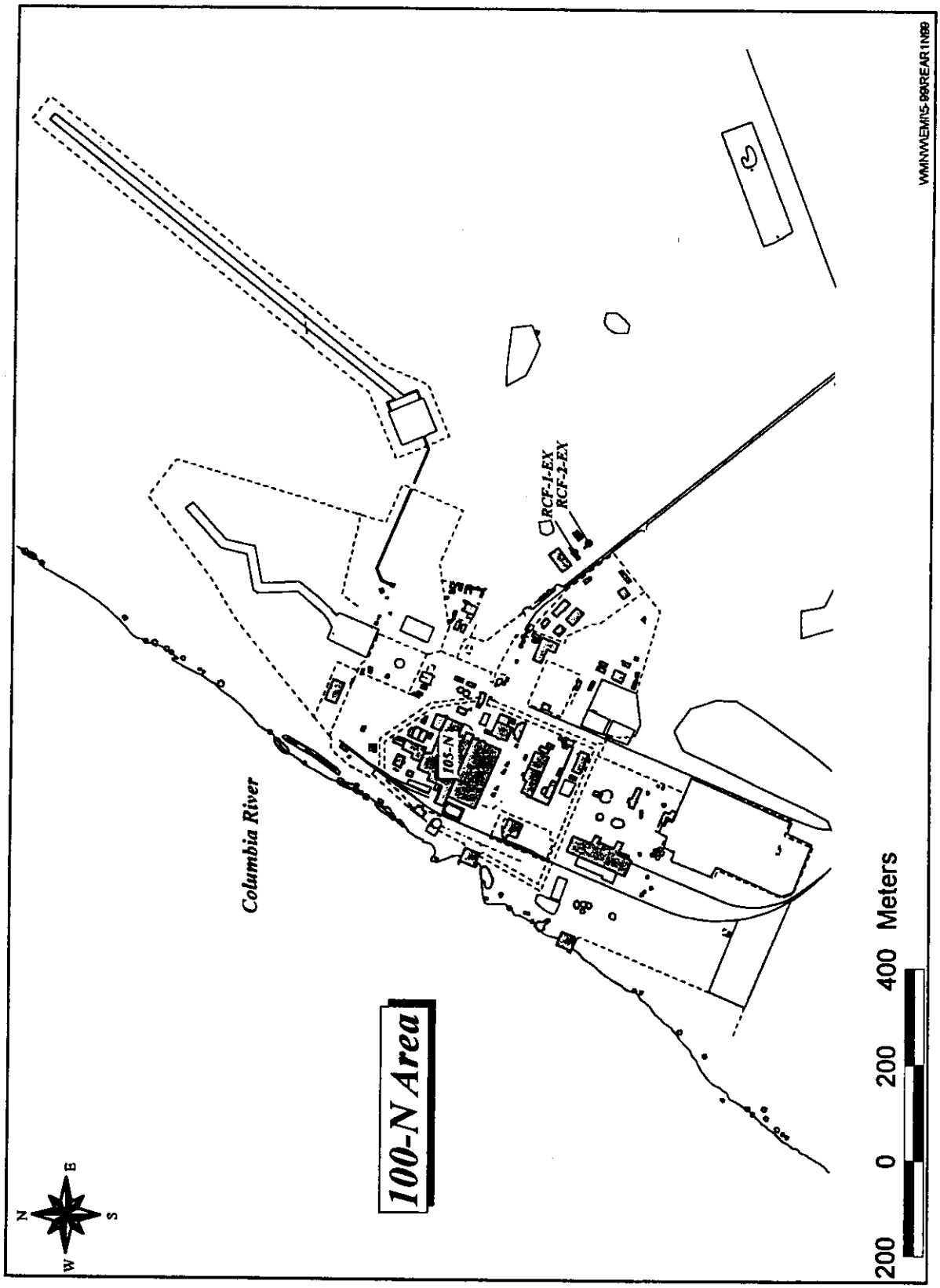


Figure 1-3. 100-N Area Emission Point Sources.

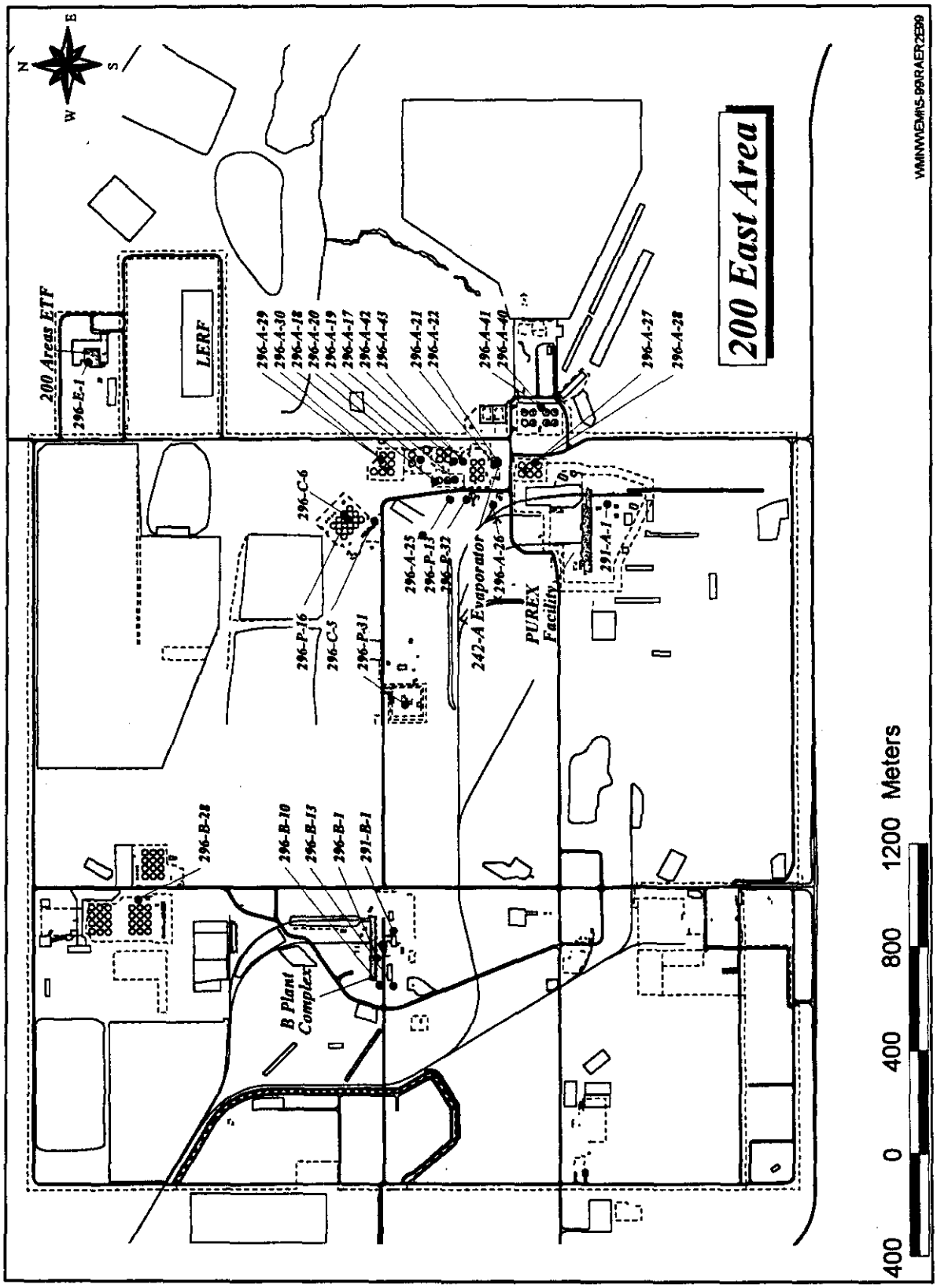


Figure 1-4. 200 East Area Emission Point Sources.

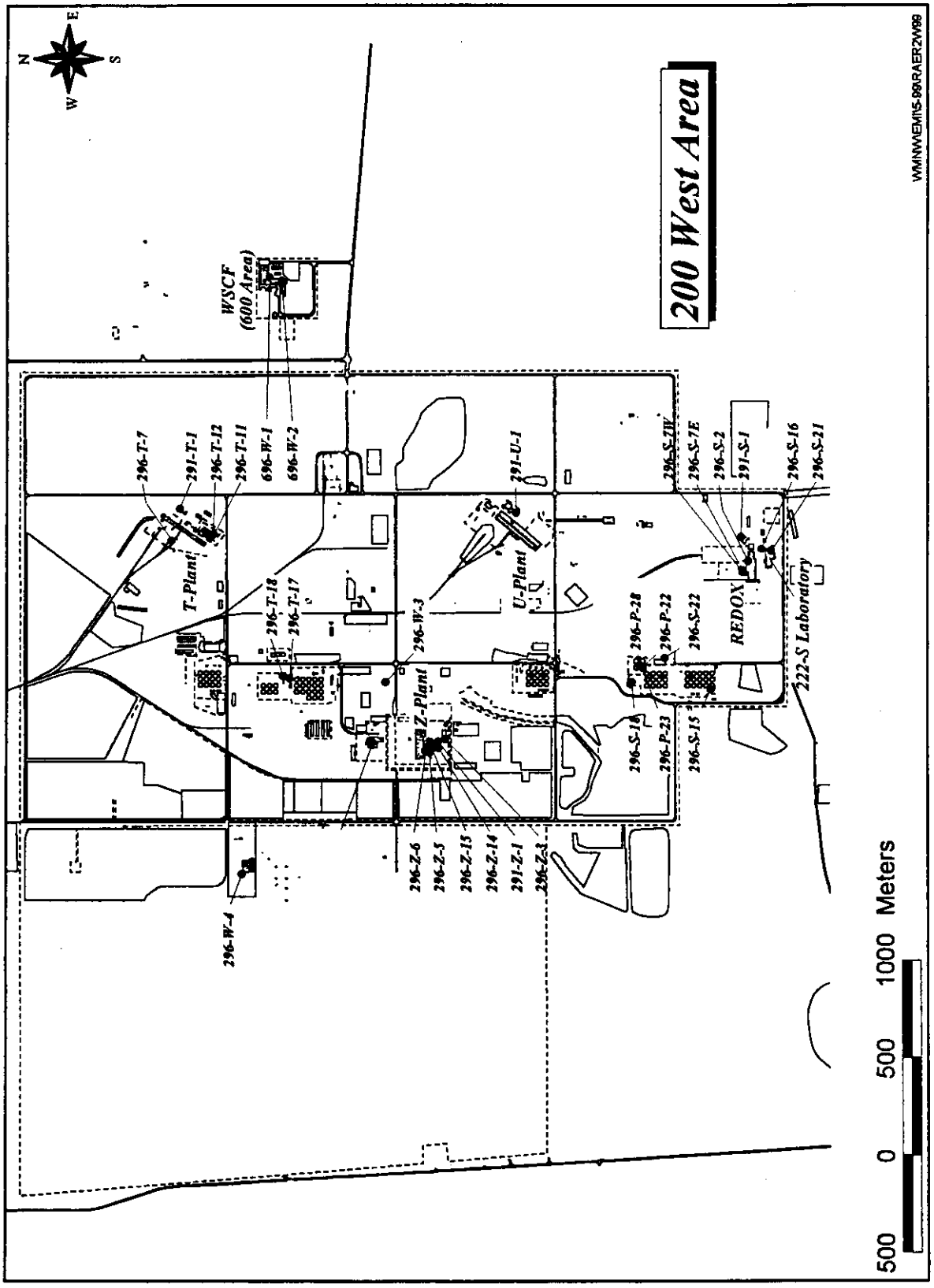


Figure 1-5. 200 West Area Emission Point Sources.

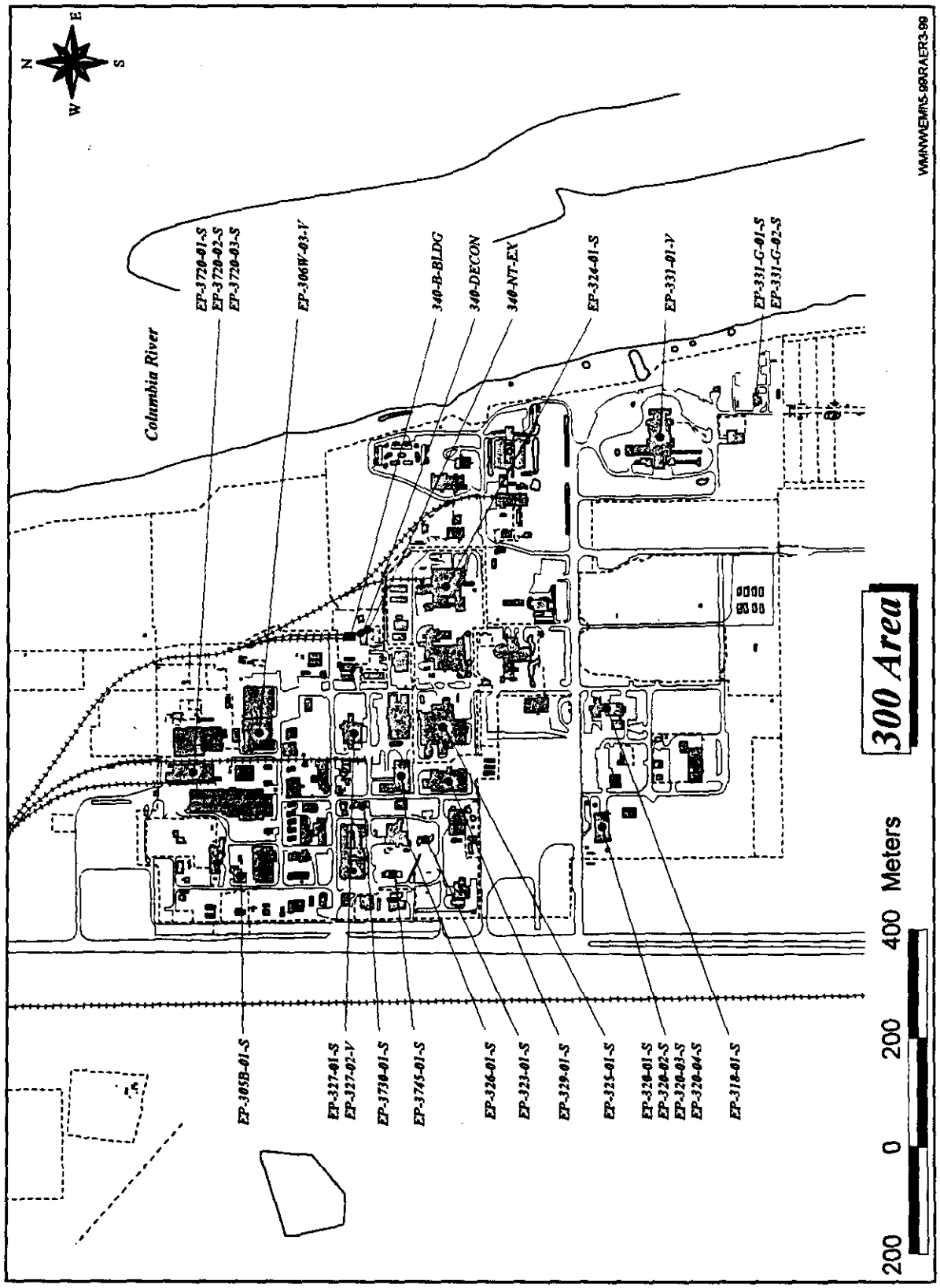


Figure 1-6. 300 Area Emission Point Sources.

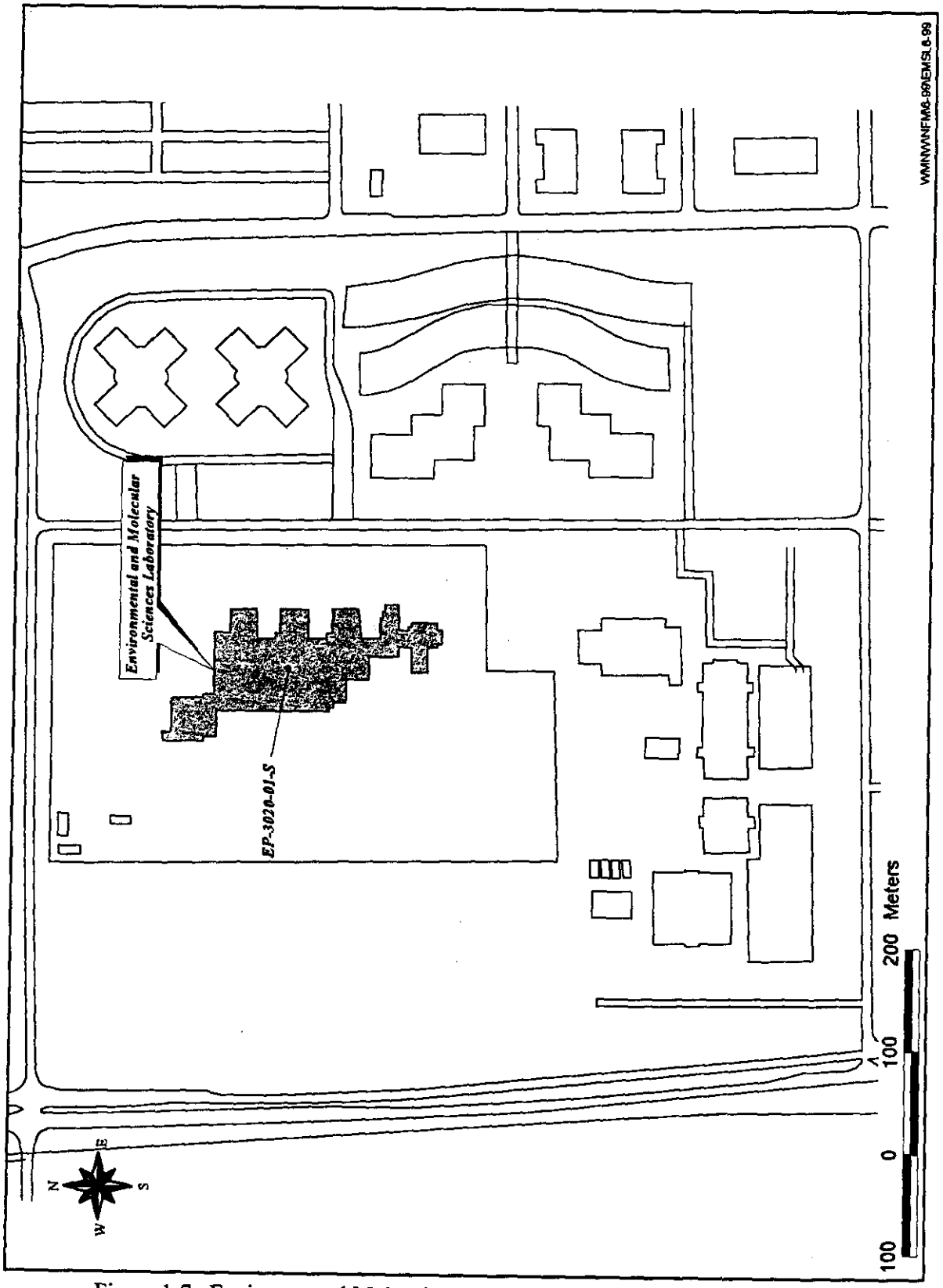


Figure 1-7. Environmental Molecular Science Laboratory Emission Point Source.

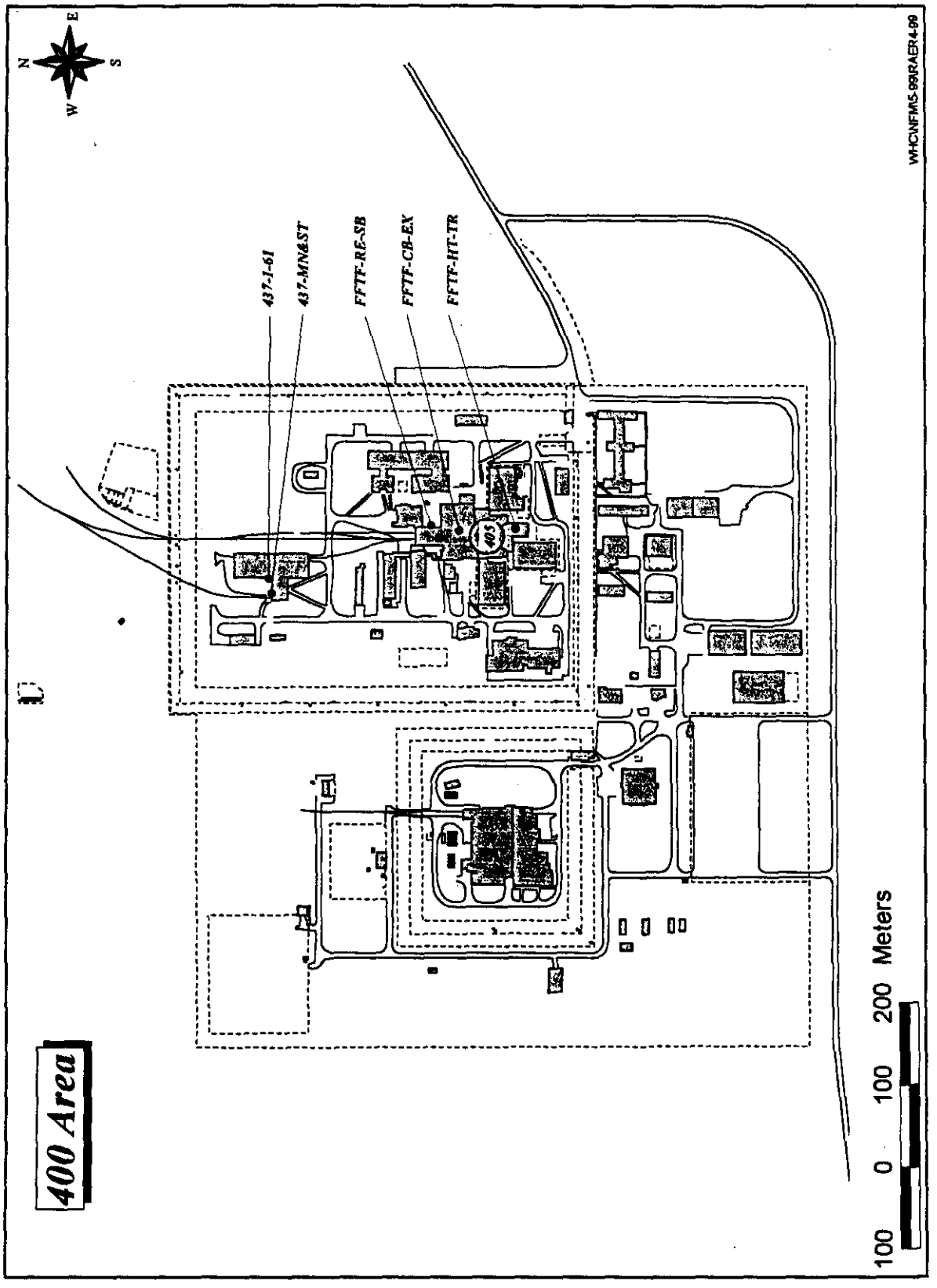


Figure 1-8. 400 Area Emission Point Sources.

This page intentionally left blank.

2.0 RADIONUCLIDE AIR EMISSION DATA ON POINT SOURCES

This section presents information on point sources of radionuclide emissions at the Hanford Site. These point sources are almost always actively (or forcibly) ventilated stacks and vents, with *actively* meaning that motor-driven exhaust fans are used to discharge air to the atmosphere. The criteria for reporting point source emissions are given in Section 1.2, which also has the basis for when an emission source is to be included in the certified sections (i.e., Sections 1.0, 2.0, and 3.0) of this report. Data on radionuclides emitted from point sources in 1999 are shown in Tables 2-1 and 2-2.

Table 2-1 displays emission data on the 26 active major point sources. A point source is classified as major when its potential maximum emissions after all treatment controls have been hypothetically removed can cause the nearest human receptor to receive greater than 0.1 mrem/yr EDE.

A point source is considered minor when its potential maximum emissions after all treatment controls have been hypothetically removed cannot cause a dose to a receptor at the nearest residence to exceed 0.1 mrem/yr EDE. Table 2-2 displays source data on the 68 minor point sources at the Hanford Site. These point sources are grouped according to facility and operating area.

Included with each point source listed are its discharge height, type of emission control (if any), and the total releases in 1999 of radionuclides or types of radioactivity. The filtration efficiencies of emission control devices are specified in footnotes to the tables.

Each emission points is assigned to the major operating area (i.e., 100, 200 East, 200 West, 300, or 400 Areas) in which it is located. For each of the operating areas, a nearest location (e.g., dwelling, business, school, or office) not at the Hanford Site is determined where a human receptor has the potential of being maximally exposed to emissions from that area. A common distance for all the emission points within an operating area is measured between the area and the respective nearest receptor. Thus, five locations of nearest receptors — one for each of the five operating areas — have been established. Radioactive doses calculated for these receptors are used to determine the compliance status of each emission point source as well as the requisite monitoring. Information on these nearest receptors is in Table 2-3, including distances to the nearest farms that produce milk, meat, and vegetables.

In contrast to the five nearest receptors is the Hanford Site maximally exposed individual (MEI). The MEI, owing to lifestyle and location, is calculated to receive the highest dose of any offsite person, caused by radionuclide emissions from *all* point sources in *all* areas at the Hanford Site, not just emissions from a single operating area. For the last several years, and again in 1999, the MEI has been modeled as a resident on a farm near Sagemoor Road in Franklin County, east of the 300 Area. The dose to the MEI is calculated using the EPA-approved dose modeling program, CAP88-PC (402-B-92-001 [CAP88-PC stands for Clean Air Act Assessment Package 1988-Personal Computer). 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 offsite member of the public.

Table 2-1. Hanford Site Radionuclide Air Emissions from Major Point Sources in 1999.
(major point source: potential of >0.1 mrem/yr EDE to nearest offsite receptor)[a] [4 sheets]

Stack (facility; contractor)	Discharge height, ft (m)	Emission control[b] (stages)	Total flow, ft³ (m³)	Annual average flow rate, ft³/min (m³/s)	Radionuclide or type of radioactivity[c]	Annual emissions, Ci[d]	EDE[e] for MEI, mrem/yr
200 Area Point Sources							
291-A-1 (PUREX Plant; BHI)	200 (61)	HEPA (3)	4.2 E+09 (1.2 E+08)	7,900 (3.7)	^{90}Sr	1.2 E-06	1.7 E-08
					^{106}Ru	ND	
					^{125}Sb	ND	
					^{129}I	1.9 E-04	2.1 E-05
					^{134}Cs	ND	
					^{137}Cs	2.9 E-06	8.9 E-08
					^{238}Pu	1.9 E-08	1.6 E-08
					^{239,240}Pu	3.0 E-07	2.7 E-07
					^{241}Pu	1.2 E-06	1.7 E-08
					^{241}Am	5.4 E-07	7.2 E-07
291-B-1 (B Plant; FH)	deregistered						
296-B-1 (B Plant; FH)	90 (27.4)	HEPA (2)	6.8 E+09 (1.9 E+08)	13,000 (6.1)	^{90}Sr	1.5 E-07	2.1 E-09
					^{125}Sb	ND	
					^{239,240}Pu	3.5 E-09	3.1 E-09
					^{241}Am	9.0 E-09	1.2 E-08
296-B-2 (B Plant; FH)	15 (4.6)	HEPA	(refer to Section 5.3 for emission information)				
296-B-10 (WESF; FH)	75 (22.9)	HEPA (1)	1.1 E+10 (3.0 E+08)	20,000 (9.4)	^{90}Sr	9.2 E-05	1.3 E-06
					^{125}Sb	ND	
					^{134}Cs	ND	
					^{137}Cs	3.4 E-05	1.0 E-06
					total α	4.1 E-07	3.6 E-07
296-A-12 (RPP; CHG)	closed and deregistered as of 10/29/99						
296-A-17 (RPP; CHG)	deactivated						
296-A-25 (RPP; CHG)	9.8 (3)	HEPA (2)	4.0 E+07 (1.1 E+06)	150 (0.069)	^{90}Sr	3.6 E-09	5.1 E-11
					^{134}Cs	ND	
					^{137}Cs	7.6 E-07	2.3 E-08
					^{238}Pu	ND	
					^{239,240}Pu	5.3 E-11	4.7 E-11
					^{241}Am	3.0 E-11	4.0 E-11
296-A-42 (RPP; CHG)	55 (16.8)	HEPA (2)	4.7 E+08 (1.3 E+07)	900 (0.42)	^{90}Sr	1.4 E-08	2.0 E-10
					^{137}Cs	ND	
					^{239,240}Pu	3.7 E-10	3.3 E-10
					^{241}Am	4.2 E-10	5.6 E-10
					total β	1.1 E-07	1.6 E-09

Table 2-1. Hanford Site Radionuclide Air Emissions from Major Point Sources in 1999.
(major point source: potential of >0.1 mrem/yr EDE to nearest offsite receptor)[a] [4 sheets]

Stack (facility; contractor)	Discharge height, ft (m)	Emission control[b] (stages)	Total flow, ft^3 (m^3)	Annual average flow rate, ft^3/min (m^3/s)	Radionuclide or type of radioactivity[c]	Annual emissions, Ci[d]	EDE[e] for MEI, mrem/yr
296-B-28 (RPP; CHG)	11 (3.4)	HEPA (2)	7.8 E+07 (2.2 E+06)	200 (0.095)	^{90}Sr	4.3 E-09	6.1 E-11
					^{134}Cs	ND	
					^{137}Cs	ND	
					^{238}Pu	ND	
					$^{239,240}Pu$	1.4 E-10	1.2 E-10
					^{241}Am	2.7 E-10	3.6 E-10
296-C-5 (RPP; CHG)	48 (14.6)	HEPA (2)	1.9 E+09 (5.4 E+07)	3,600 (1.7)	^{90}Sr	1.0 E-07	1.4 E-09
					^{137}Cs	1.3 E-07	4.0 E-09
					^{238}Pu	ND	
					$^{239,240}Pu$	8.5 E-10	7.5 E-10
					^{241}Am	2.1 E-09	3.0 E-11
296-C-6 (RPP; CHG)	18.7 (5.7)	HEPA (2)	3.8 E+07 (1.1 E+06)	340 (0.16)	^{60}Co	1.6 E-09	5.1 E-11
					^{90}Sr	1.1 E-09	1.6 E-11
					^{137}Cs	ND	
					$^{239,240}Pu$	5.3 E-10	4.7 E-10
					^{241}Am	2.5 E-10	3.6 E-12
296-P-16 (RPP; CHG)	15 (4.6)	HEPA (2)	1.2 E+09 (3.5 E+07)	3,000 (1.4)	^{90}Sr	2.4 E-07	3.4 E-09
					^{134}Cs	ND	
					^{137}Cs	8.2 E-07	2.5 E-08
					^{238}Pu	ND	
					$^{239,240}Pu$	1.1 E-09	9.7 E-10
					^{241}Am	3.9 E-09	5.2 E-09
296-P-32 (RPP; CHG)	15 (4.6)	HEPA (2)	did not operate				
296-P-33 (RPP; CHG)	15 (4.6)	HEPA (2)	1.3 E+06 (3.8 E+04)	200 (0.090)	^{90}Sr	6.7 E-09	9.5 E-11
					^{137}Cs	ND	
					$^{239/240}Pu$	1.6 E-11	1.4 E-11
296-P-34 (RPP; CHG)	15 (4.6)	HEPA (2)	5.5 E+06 (1.6 E+05)	200 (0.090)	^{90}Sr	3.9 E-09	5.5 E-11
					^{137}Cs	ND	
					$^{239,240}Pu$	6.2 E-11	5.5 E-11
					^{241}Am	8.3 E-11	1.1 E-10
					total β	1.8 E-09	2.6 E-11
296-S-22 (RPP; CHG)	12 (3.7)	HEPA (2)	5.1 E+07 (1.4 E+06)	150 (0.070)	^{90}Sr	3.1 E-09	4.4 E-11
					^{134}Cs	ND	
					^{137}Cs	ND	
					^{238}Pu	ND	
					$^{239,240}Pu$	1.4 E-11	1.2 E-11
					^{241}Am	2.1 E-10	2.8 E-10

Table 2-1. Hanford Site Radionuclide Air Emissions from Major Point Sources in 1999.
(major point source: potential of >0.1 mrem/yr EDE to nearest offsite receptor)[a] [4 sheets]

Stack (facility; contractor)	Discharge height, ft (m)	Emission control[b] (stages)	Total flow, ft^3 (m^3)	Annual average flow rate, ft^3/min (m^3/s)	Radionuclide or type of radioactivity[c]	Annual emissions, Ci[d]	EDE[e] for MEI, mrem/yr
296-T-18 (RPP; CHG)	12 (3.7)	HEPA (2)	1.4 E+08 (3.8 E+06)	260 (0.12)	^{90}Sr	1.1 E-08	2.1 E-10
					^{134}Cs	ND	
					^{137}Cs	2.5 E-09	9.5 E-11
					^{238}Pu	2.6 E-10	2.6 E-10
					$^{239,240}Pu$	9.7 E-09	1.1 E-08
					^{241}Am	2.4 E-09	3.9 E-09
296-W-4 (WRAP; FH)	47 (14.2)	HEPA (2)	8.6 E+09 (2.4 E+08)	16,000 (7.6)	***^{90}Sr***	2.6 E-07	4.9 E-09
					^{137}Cs	ND	
					$^{239,240}Pu$	1.8 E-08	2.0 E-08
					^{241}Am	1.7 E-08	2.8 E-08
291-Z-1 (PFP; FH)	200 (61)	HEPA (1-3)	1.5 E+11 (4.3 E+09)	290,000 (140)	^{238}Pu	4.8 E-06	4.8 E-06
					$^{239,240}Pu$	1.7 E-04	1.9 E-04
					^{241}Pu	1.2 E-04	2.1 E-06
					^{241}Am	4.5 E-05	7.4 E-05
300 Area Point Sources							
EP-324-01-S (324 Building; FH)	157 (48)	HEPA (1)	3.5 E+10 (1.0 E+09)	67,000 (32)	^{3}H (as HTO)[f]	1.3 E-01	2.4 E-05
					^{90}Sr	1.7 E-06	1.7 E-06
					^{125}Sb	1.1 E-07	1.2 E-08
					^{137}Cs	ND	
					^{238}Pu	ND	
					$^{239,240}Pu$	1.2 E-07	9.1 E-06
					^{241}Am	8.9 E-08	1.0 E-05
EP-325-01-S (325 Building; PNNL)	89 (27.1)	HEPA (2)	7.3 E+10 (2.1 E+09)	140,000 (66)	***^{3}H*** (as HT)[f]	4.0 E+01	7.4 E-05
					^{3}H (as HTO)[f]	1.5 E+02	2.8 E-02
					^{90}Sr	1.9 E-07	1.9 E-07
					^{137}Cs	3.4 E-09	7.2 E-09
					^{238}Pu	ND	
					$^{239,240}Pu$	1.1 E-07	8.3 E-06
					^{241}Pu	ND	
					^{241}Am	9.7 E-09	1.1 E-06
					^{243}Am	ND	
					unspec. α	6.9 E-08	5.2 E-06
					unspec. β	1.2 E-07	1.2 E-07
EP-327-01-S (327 Building; FH)	46 (14)	HEPA (1)	2.6 E+10 (7.3 E+08)	49,000 (23)	^{90}Sr	7.0 E-07	6.9 E-07
					^{137}Cs	4.2 E-07	8.9 E-07
					^{238}Pu	ND	
					$^{239,240}Pu$	2.4 E-08	1.8 E-06
					^{241}Am	4.3 E-08	4.9 E-06

Table 2-1. Hanford Site Radionuclide Air Emissions from Major Point Sources in 1999.
(major point source: potential of >0.1 mrem/yr EDE to nearest offsite receptor)[a] [4 sheets]

Stack (facility; contractor)	Discharge height, ft (m)	Emission control[b] (stages)	Total flow, ft^3 (m^3)	Annual average flow rate, ft^3/min (m^3/s)	Radionuclide or type of radioactivity[c]	Annual emissions, Ci[d]	EDE[e] for MEI, mrem/yr
EP-331-01-V (331 Building; PNNL)	62 (18.9)	HEPA (1)	3.5 E+10 (9.9 E+08)	66,000 (32)	^{90}Sr	6.9 E-08	6.8 E-08
					^{137}Cs	ND	
					^{238}Pu	ND	
					$^{239,240}Pu$	7.6 E-08	5.8 E-06
					^{241}Pu	ND	
					^{241}Am	ND	
					^{243}Am	ND	
					unspec. α	2.7 E-07	2.0 E-05
					unspec. β	8.6 E-07	8.5 E-07
340-NT-EX (340 Complex; FH)	18 (5.5)	HEPA (2)	8.8 E+08 (2.5 E+07)	1,700 (0.80)	^{137}Cs	ND	
					^{238}Pu	ND	
					$^{239,240}Pu$	1.2 E-09	9.1 E-08
					^{241}Am	8.6 E-10	9.8 E-08
EP-3720-01-S (3720 Building; PNNL)	36 (11)	HEPA (1)	1.1 E+10 (3.2 E+08)	21,000 (9.9)	^{90}Sr	3.9 E-09	3.9 E-09
					^{137}Cs	ND	
					^{238}Pu	ND	
					$^{239,240}Pu$	4.9 E-09	3.5 E-07
					^{241}Pu	7.9 E-08	9.4 E-08
					^{241}Am	ND	
					^{243}Am	ND	
					unspec. α	9.6 E-09	7.3 E-07
					unspec. β	4.6 E-08	4.6 E-08

General definitions: ft = feet; ft^3 = cubic feet; HEPA = high-efficiency particulate air (as in HEPA filter); m^3 = cubic meters; min = minute; mrem = millirem; s = second; yr = year

Contractor and facility definitions: BHI = Bechtel Hanford, Inc.; CHG = CHM2 HILL Hanford Group, Inc.; FH = Fluor Hanford; PNNL = Pacific Northwest National Laboratory; PFP = Plutonium Finishing Plant; RPP = River Protection Project; WESF = Waste Encapsulation and Storage Facility; WRAP = Waste Receiving and Processing Plant.

[a] To determine the state of compliance with 40 CFR 61, *National Emission Standards for Hazardous Air Pollutants* (NESHAP), Subpart H, for each point source necessitated using nearest offsite receptors, who differ from the MEI.

[b] Efficiencies are: ≥99.95% for HEPA, ≥95% for charcoal, ≥99.8% for sand filter, and zero for no emission control.

[c] Radionuclides in italic and bold print identify those required by 40 CFR 61, Subpart H, for mandatory sampling and analysis; "unspec. α" and "unspec. β" stand for unspecified alpha and unspecified beta, respectively. Unspecified alpha releases are derived by subtracting the total activity of specifically analyzed alpha emitters released from the total analytical value of alpha activity released. The same process was used to calculate releases for unspecified beta emitters.

[d] Ci = curie; 1 Ci = 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.

[e] EDE for MEI = effective dose equivalent for the maximally exposed individual (located at Sagemoor, not the nearest residence); 1 mrem = 1 E-02 mSv.

[f] HT is tritium, or elemental tritium, in the form of an incondensable gas; HTO, or tritiated water vapor, in the form of condensable water vapor.

Table 2-2. Hanford Site Radionuclide Air Emissions from Minor Point Sources in 1999.
(minor point source: potential of ≤0.1 mrem/yr EDE to nearest offsite receptor) [5 sheets]

Source ID[a] (facility; contractor)	Discharge height, ft (m)	Emission control[b]	Total flow, ft^3 (m^3)	Annual average flow rate, ft^3/min (m^3/s)	Radionuclide or type of radioactivity[c]	Annual emissions, Ci[d]
100 Area						
105-KE Basin (100-K Area; FH)	42 (12.8)	none	2.5 E+10 (7.0 E+08)	48,000 (22)	^{90}Sr ^{125}Sb ^{137}Cs ^{154}Eu ^{238}Pu $^{239,240}Pu$ ^{241}Pu ^{241}Am	1.9 E-05 3.5 E-08 4.3 E-05 4.8 E-08 5.8 E-07 4.1 E-06 5.0 E-05 2.3 E-06
105-KW Basin (100-K Area; FH)	42 (12.8)	none	1.1 E+10 (3.2 E+08)	21,000 (10)	^{60}Co ^{90}Sr ^{125}Sb ^{137}Cs ^{238}Pu $^{239,240}Pu$ ^{241}Pu ^{241}Am	3.9 E-08 6.4 E-07 1.5 E-08 2.5 E-06 ND 6.8 E-08 8.4 E-07 8.0 E-08
1706-KE (100-K Area; FH)	25 (7.6)	HEPA	4.6 E+08 (1.3 E+07)	980 (0.46)	total α total β	2.9 E-09 3.5 E-08
RCF-1-EX (100-N Area; BHI)	9.8 (3)	HEPA	3.6 E+07 (1.0 E+06)	69 (0.033)	total α total β	6.0 E-11 1.6 E-09
RCF-2-EX (100-N Area; BHI)	9.8 (3)	HEPA	3.1 E+08 (8.8 E+06)	590 (0.28)	total α total β	ND 1.4 E-08
200 East Area						
296-A-13 (RPP; CHG)	125 (38.1)	HEPA	0	0	did not operate	
296-A-18 (RPP; CHG)	15 (4.6)	HEPA	0	0	did not operate	
296-A-19 (RPP; CHG)	15 (4.6)	HEPA	5.8 E+08 (1.6 E+07)	1,100 (0.52)	total α total β	1.6 E-08 1.4 E-08
296-A-20 (RPP; CHG)	24 (7.3)	HEPA	0	0	did not operate	
296-A-26 (RPP; CHG)	31 (9.4)	HEPA	8.7 E+08 (2.5 E+07)	1,700 (0.80)	total α total β	ND 1.3 E-08
296-A-27 (RPP; CHG)	12 (3.7)	HEPA	5.0 E+08 (1.4 E+07)	950 (0.45)	total α total β	2.6 E-09 1.1 E-07
296-A-28 (RPP; CHG)	12 (3.7)	HEPA	2.0 E+09 (5.6 E+07)	3,700 (1.7)	total α total β	9.7 E-08 5.1 E-07
296-A-29 (RPP; CHG)	12 (3.7)	HEPA	3.9 E+08 (1.1 E+07)	740 (0.35)	total α total β	ND 1.2 E-07

Table 2-2. Hanford Site Radionuclide Air Emissions from Minor Point Sources in 1999.
(minor point source: potential of ≤0.1 mrem/yr EDE to nearest offsite receptor) [5 sheets]

Source ID[a] (facility; contractor)	Discharge height, ft (m)	Emission control[b]	Total flow, ft^3 (m^3)	Annual average flow rate, ft^3/min (m^3/s)	Radionuclide or type of radioactivity[c]	Annual emissions, Ci[d]
296-A-30 (RPP; CHG)	12 (3.7)	HEPA	2.5 E+09 (7.1 E+07)	4,800 (2.3)	total α total β	4.3 E-08 2.8 E-07
296-A-40 (RPP; CHG)	13.4 (4.1)	HEPA	4.6 E+08 (1.3 E+07)	870 (0.41)	^{90}Sr ^{137}Cs ^{238}Pu $^{239,240}Pu$ ^{241}Am	8.8 E-09 ND ND 1.5 E-10 3.9 E-10
296-A-41 (RPP; CHG)	29 (8.9)	HEPA	4.4 E+09 (1.2 E+08)	8,300 (3.9)	total α total β	ND 7.5 E-08
296-A-43 (RPP; CHG)	55 (16.8)	HEPA	4.6 E+08 (1.3 E+07)	880 (0.42)	total α total β	ND 6.3 E-09
296-P-31 (RPP; CHG)	33 (10)	HEPA	4.7 E+08 (1.3 E+07)	900 (0.42)	total α total β	2.1 E-08 5.0 E-08
296-A-21 (242-A Evaporator; FH)	22 (6.7)	HEPA	6.1 E+09 (1.7 E+08)	12,000 (5.7)	total α total β	9.0 E-08 1.6 E-07
296-A-22 (242-A Evaporator; FH)	61 (18.6)	HEPA	2.3 E+08 (6.6 E+06)	440 (0.21)	total α total β	1.9 E-09 2.5 E-08
296-E-1 (ETF; FH)	51 (15.5)	HEPA	3.1 E+10 (8.8 E+08)	59,000 (28)	total α total β	1.1 E-07 3.0 E-07
200 West Area						
296-P-22 (RPP; CHG)	15 (4.6)	HEPA	4.6 E+08 (1.3 E+07)	890 (0.42)	total α total β	3.4 E-09 1.4 E-08
296-P-23 *backup: 296-P-28* (RPP; CHG)	15 (4.6)	HEPA	5.6 E+08 (1.3 E+07)	900 (0.42)	total α total β	4.0 E-10 7.8 E-07
296-S-15 (RPP; CHG)	15 (4.6)	HEPA	1.7 E+09 (4.9 E+07)	3,300 (1.6)	total α total β	5.0 E-09 2.9 E-07
296-S-18 (RPP; CHG)	22 (6.7)	HEPA	3.4 E+09 (9.6 E+07)	6,700 (3.2)	total α total β	1.4 E-07 4.4 E-07
296-T-17 (RPP; CHG)	33 (10.1)	HEPA	6.2 E+08 (1.8 E+07)	1,200 (0.57)	total α total β	ND 1.9 E-08
291-S-1 (REDOX Plant; BHI)	200 (61)	sand filter	1.0 E+10 (2.9 E+08)	19,000 (9.0)	total α total β	2.1 E-07 3.9 E-06
296-S-2 (REDOX Plant; BHI)	68 (20.7)	HEPA	6.0 E+08 (1.7 E+07)	1,100 (0.52)	total α total β	1.6 E-07 1.5 E-07
296-S-7W *backup: 296-S-7E* (REDOX Plant; BHI)	25 (7.6)	HEPA	5.1 E+09 (1.5 E+08)	1,900 (0.90)	total α total β	4.9 E-06 1.3 E-06

Table 2-2. Hanford Site Radionuclide Air Emissions from Minor Point Sources in 1999.
(minor point source: potential of ≤0.1 mrem/yr EDE to nearest offsite receptor) [5 sheets]

Source ID[a] (facility; contractor)	Discharge height, ft (m)	Emission control[b]	Total flow, ft^3 (m^3)	Annual average flow rate, ft^3/min (m^3/s)	Radionuclide or type of radioactivity[c]	Annual emissions, Ci[d]
296-S-16 (222-S; FH)	9.8 (3)	HEPA	4.2 E+10 (1.2 E+09)	80,000 (38)	total α total β	8.3 E-06 2.7 E-05
296-S-21 (222-S; FH)	38 (11.6)	HEPA	9.8 E+07 (2.8 E+06)	190 (0.090)	total α total β	ND 9.2 E-10
291-T-1 (T Plant; FH)	200 (61)	HEPA	1.7 E+10 (4.8 E+08)	32,000 (15)	total α total β	2.9 E-05 9.6 E-05
296-T-7 (T Plant; FH)	28 (8.5)	HEPA	2.5 E+09 (7.1 E+07)	4,800 (2.3)	total α total β	ND 6.5 E-08
296-T-11 (224-T TRUSAF; FH)	25 (7.6)	HEPA	0	0	did not operate	
296-T-12 (224-T TRUSAF; FH)	25 (7.6)	HEPA	8.6 E+09 (2.4 E+08)	16,000 (7.6)	total α total β	ND 2.1 E-07
291-U-1 (U Plant; BHI)	200 (61)	sand filter	1.5 E+10 (4.2 E+08)	28,000 (13)	total α total β	1.5 E-06 1.6 E-04
296-W-3 (RPP; CHG)	25 (7.6)	HEPA	0	0	did not operate	
296-Z-3 (PFP; FH)	25 (7.6)	HEPA	4.5 E+08 (1.3 E+07)	850 (0.40)	^{238}Pu $^{239,240}Pu$ ^{241}Pu ^{241}Am total β	3.5 E-08 2.9 E-08 6.5 E-08 1.0 E-08 3.9 E-08
296-Z-5 (PFP; FH)	28 (8.5)	HEPA	5.3 E+09 (1.5 E+08)	10,000 (4.7)	total α total β	ND 1.4 E-07
296-Z-6 (PFP; FH)	15 (4.5)	HEPA	3.8 E+09 (1.1 E+08)	7,300 (3.4)	total α total β	ND 1.2 E-07
296-Z-14 (PFP; FH)	20 (6.1)	HEPA	6.3 E+08 (1.8 E+07)	1,200 (0.57)	total α total β	1.7 E-08 4.4 E-08
296-Z-15 (PFP; FH)	42 (12.8)	HEPA	7.9 E+08 (2.2 E+07)	1,500 (0.71)	total α total β	ND 4.3 E-09
300 Area						
EP-305B-01-S (305-B Building; PNNL)	33 (10)	HEPA	5.8 E+08 (1.5 E+07)	1,100 (0.52)	unspec. α unspec. β	1.2 E-09 6.3 E-09
EP-306W-03-V (306-W Building; PNNL)	29 (8.8)	HEPA	1.4 E+10 (4.0 E+08)	27,000 (13)	unspec. α unspec. β	2.2 E-08 4.4 E-07
309-PRTR (309 Building; FH)	29 (8.8)	none	9.7 E+08 (2.8 E+07)	1,900 (0.90)	total α total β	1.1 E-08 2.7 E-08
EP-318-01-S (318 Building; PNNL)	29 (8.8)	none	2.6 E+08 (7.5 E+06)	490 (0.20)	unspec. α unspec. β	2.9 E-09 3.9 E-08

Table 2-2. Hanford Site Radionuclide Air Emissions from Minor Point Sources in 1999.
(minor point source: potential of ≤0.1 mrem/yr EDE to nearest offsite receptor) [5 sheets]

Source ID[a] (facility; contractor)	Discharge height, ft (m)	Emission control[b]	Total flow, ft^3 (m^3)	Annual average flow rate, ft^3/min (m^3/s)	Radionuclide or type of radioactivity[c]	Annual emissions, Ci[d]
EP-320-01-S (320 Building; PNNL)	40 (12.1)	HEPA	1.5 E+10 (4.5 E+08)	29,000 (14)	unspec. α unspec. β	1.1 E-08 1.8 E-07
EP-320-02-S (320 Building; PNNL)	32 (9.7)	HEPA	2.7 E+08 (7.6 E+06)	520 (0.2)	unspec. α unspec. β	2.6 E-09 8.6 E-09
EP-320-03-S (320 Building; PNNL)	26 (7.9)	HEPA	2.3 E+08 (6.4 E+06)	430 (0.2)	unspec. α unspec. β	ND 8.0 E-11
EP-320-04-S (320 Building; PNNL)	26 (7.9)	HEPA	2.1 E+08 (4.9 E+06)	410 (0.2)	unspec. α unspec. β	1.7 E-09 2.1 E-09
EP-323-01-S (323 Building; PNNL)	16 (4.9)	HEPA	2.6 E+09 (7.1 E+07)	4,900 (2.2)	unspec. α unspec. β	8.2 E-09 1.0 E-07
EP-326-01-S (326 Building; PNNL)	47.6 (14.5)	HEPA	2.7 E+10 (8.4 E+08)	52,000 (27)	unspec. α unspec. β	3.7 E-07 5.0 E-06
EP-327-02-V (327 Building; FH)	29.5 (9)	HEPA	4.0 E+08 (1.1 E+07)	770 (0.36)	total α total β	8.1 E-10 5.5 E-09
EP-329-01-S (329 Building; PNNL)	62.6 (19.1)	HEPA	2.5 E+10 (7.6 E+08)	47,000 (24)	unspec. α unspec. β	8.9 E-09 4.8 E-08
340-B-BLDG (340 Complex; FH)	38 (11.6)	HEPA	0	0	did not operate	
340-DECON (340 Complex; FH)	9.8 (3)	HEPA	3.6 E+09 (1.0 E+08)	7,000 (3.3)	total α total β	ND 5.9 E-07
EP-3020-01-S (EMSL; PNNL)	52.5 (16)	HEPA	3.6 E+09 (9.7 E+07)	6,800 (3.1)	unspec. α unspec. β	ND[e] ND[e]
EP-3720-02-S (3720 Building; PNNL)	16.4 (5)	HEPA	0	0	did not operate	
EP-3720-03-S (3720 Building; PNNL)	30.5 (9.3)	HEPA	3.9 E+09 (1.2 E+08)	7,400 (3.7)	unspec. α unspec. β	6.3 E-10 ND
EP-3730-01-S (3730 Building; PNNL)	19.4 (5.9)	HEPA	1.8 E+08 (5.1 E+06)	350 (0.2)	unspec. α unspec. β	6.9 E-11 1.6 E-09
EP-3745-01-S (3745 Building; PNNL)	9.2 (2.8)	HEPA	4.0 E+08 (8.4 E+06)	750 (0.3)	unspec. α unspec. β	ND 1.0 E-08
400 Area						
FFTF-CB-EX (FFTF; FH)	47 (14.3)	none	1.1 E+10 (3.0 E+08)	20,000 (9.4)	total α total β	1.5 E-08 4.3 E-07
FFTF-HT-TR (FFTF; FH)	29 (8.8)	none	2.9 E+09 (8.1 E+07)	5,400 (2.5)	total α total β	ND 1.1 E-07

Table 2-2. Hanford Site Radionuclide Air Emissions from Minor Point Sources in 1999.
(minor point source: potential of ≤0.1 mrem/yr EDE to nearest offsite receptor) [5 sheets]

Source ID[a] (facility; contractor)	Discharge height, ft (m)	Emission control[b]	Total flow, ft^3 (m^3)	Annual average flow rate, ft^3/min (m^3/s)	Radionuclide or type of radioactivity[c]	Annual emissions, Ci[d]
FFTF-RE-SB (FFTF; FH)	20 (6.1)	none	6.7 E+09 (1.9 E+08)	13,000 (6.1)	total α total β	2.9 E-07 1.0 E-06
437-MN&ST (MASF; FH)	30 (9.1)	HEPA	7.5 E+09 (2.1 E+08)	14,000 (6.6)	total α total β	ND 2.3 E-07
437-1-61 (MASF; FH)	38.4 (11.7)	HEPA	7.1 E+09 (2.0 E+08)	14,000 (6.6)	total α total β	ND 1.3 E-07
600 Area						
696-W-1 (WSCF; FH)	25 (7.6)	HEPA	2.6 E+10 (7.2 E+08)	49,000 (23)	total α total β	ND 1.3 E-07
696-W-2 (WSCF; FH)	32 (9.8)	HEPA	5.3 E+08 (1.5 E+07)	1,000 (0.47)	total α total β	ND 4.1 E-09

General definitions: ft = feet; ft^3 = cubic feet; HEPA = high-efficiency particulate air (as in HEPA filter); m^3 = cubic meters; min = minute; mrem = millirem; s = second; yr = year

Contractor and facility definitions: BHI = Bechtel Hanford, Inc.; CHG = CHM2 HILL Hanford Group, Inc.; FH = Fluor Hanford; PNNL = Pacific Northwest National Laboratory; PFP = Plutonium Finishing Plant; RPP = River Protection Project; WESF = Waste Encapsulation and Storage Facility; WRAP = Waste Receiving and Processing Plant.

[a] ID = identification, i.e., the alpha-numeric designator for the respective point source; BHI = Bechtel Hanford, Inc.; CHG=CHM2 HILL Group; FH = Fluor Hanford; PNNL = Pacific Northwest National Laboratory.

[b] Efficiencies are: ≥99.95% for HEPA; ≥95% for charcoal; ≥99.8% for sand filter; zero for no emission control.

[c] "Unspec. α" and "unspec. β" stand for unspecified alpha and unspecified beta, respectively. Unspecified alpha releases are derived by subtracting the total activity of specifically analyzed alpha emitters released from the total analytical value of alpha activity released. The same process was used to calculate releases for unspecified beta emitters.

[d] 1 curie = 3.7 E+10 becquerels (Bq); ND = none 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).

[e] No unsealed radioactive material was present in this facility during 1999; for the same period, therefore, no radionuclides were emitted from this stack.

Table 2-3. Distances and Directions from Major Operating Areas *to Receptors at Respective Nearest Residences.*

Receptor		Distance (mi) and direction from major operating area[a]				
		100 Area	200-E Area	200-W Area	300 Area	400 Area
Residence[b]	Nearest	7.0 NNW	13.2 E	8.5 W	0.9 NE	5.5 E
	Nearest in prevailing wind	15.1 E	13.2 E	16.9 SE	2.1 S	6.7 SE
Vegetable-producing farm	Nearest	6.1 NW	13.1 E	11.0 NW	2.0 E	6.5 ESE
	Nearest in prevailing wind	15.5 E	13.1 E	18.6 E and 18.6 SE	2.5 NE	7.8 SE
Milk-producing farm	Nearest	21.7 E	18.1 ENE	21.5 S	3.6 SES	8.3 E
	Nearest in prevailing wind	21.7 E	19.0 ESE	24.2 ESE	5.7 NE	9.5 SE
Meat-producing farm	Nearest	7.0 NNW	13.0 WNW	11.0 WSW	1.7 ESE	7.6 SE
	Nearest in prevailing wind	19.5 ESE	14.9 E	16.8 SE	5.0 NE	7.6 SE

[a] 1 mi = 1.609 km; all emission points within emission area are assigned a single distance to the nearest receptor.

[b] Residence includes dwelling, school, business, or office.

This page intentionally left blank.

3.0 POINT SOURCE EMISSION DOSE ASSESSMENTS

3.1 DESCRIPTION OF POINT SOURCE EMISSIONS DOSE MODEL

The CAP88-PC computer code (402-B-92-001) was used to determine the compliance status of Hanford Site radionuclide air emissions with the 10 mrem/yr EDE standard set in both Subpart H of 40 CFR 61and in WAC 246-247. Because the Hanford Site has numerous emission points that are widely separated, it is necessary to determine the point at which the maximum dose would be received from the combined air emissions released from all locations. Emission points used for modeling purposes were centered on each of the major operating areas that released radionuclides to the atmosphere during 1999. A single geographical reference location for each of the five major operating areas has been chosen, representative of all points sources in each respective area. For the 100 Area, that location is the spent fuel storage basin in the 105-KE Building; for the 200 East Area, the PUREX Facility; for the 200 West Area, PFP; for the 300 Area, the 325 Building; and for the 400 Area, FFTF.

Emission point sources in the major operating areas are listed in Table 3-1. The location of the MEI selected for the compliance analysis is a resident at Sagemoor. Table 3-2 lists the EDE to this receptor, caused by all radionuclide air emissions in 1999 from all point sources, as well as the five unified locations of those sources relative to Sagemoor where the MEI resides.

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). Release estimates, grouped by major operating area, were used to perform dose calculations (Table 3-1). Releases from point sources were modeled using 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). Releases reported as total alpha or total beta were generally evaluated as ^{239}Pu or ^{90}Sr, respectively, to provide a conservative estimate of the expected impact. In the case of 400 Area, releases reported as total beta measurements were modeled as ^{137}Cs, based on facility-specific information.

Radionuclide data used for the dose calculations are listed in Appendix A; all other radionuclide-specific parameters were default values provided by CAP88-PC data libraries. The maximum individual exposure and consumption parameters were those determined previously for the Hanford Site; they also are included in Appendix A. Parameters used for the ingestion pathway assumed that the receptor's entire diet was produced at the residence's location, which is the "local" food production option in CAP88-PC.

Radionuclide air concentrations at the receptor location were determined using site-specific meteorological data for each release point. Joint frequency distributions and CAP88-PC wind files were prepared from data collected at weather stations in each of the operating areas, and these represent the average of hourly data taken during 1999. This information was used to determine annual average dispersion coefficients in 1999 for each of the major release points (refer to Appendix A).

3.3 COMPLIANCE ASSESSMENT

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

For radionuclide air emissions from DOE facilities, the standard in 40 CFR 61, Subpart H, for a maximum dose to any member of the public is 10 mrem/yr EDE. During 1999, the combined dose to the MEI at Sagemoor attributable to routine and nonroutine radionuclide air emissions from all point sources on the Hanford Site was 0.029 mrem (2.9 E-04 mSv) EDE. As shown in Table 3-2, this dose resulted mainly from tritium.

Figure 3-1 displays the offsite MEI doses (in accordance with requirements in 40 CFR 61, Subpart H) attributable to radionuclide emissions from Hanford Site point sources since 1990, the first year this annual report was issued. Doses from 1990 through 1992 were modeled using CAP-88 (Clean Air Act Assessment Package-1988, which is the mainframe version of CAP88-PC) and an MEI location at Ringold. The doses from 1993 through 1999 were modeled using CAP88-PC and an MEI location at Sagemoor Road. CAP88-PC is the personal computer version of CAP-88, which relies on default parameters more than the mainframe version does.

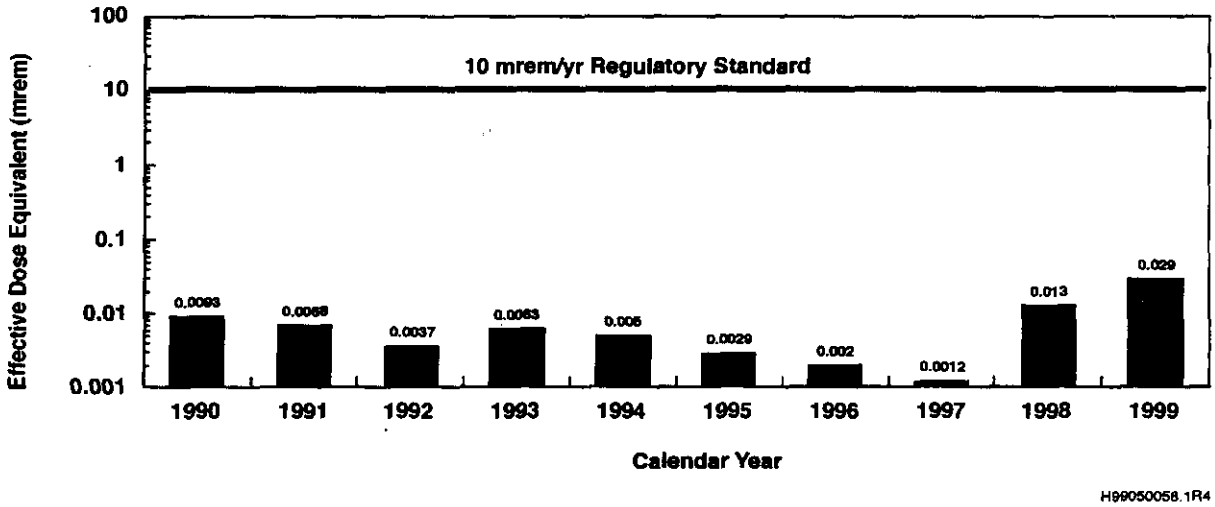


Figure 3-1. Historical Doses to the MEI Due to Point Source Emissions of Radionuclides from the Hanford Site.

3.3.2 Washington Administrative Code 246-247 Regulatory Standard

For Hanford Site radionuclide air emissions, Washington state has adopted the federal dose standard of 10 mrem/yr EDE. The state requires that the dose to the MEI also include those attributable to diffuse and fugitive emission and to nonroutine operations (refer to Section 3.5). The same MEI used in calculations of the point source dose (i.e., the Sagemoor resident) was used in calculations of the dose from diffuse and fugitive emissions. The dose from diffuse and fugitive emissions estimated at Sagemoor was 0.039 mrem (3.9 E-04 mSv) EDE. For 1999, the combined dose to a receptor at Sagemoor attributable to radionuclides emitted from all Hanford Site sources (i.e., point , diffuse, and fugitive) was 0.068 mrem (6.8 E-04 mSv) EDE.

Table 3-1. Hanford Site Radionuclide Air Emissions in 1999.

Radionuclide	Releases, Ci[a]					
	100 Areas	200 East Area	200 West Area	300 Area	400 Area	Total
^{3}H (as HT)	NM	NM	NM	40	NM	40
^{3}H (as HTO)	NM	NM	NM	150	1.4	151
^{60}Co	3.90 E-08	1.6 E-09	ND	ND	NM	3.90 E-08
^{90}Sr	1.90 E-05	9.60 E-05[b]	2.90 E-04[b]	1.01 E-05	NM	4.14 E-04
^{106}Ru	ND	ND	NM	ND	NM	ND
^{125}Sb	5.00 E-08	ND	NM	1.10 E-07	NM	1.60 E-07
^{129}I	NM	1.90 E-04	NM	NM	NM	1.90 E-04
^{134}Cs	ND	ND	ND	ND	NM	ND
^{137}Cs	4.50 E-05	3.90 E-05	2.50 E-09	4.23 E-07	1.90 E-06[c]	8.63 E-05
^{154}Eu	4.80 E-08	ND	ND	ND	ND	4.80 E-08
^{238}Pu	5.80 E-07	1.90 E-08	4.90 E-06	ND	NM	5.50 E-06
$^{239,240}Pu$	4.20 E-06	6.90 E-07[e]	2.10 E-04[e]	1.12 E-06	3.00 E-07[d]	2.16 E-04
^{241}Pu	5.10 E-05	1.20 E-06	1.20 E-04	7.90 E-08	NM	1.72 E-04
^{241}Am	2.40 E-06	5.60 E-07	4.50 E-05	1.40 E-07	NM	4.81 E-05
^{243}Am	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] This value includes total beta release data; total beta and unspecified beta data assumed to be ^{90}Sr in dose calculations.

[c] This value includes total beta release data; total beta data assumed to be ^{137}Cs from FFTF emissions in dose calculations.

[d] This value includes total alpha release data; total alpha and unspecified alpha data assumed to be $^{239,240}Pu$ in dose calculations.

[e] HT = tritium in the form of an incondensable gas; HTO = tritium in the form of condensable water vapor.

Table 3-2. CAP88-PC Effective Dose Equivalent Estimates for Maximally Exposed Individual at Sagemoor, Resulting from Hanford Site Radionuclide Air Emissions in 1999

Distances, directions, and effective dose equivalent (mrem) to offsite MEI, by radionuclide and operating area[a]						EDE (40 CFR 61, Subpart H), by radionuclide	
Radionuclide	100 Areas	200-E Area	200-W Area	300 Area	400 Area	EDE total (mrem)	Percent of EDE total
	41 km SE	28 km SE	35 km SE	1.5 km E	11 km SE		
^{3}H	0	0	0	2.8 E-02[b]	3.6 E-05	2.8 E-02	98.4
^{60}Co	8.7 E-10	5.1 E-11	0	0	0	9.2 E-10	0.0
^{90}Sr[c]	1.9 E-07	1.4 E-06	5.5 E-06	1.0 E-05	0	1.7 E-05	0.1
^{125}Sb	1.2 E-10	0	0	2.6 E-08	0	2.6 E-08	0.0
^{129}I	0	2.1 E-05	0	0	0	2.1 E-05	0.1
$^{137}Cs/Ba$	9.7 E-07	1.2 E-06	9.5 E-11	9.0 E-07	5.0 E-07[d]	3.6 E-06	0.0
^{154}Eu	8.5 E-10	0	0	0	0	8.5 E-10	0.0
^{238}Pu	3.6 E-07	1.6 E-08	4.9 E-06	0	0	5.3 E-06	0.0
^{239}Pu[e]	2.8 E-06	6.1 E-07	2.3 E-04	8.5 E-05	2.7 E-06	3.2 E-04	1.1
^{241}Pu	5.4 E-07	1.7 E-08	2.1 E-06	9.4 E-08	0	2.7 E-06	0.0
^{241}Am	2.5 E-06	7.5 E-07	7.4 E-05	1.6 E-05	0	9.4 E-05	0.3
Dose Totals	7.3 E-06	2.5 E-05	3.1 E-04	2.8 E-02	4.0 E-05	2.9 E-02	100

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

[b] The HT release was converted to equivalent curies of HTO for dose modeling purposes because the CAP88-PC models assume that tritium is in the oxidized form. For this assessment, 1 Ci of HT was assumed to be equivalent to 0.01 Ci of HTO (Brown et al. 1990).

[c] This value includes total beta release data. Total beta and unspecified beta results were assumed to be ^{90}Sr for dose calculations at all facilities other than FFTF.

[d] This value includes total beta release data, which were assumed to be ^{137}Cs for dose calculations from FFTF emissions.

[e] This value includes total alpha release data; those data as well as unspecified alpha results were assumed to be $^{239,240}Pu$ for dose calculations.

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 s/m^3. Combining these factors with annual average release rates yields predictions of average radionuclide air concentrations for the year. Annual average dispersion factors around the 100, 200, 300, and 400 Areas for 1999 are in Appendix A.

3.5 NONROUTINE RELEASES OF RADIONUCLIDES TO THE ATMOSPHERE

Nonroutine Release from 291-Z-1 Stack at Plutonium Finishing Plant

On March 3, 1999, a high-radiation alarm sounded at the 291-Z-1 stack. The concentration of alpha activity was conservatively estimated by the facility personnel to be 8.5 E-05 Ci of ^{239,240}Pu. This release was accounted for in routine record sampling and analysis, which was in Section 2, Table 2.1. The cause of the alarm was believed to be from fixed contamination on the inside of the stack that had flaked off. The cause of the flaking was very likely high winds, of up to 50 mph, that induced the 200-ft-high stack to sway slightly. No work in the facility, such as in gloveboxes, occurred during this period, eliminating that as a possible source for the transient elevation in release concentration that triggered the high-radiation alarm. The sample filter was collected and sent to WSCF for analysis. The event was reported to WDOH as a standard noncompliance in accordance with the WAC 246-247-080(5) as it pertains to "as low as reasonably achievable control technology" provisions.

3.6 ADDITIONAL INFORMATION

Construction Projects and Modifications Exempted from 40 CFR 61.96

No waivers or exemptions of the approval process under 40 CFR 61.96 were granted in 1999. In late 1992, the EPA determined that some of the emission units at the Hanford Site were out of compliance with the requirements specified in 40 CFR 61, Subpart H, which contains National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations for emissions of radionuclides from DOE facilities. As a consequence of these noncompliant emission units, a Federal Facilities Compliance Agreement (FFCA) for NESHAP regulations was made between RL and EPA Region 10. Until all milestones in the FFCA are complete, EPA approval is required for all construction or modification projects with the potential to increase radionuclide emissions.

Table 3-3. Doses from Major Point Sources at the Hanford Site in 1999.

Source identification (contractor)	Effective dose equivalent (mrem)[a]	Percent of dose total[b]
200 East Area		
291-A-1 (BHI)	2.2 E-05	<0.1%
296-B-1 (FH)	1.7 E-08	<0.1%
296-B-10 (FH)	2.7 E-06	<0.1%
296-A-25 (FH)	2.3 E-08	<0.1%
296-A-42 (FH)	1.1 E-09	<0.1%
296-B-28 (CHG)	5.4 E-10	<0.1%
296-C-5 (CHG)	6.2 E-09	<0.1%
296-C-6 (CHG)	5.4 E-10	<0.1%
296-P-16 (CHG)	3.5 E-08	<0.1%
296-P-33 (CHG)	1.1 E-10	<0.1%
296-P-34 (CHG)	2.4 E-10	<0.1%
200 West Area		
296-S-22 (CHG)	3.4 E-10	<0.1%
296-T-18 (CHG)	1.5 E-08	<0.1%
296-W-4 (FH)	5.3 E-08	<0.1%
291-Z-1 (FH)	2.7 E-04	0.96%
300 Area		
EP-324-01-S (FH)	4.5 E-05	0.16%
EP-325-01-S (PNNL)	2.8 E-02	>98%
EP-327-01-S (FH)	8.3 E-06	<0.1%
EP-331-01-V (PNNL)	2.7 E-05	<0.1%
340-NT-EX (FH)	1.9 E-07	<0.1%
EP-3720-01-S (PNNL)	1.4 E-07	<0.1%
Major point source totals	2.8 E-02	/99%

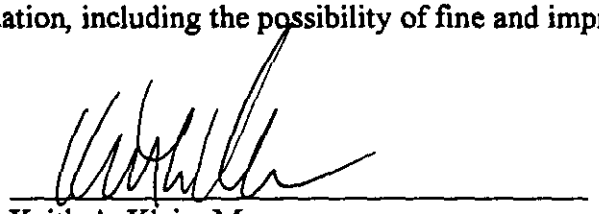
[a] 1 mrem = 1.0 E-02 mSv; doses and percentages in this table exclude those attributable to radon and thoron emissions.

b The small dose total from minor stacks accounts for the balance of 100% of doses attributable to all point-source emissions. Slight differences in totals are due mainly to the dose values having been rounded to two significant figures.

3.7 CERTIFICATION

This certification applies only to Sections 1.0, 2.0, and 3.0.

"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."



6/27/00

Keith A. Klein, Manager
U.S. Department of Energy,
Richland Operations Office

Date

This page intentionally left blank.

4.0 DIFFUSE AND FUGITIVE SOURCES OF EMISSIONS

Diffuse and fugitive sources include all radioactive emission sources that are not actively ventilated or are not routinely sampled (e.g., passively ventilated tank vents, vented containers, outdoor surface contamination areas, cracks between cover blocks, etc.). All diffuse and fugitive emission sources are monitored by the Hanford Site diffuse and fugitive emissions monitoring program, as described in Section 4.1. There are numerous types of these sources in and around the facilities, as described in Section 4.3.

WAC 246-247 requires facilities to monitor nonpoint (i.e., diffuse) and fugitive emissions of radioactive material. DOE Headquarters (DOE-HQ) has requested that estimated doses to the public, related to radioactive emissions from both point sources along with diffuse and fugitive sources, be included in this report. This request is based on the requirement in 40 CFR 61, Subpart H, that the dose from all potential emission sources at DOE facilities not exceed 10 mrem/yr EDE to any member of the public. This section describes the diffuse and fugitive emissions monitoring program and gives the EDE estimate to the public, attributable to diffuse and fugitive sources.

Currently, all nuclear material production facilities at the Hanford Site have been shut down or are in a standby mode. Only waste minimization and stabilization processes continue. In the past, when the Hanford Site was operating at or near full capacity, point source emissions were easily detected. Now, however, emissions from point sources have diminished in most instances to background levels. Therefore, the environmental contribution from diffuse and fugitive emissions has become a larger percentage of the total radioactivity attributable to activities at the Hanford Site, even though diffuse and fugitive emissions have remained relatively small and constant.

The standard approach for assessing offsite doses from forced ventilation exhaust points is by applying atmospheric transport models to measured releases. Assessing offsite doses from diffuse and fugitive emissions, however, is not as straightforward. It is complicated by the difficulties involved in quantifying the emissions from the source term. Methods for quantifying diffuse and fugitive emissions are still being developed, with factors such as these continuing to complicate the effort: 1) difficulty in accurately quantifying air flow from the source, 2) greater complexity in the influences from meteorological conditions, and 3) exceedingly low detection levels. Passively ventilated emissions are considered diffuse in nature because they lack a measurable flow.

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 ambient temperature and pressure changes. 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, whereas actively ventilated stacks and vents are. As an alternative to routine record sampling, estimates of radionuclides discharged as diffuse and fugitive emissions sources are made based on data collected from a comprehensive network of ambient air samplers. Dose estimates are then calculated using these data. Section 4.2 contains the dose and release estimates for Hanford Site diffuse and fugitive emissions in 1999.

For this report, doses have been calculated for emissions from both actively ventilated point sources and diffuse and fugitive sources. The methods used for calculating diffuse and fugitive emissions are still being refined. Dose calculations for each type of emission are presented separately. As methods for estimating the dose from diffuse and fugitive emissions are further developed, more precise values that account for radionuclides from natural sources, nuclear-testing fallout, and non-DOE nuclear facilities might be subtracted from measured ambient air concentrations. The older 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 Environmental Surveillance Program. Apart from the effects these events (i.e., atmospheric nuclear testing and the Chernobyl disaster) clearly had in elevating regional concentrations, the ambient air concentrations from sample locations at the Hanford Site perimeter are seen to differ little from the concentrations measured at distant locations.

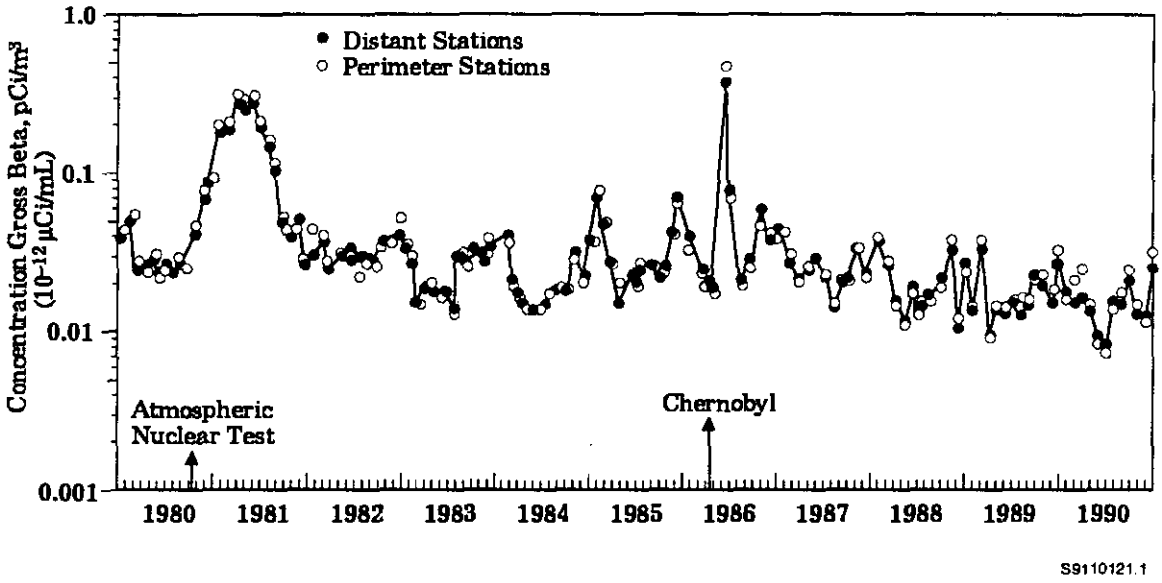


Figure 4-1. Historical Impact on Gross Beta Radioactivity in Hanford Site Ambient Air Samples, 1979 through 1990 (PNL-7346).

4.1 DIFFUSE AND FUGITIVE EMISSIONS MONITORING

At the Hanford Site, two programs, the Near-Facility Environmental Monitoring Program and the Environmental Surveillance Program, monitor diffuse and fugitive emissions. These two programs monitor locations on and off the Hanford Site. They are designed to detect and quantify both the amount of radiological and nonradiological contaminants released to the environment that might reach humans via all pathways. They also quantify the environmental and health significance of these contaminants. Monitoring program information is presented here on diffuse and fugitive emissions of radionuclides that enter atmospheric pathways.

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, surface water, external radiation doses, vadose zone, soil, sediment, 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. Atmospheric transport is the most efficient offsite transport vector, and, thus, ambient air is the principle medium monitored in the near-facility region, although other media samples might also be useful as secondary indicators.

In 1999, airborne radioactivity was sampled by a network of continuously operating samplers at 86 locations near facilities, as shown in the following list:

Number of Samplers	Location
4	100-N Area
8	100-K Area
11	100-D/DR Area
5	100-B/C Area
2	100-F Area
4	100-H Area
42	200 Areas
3	Environmental Restoration Disposal Facility
5	300-FF-1 Project (north of 300 Area)
1	300 Area Treated Effluent Disposal Facility
1	Wye Barricade

The station at the Wye Barricade is collocated with samplers operated by the PNNL Surface Environmental Surveillance Project and WDOH. 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 total alpha activity, total beta activity, gamma-emitting isotopes, ^{90}Sr, uranium isotopes (^{234}U, ^{235}U, and ^{238}U), plutonium isotopes (^{238}Pu and $^{239,240}Pu$). Gamma-emitting isotopes routinely reported include ^{60}Co, ^{65}Zn, ^{95}Zr, ^{106}Ru, ^{125}Sb, ^{134}Cs, ^{137}Cs, ^{154}Eu, ^{155}Eu, and any other detected isotopes. The 100-K Area air samples are also analyzed for ^{241}Am and ^{241}Pu. Figure 4-2 depicts the locations of the ambient air samplers used for near-facility monitoring. More detailed descriptions of these monitoring programs can be found in the *Hanford Site Environmental Report* (PNNL-13230) and the *Hanford Site Near-Facility Environmental Monitoring Data Report* (PNNL-13230 APP. 2).

4.1.2 Environmental Surveillance

Environmental surveillance encompasses sampling and analyzing for potential radiological contaminants on and off the Hanford Site. Monitoring locations are divided among four surveillance zones or areas on and off the Hanford Site.

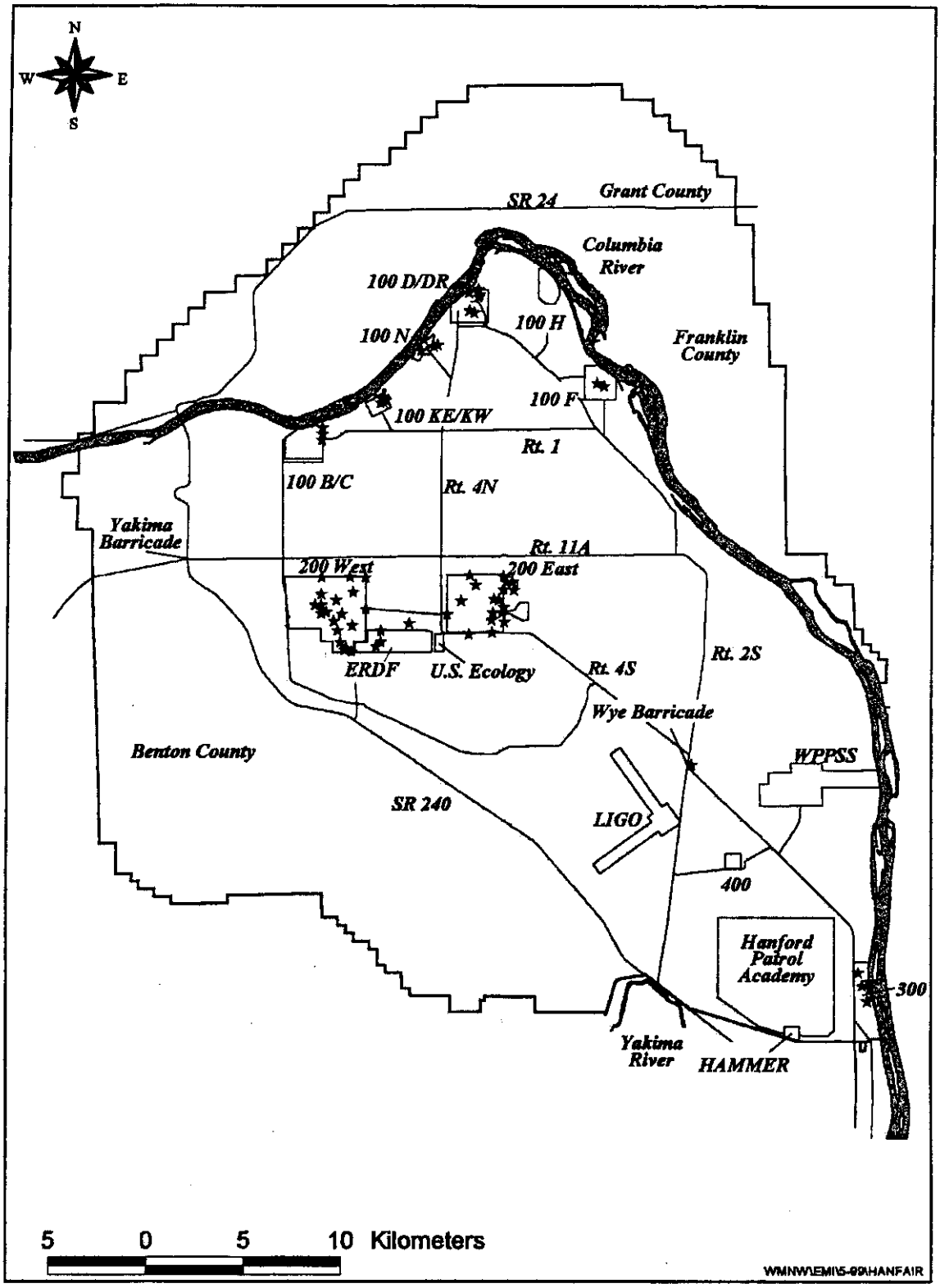


Figure 4-2. Near-Facility Ambient Air Sampling Locations.

The first surveillance area extends from the near-facility monitoring locations to the Hanford Site perimeter. The second area consists of a series of perimeter sampling stations near or just inside the Hanford Site boundary and along State Highway 240. The third consists of nearby community sampling locations within a 50-mi (80-km) radius of the Hanford Site. And the fourth surveillance area (i.e., background locations) is performed at distant community locations unaffected by Hanford Site 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 diffuse and fugitive emissions.

The air surveillance network consists of 44 sampling stations, of which 23 are onsite, 11 at the Hanford Site perimeter, 8 in nearby communities, and 2 in distant communities (considered as background locations). 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. 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 required to be reported are ^{7}Be, ^{40}K, ^{60}Co, ^{106}Ru, ^{125}Sb, ^{134}Cs, ^{137}Cs, ^{154}Eu, and ^{155}Eu. Figure 4-3 depicts the locations of the ambient air samplers for the Surface Environmental Surveillance Project. A more detailed description of this program can be found in the *Hanford Site Environmental Report* (PNNL-13230).

4.2 ESTIMATED DOSES FROM DIFFUSE AND FUGITIVE EMISSIONS

The potential dose to an offsite individual and the potential releases from diffuse and fugitive sources were estimated using ambient air monitoring data from environmental surveillance air sampling locations along the Hanford Site perimeter. Data from 13 perimeter and nearby community locations (refer to Figure 4-3) were used to perform the assessment of the 1999 emissions (PNNL-13230 and PNNL-13230 APP. 2).

4.2.1 Description of Dose Assessment Method

Diffuse and fugitive emission sources are estimated from environmental surveillance ambient air monitoring data collected at the Hanford Site perimeter. This method is preferred for two reasons: 1) these data most accurately represent the actual exposures of an offsite individual to airborne radioactivity and 2) there is currently insufficient information concerning the extent and characteristics of soil contamination onsite to use particle resuspension estimates in conjunction with estimating emissions from other sources of diffuse and fugitive emissions. The ambient air sampling results consisted of measured air concentrations for radionuclides that could be released from Hanford Site operations and diffuse and fugitive sources. Radionuclides sampled and analyzed for include ^{3}H, ^{60}Co, ^{90}Sr, ^{106}Ru, ^{125}Sb, ^{129}I, ^{134}Cs, ^{137}Cs, ^{154}Eu, ^{155}Eu, ^{234}U, ^{235}U, ^{238}U, ^{238}Pu, and $^{239,240}Pu$.

Radionuclide air concentrations resulting from stack emissions during 1999 were calculated for each of the 13 selected sample locations using the CAP88-PC atmospheric dispersion modeling code. The combined contributions to airborne radionuclide concentrations attributable to the stack emissions from all operating areas were subtracted from the ambient air sampling

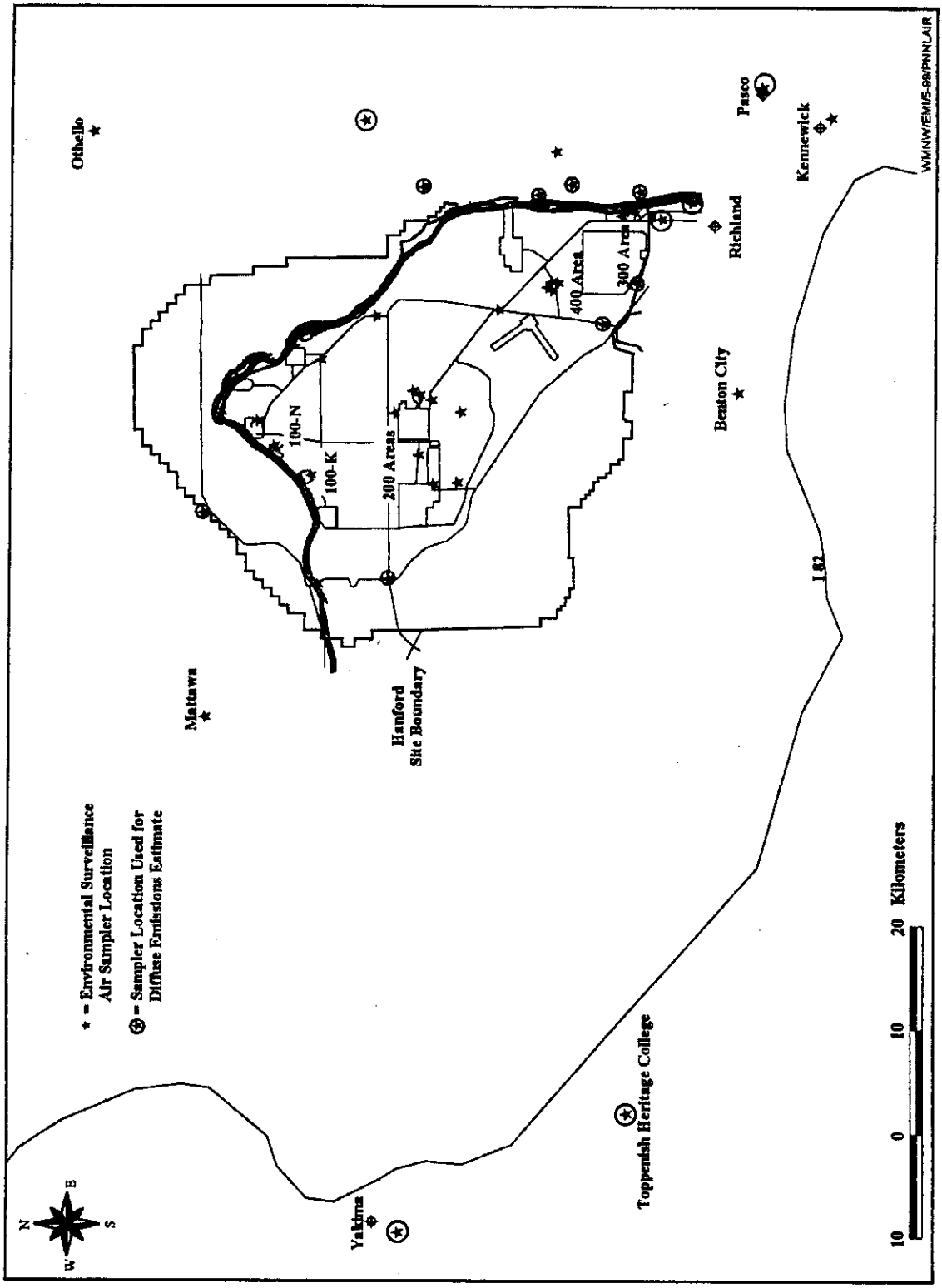


Figure 4-3 Environmental Surveillance Ambient Air Sampling Locations.

results. Averaged regional background concentrations for each radionuclide were calculated from the air sample results obtained from distant community sampling stations in Toppenish and Yakima. The average background concentration at these stations was also subtracted from the ambient monitoring results at perimeter stations, leaving the radionuclide concentrations attributable to diffuse and fugitive emissions. The only radionuclide concentrations attributable to emissions from non-DOE nuclear sites that have been subtracted were the concentrations attributable to ATG waste management facilities and to WNP-2, because the release data for these facilities were available at the time this report was prepared. As a result, the actual diffuse and fugitive emissions from the Hanford Site are possibly somewhat lower than the estimates presented in this report, since these estimates might contain contributions from other non-DOE nuclear sites.

Releases from diffuse and fugitive sources were estimated using the average air concentrations, attributable to diffuse and fugitive emissions, and by performing a back-calculation using CAP88-PC. The 200 West Area was assumed to be the source of all diffuse and fugitive emissions, resulting in the highest release estimates.

The estimated diffuse and fugitive emissions were used to calculate doses at selected Hanford Site perimeter locations with the CAP88-PC code. All diffuse and fugitive emissions were modeled as though they were from the 200 West Area.

4.2.2 Results of Dose Assessment

During 1999, the annual average ambient air concentrations at perimeter sampling stations were found to be numerically greater than the combined contributions from stack releases and background for several analytes, including ^{60}Co, ^{90}Sr, ^{125}Sb, ^{129}I, ^{137}Cs, ^{155}Eu, ^{234}U, ^{235}U and ^{238}U. Except for ^{129}I, these perimeter concentrations were not statistically different from those measured at the distant community stations (background locations), which are unaffected by Hanford Site effluents (PNNL-13230 and PNNL-13230 APP. 2).

Concentrations of other radionuclides might have been greater than those caused by stack releases and background radioactivity at individual monitoring stations. However, the estimated releases, based on the corrected average air concentrations for those nuclides at all sampling stations, were less than zero.

Releases from diffuse and fugitive sources were estimated from the corrected air concentrations by performing a back-calculation using CAP88-PC. The 200 West Area was assumed to be the source of diffuse and fugitive emissions for all radionuclides, which results in the highest release estimate. The diffuse and fugitive source releases reported in Table 4-1 represent the mean of the release estimates for each of the selected perimeter locations at which a particular radionuclide was sampled. Note that not all radionuclides were evaluated at every sampling station; the estimated releases for any particular radionuclide are based on those stations where samples were analyzed for that radionuclide.

In accordance with previous guidance from DOE-HQ, the average release estimates for diffuse and fugitive sources were calculated using air concentrations that were both positive and negative with respect to the regional background and stack emission estimates. Where the resulting mean release estimate reported in Table 4-1 for an individual radionuclide is less than zero, the average of the monitored air concentrations at the perimeter stations was numerically smaller than the combined concentrations expected as a result of stack emissions and regional background. In

such cases, it is unlikely that diffuse and fugitive sources contributed significantly to the offsite measured air concentrations for those radionuclides.

The estimated diffuse or fugitive releases for the sampled radionuclides were also used to calculate the dose at the perimeter sampling stations. An individual at the Horn Rapids sampling station had the highest estimated dose. The Byers' Landing station was closest in distance to the Sagemoor MEI, which is the location of the MEI for monitored point sources at the Hanford Site. Table 4-1 shows the hypothetical mean doses to individuals at these two locations during 1999 were 0.048 mrem (4.8 E-4 mSv) and 0.039 mrem (3.9 E-4 mSv), respectively. The doses for the other sampling stations are not shown in Table 4-1, but were lower than those at the Horn Rapids location.

Where the release estimate for a particular radionuclide was numerically less than zero, the dose estimate for that nuclide was set equal to zero before combining the contributions of all radionuclides to obtain the total dose at each location. Although the estimated dose from diffuse and fugitive sources at the Sagemoor location is somewhat higher than the dose from point sources, the combined dose from point sources and diffuse and fugitive sources during 1999 was substantially below the federal and state 10 mrem/yr standard.

In addition to the sitewide diffuse and fugitive emissions estimates, diffuse and fugitive tritium emissions from two sources during 1999 were estimated to determine their potential contribution to the public radiological dose. Tritium emissions from the 100-K Basins and 200-E Area in a dose of 8.8 E-6 mrem (8.8 E-8 mSv) and 3.8 E-5 mrem (3.8 E-7 mSv), respectively, to the Sagemoor MEI. 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 obtain an estimate of the uncertainty in the diffuse and fugitive emissions dose estimates, the reported 1999 air concentrations at the Byers' Landing sampling station and at the distant community stations were used to estimate the mean and 95% confidence intervals for each location. This analysis employed the uncorrected air concentrations at the reference locations, including contributions from monitored point source releases at DOE facilities, diffuse and fugitive sources, sources other than DOE facilities, and regional background. The Byers' Landing station was selected for this analysis because it is closest to the location of the Hanford Site MEI, and also was the only perimeter station at which all radionuclides were evaluated.

The 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 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 1.0 E-1 mrem (1.0 E-3 mSv) for artificially produced radionuclides sampled at that location, with a 95% confidence interval of 5.6 E-2 to 1.5 E-1 mrem (5.6 E-4 to 1.5 E-3 mSv). The corresponding result for the distant community monitoring stations was 5.7 E-2 mrem (5.7 E-4 mSv) with 95% confidence limits of 2.5 E-2 to 9.3 E-2 mrem (2.5 E-4 to 9.3 E-4 mSv). The mean dose estimates and the upper 95%

confidence limits were slightly higher at the site perimeter than at the distant community stations. The estimated dose at perimeter stations was largely a result of background radioactive materials (naturally occurring radionuclides and fallout). The estimated diffuse and fugitive source component was a relatively small fraction of the total offsite dose; therefore, the 95% confidence interval for the dose from diffuse and fugitive sources would be expected to be less than, or equal to, the overall dose at these locations.

4.2.4 Discussion

It should be noted that the release estimates for diffuse and fugitive sources in Table 4-1 were obtained using CAP88-PC, which incorporates a continuous-release Gaussian-plume dispersion model. Releases from diffuse and 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 resuspension of contaminated soil, and to some extent for emissions from sources such as evaporation ponds, which are a function of wind speed. 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 in 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 these 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 diffuse and 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 DIFFUSE AND FUGITIVE EMISSION SOURCES

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

Almost all point, diffuse, and fugitive sources of radionuclide emissions are located in the five operational areas or are modeled for those areas because of close proximity. Point source emissions are measured directly or calculated from process knowledge. Emissions from diffuse and 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. 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 diffuse and fugitive sources, in addition to known point source stacks.

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 diffuse and fugitive sources.

Table 4-1. Estimated the Hanford Site Diffuse and Fugitive Emissions in 1999 and Resulting Effective Dose Equivalents[a]

Location ▶		Byers' Landing (closest to MEI Location)	Ringold (highest dose from emissions)
Radionuclide	**Estimated diffuse and fugitive emissions release from 200 Areas (Ci)[b]**	**Estimated dose at location (mrem)[c]**	**Estimated dose at location (mrem)[c]**
^{3}H	-5.2 E+00	—	—
^{60}Co	1.8 E-01	1.3 E-02	1.6 E-02
^{90}Sr	2.3 E-02	7.7 E-04	9.5 E-04
^{106}Ru	-8.2 E-01	—	—
^{125}Sb	-4.7 E-01	—	—
^{129}I	3.6 E-02	1.4 E-03	1.9 E-03
^{134}Cs	-4.7 E-01	—	—
^{137}Cs	-1.0 E-01	—	—
^{154}Eu	-2.7 E-01	—	—
^{155}Eu	2.3 E-01	5.4 E-04	6.6 E-04
^{234}U	1.6 E-02	1.4 E-02	1.7 E-02
^{235}U	4.4 E-04	3.7 E-04	4.5 E-04
^{238}U	1.1 E-02	8.9 E-03	1.1 E-02
^{238}Pu	-1.5 E-04	—	—
$^{239,240}Pu$	-6.8 E-04	—	—
Total		**3.9 E-02**	**4.8 E-02**

[a] Hanford Site stack emissions, background radioactivity, and emissions from WNP-2, ATG, and Siemens have been subtracted from these diffuse and fugitive emissions estimates, which may contain releases from other non-DOE nuclear facilities. Negative values for releases of a particular 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] 1 Ci = 3.7 E+10 Bq; Emissions from diffuse and 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.

[c] 1 mrem = 1.0 E02 mSv; Dose is based on air monitoring results for sample stations at the site perimeter. Radionuclides with negative releases are assumed to have a zero dose.

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 operating areas to offsite regions (PNNL-13230).

The first area begins near the operating facilities and ends at the Hanford Site perimeter. Diffuse and 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 diffuse and fugitive sources at the Hanford Site.

The third surveillance area encompasses nearby and distant communities within an 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 that 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 5400.1, and 4) the DOE *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE/EH-0173T). The surveillance program (PNNL-13230) 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 background of information for planning and data interpretation.

4.3.1 Description of Diffuse and Fugitive Emission Sources

The presently identified actual or potential sources of diffuse and fugitive radionuclide emissions to the environment at the Hanford Site are described in this section. Among the sources that could contribute diffuse and fugitive radionuclide 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. Operating facilities or facilities on standby or that are inactive also could contribute diffuse and fugitive emissions. Deactivation, decontamination, and decommissioning of facilities and cleanup of inactive waste sites could also contribute diffuse and fugitive emissions. Table 4-2 shows the numbers of and

types of waste sites. Table 4-3 lists the types of diffuse and fugitive emission sources. Each site or facility usually has one or more unique features or characteristics that could contribute to the release of diffuse and fugitive emissions. Features could include passive vents, risers, equipment and personnel access doors, and exhausters. Characteristics could include an undetected leak, unburied waste, or an absence of intrusion barriers. Rates of diffuse and fugitive emissions could

Table 4-2. Types of Waste and Number of Waste Sites at the Hanford Site.

Types of waste	Number of waste sites
Nonhazardous	613
Hazardous	263
Radioactive	259
Mixed	1,102
Total	2,273

Table 4-3. Types of Diffuse and Fugitive Emission Sources.

Categories of sources	Active	Inactive
Single-shell tanks (passively ventilated)*	0	145
Cribs	1	127
Trenches, ponds, ditches, and retention basins	0	153
Reverse wells	0	12
French drains	3	48
Unplanned release sites	0	385
Vented containers	12	0
Burial grounds	7	98
Total	23	968

* Excludes saltwell pumping exhausters and tanks connected by cascade lines.

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.

The general types of sites and facilities and their potential primary sources of diffuse and 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. These engineered structures promote downward flow of liquids disposed in the cribs but also provide pathways to the surface and atmosphere. Secondary causes of diffuse and fugitive emissions include erosion, and uptake and intrusion by biota, followed by wind-caused particle resuspension.

4.3.1.2 Pond

Ponds were used to manage large quantities of water (i.e., cooling water and chemical sewer wastewater) associated with chemical reprocessing operations. Normally, these liquid effluents were uncontaminated. The ponds allowed percolation of the liquid effluent into the soil column. Diffuse and fugitive emissions from ponds occur primarily from wind-caused particle resuspension .

4.3.1.3 Ditch

A ditch is an open, unlined excavation used for disposing of liquid effluents or transporting liquid effluents to ponds for disposal. Diffuse and fugitive emissions from ditches occur primarily from wind-caused particle resuspension.

4.3.1.4 Trench

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

4.3.1.5 Retention Basin

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

4.3.1.6 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 diffuse and fugitive emissions.

4.3.1.7 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 diffuse and fugitive emissions.

4.3.1.8 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 disposed of potentially contaminated liquid waste by promoting percolation into the soil. The natural filtration properties of the soil removed radioactive material from effluent water. Diffuse and fugitive emissions from French drains and reverse wells might occur through erosion or uptake and intrusion by biota, followed by wind-caused particle resuspension.

4.3.1.9 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 diffuse and 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.

4.3.1.10 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. Diffuse and fugitive emissions occur at burial grounds through direct release to the atmosphere before the waste is buried, followed by erosion, uptake and intrusion by biota, and wind-caused particle resuspension.

4.3.1.11 Deactivation, Decontamination and Decommissioning Activities

Deactivation, decontamination and decommissioning activities are being 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. This allows surveillance and maintenance programs to more cost effectively prevent unacceptable risk to the public or the environmental until the ultimate disposition of each facility is decided and implemented.

Decontamination consists of either physically removing contaminants or fixing contaminants in place 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. To date, no significant increases in contamination at demolition sites have been observed.

4.3.1.12 Waste Site Cleanup Activities

Cleanup activities are being conducted to minimize the potential release or spread of contamination from inactive waste sites. Contaminated soils and structures are being excavated

and transported to the ERDF for disposal. Contaminated materials are exposed to the atmosphere during excavation and disposal activities. Proper planning and controls such as tarps, 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.

4.3.1.13 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 magnitude, in acres, of outdoor surface contamination varies. The magnitude is not fixed because there of the continuing effort 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. Eighty percent of all surface contamination are estimated to have dose rates of less than 1 mrem/hr.

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 4-4. Diffuse and fugitive emissions from areas of soil contamination are caused primarily by erosion, uptake, and intrusion by biota, followed by wind-caused particle resuspension.

Table 4-4. Hanford Site Soil and Underground Contamination Areas for 1999.

Hanford Site operating area	Soil contamination areas,[a] acres (hectares)	Underground radioactive material areas,[b] acres (hectares)
100 Areas	111 (44)	398 (161)
200 Areas[c]	232 (94)	895 (362)
300 Area (north)	47 (19)	32 (13)
600 Area[d]	8,599 (3,480)	136 (55)
Total	**9,859 (3,637)**	**1,461 (591)**

[a] Includes areas posted as Soil Contamination Areas or as Radiological Controlled Areas and areas that have both underground and soil contamination.
[b] Includes areas with only underground contamination. Does not include areas that had surface and underground radioactive material.
[c] Includes Tank Farms
[d] BC controlled-zone and waste disposal facilities outside the 200 East Area boundary that received waste from 200 East Area facilities (e.g., 216-A-25, 216-B-3-3, etc.), and waste disposal facilities outside the 200 West Area boundary that received waste from the 200 West Area facilities (e.g., 216-S-19, 216-U-11, etc.).

4.3.1.14 Structures with Radioactive Contamination

Structures having indoor contamination and not actively ventilated through a point source are sources for diffuse and fugitive emissions. Many structures control diffuse and fugitive emissions with ventilation systems and contamination control practices. Ventilation systems help maintain a negative indoor air pressure, preventing airborne contaminants from leaving the building. The 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 that have routinely sampled actively ventilated and filtered point sources are not considered a source of diffuse and 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.

4.3.2 Description of Specific Diffuse and Fugitive Emission Sources

This section contains brief descriptions of the identified sources of diffuse and 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, and 100-H 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 place them in ISS pending final disposition. The potential sources for diffuse and fugitive emissions included personnel and equipment passing through access doors during surveillance and maintenance and from inactive exhaust vents and risers, and from ISS activities.

A special case is the N Springs (i.e., a stretch of Columbia River shoreline below the retired 1301-N Crib), from which discharges of low-level contamination (primarily ^{90}Sr) enter the Columbia River. These springs are perhaps more closely monitored than any comparable component of the ecosystem at the Hanford Site. Other means of diffuse and 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 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 100-KE and 105-KW reactor systems underwent decontaminating and decommissioning (D&D) after having been shut down. Most of the fuel was sent to 200 East Area for processing. After the initial D&D was completed, the fuel storage basins within the 105-KE and 105-KW Buildings were modified to store N Reactor irradiated fuel. Storing this fuel began in 1975 at

105-KE and in 1981 at 105-KW; fuel is still stored in both basins. Shipments of fuel to the basins from 100-N Area ceased in 1989.

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

4.3.2.3 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 diffuse and fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.4 Uranium-Oxide 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 sealed in steel drums for shipment offsite.

Uranium was formerly the potential primary source of radioactive diffuse and fugitive emissions from the UO_3 Plant. Since the UO_3 Plant was deactivated, only trace amounts of UO_3 remain, all of which is sealed inside of equipment. Deactivation of the UO_3 Plant has significantly reduced the potential diffuse and fugitive emissions from the facility. The noble gases radon and thoron remain as the only source of diffuse and fugitive emissions, due to residual contamination sealed inside the UO_3 Plant equipment. Potential diffuse and fugitive emission release points include access doors, all of which are restricted and controlled.

4.3.2.5 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 safeguarding of the existing stock as well as clean-up activities.

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

4.3.2.5.1 234-5Z Building

The 234-5Z Building is often referred to as PFP 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 plutonium processing lines (Remote Mechanical A and Remote Mechanical C

Lines) and their control rooms, 2) scrap stabilization 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 diffuse and fugitive release points include access doors, passively ventilated waste drain line vents, and the inlet-exhaust ventilation system.

4.3.2.5.2 236-Z Building

The 236-Z Building, or the Plutonium Reclamation Facility (PRF), 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 diffuse and fugitive release points include access doors and the inlet-exhaust ventilation system.

4.3.2.5.3 232-Z Building

The 232-Z Building houses the layaway commonly called the Incinerator, which was partially decontaminated and decommissioned in 1984, with additional decontamination activities performed in 1995.

Radionuclides primarily associated with the 232-Z Building include ^{239,240}Pu and ^{241}Am. Potential diffuse and fugitive emission release points include access doors and inlet-exhaust ventilation systems.

4.3.2.5.4 241-Z and 242-Z Buildings

The 241-Z Building houses sumps, which are five separate enclosures or ventilated cells, each containing six tanks (five active and one inactive) used to accumulate and treat the liquid wastes generated by PFP before being transferred to the DST System. The 241-Z Building is ventilated by the 296-Z-3 stack.

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 241-Z and 242-Z Buildings include ^{239,240}Pu and ^{241}Am. Potential diffuse and fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.5.5 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.

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

4.3.2.5.6 216-Z-20 Crib Effluent Facility

The 216-Z-20 Crib Effluent Facility (216-Z-20 Crib) was constructed and commissioned for use in September 1981 to dispose of waste water previously discharged to the 216-U-10 Pond through the 216-Z-19 Ditch. Use of the crib allowed the radioactively contaminated 216-Z-19 Ditch and 216-U-10 Pond to be decommissioned.

The inactive 216-Z-20 Crib is approximately 1,500 ft (460 m) long with a cross section at the bottom that is approximately 10 ft (3 m) wide. Gravel was used as backfill to distribute effluents throughout the crib. A vapor barrier was placed above the gravel backfill. Soil was placed over the top to bring the area back to the surrounding grade.

Radionuclides primarily associated with the 216-Z-20 Crib include ^{239,240}Pu and ^{241}Am. Diffuse and fugitive emissions could be released by way of vents, risers, erosion, biotic uptake and intrusion, and wind-caused resuspension.

4.3.2.6 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 for radioactive decontamination of equipment and the processing of 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 Facilities; the 214-T Storage Building; storage modules; and outdoor treatment and storage pads. Ancillary buildings, structures, and areas are the 271-T, 291-T and 221-TA Buildings, and the 211-T Area.

Decontamination processes are conducted in the 221-T Building and 2706-T Facility. The 221-T Building Head-End is used for waste processing activities. The 214-T Building stores chemicals and the 211-T Waste Storage Area consists of a pad that can store radioactive and nonradioactive waste. The 271-T Building provides office space to staff supporting T Plant operations. The 291-T Building houses the exhaust ventilation fans for the 291-T-1 main stack.

Radioactive decontamination activities are performed on the canyon deck. The canyon area consists of 37 cells and one railroad tunnel door. The railroad tunnel (used for transporting equipment into and out of the canyon, as well as for some decontamination) 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 diffuse and fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.6.1 2706-T Facility

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

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

4.3.2.6.2 221-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 diffuse and fugitive emission release points include access doors and inlet-exhaust ventilation system.

4.3.2.6.3 221-T Building — Pressurized-Water Reactor Fuel Assembly Storage

Canyon cell 2R has been modified to store approximately 76 pressurized-water reactor Core 2 blanket fuel assemblies that were used to power the Shippingport Reactor. Provisions have been made to store the assemblies at the Hanford Site for up to 20 years.

The 221-T Building galleries are maintained at atmospheric pressure, while the 221-T Building canyon area is maintained at a negative pressure with respect to atmosphere. 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. In addition, the canyon ventilation system is operated at negative pressures with respect to the other systems.

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 diffuse and fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.7 224-T TRUSAF Building

The 224-T TRUSAF Building was originally used to purify plutonium nitrate by the lanthanum fluoride process. After phase-out of the bismuth phosphate plants, the lanthanum fluoride process was no longer needed and the facility remained inactive until the early 1970s. At that time, the building was modified for storage of plutonium scrap in liquid and solid forms. In 1984, the mission of the building changed to housing the TRU waste storage and assay (TRUSAF) operation, in which TRU waste containers were nondestructively tested and stored for eventual

shipment to the Waste Isolation Pilot Plant (WIPP). All stored TRU wastes were removed by September 1998, and nondestructive examination and nondestructive assay operations terminated. Currently, no waste is stored and no waste operations are performed at the 224-T TRUSAF Building.

Radionuclides primarily associated with 224-T include ^{90}Sr, ^{137}Cs, and $^{239,240}Pu$. Potential diffuse and fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.8 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. Chemicals are no longer stored there either.

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 diffuse and fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.9 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 diffuse and fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.10 222-S Laboratory Complex

The 222-S Laboratory Complex is located in 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.

4.3.2.10.1 222-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, 11 environmental hot cells, 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 and ^{137}Cs. Potential diffuse and fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.10.2 222-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 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 diffuse and fugitive emissions.

4.3.2.10.3 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. There are no radioactive diffuse fugitive emissions from the 2716-S Storage Building.

4.3.2.10.4 207-SL Retention Basin

The 207-SL Retention Basin acts as a temporary holding facility for potentially radioactive or hazardous liquid effluents before they are transferred by means of a cross-site pipeline to the Treated Effluent Disposal Facility, located in the 200 East Area. The basin is a covered, below-grade concrete structure, directly east 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 diffuse fugitive release points include access doors and seams in the basin cover blocks.

4.3.2.10.5 219-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 diffuse and 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 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.

Radionuclides primarily associated with the 219-S Waste Handling Facility include ^{90}Sr and ^{137}Cs. Potential diffuse fugitive release points include access doors and seams in the vault cover blocks.

4.3.2.10.6 222-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 by the 222-SE Filter Building.

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

4.3.2.10.7 222-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 Filter Building. A total of four stages of HEPA filtration are provided for the hot cell ventilation exhaust.

Radionuclides primarily associated with the 222-SC Filter Building include ^{90}Sr and ^{137}Cs. Potential diffuse and fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.10.8 222-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 and ^{137}Cs. Potential diffuse and fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.10.9 218-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 dry-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 diffuse and fugitive emissions.

4.3.2.10.10 216-S-26 Crib

The 216-S-26 Crib is no longer in service and the pipeline to the crib has been sealed off. All waste water collected in the 207-SL Retention Basins is now discharged to the Treated Effluent Disposal Facility, located in the 200 East Area. Additionally, the 222-SA waste water has been

rerouted from the crib to the 207-SL Retention Basins. The line from the 291-S Stack Fan House, which formerly discharged steam condensate to the crib, has been isolated.

Radionuclides historically discharged to the 216-S-26 Crib include ^{90}Sr, ^{137}Cs, and $^{239,240}Pu$. Diffuse and fugitive emissions may be released by way of vents, risers, erosion, biotic uptake and intrusion, and wind-caused resuspension.

4.3.2.11 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 the 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 ^{90}Sr and ^{137}Cs; low-level waste is present also. Potential diffuse and fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.12 Central Waste Complex

CWC is a group of structures located on the west side of 200 West Area exclusion zone. 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 diffuse and fugitive emission release points include access doors and the inlet-exhaust ventilation system. The CWC consists of the following: Flammable and Alkali Metal Waste Storage Modules; Waste Storage Buildings; Waste Storage Pad; and Waste Receiving and Staging Area.

4.3.2.12.1 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 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.

4.3.2.12.2 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.

4.3.2.12.3 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.

4.3.2.12.4 2304-WA through 2304-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.

4.3.2.12.5 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.

4.3.2.12.6 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.

4.3.2.13 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 East Area waste generators to the DSTs, between the DSTs, and from the DSTs to treatment and storage units in the 200 East and 200 West Areas.

Radionuclides primarily associated with the Tank Farms include ^{3}H, ^{14}C, ^{90}Sr, ^{125}Sb, ^{129}I, ^{137}Cs, $^{239,240}Pu$, and ^{241}Am. Diffuse and fugitive emission release locations may include vents, risers, access hole covers, inlet-exhaust ventilation systems, diversion boxes, transfer lines, and storage vaults.

4.3.2.13.1 *Double-Shell Waste Tanks*

The DSTs are of two distinctly different types. The capacity of the first type is 1 to 1.2 million gal (3.79 to 4.54 million L), and is designed for long-term storage (up to 50 years) of high-activity mixed waste. Twenty-four 1.2-million-gal (4.5-million-L) non-aging waste DSTs and four 1.0-million-gal (3.8-million-L) aging-waste DSTs have been built. For efficiency during construction and operation, the 1-million-gal 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.

All DSTs were fabricated as three concentric tanks. Waste is stored in the free-standing primary tank. The secondary tank sits on a concrete pad. The completely enclosed annulus serves as a containment barrier if the primary tank should leak. The annulus is ventilated and continually monitored for evidence of primary tank leakage. The third tank is a concrete shell that encloses the sides of both primary and secondary tanks for additional containment, radiation shielding, and structural support.

Ancillary equipment also is present, such as transfer lines between Tank Farms and DCRTs, valve pits, diversion boxes, and tank-farm piping.

4.3.2.14 242-A Evaporator

The 242-A Evaporator complex is located in the 200 East Area . The 242-A Building is located south of the 241-A and 241-AX Tank Farms and north of the 242-AW Tank Farm. The 242-A Building contains the evaporator vessel and supporting process equipment. The building ventilation exhaust fans and HEPA-filter housings are located on the south side of the building. An emergency diesel generator is located on the south side of the building. Raw water, steam, and electrical power are provided to the 242-A Building from existing service facilities in the 200 East Area.

Radionuclides primarily associated with 242-A include ^{3}H, ^{14}C, ^{90}Sr, ^{106}Ru, ^{125}Sb, ^{137}Cs, $^{239,240}Pu$, and ^{241}Am. Potential diffuse and fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.15 242-S Evaporator

The 242-S Evaporator, currently on standby, is located in the 200 West Area, west of the 241-SY Tank Farm. It consists of an evaporator vessel and supporting process equipment. The building ventilation exhaust fans and HEPA-filter housings are on the south side of the building.

Radionuclides primarily associated with 242-S include ^{14}C, ^{90}Sr, ^{125}Sb, ^{129}I, ^{137}Cs, $^{239,240}Pu$, and ^{241}Am. Potential diffuse and fugitive emission release points include access doors and the inlet-exhaust ventilation system.

4.3.2.16 242-T Evaporator

The 242-T Evaporator, currently inactive, is located in the 200 West Area, east of the 241-TX and 241-TY Tank Farms. 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.

4.3.2.17 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 diffuse and fugitive emission release modes include vents, risers, and the inlet-exhaust ventilation system.

4.3.2.18 Low-Level Burial Grounds

The LLBG is a 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 and identifies the generic types of waste disposed of in the LLBG. An electronic database is maintained that documents each waste receipt, type of waste and disposal location.

4.3.2.18.1 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.

4.3.2.18.2 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.

4.3.2.18.3 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, alpha caissons, and retrievable TRU waste.

4.3.2.18.4 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.

4.3.2.18.5 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.

4.3.2.18.6 Burial Ground 218-W-6

The 218-W-6 Burial Ground is approximately 4 acres (16 hectares) in size and has not received any waste. It is reserved for future mixed-waste disposal.

4.3.2.18.7 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 placed in the burial ground include failed equipment, rags, paper, rubber gloves, disposable supplies, broken tools, and post-August 19, 1987-RCRA and state-only designated mixed waste.

4.3.2.18.8 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.

4.3.2.19 340 Complex

The 340 Complex is located in the 300 Area near the Columbia River. The 340 Complex was constructed to collect, store, and transport radioactive liquid wastes from 300 Area facilities. The 324, 325, 326, 327, and 329 Buildings are connected to the Radioactive Liquid Waste System (RLWS) which empties directly into the 340 vault tanks. The drains in the 326 and 329 Buildings have been isolated from the RLWS. Direct shipments of containers or tankers are also received at the 340 Facility and added to the vault tanks. The 340 Complex also houses the 300 Area Retention Process Sewer (RPS), which collects process wastewater with the potential to become radioactively contaminated. This waste stream is accumulated in the 307 Basins. This waste stream is monitored for radioactive materials and can be transferred to the 340 vault tanks if necessary. After sampling and analysis in the 307 Basins, the wastewater is pumped to the process sewer for treatment at the 300 Area Treated Effluent Disposal Facility.

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 diffuse and fugitive emission release points include access doors and the inlet-exhaust ventilation system and the 307 Retention Basin.

4.3.2.19.1 340-A Building

The 340-A Building houses six aboveground storage tanks, which provide temporary storage of radioactive liquid waste. The 340-NT-EX Stack powered exhaust system provides airborne ventilation to the 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 diffuse and fugitive emissions from the facility.

4.3.2.19.2 340-B East Building

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

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

4.3.2.19.3 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, which transport liquid wastes 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 liquids to the 340 Facility Radioactive Liquid Waste System when predetermined levels are exceeded. Composite samples of 307-Basin influent are collected and analyzed prior to release of the Basin contents. If alpha contamination is detected above specified action levels, the wastewater can be isolated and pumped to the 340 Vault tanks for shipment to an onsite TSD facility.

4.3.2.19.4 340 Vault

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

4.3.2.20 300 Area Fuel Supply Facility

The 300 Area Fuel Supply Shutdown (FSS) Facility was previously known as the N Reactor Fuels Fabrication Facility. The FSS consists of 16 buildings, two Tank Farms, and associated pipe trenches and drains. The structures are located on the north side of the 300 Area. The 300 Area Fuels Fabrication Facilities began operation in 1944 with some structures being added in the 1950s and 1960s. The following sections provide information on each of the facilities. The 300 Area Fuel Fabrication Facility buildings have been decontaminated in preparation for transferring facility management responsibilities to the ERC.

Building	Current Function
303-A	Uranium fuel element storage
303-B	Uranium billet storage
303-E	Uranium fuel element storage (empty)
303-G	Uranium billet storage
3712	Finished uranium fuel element and billet storage
3716	Unfinished uranium fuel element storage
313	Inactive fuels fabrication support facility
333	Inactive fuel manufacturing
303-K/3707-G	Inactive radioactive material and waste storage (303-K) and change room (3707-G)
303-F	Inactive neutralized waste acid pump house
304/304-A	Inactive uranium concretion facility (304) and change room (304-A)
334-A	Inactive waste acid storage and transfer system (RCRA closure)
334	Inactive process sewer monitoring system
303-M	Uranium oxide facility (inactive)
	Inactive Waste Transfer Systems (waste acid transfer system pipe trenches within and between Systems 333, 334-A, 334-TF, 313, 303-F and 311-TF Facilities)
311-TF	Inactive neutralized waste acid storage and transfer facility (adjacent to 303-F Building)
334-TF	Inactive product and waste acid storage facility (adjacent to the 334 Building)

A significant unirradiated uranium inventory, present at the time the N Reactor standby was announced, is stored in the 303-A, 303-B, 303-G, 3712, and 3716 Buildings and at the 300 Area FSS Facility. A portion of the uranium is in the form of extrusion billets. The balance is in the form of unenriched fuel elements. Some of the stored fuel elements are partially processed elements, recovered at the time fabrication ceased.

4.3.2.20.1 333 Building

The primary N Reactor Fuels Fabrication activities were conducted in the 333 Building. The fuel fabrication operation produced N Reactor fuel from 1961 until 1987 when operations were stopped. This facility used a variety of mechanical, chemical, and electrical processes to convert uranium billets and assorted components into finished fuel assemblies for irradiation at

N Reactor. Operations and resulting radionuclide air emissions in the 333 Building ceased in January 1987. Emission monitoring equipment was shut down at that time. Process liquid effluents are no longer generated. However, air conditioning water and stormwater continue to be discharged from the building by way of the process sewer.

Uranium and ^{99}Tc are the most significant radionuclides in surface contamination at the 333 Building. The occasional operation of the heating and cooling ventilation system results in potential diffuse and fugitive emissions by way of equipment and personnel access doors. Normally, ventilation systems are shut down, with the exception of comfort heating and cooling in the office areas. Consequently, infiltration and exfiltration induced by wind and ambient pressure changes results in potential diffuse and fugitive emissions from the building. However, ongoing surveillance activities within the building indicate that radioactive contamination is not present in a dispersible form.

4.3.2.20.2 313 Building

The south end of the building housed the uranium laboratory, copper-casting equipment, waste-acid treatment facility, engineering development laboratory, training rooms, and office areas, all of which have been shut down or are no longer occupied. The north end of the 313 Building houses a complete N Reactor pressure-tube fabrication facility consisting of a 4,000-ton Sutton extrusion press, draw bench, grinders, autoclaves, inspection equipment, and chemical cleaning equipment, none of which was ever used for their intended purpose. The Hanford Metal Working process equipment has been sold to a commercial company, and the north section of the 313 Building has been leased for the commercial operation of the extrusion equipment.

The 313 Building was used from 1944 to 1971 for fabricating uranium fuel elements for the eight retired, single-pass reactors in the 100 Areas. The function of the building changed when those reactors ceased operating. The building then was used as an N Fuels Fabrication Support Facility to treat uranium-bearing acid in the waste-acid treatment system. The recovered uranium sludge was recycled to form new uranium billets at Fernald, Ohio. Engineering development laboratory work and continuous monitoring of airborne emissions were terminated in 1991.

Uranium and ^{99}Tc are the potential primary radioactive constituents in diffuse and fugitive emissions from the 313 Building. Heating and cooling ventilation system in the southern portions of the building are no longer in operation. Infiltration and exfiltration, induced by wind and ambient pressure changes, results in potential diffuse and fugitive emission release points via equipment and personnel access doors.

4.3.2.20.3 303-K/3707-G Radioactive Mixed Waste Storage Facility

The 303-K Facility was designed and constructed in 1943. The facility is a concrete-block building with a poured concrete ceiling. A storage pad outside consists of two concrete pads, two asphalt pads, and a gravel area. The north room of the 303-K Facility originally had one roof exhaust fan. The fan was used from 1953 to 1977 while aluminum spacer and equipment decontaminating was done. The roof vent fan was replaced with a HEPA-filtered exhaust system in 1977, which was used until the fall of 1982. The exhaust system was only turned on at the end of the curing operation for the concreted billets of recyclable scrap uranium chips and fines or if hydrogen levels indicated a billet fire had occurred. The HEPA exhaust system has not operated since the concrete-curing operation was discontinued in 1982. 3707-G is a small adjoining

building used as a change room. The 3707-G Building also serves as an entry point into portions of the 303-K Building, the adjacent outdoor fenced area, and the concrete pad area.

These buildings no longer discharge either air emissions or liquid effluents to the environment. They were used to store radioactive and mixed waste until 1994. Only small quantities of nondispersible radioactive contamination remain in the buildings.

Uranium and ^{99}Tc are the primary radioactive constituents in potential diffuse and fugitive emissions from the 303-K Facility. Infiltration and exfiltration, induced by wind and ambient pressure changes, results in potential diffuse and fugitive emissions via equipment and personnel access doors.

4.3.2.20.4 303-M Uranium Oxide Facility

The 303-M Uranium Oxide Facility is adjacent to the 333 Building and consists of one building, an adjacent outdoor drum storage area, and a small process sewer filter building. The 303-M Uranium Oxide Facility stored and treated recycled material generated during the N Reactor fuel fabrication processes. The fuel fabrication waste material consisted of pyrophoric saw fines and lathe turnings, known as chips, composed of slightly enriched uranium and Zircaloy-2. The wastes were calcinated to remove their pyrophoric properties, thus eliminating the possibility of spontaneous combustion during transportation.

The 303-M Uranium Oxide Facility operated from 1983 to 1987 for the calcination of the wastes generated. The facility ceased operating in 1987.
During operation, the facility operated under negative pressure and the building exhaust was released to the atmosphere through a single stack. The emissions were controlled with a bag-house and HEPA filters.

The 303-M Building is currently closed. The water and electricity have been shut off and the exhaust stack capped. The primary radionuclides associated with the facility are uranium and ^{99}Tc.

4.3.2.20.5 304/304-A Uranium Concretion Facility

The 304 Building was designed and constructed in 1952 as a pilot plant for the lead-dip canning process. The uranium concretion equipment in the 304 Building was installed in 1971 with a drainage trench and sump to remove liquids resulting from spills, leaks, and daily operations. Standard spill-response procedures inside the building included washing the spilled waste to the sump where the fines would settle out. The wastewater was drained into the 300 Area process sewer, and the fines were shoveled from the sump and concreted. Additionally, an outside storage area is on the north side of the facility. The storage area is a concrete pad surrounded by asphalt. The 304-A Building is a change-room addition to the 304 Building.

The building has no inlet air supply system, the water is shut off, and drains have been plugged. The exhaust stack was capped in 1994. Uranium and ^{99}Tc are the primary radionuclides potentially present in diffuse and fugitive emissions via personnel and equipment access doors.

4.3.2.20.6 311 Tank Farm

The recoverable and nonrecoverable uranium-bearing neutralized waste solutions from the 313 Building were combined in aboveground tanks (tanks 40 and 50) in the 311 Tank Farm. These

liquid wastes eventually were transferred to tanker trucks and disposed of in the 183-H Basins or the 200 Areas. After 1988, if the wastes were below radioactive release limits, they were shipped to offsite contractors for treatment, storage, and/or disposal. The two tanks received approximately 420,000 gal (1.6 million L) of waste each year, during periods of peak production.

In addition to waste tanks 40 and 50, the 311 Tank Farm has a 4,000-gal (15,000-L) tank used to store nitric acid and two 10,000-gal (38,000-L) tanks that were used to store sodium hydroxide. The tanks were emptied in 1991 and no longer contain nitric acid or sodium hydroxide.

Uranium and ^{99}Tc are the potential primary radioactive constituents in diffuse and fugitive emissions from the 311 Tank Farm. Diffuse and fugitive emissions may be released by way of uranium-bearing material transfers and unplanned releases.

4.3.2.20.7 334-A Waste Acid Storage Building

The 334-A Waste Acid Storage Building was completed in late 1974 and placed in use in January 1975. For four months in 1973, an underground tank and tank 4 in the 334 Tank Farm were used to collect acid waste that would be transferred to the 313 Building for neutralization. The underground tank began to leak in August 1973 and was removed during construction of the 334-A Building. The waste acids were discharged directly into the process sewer until the 334-A Building was built in December 1974. The tanks in the 334-A building received approximately 210,000 gal (790,000 L) of waste acids per year. These waste acids consisted of hydrofluoric, nitric, and sulfuric acids with copper, zirconium, chromium, and uranium in solution. Following storage, the acids were pumped from the 334-A Building to the south end of the 313 Building for neutralization.

The building heating and cooling air handling systems have been shut down, the water and electricity have been shut off, and drains have been plugged. The storage tanks in the building have been isolated and cleaned. Uranium and ^{99}Tc are the potential primary radioactive constituent in diffuse and fugitive emissions from the 334-A Building. The potential diffuse and fugitive emission release points include personnel and equipment access doors.

4.3.2.20.8 303-A, 303-B, and 303-G Uranium Fuel Storage Buildings

The fuel stored in the 303-A, 303-B and 303-G Buildings includes unused fuel elements, uranium billets and some irradiated fuel elements, which had been loaded into N Reactor. The fuel elements that had been loaded into N Reactor were recovered during reactor defueling with only low levels of surface contamination on them. These fuel elements are appropriately packaged for safe handling and storage at their present storage location. The structures are single story concrete block and cement construction with only three doors and no windows. The roofs are precast concrete slabs covered with felt, tar, and gravel. There are four 10-in- (25-cm-) diameter holes in the walls at floor level for water drainage in the unlikely event of a sprinkler system discharge. The buildings are unheated and are not provided with active ventilation. The buildings are equipped with automatic fire detection and sprinkler (dry) systems with freeze protection in the valve rooms. Infiltration and exfiltration, induced by wind and ambient pressure changes, results in potential diffuse and fugitive emissions from equipment and personnel access doors.

4.3.2.20.9 303-E Uranium Fuel Storage Building

No fuel is currently stored in the 303-E Building. Until 1996, the 303-E Building had been used to store non-irradiated fuel, like the 303-A, 303-B, and 303-G Buildings, until the fuel inventory in the building was removed. Only small quantities of radiological contamination remain in the building. Infiltration and exfiltration, induced by wind and ambient pressure changes, result in potential diffuse and fugitive emissions from equipment and personnel access doors.

4.3.2.20.10 3712 Uranium Fuel Storage Building

The 3712 Building is a one-story steel-frame structure with metal panel siding, metal panel roof, and a concrete floor and foundation. The building is used to store uranium billets, finished fuel elements, uranium/scrap and standards, and unfinished fuel pieces. An HVAC unit provides heating and cooling of the south portion of the building, when occupied. Infiltration and exfiltration, induced by wind and ambient pressure changes, results in potential diffuse and fugitive emissions from equipment and personnel access doors.

4.3.2.20.11 3716 Uranium Fuel Storage Building

The 3716 Building is a single-story building with insulated aluminum siding and roof. The building is used to store unfinished fuel pieces, which are capped with plastic caps and kept in wooden boxes. The steam heating system and evaporative cooler for the building have been shut down. Infiltration and exfiltration, induced by wind and ambient pressure changes, results in potential diffuse and fugitive emissions from equipment and personnel access doors.

4.3.2.20.12 Waste Transfer System

The waste transfer system serves as an inter-facility pipe chase between the 333 Building, 334-A Building, 334 Tank Farm, 313 Building, 303-F Building, and the 311 Tank farm. This system comprises various-sized concrete trenches topped with removable reinforced concrete or steel panels. Due to historic spills, there are some portions of the system that contain small quantities of radioactive contamination. There is no ventilation system associated with the pipe chase. Infiltration and exfiltration, induced by wind and ambient pressure changes, results in potential diffuse and fugitive emissions from crevices between the pipe chase covers.

4.3.2.21 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 diffuse and fugitive emission release points include the personnel and equipment access doors and the inlet-exhaust ventilation system.

5.0 SUPPLEMENTAL INFORMATION

This section has supplemental information related to Hanford Site radionuclide air emissions in 1999, 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., collective effective dose equivalent [CEDE]) from Hanford Site air emissions in 1999 was calculated using the GENII computer code (PNL-6584). This population consisted of approximately 376,000 people residing within a 50-mi (80-km) radius of the five designated Hanford Site operating areas (PNL-7803). Pathways of 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 CEDE for 1999 from radionuclide air emissions was 0.19 person-rem (1.9 E-3 person-Sv). Radionuclide releases from the Hanford Site to surface water added 0.059 person-rem (5.9 E-2 person-Sv). Therefore, the total population dose in 1999 from both air- and liquid-borne radionuclides originating from the Hanford Site was 0.25 person-rem (2.5 E-3 person-Sv).

5.2 COMPLIANCE STATUS WITH 40 CODE OF FEDERAL REGULATIONS PART 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 the 20 $pCi/m^2/s$. The Hanford Site has no storage and disposal facilities for radium-bearing waste materials; therefore, the provisions of Subpart Q do not apply.

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," these types of owners and operators 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 not conducted at the Hanford Site, Subpart T does not apply.

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

This section contains emission estimates and periodic confirmatory measurement data as required by specific 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 *Air Emissions Notice of Construction for Portable/Temporary Radioactive Air Emission Units* (PTRAEUs) (DOE/RL-95-75), which requires that the estimated emissions from these units be summarized in this document, with the information in Table 5-1 fulfilling this requirement. The estimated emissions were obtained from Section 10.2 of the NOC for PTRAEUs. When documentation demonstrates that the handling limits for these emission units have not been exceeded, the estimated emissions are considered to be equal to or less than the values provided in Section 10.2 of the NOC.

Table 5-1. Emission Estimates for Portable/Temporary Radioactive Emission Units in 1999.

Unit Type	Radionuclide	Annual estimated emissions, Ci
Type I Units[a]	^{137}Cs	≤6.9 E-05
Type II Units[b]	^{90}Sr ^{137}Cs ^{241}Am	≤1.2 E-06 ≤2.2 E-06 ≤7.3 E-10
Type III Units[c]	^{90}Sr ^{137}Cs ^{241}Am	≤5.2 E-06 ≤9.6 E-06 ≤3.2 E-08

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

[a] The listed emission quantity for Type I units is based on the assumption that the units operated at the daily handling limit, 365 days per year, which would have been 87,600 hours of operation (i.e., 10 units x 24 hours/day x 365 days/year). Actual hours of operation for Type I units in 1999 totaled only 205 hours, at less than the daily handling limit.

[b] Type II emission units did not operate in 1999.

[c] The listed emission quantities for Type III emission units are based on the assumption that the three units operated at their daily handling limit, 365 days per year, which would be 26,280 hours of operation (i.e., 3 units x 24 hours/day x 365 days/year). Actual hours of operation for Type III units in 1999 totaled only 24.5 hours, at less than the daily handling limit.

Table 5-2 presents information on HEPA-filtered vacuums, another category of portable exhausters used at the Hanford Site.

Table 5-2. HEPA-Filtered Vacuum Usage in 1999.
(NOC DOE/RL-97-50 as approved by AIR 98-312)

Facility	Area	Alpha possession quantity NOC limit, Ci	Beta-gamma possession quantity NOC limit, Ci	Alpha possession quantity in 1999, Ci	Beta-gamma possession quantity in 1999, Ci	Compliance status (annual possession quantity, exhauster smears)
BHI						
100-NR-2 Pump and Treat	100	7.55 E-04	3.81 E-02	1.26 E-08	4.73 E-04	CERCLA
CHG						
244-AR	200-E	4.57 E-03	2.30 E-01	0	0	compliant

5.3.2 Miscellaneous Periodic Confirmatory Emission Measurements

Table 5-3 shows information confirmatory of low emissions in compliance with an NOC for the 331G Building in the 300 Area.

Table 5-3. Radionuclide Emissions Estimate for PNNL NOC at 331G Building for Calendar Year 1999.

Radionuclide	Form[a]	Quantity, Ci	Release fraction	Annual release quantity, Ci[b,c]
^{14}C	liquid/solid	5.0 E-06	1.0 E-03	5.0 E-09

[a] The radioactive material is incorporated within animal tissue, feces, and urine.

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

[c] Emissions estimated using methods from 40 CFR 61, Appendix D.

Table 5-4 shows information confirmatory of low emissions as indicated by results from nondestructive analysis of HEPA filters.

Table 5-4. Nondestructive Analysis Results for Calendar Year 1999.

Location	Date	Filtration	^{137}Cs activity, Ci
Blue Max at ER-152 Diversion Box	04/14/99[a]	single HEPA	1.05 E-06
Blue Max on 244-A	5/16/99	single HEPA	1.80 E-05
S-23 Stack	04/21/99	single HEPA	1.62 E-06
SX Exhauster, vadose job	10/14/99	single HEPA	5.12 E-10 as ^{137}Cs; 3.99 E-07 as ^{99}Tc
296-B-2 passive exhaust	09/21/99	dual HEPA	8.00 E-08[b]

[a] This date is when the NOC activity requiring the us of the Blue Max ended; the nondestructive analysis of the Blue Max HEPA filter was conducted on 04/20/99.

[b] The activities of other radionuclides are estimated by determining their ratios to ^{137}Cs in the final set of measured emissions data associated with the 291-B-1 stack. These ratios are presumed to apply to emissions that passively pass through the HEPA filters of the 296-B-2 stack. Those nuclides and their estimated activities released are: 6.1 E-06 Ci of ^{90}Sr, 7.8 E-07 Ci of ^{239,240}Pu, and 6.8 E-08 Ci of ^{241}Am. The value reported is the final in a short series of measurements conducted in 1999; measurement efficiencies were improved, resulting in this value being the lowest of the group and best reflective of the activity present.

5.3.3 Periodic Confirmatory Measurements in 1999 on Notice of Construction Sources Not Equipped with Record Sampling

This subsection identifies NOC locations that are potential sources of radionuclide emissions at which record sampling is not performed. Before these NOCs were approved, potential emission levels were calculated based on descriptions of work proposed at the sources. Consistently these calculated levels have been too low to measure using conventional stack sampling methods. These low levels also correlate to negligible dose effects. Because of these factors, WDOH requires only periodic confirmatory measurements (PCMs) to verify low emission levels have been maintained. Information on these NOCs and their corresponding PCMs is summarized in Table 5-3, which includes the operating and emission status in 1999 for each source; details of these measurements are kept on file. The information is consistent with the database maintained for the Hanford Site Air Operating Permit.

In the far right-hand column of Table 5-5, all "Y" entries have a superscripted numeral alongside them. "Y" stands for "yes"; "N," for "no"; and "NA" for "not applicable." The numerals correspond to PCM verification methods used, which are:

1 — stack monitoring (for stacks at or near NOC sources)
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
6 — estimates derived from using factors in 40 CFR 61, Appendix D
7 — destructive analysis of HEPA filters.

Table 5-5 Notice of Construction Emission Sources Not Record Sampled.

Emission point	Project title	Permit ID	Issue date	Operated in 1999? (Y or N)[a]	Verified low emissions? (Y, N, or NA)[a]
CHG					
not assigned	Tank Waste Remediation System Vadose Zone Characterization	DOE/RL-99-34	7/14/99	Y	Y[5]
not assigned	Tank Waste Remediation system Decommissioning and Sampling of Borehole 41-09-39 Introduction	none	5/7/99	Y	Y[2]
296-A-12	Isolation of 296-A-12 Exhauster from the 244-AR Vessel Vent System	DOE/RL-99-55	8/9/99	Y	Y[2]
296-P-17	Isolation of 296-P-17 Exhauster from the A-105 Tank	DOE/RL-99-57	12/9/99	Y	Y[2]
not assigned	HEPA Filtered Vacuum Radioactive Emission Units	DOE/RL-97-50	11/4/99	Y	Y[2]
not assigned	Portable/Temporary Radionuclide Airborne Emissions Units (PTRAEU)	DOE/RL-96-75	11/4/99	Y	Y[2]
296-A-25	W420	DOE/RL-98-90	1/29/99	Y	Y[2]
296-B-28	W420	DOE/RL-98-92	1/29/99	Y	Y[2]
296-C-05	W420	DOE/RL-98-91	1/29/99	Y	Y[2]
296-P-16	W420	DOE/RL-98-93	1/29/99	Y	Y[2]
296-S-22	W420	DOE/RL-98-94	1/29/99	Y	Y[2]
296-T-18	W420	DOE/RL-98-95	1/29/99	Y	Y[2]
not assigned	241-ER-311 Catch Tank	DOE-RL-99-81	11/16/99	Y	Y[1]
not assigned	Tank Waste Transfer Pits Designated 241-ER-152	none	2/23/99	Y	Y[1,5]
not assigned	By-Passing the 244-U Double-Contained Receiver Tank During Salt-Well Pumping	none	5/4/99	Y	Y[2]
not assigned	241-SY-101 Crust Growth Near-Term Mitigation	DOE/RL-99-30	4/23/99	Y	Y[1]
not assigned	Salt-Well Pumping Tank 241-SX-104	none	3/12/98	Y	Y[1]
not assigned	Salt-Well Pumping Tank 241-SX-106	none	7/2/98	Y	Y[1]
not assigned	Use of the Guzzler Vacuum Excavation System for Radiological Limited Activities on the Hanford Site	none	12/18/98	Y	Y[2]
not assigned	Guzzler Excavation and Backfilling Activities in Support of the 200 East Area A Farm Complex	none	12/23/97	Y	Y[2]
not assigned	Work in the Tank Farm 241-S-151	DOE/RL-99-75	8/28/99	N	NA
not assigned	Work in the Tank Farm 244-CR Vault	DOE/ORP-99-07	1/25/00	N	NA
not assigned	Work in Tank Farm 241-TX-154 Diversion Box	DOE/RL-99-76	10/29/99	N	NA
not assigned	Tank Farm Waste Transfer Pit 244-TX Double-Contained Receiver Tank	DOE/RL-99-47	10/6/99	N	NA
not assigned	Work in Tank Farm 241-UX-154 Diversion Box	DOE/RL-99-52	10/6/99	N	NA
not assigned	Soil Characterization Around the 241-AX-104 Tank Using the Cone Penetrometer	none	10/29/98	N	NA

Emission point	Project title	Permit ID	Issue date	Operated in 1999? (Y or N)[a]	Verified low emissions? (Y, N, or NA)[a]
not assigned	Rotary Mode Core Sampling in SX Tank Farm	DOE/RL-97-70	11/13/97	N	NA
not assigned	W-058 Project Excavation and Backfilling in Support of the Cross-Site Transfer System	none	6/13/97	N	NA
not assigned	Excavation and Backfill Activity for Two Diesel Underground Storage Tanks and Ancillary Piping	none	8/18/98	N	NA
not assigned	Project W314: 241-AN-A Valve Pit Upgrades; Excavation for Electrical Installation; 241-AN Leak Test Jumper in AN-A&B; Perform Pothole Excavations; 241-AN Farm Pothole Excavation; 241-AN, FAB & Install Elect Components; 241-AX-B, Install Blanks; 241-AN A&B Perform TO-020-003 (for OTP-314-1); Geotechnical Investigation Soil Borings 200E; 241-AN Jumper Valve Pit Leak Detectors; 241-AN-A Modify Shield Plug IAW ECN	none		Y	Y[1,2,3]
not assigned	241-AN-A/B Nozzle and Jumper Installation	none		Y	Y[3]
not assigned	241-AN-A Valve Pit Mechanical Upgrades	none		Y	Y[2]
not assigned	241-AN-B Valve Pit Mechanical Upgrades	none		Y	Y[3]
not assigned	241-AN-A&B Valve Pit/VLV Actuator Installation	none		Y	Y[2]
not assigned	AN-A&B Pit Floor Drain Seal Assembly Installation	none		Y	Y[3]
not assigned	Decontaminate 241-AN-A&B Pit Floor Drain Area	none		Y	Y[3]
not assigned	Paint 241-AN Pit A&B	none		Y	Y[3]
not assigned	Leak Check Jumpers in AN A&B	none		Y	Y[2]
not assigned	241-AN-A Leak Detection & Valve Position IND ATP	none		Y	Y[2]
not assigned	241-AN-B Pit Leak Detection & VLV Position ATP	none		Y	Y[2]
not assigned	SN-268 Encasement Leak Detection ATP	none		Y	Y[2]
not assigned	241-AN Remove Water & Contamination	none		Y	Y[2]
not assigned	241-AN A&B Pit Install Hand Rail Sockets	none		Y	Y[2]
not assigned	AY-102-02A Pump Pit Upgrades Prep	none		Y	Y[2]
not assigned	241-SY Install SN-635 Transfer Line	none		Y	Y[2]
not assigned	Potholing			Y	Y[1]
not assigned	Rework 241-AN-A Floor Drain Assembly	none		Y	Y[2]
not assigned	241-AN A&B Change Actuators	none		Y	Y[2]
not assigned	Excavation for Future Installation of SN-635	none		Y	Y[3]
not assigned	AN-A Valve Pit Drain, Lost Tooling	none		Y	Y[2]
not assigned	Excavation and Conduit Installation, 241-AN-105	none		Y	Y[2]

Emission point	Project title	Permit ID	Issue date	Operated in 1999? (Y or N)[a]	Verified low emissions? (Y, N, or NA)[a]
not assigned	AY-101-01A Pump Pit Upgrades	none		Y	Y[2]
not assigned	241-AX-B, Flush and Apply Fixative	none		Y	Y[2]
not assigned	AY-01A Pump Pit, Prep Pit, Paint	none		Y	Y[2]
	DynCorp				
W-PORTEX 021	Use of the Guzzler Vacuum Excavation System for Radiologically Limited Activities on the Hanford Site	AIR 98-1215	12/18/98	N	NA
200 W-PORTEX 006	Guzzler Excavation and Backfilling Activities in Support of the 200 East Area A Tank Farm Complex	RTAM	12/23/97	N	NA
200E W-PORTEX 001	Guzzler Excavation and Backfilling Activities in Support of the 200 East Area A Farm Complex			N	NA
200E W-PORTEX 001	Guzzler Excavation and Backfilling Activities in support of the 200 East Area A Farm Complex	Short-form NOC	12/23/97	N	NA
200E W-PORTEX 017	Guzzler Excavation and Backfilling Activities in Support of the L-286, 200 Area Sanitary Water Distribution System	Short-form NOC	10/12/98	Y	Y[2]
300 J-NONPOINT 013	3732 Process Equipment Development Laboratory Demolition	RTAM	9/5/97	N	NA
300 J-NONPOINT 014	Excavation and Backfilling in Support of the 315D Backwash Pond Discharge Piping	RTAM	11/17/97	Y	Y[2]
300 J-NONPOINT 015	Excavation and Backfilling Support of a Potable Water Line Repair	Short-form NOC	11/20/97	N	NA
300 W-PORTEX 012	Guzzler Excavation and Backfilling Activities in Support of the 3706 Building Isolation of Water Lines	RTAM	5/7/98	Y	Y[2]
300 W-PORTEX 013	Guzzler Excavation and Backfilling Activities in Support of the 300 Area Powerhouse Shutdown	RTAM	2/17/98	Y	Y[2]
300 W-PORTEX 014	Guzzler Excavation and Backfilling Activities in Support of the 321 Building Isolation of Water Lines	Short-form NOC	9/29/98	Y	Y[2]
300 W-PORTEX 015	Guzzler Excavation and Backfilling Activities in Support of the 3701D Building Water Line Repairs	Short-form NOC	9/29/98	Y	Y[2]
300 W-PORTEX 018	Guzzler Excavation and Backfilling Activities in Support of the 3760 Building Water Line Repairs	Short-form NOC	10/19/98	N	NA
Richland J-NONPOINT 005	Recovery of Radioactive Material from the City of Richland Landfill and Transportation to Burial Ground	Short-form NOC	10/7/98	Y	Y[2,3]
	ERC				
	216-B-2-2 Ditch	RTAM (CERCLA)	10/17/97	Y	Y[4]
	216-A-29 Ditch	RTAM	6/29/98	Y	Y[2]
100 P-105-C 001	105-C Reactor Safe Storage	AIR 96-802	8/12/96	Y	Y[4]
100-N 1330-N PermaCon	1330-N Waste Handling Facility	RTAM	4/18/95	N	NA
	1310-N/1314-N	RTAM	3/17/97	Y	Y[4]
600 J-NONPOINT 012	Purgewater Modutanks	AIR 91-803	8/27/91	Y	Y[4]
600 J-NONPOINT 012	Purgewater Modutanks	RTAM	7/9/98	Y	Y[4]

Emission point	Project title	Permit ID	Issue date	Operated in 1999? (Y or N)[a]	Verified low emissions? (Y, N, or NA)[a]
		FH			
not assigned	231-Z Bldg. deactivation activities	NA	8/12/95	N	NA
not assigned	304 and 303-M	RTAM	5/14/96	N	NA
not assigned	306-E	RTAM	11/14/95	N	NA
not assigned	309 Bldg.	RTAM	1/14/97	N	NA
not assigned	313 Bldg.	RTAM	11/14/95	N	NA
300 P-309PRTR-001	309 Bldg.	AIR 95-401	4/3/95	N	NA
not assigned	313 Bldg.	RTAM	12/12/95	N	NA
not assigned	B Plant organic transfer and storage	RTAM	4/9/96	N	NA
not assigned	CO_2 Decon Facility (B Plant)	AIR 93-912	9/17/93	N	NA
not assigned	B Plant	AIR 94-802	8/1/94	N	NA
not assigned	PFP (231-Z)	RTAM	8/8/95	N	NA
not assigned	PUREX	RTAM	12/12/95	N	NA
not assigned	PUREX Deactivation	AIR 94-311	3/18/94	N	NA
not assigned	PUREX Deactivation	AIR 94-313	3/30/94	N	NA
not assigned	PUREX Deactivation	RTAM	9/12/95	N	NA
not assigned	PUREX Deactivation	RTAM	6/12/96	N	NA
not assigned	PUREX Storage Tunnels	AIR 96-603	6/7/96	N	NA
not assigned	Tank 50 Waste Water Disposal	RTAM	4/18/95	N	NA
296-B-1, 296-B-2	B Plant Modification of the Ventilation System	AIR 97-805	8/20/97	N	NA
296-B-1, 296-B-2	B Plant Ventilation Upgrades	AIR 97-1012	10/28/97	N	NA
296-B-1, 296-B-2	B Plant Ventilation Upgrades (Project W-059)	RTAM	6/16/98	N	NA
296-B-1, 296-B-2	Minor changes to NOC "Radioactive Air Emissions for Modifications of . . . 221-B Canyon Building"	RTAM	7/21/98	Y	Y[1,5]
300 Area Fuel Supply	300 Area Fuel Supply Shutdown Activities, Rev 1	AIR 97-803	8/13/97	N	NA
300 Area Fuel Supply	300 Area Fuel Supply Shutdown Facilities	AIR 96-1001, Rev 1	10/14/96	N	NA
300 P-309RTFEX-001	309 Bldg.	RTAM	7/11/95	N	NA
300 P-309RTFEX-001	309 Bldg.	RTAM	12/12/95	N	NA
400 Na Storage Facility	Construction and Operation of Sodium Storage Facility	Air 95-204	2/24/95	N	NA
not assigned	PUREX Plant fuel transfers to 105-KW Basin		8/14/95	N	NA
200-W-PORTEX 005	200 Area Interim Storage Area (ISA)	AIR 98-503	5/20/98	N	NA
not assigned	300 Area sewer upgrades	RTAM	8/8/95	N	NA
not assigned	300 Area sewer upgrades		10/9/95	N	NA
not assigned	304 Concretion Facility	AIR93-1026	10/15/93	N	NA
not assigned	306-E Radiological Air Emissions Abatement	Meeting	10/10/95	N	NA
not assigned	306-E Radiological Air Emissions Abatement	RTAM	12/12/95	N	NA
not assigned	377 Bldg. RO skid work	Meeting	8/25/95	N	NA
not assigned	ESL Burial Box Stabilization Project	RTAM	5/14/96	N	NA
not assigned	Liquid Effluent Retention Facility (LERF) and Effluent Treatment Facility (ETF) Load-In Station	RTAM	1/14/97	Y	Y[4]
not assigned	Open RLAIX Vault for Characterization/Sampling Activities	RTAM	7/11/95	N	NA

Emission point	Project title	Permit ID	Issue date	Operated in 1999? (Y or N)[a]	Verified low emissions? (Y, N, or NA)[a]
not assigned	T Plant	RTAM	6/12/96	N	NA
not assigned	T Plant/Solid Waste	RTAM	3/25/96	N	NA
200-W CWC	Central Waste Complex	AIR 95-1008	10/24/95	N	NA
200-W CWC	Central Waste Complex and Enhanced Radioactive and Mixed Waste Storage, Phase V	AIR 95-1009	10/25/95	N	NA
200-W CWC	Modification to Central Waste Complex CWC) Radioactive Air Emission NOC for Vented Containers	RTAM	8/24/98	Y	Y[3]
200-W J-NONPOINT 018	Grouting Radionuclide Inventory In Tanker Rail Car HO-10H-18581	RTAM	9/28/98	N	NA
200-W J-NONPOINT 019	Unloading Radiologically Contaminated Hanford Garbage Trucks at the 200 West Low-Level Burial Grounds	RTAM	10/13/98	Y	Y[2,4]
200-W P-Trench 31 001	Trench 31: Leachate Collection and Storage Tank (LLBG Mixed Waste Disposal)	RTAM	7/20/94	N	NA
200-W P-Trench 34 001	Trench 34: Leachate Collection and Storage Tank (LLBG Mixed Waste Disposal)	RTAM	8/8/95	N	NA
200-W W-PORTEX 011	Modular Containment (PermaCon) for Sampling Activities at the Central Waste Complex	RTAM	8/18/98	N	NA
200-W W-PORTEX 019	T Plant Complex — Euroclean HEPA-filtered vacuums to be used for contamination control and in waste handling activities	RTAM	12/10/96	N	NA
PNNL					
300 EP-331G-01-S	Registration of Existing Stacks at the 331-G Building	RTAM	1/16/98	Y	Y[6]
300 EP-331G-02-S	Registration of Existing Stacks at the 331-G Building	RTAM	1/16/98	Y	Y[6]
Sitewide					
Sitewide HEPA Vacuum	High-Efficiency Particulate Air (HEPA) Filtered Vacuum Units	AIR 98-312	3/25/98	Y	Y[2]
Sitewide PTRAEU	Portable/Temporary Radionuclide Airborne Emissions Units (PTRAEU) DOE/RL-96-75 Rev 1A	IR 98-1008	10/22/98	Y	Y[6]
WMTS					
Sitewide ODEX Drilling	ODEX Drilling System	RTAM	10/8/96	N	NA

5.4 AMBIENT AIR SAMPLING MEASUREMENTS

The near-field monitoring (NFM) program comprises a comprehensive network of monitoring locations near facilities and projects at the Hanford Site. It monitors soil, vegetation, and ambient air that may contain radionuclides dispersed there by onsite activities. It also measures 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 with permanent 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 periodically measured to verify whether or not they are low. Verification at the Hanford Site is currently done using a variety of data, including those from the NFM program, which provides valuable confirmatory data. Other confirmatory data generally consist of measurements taken from dose-rate surveys, surface smears, CAM sampling, and both NDA and destructive analysis, especially of HEPA filters. Further verification 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 1999. 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.

(The following definitions apply to abbreviations used in Table 5-6: 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; pCi/m^3 = picocuries per cubic meter; NA = not applicable [because up to 26 samples were analyzed each half year, and up to 13 a quarter, and this table shows only the single isotopic result obtained in that period]; ND = not detected [i.e., result less than zero, less than its overall analytical error, or no peak detected]; C = project completed; NS = project not started.)

Table 5-6. Hanford Site Near-Field Monitoring Air Sampling Results for 1999.

100-B/C Remedial Action Project					
EDP code	**Radionuclide or type of radioactivity**	**1st-half concentration, pCi/m^3**	**2nd-half concentration, pCi/m^3**	**Average concentration, pCi/m^3**	**Average concentration, pCi/m^3**
N464	total α	NA	NA	1.6 E-03	2.0 E-03
	total β	NA	NA	1.6 E-02	2.2 E-02
	^{234}U	5.6 E-05	C	5.6 E-05	5.6 E-05
	^{235}U	3.3 E-05	C	3.3 E-05	3.3 E-05
	^{238}U	9.6 E-05	C	9.6 E-05	9.6 E-05
N465	total α	NA	NA	1.1 E-03	1.4 E-03
	total β	NA	NA	1.3 E-02	1.5 E-02
	^{90}Sr	2.1 E-03	C	2.1 E-03	2.1 E-03
	^{234}U	4.3 E-05	C	4.3 E-05	4.3 E-05
	^{235}U	3.1 E-05	C	3.1 E-05	3.1 E-05
	^{238}U	2.5 E-05	C	2.5 E-05	2.5 E-05

100-B/C Remedial Action Project					
EDP code	Radionuclide or type of radioactivity	1st-half concentration, pCi/m³	2nd-half concentration, pCi/m³	Average concentration, pCi/m³	Average concentration, pCi/m³
N466	total α	NA	NA	9.8 E-04	1.4 E-03
	total β	NA	NA	1.1 E-02	1.8 E-02
	^{234}U	2.1 E-05	C	2.1 E-05	2.1 E-05
	^{238}U	8.5 E-06	C	8.5 E-06	8.5 E-06
	$^{239,240}Pu$	1.6 E-05	C	1.6 E-05	1.6 E-05
N496	total α	NA	NA	1.2 E-03	2.1 E-03
	total β	NA	NA	9.0 E-03	1.5 E-02
	^{90}Sr	2.5 E-05	C	2.5 E-05	2.5 E-05
	^{234}U	4.1 E-05	C	4.1 E-05	4.1 E-05
	^{235}U	2.1 E-05	C	2.1 E-05	2.1 E-05
	^{238}U	2.3 E-05	C	2.3 E-05	2.3 E-05
	^{238}Pu	3.9 E-05	C	3.9 E-05	3.9 E-05
N497	total α	NA	NA	9.9 E-04	1.6 E-03
	total β	NA	NA	8.1 E-03	1.4 E-02
	^{90}Sr	3.8 E-04	C	3.8 E-04	3.8 E-04
	^{234}U	1.8 E-05	C	1.8 E-05	1.8 E-05
	^{235}U	1.8 E-05	C	1.8 E-06	1.8 E-05
	^{238}U	2.0 E-05	C	2.0 E-05	2.0 E-05

100-D Remedial Action Project					
EDP code	Radionuclide or type of radioactivity	1st-half concentration, pCi/m³	2nd-Half concentration, pCi/m³	Average concentration, pCi/m³	Maximum concentration, pCi/m³
N467	total α	NA	NA	1.1 E-03	2.0 E-03
	total β	NA	NA	1.3 E-02	2.8 E-02
	^{90}Sr	ND	2.3 E-04	2.3 E-04	2.3 E-04
	^{234}U	3.0 E-05	9.5 E-06	2.0 E-05	3.0 E-05
	^{235}U	1.1 E-05	4.6 E-06	7.8 E-06	1.1 E-05
	^{238}U	3.2 E-05	1.2 E-05	2.2 E-05	3.2 E-05
	^{238}Pu	5.5 E-05	3.2 E-06	4.3 E-06	5.5 E-06
N468	total α	NA	NA	1.1 E-03	3.3 E-03
	total β	NA	NA	1.3 E-02	3.0 E-02
	^{90}Sr	1.3 E-04	1.2 E-04	1.3 E-04	1.3 E-04
	^{137}Cs	ND	1.4 E-04	1.4 E-04	1.4 E-04
	^{234}U	3.0 E-05	1.8 E-05	2.4 E-05	3.0 E-05
	^{235}U	8.7 E-06	ND	8.7 E-06	8.7 E-06
	^{238}U	2.1 E-05	1.4 E-05	1.8 E-05	2.1 E-05
	$^{239,240}Pu$	7.4 E-06	2.0 E-05	1.4 E-05	2.0 E-05
N469	total α	NA	NA	1.0 E-03	2.0 E-03
	total β	NA	NA	1.3 E-02	3.1 E-02
	^{90}Sr	2.1 E-04	1.8 E-04	2.0 E-04	2.1 E-04
	^{137}Cs	ND	1.7 E-04	1.7 E-04	1.7 E-04
	^{152}Eu	7.6 E-04	1.6 E-03	1.2 E-03	1.6 E-03
	^{234}U	2.0 E-05	1.3 E-05	1.7 E-05	2.0 E-05
	^{235}U	1.0 E-05	6.8 E-06	8.4 E-06	1.0 E-05
	^{238}U	1.0 E-05	1.7 E-05	1.3 E-05	1.7 E-05
	$^{239,240}Pu$	1.1 E-05	ND	1.1 E-05	1.1 E-05

100-D Remedial Action Project					
EDP code	Radionuclide or type of radioactivity	1st-half concentration, pCi/m^3	2nd-Half concentration, pCi/m^3	Average concentration, pCi/m^3	Maximum concentration, pCi/m^3
N470	total α	NA	NA	1.0 E-03	1.3 E-03
	total β	NA	NA	1.3 E-02	3.1 E-02
	^{137}Cs	ND	2.1 E-04	2.1 E-04	2.1 E-04
	^{234}U	1.8 E-05	1.9 E-05	1.8 E-05	1.9 E-05
	^{235}U	6.8 E-06	ND	6.8 E-06	6.8 E-06
	^{238}U	1.6 E-05	1.8 E-05	1.7 E-05	1.8 E-05
	$^{239,240}Pu$	2.8 E-05	3.8 E-05	3.3 E-05	3.8 E-05
N511	total α	NA	NA	1.0 E-03	1.3 E-03
	total β	NA	NA	1.3 E-02	3.1 E-02
	^{137}Cs	ND	2.1 E-04	2.1 E-04	2.1 E-04
	^{234}U	1.8 E-05	1.9 E-05	1.8 E-05	1.9 E-05
	^{235}U	6.8 E-06	ND	6.8 E-06	6.8 E-06
	^{238}U	1.6 E-05	1.8 E-05	1.7 E-05	1.8 E-05
	$^{239,240}Pu$	2.8 E-05	3.8 E-05	3.3 E-05	3.8 E-05
N512	total α	NA	NA	1.0 E-03	1.3 E-03
	total β	NA	NA	1.3 E-02	3.1 E-02
	^{137}Cs	ND	2.1 E-04	2.1 E-04	2.1 E-04
	^{234}U	1.8 E-05	1.9 E-05	1.8 E-05	1.9 E-05
	^{235}U	6.8 E-06	ND	6.8 E-06	6.8 E-06
	^{238}U	1.6 E-05	1.8 E-05	1.7 E-05	1.8 E-05
	$^{239,240}Pu$	2.8 E-05	3.8 E-05	3.3 E-05	3.8 E-05
N513	total α	NA	NA	1.0 E-03	1.3 E-03
	total β	NA	NA	1.3 E-02	3.1 E-02
	^{137}Cs	ND	2.1 E-04	2.1 E-04	2.1 E-04
	^{234}U	1.8 E-05	1.9 E-05	1.8 E-05	1.9 E-05
	^{235}U	6.8 E-06	ND	6.8 E-06	6.8 E-06
	^{238}U	1.6 E-05	1.8 E-05	1.7 E-05	1.8 E-05
	$^{239,240}Pu$	2.8 E-05	3.8 E-05	3.3 E-05	3.8 E-05
N514	total α	NA	NA	1.0 E-03	1.3 E-03
	total β	NA	NA	1.3 E-02	3.1 E-02
	^{137}Cs	ND	2.1 E-04	2.1 E-04	2.1 E-04
	^{234}U	1.8 E-05	1.9 E-05	1.8 E-05	1.9 E-05
	^{235}U	6.8 E-06	ND	6.8 E-06	6.8 E-06
	^{238}U	1.6 E-05	1.8 E-05	1.7 E-05	1.8 E-05
	$^{239,240}Pu$	2.8 E-05	3.8 E-05	3.3 E-05	3.8 E-05
N515	total α	NA	NA	1.0 E-03	1.3 E-03
	total β	NA	NA	1.3 E-02	3.1 E-02
	^{137}Cs	ND	2.1 E-04	2.1 E-04	2.1 E-04
	^{234}U	1.8 E-05	1.9 E-05	1.8 E-05	1.9 E-05
	^{235}U	6.8 E-06	ND	6.8 E-06	6.8 E-06
	^{238}U	1.6 E-05	1.8 E-05	1.7 E-05	1.8 E-05
	$^{239,240}Pu$	2.8 E-05	3.8 E-05	3.3 E-05	3.8 E-05

Spent Nuclear Fuels and Canister Storage Building					
EDP code	**Radionuclide or type of radioactivity**	**1st-half concentration, pCi/m³**	**2nd-half concentration, pCi/m³**	**Average concentration, pCi/m³**	**Maximum concentration, pCi/m³**
N401	total α	NA	NA	1.1 E-03	2.3 E-03
	total β	NA	NA	1.3 E-02	2.2 E-02
	^{90}Sr	2.3 E-04	ND	2.3 E-04	2.3 E-04
	^{234}U	1.7 E-05	2.2 E-05	1.9 E-05	2.2 E-05
	^{235}U	3.7 E-06	ND	3.7 E-05	3.7 E-05
	^{238}U	1.6 E-05	1.6 E-05	1.6 E-05	1.6 E-05
	$^{239,240}Pu$	3.3 E-05	1.4 E-05	2.4 E-05	3.3 E-05
	^{241}Am	ND	4.0 E-05	4.0 E-05	4.0 E-05
N402	total α	NA	NA	1.1 E-03	1.8 E-03
	total β	NA	NA	1.1 E-02	2.6 E-02
	^{90}Sr	2.7 E-04	1.7 E-04	2.2 E-04	2.7 E-04
	^{137}Cs	ND	8.4 E-05	8.4 E-05	8.4 E-05
	^{234}U	1.7 E-05	8.2 E-06	1.3 E-05	1.7 E-05
	^{235}U	1.1 E-05	3.8 E-06	7.4 E-06	1.1 E-05
	^{238}U	1.6 E-05	1.1 E-05	1.4 E-05	1.6 E-05
	$^{239,240}Pu$	3.0 E-06	1.5 E-05	9.0 E-06	1.5 E-05
	^{241}Am	1.7 E-05	2.8 E-05	2.3 E-05	2.8 E-05
N403	total α	NA	NA	1.2 E-03	2.8 E-03
	total β	NA	NA	1.4 E-02	3.0 E-02
	^{90}Sr	4.0 E-04	1.6 E-04	2.8 E-04	4.0 E-04
	^{234}U	3.1 E-05	1.4 E-05	2.3 E-05	3.1 E-05
	^{235}U	1.1 E-05	ND	1.1 E-05	1.1 E-05
	^{238}U	1.8 E-05	8.1 E-06	1.8 E-05	1.8 E-05
	$^{239,240}Pu$	1.0 E-04	3.5 E-05	6.8 E-05	1.0 E-04
	^{241}Pu	ND	1.3 E-03	1.3 E-03	1.3 E-03
	^{241}Am	4.3 E-05	2.3 E-05	3.3 E-05	4.3 E-05
N404	total α	NA	NA	1.0 E-03	1.7 E-03
	total β	NA	NA	1.3 E-02	2.4 E-02
	^{90}Sr	3.4 E-04	ND	3.4 E-04	3.4 E-04
	^{234}U	1.6 E-05	1.6 E-05	1.6 E-05	1.6 E-05
	^{235}U	8.1 E-06	ND	8.1 E-05	8.1 E-05
	^{238}U	1.4 E-05	1.3 E-05	1.4 E-05	1.4 E-05
	$^{239,240}Pu$	5.7 E-06	ND	5.7 E-06	5.7 E-06
	^{241}Am	3.4 E-05	ND	3.4 E-05	3.4 E-05
N476	total α	NA	NA	1.0 E-03	2.1 E-03
	total β	NA	NA	1.3 E-02	3.0 E-02
	^{90}Sr	3.1 E-04	ND	3.1 E-04	3.1 E-04
	^{234}U	2.5 E-05	1.2 E-05	1.9 E-05	2.5 E-05
	^{235}U	6.8 E-06	ND	6.8 E-06	6.8 E-06
	^{238}U	1.1 E-05	1.2 E-05	1.2 E-05	1.2 E-05
	^{241}Am	ND	3.2 E-05	3.2 E-05	3.2 E-05
N477	total α	NA	NA	9.4 E-04	1.6 E-03
	total β	NA	NA	1.3 E-02	3.0 E-02
	^{234}U	2.0 E-05	1.1 E-05	1.5 E-05	2.0 E-05
	^{235}U	1.3 E-05	ND	1.3 E-05	1.3 E-05
	^{238}U	6.1 E-06	9.5 E-06	7.8 E-06	9.5 E-05
	^{241}Am	ND	2.3 E-05	2.3 E-05	2.3 E-05

Spent Nuclear Fuels and Canister Storage Building					
EDP code	**Radionuclide or type of radioactivity**	**1st-half concentration, pCi/m³**	**2nd-half concentration, pCi/m³**	**Average concentration, pCi/m³**	**Maximum concentration, pCi/m³**
N478	total α	NA	NA	1.1 E-03	2.6 E-03
	total β	NA	NA	1.3 E-02	2.8 E-02
	^{90}Sr	2.7 E-04	ND	2.7 E-04	2.7 E-04
	^{234}U	2.3 E-05	1.1 E-05	1.7 E-05	2.3 E-05
	^{235}U	1.0 E-05	ND	1.0 E-05	1.0 E-05
	^{238}U	1.2 E-05	8.8 E-06	1.2 E-05	1.0 E-05
	^{241}Am	2.7 E-05	3.0 E-05	2.9 E-05	3.0 E-05
N479	total α	NA	NA	1.1 E-03	1.5 E-03
	total β	NA	NA	1.2 E-02	2.9 E-02
	^{90}Sr	4.1 E-04	ND	4.1 E-04	4.1 E-04
	^{234}U	1.9 E-05	ND	1.9 E-05	1.9 E-05
	^{235}U	8.3 E-06	ND	8.3 E-06	8.3 E-06
	^{238}U	1.1 E-05	9.4 E-06	1.0 E-05	1.1 E-05
	$^{239,240}Pu$	6.6 E-06	ND	6.6 E-06	6.6 E-06
	^{241}Am	3.4 E-05	2.2 E-05	2.8 E-05	3.4 E-05
N480	total α	NA	NA	1.1 E-03	1.7 E-03
	total β	NA	NA	1.2 E-02	2.8 E-02
	^{90}Sr	2.5 E-04	ND	2.5 E-04	2.5 E-04
	^{234}U	2.7 E-05	ND	2.7 E-05	2.7 E-05
	^{235}U	1.5 E-05	ND	1.5 E-05	1.5 E-05
	^{238}U	2.5 E-05	1.1 E-05	1.8 E-05	2.5 E-05
	$^{239,240}Pu$	1.1 E-05	ND	1.1 E-05	1.1 E-05
	^{241}Am	2.2 E-05	ND	2.2 E-05	2.2 E-05
N481	total α	NA	NA	1.1 E-03	2.1 E-03
	total β	NA	NA	1.1 E-02	2.3 E-02
	^{90}Sr	2.8 E-04	ND	2.8 E-04	2.8 E-04
	^{234}U	1.2 E-05	ND	1.2 E-05	1.2 E-05
	^{235}U	7.9 E-06	ND	7.9 E-06	7.9 E-06
	^{238}U	7.9 E-06	1.0 E-05	8.9 E-06	1.0 E-05
	$^{239,240}Pu$	ND	1.3 E-05	1.3 E-05	1.3 E-05
	^{241}Am	2.9 E-05	ND	2.9 E-05	2.9 E-05

100-N Surveillance and Maintenance Project					
EDP code	Radionuclide or type of radioactivity	1st-half concentration, pCi/m³	2nd-half concentration, pCi/m³	Average concentration, pCi/m³	Maximum concentration, pCi/m³
N102	total α	NA	NA	1.2 E-03	2.2 E-03
	total β	NA	NA	1.4 E-02	3.0 E-02
	^{60}Co	2.5 E-04	ND	2.5 E-04	2.5 E-04
	^{90}Sr	2.5 E-04	1.8 E-04	2.2 E-04	2.5 E-04
	^{234}U	1.7 E-05	1.6 E-05	1.6 E-05	1.7 E-05
	^{238}U	1.2 E-05	1.2 E-05	1.2 E-05	1.2 E-05
	$^{239,240}Pu$	4.4 E-05	1.3 E-05	2.9 E-05	4.4 E-05
N103	total α	NA	NA	1.1 E-03	2.2 E-03
	total β	NA	NA	1.4 E-02	3.5 E-02
	^{90}Sr	1.4 E-04	8.2 E-05	1.1 E-04	1.4 E-04
	^{234}U	1.0 E-05	1.5 E-05	1.3 E-05	1.5 E-05
	^{238}U	5.0 E-06	1.2 E-05	8.5 E-06	1.2 E-05
	$^{239,240}Pu$	8.2 E-05	5.2 E-05	6.7 E-05	8.2 E-05
N105	total α	NA	NA	8.8 E-04	1.6 E-03
	total β	NA	NA	1.2 E-02	2.4 E-02
	^{60}Co	2.7 E-04	3.0 E-04	2.9 E-04	3.0 E-04
	^{90}Sr	1.7 E-04	2.2 E-04	2.0 E-04	2.2 E-04
	^{137}Cs	1.7 E-04	ND	1.7 E-04	1.7 E-04
	^{234}U	2.0 E-05	1.9 E-05	1.9 E-05	2.0 E-05
	^{235}U	4.9 E-06	ND	4.9 E-06	4.9 E-06
	^{238}U	6.1 E-06	9.0 E-06	7.5 E-06	9.0 E-06
	$^{239,240}Pu$	1.9 E-05	ND	1.9 E-05	1.9 E-05
N106	total α	NA	NA	1.1 E-03	1.9 E-03
	total β	NA	NA	1.1 E-02	1.9 E-02
	^{90}Sr	1.8 E-04	1.3 E-04	1.5 E-04	1.8 E-04
	^{234}U	1.7 E-05	1.3 E-05	1.5 E-05	1.7 E-05
	^{235}U	5.8 E-06	ND	5.8 E-06	5.8 E-06
	^{238}U	1.3 E-05	1.1 E-05	1.2 E-05	1.3 E-05
	$^{239,240}Pu$	2.9 E-05	1.5 E-05	2.2 E-05	2.9 E-05

100-DR and 100-F Interim Safe Storage Project							
EDP code	Radionuclide or type of radioactivity	Concentration, pCi/m³					
		1st quarter	2nd quarter	3rd quarter	4th quarter	Average	Maximum
N492	total α	NA	NA	NA	NA	1.1 E-03	2.2 E-03
	total β	NA	NA	NA	NA	1.3 E-02	2.4 E-02
	^{90}Sr	1.9 E-04	2.9 E-04	1.5 E-03	NA	6.6 E-04	1.5 E-03
	^{234}U	3.6 E-05	2.1 E-05	4.1 E-05	1.5 E-05	2.8 E-05	4.1 E-05
	^{235}U	3.4 E-05	1.2 E-05	1.1 E-05	NA	1.9 E-05	3.4 E-05
	^{238}U	1.6 E-05	2.6 E-05	2.4 E-05	NA	2.2 E-05	2.6 E-05
	$^{239,240}Pu$	6.1 E-05	NA	2.2 E-05	NA	4.2 E-05	6.1 E-05
N493	total α	NA	NA	NA	NA	1.1 E-03	2.4 E-03
	total β	NA	NA	NA	NA	1.2 E-02	2.4 E-02
	^{90}Sr	3.7 E-04	NA	3.2 E-04	9.2 E-04	5.4 E-04	9.2 E-04
	^{234}U	3.8 E-05	3.6 E-05	2.8 E-05	1.5 E-05	2.9 E-05	3.8 E-05
	^{235}U	1.2 E-05	1.6 E-05	9.7 E-05	1.1 E-05	1.2 E-05	1.6 E-05
	^{238}U	2.4 E-05	2.4 E-05	1.6 E-05	1.1 E-05	1.9 E-05	2.4 E-05

100-DR and 100-F Interim Safe Storage Project							
EDP code	Radionuclide or type of radioactivity	Concentration, pCi/m³					
		1st quarter	2nd quarter	3rd quarter	4th quarter	Average	Maximum
N494	total α	NA	NA	NA	NA	1.1 E-03	2.5 E-03
	total β	NA	NA	NA	NA	1.2 E-02	2.7 E-02
	^{90}Sr	4.1 E-05	NA	NA	8.7 E-04	6.4 E-04	8.7 E-04
	^{234}U	2.8 E-05	1.9 E-05	3.3 E-05	1.2 E-05	2.3 E-05	3.3 E-05
	^{235}U	1.4 E-05	7.9 E-06	9.5 E-06	NA	1.0 E-05	1.4 E-05
	^{238}U	1.6 E-05	2.6 E-05	2.4 E-05	NA	2.2 E-05	2.6 E-05
	$^{239,240}Pu$	1.6 E-05	NA	NA	NA	1.6 E-05	1.6 E-05
N495	total α	NA	NA	NA	NA	1.1 E-03	2.0 E-03
	total β	NA	NA	NA	NA	1.1 E-02	2.3 E-02
	^{90}Sr	3.7 E-04	2.6 E-04	2.0 E-04	3.0 E-04	2.8 E-04	3.7 E-04
	^{234}U	3.4 E-05	3.6 E-05	2.3 E-05	2.2 E-04	2.9 E-05	3.6 E-05
	^{235}U	2.6 E-05	5.2 E-05	NA	NA	1.6 E-05	2.6 E-05
	^{238}U	1.7 E-05	1.0 E-05	1.4 E-05	NA	1.4 E-05	1.7 E-05
	$^{239,240}Pu$	1.4 E-05	NA	NA	NA	1.4 E-05	1.4 E-05

100-H Remedial Action Project					
EDP code	Radionuclide or type of radioactivity	1st-half concentration, pCi/m³	2nd-half concentration, pCi/m³	Average concentration, pCi/m³	Maximum concentration, pCi/m³
N507	total α	NA	NA	1.1 E-03	2.6 E-03
	total β	NA	NA	1.4 E-02	3.6 E-02
	^{234}U	3.6 E-05	1.3 E-05	2.4 E-05	3.6 E-04
	^{235}U	1.2 E-05	ND	1.2 E-05	1.2 E-05
	^{238}U	1.8 E-05	1.3 E-05	1.5 E-05	1.8 E-05
	$^{239,240}Pu$	ND	1.2 E-05	1.2 E-05	1.2 E-05
N508	total α	NA	NA	1.2 E-03	2.4 E-03
	total β	NA	NA	1.3 E-02	2.7 E-02
	^{90}Sr	2.4 E-04	ND	2.4 E-04	2.4 E-04
	^{234}U	3.6 E-05	1.4 E-05	2.5 E-05	3.6 E-05
	^{235}U	1.1 E-05	ND	1.1 E-05	1.1 E-05
	^{238}U	1.7 E-05	1.4 E-05	1.5 E-05	1.7 E-05
N509	total α	NA	NA	1.0 E-03	2.1 E-03
	total β	NA	NA	1.2 E-02	3.0 E-02
	^{90}Sr	3.1 E-04	ND	3.1 E-04	3.1 E-04
	^{137}Cs	ND	1.7 E-04	1.7 E-04	1.7 E-04
	^{152}Eu	ND	4.2 E-04	4.2 E-04	4.2 E-04
	^{234}U	2.3 E-05	1.5 E-05	1.9 E-05	2.3 E-05
	^{238}U	1.8 E-05	1.4 E-05	1.6 E-05	1.8 E-05
	$^{239,240}Pu$	4.9 E-06	7.6 E-06	6.2 E-06	7.6 E-06
N510	total α	NA	NA	1.0 E-03	2.1 E-03
	total β	NA	NA	1.1 E-02	2.7 E-02
	^{90}Sr	1.4 E-04	ND	1.4 E-04	1.4 E-04
	^{234}U	1.4 E-05	1.6 E-05	1.5 E-05	1.6 E-05
	^{238}U	1.3 E-05	9.0 E-06	1.3 E-05	1.1 E-05

200 East Area					
EDP code	**Radionuclide or type of radioactivity**	**1st-half concentration, pCi/m³**	**2nd-half concentration, pCi/m³**	**Average concentration, pCi/m³**	**Maximum concentration, pCi/m³**
N019	total α	NA	NA	1.0 E-03	1.8 E-03
	total β	NA	NA	1.1 E-02	2.9 E-02
	^{90}Sr	1.0 E-04	2.8 E-04	1.9 E-04	2.8 E-04
	^{137}Cs	ND	2.9 E-04	2.9 E-04	2.9 E-04
	^{234}U	1.9 E-05	3.0 E-05	2.5 E-05	3.0 E-05
	^{235}U	1.1 E-05	1.0 E-05	1.0 E-05	1.1 E-05
	^{238}U	1.4 E-05	1.4 E-05	1.4 E-05	1.4 E-05
N158	total α	NA	NA	1.2 E-03	3.6 E-03
	total β	NA	NA	1.4 E-02	3.4 E-02
	^{90}Sr	2.0 E-04	2.5 E-04	2.3 E-04	2.5 E-04
	^{137}Cs	ND	3.2 E-04	3.2 E-04	3.2 E-04
	^{234}U	1.1 E-05	3.8 E-05	2.4 E-05	3.8 E-05
	^{235}U	5.0 E-06	1.7 E-05	1.1 E-05	1.7 E-05
	^{238}U	8.6 E-06	2.1 E-05	1.5 E-05	2.1 E-05
	$^{239,240}Pu$	ND	6.4 E-05	6.4 E-05	6.4 E-05
N498	total α	NA	NA	1.0 E-03	2.2 E-03
	total β	NA	NA	1.3 E-02	3.0 E-02
	^{90}Sr	2.4 E-04	ND	2.4 E-04	2.4 E-04
	^{137}Cs	1.8 E-04	ND	1.8 E-04	1.8 E-04
	^{234}U	1.8 E-05	ND	1.8 E-05	1.8 E-05
	^{235}U	1.1 E-05	ND	1.1 E-05	1.1 E-05
	^{238}U	1.7 E-05	ND	1.7 E-05	1.7 E-05
	$^{239,240}Pu$	2.6 E-05	ND	2.6 E-05	2.6 E-05
N499	total α	NA	NA	1.1 E-03	2.4 E-03
	total β	NA	NA	1.2 E-02	2.5 E-02
	^{90}Sr	2.8 E-04	ND	2.8 E-04	2.8 E-04
	^{234}U	3.6 E-05	1.5 E-05	2.5 E-05	3.6 E-05
	^{235}U	4.0 E-05	6.9 E-06	2.3 E-05	4.0 E-05
	^{238}U	1.6 E-05	1.5 E-05	1.5 E-05	1.6 E-04
	$^{239,240}Pu$	ND	6.9 E-06	6.9 E-06	6.9 E-06
N957	total α	NA	NA	1.0 E-03	1.6 E-03
	total β	NA	NA	1.3 E-02	3.1 E-02
	^{90}Sr	2.3 E-04	1.7 E-04	2.0 E-04	2.3 E-04
	^{234}U	1.2 E-05	1.4 E-05	1.3 E-05	1.4 E-05
	^{238}U	1.6 E-05	1.5 E-05	1.5 E-05	1.6 E-05
N967	total α	NA	NA	1.1 E-03	1.9 E-03
	total β	NA	NA	1.3 E-02	3.8 E-02
	^{90}Sr	1.1 E-04	ND	1.1 E-04	1.1 E-04
	^{234}U	2.1 E-05	1.2 E-05	1.7 E-05	2.1 E-05
	^{235}U	1.6 E-05	ND	1.6 E-05	1.6 E-05
	^{238}U	1.2 E-05	5.6 E-06	8.8 E-06	1.2 E-05
	$^{239,240}Pu$	9.5 E-06	ND	9.5 E-06	9.5 E-06

200 East Area					
EDP code	**Radionuclide or type of radioactivity**	**1st-half concentration, pCi/m³**	**2nd-half concentration, pCi/m³**	**Average concentration, pCi/m³**	**Maximum concentration, pCi/m³**
N968	total α	NA	NA	1.1 E-03	1.9 E-03
	total β	NA	NA	1.1 E-02	2.5 E-02
	^{90}Sr	1.1 E-04	ND	1.1 E-04	1.1 E-04
	^{234}U	1.9 E-05	1.6 E-05	1.7 E-05	1.9 E-05
	^{235}U	ND	3.6 E-06	3.6 E-06	3.6 E-06
	^{238}U	1.6 E-05	ND	1.6 E-05	1.6 E-05
	$^{239,240}Pu$	6.4 E-06	6.5 E-06	6.5 E-06	6.5 E-06
N969	total α	NA	NA	1.1 E-03	2.5 E-03
	total β	NA	NA	1.2 E-02	2.7 E-02
	^{90}Sr	1.0 E-03	ND	1.0 E-03	1.0 E-03
	^{234}U	1.8 E-05	6.8 E-06	1.2 E-05	1.8 E-05
	^{238}U	7.3 E-06	1.7 E-05	1.2 E-05	1.7 E-05
	^{238}Pu	2.3 E-05	ND	2.3 E-05	2.3 E-05
N970	total α	NA	NA	1.1 E-03	2.0 E-03
	total β	NA	NA	1.2 E-02	2.6 E-02
	^{90}Sr	8.5 E-05	ND	8.5 E-05	8.5 E-05
	^{234}U	2.2 E-05	1.2 E-05	2.2 E-05	2.2 E-05
	^{235}U	4.3 E-06	ND	4.3 E-06	4.3 E-06
	^{238}U	1.4 E-05	1.6 E-05	1.5 E-05	1.6 E-05
	$^{239,240}Pu$	ND	2.9 E-05	2.9 E-05	2.9 E-05
N972	total α	NA	NA	1.0 E-03	2.2 E-03
	total β	NA	NA	1.1 E-02	2.5 E-02
	^{90}Sr	2.2 E-04	ND	2.2 E-04	2.2 E-04
	^{234}U	8.1 E-06	1.5 E-05	1.2 E-05	1.5 E-05
	^{238}U	1.3 E-05	1.9 E-05	1.6 E-05	1.9 E-05
	$^{239,240}Pu$	1.9 E-05	1.2 E-05	1.5 E-05	1.9 E-05
N973	total α	NA	NA	1.3 E-03	3.1 E-03
	total β	NA	NA	1.3 E-02	3.3 E-02
	^{90}Sr	2.8 E-04	1.2 E-04	2.0 E-04	2.8 E-04
	^{234}U	9.4 E-06	1.6 E-05	1.3 E-05	1.6 E-05
	^{238}U	1.2 E-05	1.0 E-05	1.1 E-05	1.2 E-05
	$^{239,240}Pu$	5.7 E-06	1.8 E-05	1.2 E-05	1.8 E-05
N976	total α	NA	NA	9.7 E-04	1.5 E-03
	total β	NA	NA	1.1 E-02	2.2 E-02
	^{90}Sr	1.5 E-04	2.0 E-04	1.8 E-04	2.0 E-04
	^{234}U	1.8 E-05	1.0 E-05	1.4 E-05	1.8 E-05
	^{235}U	3.4 E-06	ND	3.4 E-06	3.4 E-06
	^{238}U	1.5 E-05	1.8 E-05	1.7 E-05	1.8 E-05
N977	total α	NA	NA	1.1 E-03	1.6 E-03
	total β	NA	NA	1.1 E-02	2.5 E-02
	^{90}Sr	3.2 E-04	4.7 E-04	3.9 E-04	4.7 E-04
	^{234}U	1.6 E-05	1.5 E-05	1.5 E-05	1.6 E-05
	^{235}U	1.0 E-05	ND	1.0 E-05	1.0 E-05
	^{238}U	8.6 E-06	1.0 E-05	1.0 E-05	8.6 E-06

200 East Area					
***EDP* code**	**Radionuclide or type of radioactivity**	**1st-half concentration, pCi/m³**	**2nd-half concentration, pCi/m³**	**Average concentration, pCi/m³**	**Maximum concentration, pCi/m³**
N978	total α	NA	NA	1.1 E-03	2.5 E-03
	total β	NA	NA	1.1 E-02	2.7 E-02
	^{90}Sr	9.1 E-05	1.3 E-04	1.1 E-04	1.3 E-04
	^{234}U	1.8 E-05	1.4 E-05	1.6 E-05	1.8 E-05
	^{235}U	6.9 E-06	ND	6.9 E-06	6.9 E-06
	^{238}U	1.4 E-05	1.8 E-05	1.6 E-05	1.8 E-05
	$^{239,240}Pu$	6.2 E-06	4.4 E-06	5.3 E-06	6.2 E-06
N984	total α	NA	NA	1.1 E-03	2.3 E-03
	total β	NA	NA	1.3 E-02	3.1 E-02
	^{90}Sr	1.8 E-04	2.2 E-04	2.0 E-04	2.2 E-04
	^{137}Cs	1.3 E-04	ND	1.3 E-04	1.3 E-04
	^{234}U	1.5 E-05	1.2 E-05	1.4 E-05	1.5 E-05
	^{235}U	ND	6.0 E-06	6.0 E-06	6.0 E-06
	^{238}U	1.4 E-05	1.4 E-05	1.4 E-05	1.4 E-05
	$^{239,240}Pu$	8.3 E-06	4.2 E-06	6.2 E-06	8.3 E-06
N985	total α	NA	NA	1.0 E-03	1.5 E-03
	total β	NA	NA	1.1 E-02	2.3 E-02
	^{90}Sr	3.1 E-04	1.7 E-04	2.4 E-04	3.1 E-04
	^{234}U	3.1 E-05	1.3 E-05	2.2 E-05	3.1 E-05
	^{235}U	9.6 E-06	4.8 E-06	7.2 E-06	9.6 E-06
	^{238}U	1.2 E-05	1.5 E-05	1.4 E-05	1.5 E-05
	$^{239,240}Pu$	9.6 E-06	ND	9.6 E-06	9.6 E-06
N999	total α	NA	NA	1.1 E-03	2.5 E-03
	total β	NA	NA	1.2 E-02	2.4 E-02
	^{90}Sr	1.7 E-04	1.9 E-04	1.8 E-04	1.9 E-04
	^{234}U	1.9 E-05	1.9 E-05	1.9 E-05	1.9 E-05
	^{238}U	1.7 E-05	1.2 E-05	1.4 E-05	1.7 E-05

200 West Area					
EDP code	**Radionuclide or type of radioactivity**	**1st-half concentration, pCi/m³**	**2nd-half concentration, pCi/m³**	**Average concentration, pCi/m³**	**Maximum concentration, pCi/m³**
N155	total α	NA	NA	1.0 E-03	2.5 E-03
	total β	NA	NA	1.1 E-02	2.5 E-02
	^{90}Sr	1.8 E-04	4.6 E-04	3.2 E-04	4.6 E-04
	^{137}Cs	4.3 E-04	6.0 E-04	5.2 E-04	6.0 E-04
	^{234}U	1.5 E-05	4.0 E-05	2.8 E-05	4.0 E-05
	^{235}U	ND	1.7 E-05	1.5 E-05	1.7 E-05
	^{238}U	1.1 E-05	3.2 E-05	2.2 E-05	3.2 E-05
	$^{239,240}Pu$	1.1 E-05	9.7 E-06	1.0 E-05	1.1 E-05
N161	total α	NA	NA	1.2 E-03	2.3 E-03
	total β	NA	NA	1.2 E-02	2.9 E-02
	^{90}Sr	3.2 E-04	1.7 E-04	2.5 E-04	3.2 E-04
	^{234}U	1.8 E-05	2.0 E-05	1.9 E-05	2.0 E-05
	^{235}U	3.5 E-06	1.4 E-05	1.3 E-05	1.4 E-05
	^{238}U	1.2 E-05	1.4 E-05	1.3 E-05	1.4 E-05
	$^{239,240}Pu$	1.0 E-04	1.1 E-05	5.5 E-05	1.1 E-04
N165	total α	NA	NA	1.2 E-03	2.4 E-03
	total β	NA	NA	1.3 E-02	2.2 E-02
	^{90}Sr	6.4 E-04	1.5 E-04	3.9 E-04	6.4 E-04
	^{234}U	2.4 E-05	2.5 E-05	2.5 E-05	2.5 E-05
	^{235}U	ND	1.7 E-05	1.7 E-05	1.7 E-05
	^{238}U	2.1 E-05	1.5 E-05	1.8 E-05	2.1 E-05
	$^{239,240}Pu$	6.2 E-05	7.3 E-05	6.7 E-05	7.3 E-05
N168	total α	NA	NA	1.1 E-03	2.7 E-03
	total β	NA	NA	1.2 E-02	2.9 E-02
	^{60}Co	ND	1.7 E-04	1.7 E-04	1.7 E-04
	^{90}Sr	1.3 E-04	3.2 E-04	2.2 E-04	3.2 E-04
	^{137}Cs	1.7 E-04	ND	1.7 E-04	1.7 E-04
	^{234}U	1.4 E-05	1.8 E-05	1.6 E-05	1.8 E-05
	^{235}U	6.3 E-06	3.9 E-06	5.1 E-06	6.3 E-06
	^{238}U	1.3 E-05	1.3 E-05	1.3 E-05	1.3 E-05
	$^{239,240}Pu$	8.9 E-06	1.1 E-05	1.0 E-05	1.1 E-05
N200	total α	NA	NA	9.9 E-04	2.4 E-03
	total β	NA	NA	1.0 E-02	3.0 E-02
	^{90}Sr	1.0 E-04	2.1 E-04	1.6 E-04	2.1 E-04
	^{234}U	2.2 E-05	2.1 E-05	2.2 E-05	2.2 E-05
	^{235}U	ND	1.1 E-05	1.1 E-05	1.1 E-05
	^{238}U	1.6 E-05	2.2 E-05	1.9 E-05	2.2 E-05
	$^{239,240}Pu$	6.4 E-06	ND	6.4 E-06	6.4 E-06
N304	total α	NA	NA	1.0 E-03	1.7 E-03
	total β	NA	NA	1.1 E-02	2.2 E-02
	^{90}Sr	8.3 E-05	2.5 E-04	1.7 E-04	2.5 E-04
	^{234}U	1.6 E-05	1.4 E-05	1.5 E-05	1.63 E-05
	^{235}U	8.3 E-06	ND	8.3 E-06	8.3 E-06
	^{238}U	9.1 E-06	1.5 E-05	1.2 E-05	1.5 E-05
	$^{239,240}Pu$	1.3 E-05	ND	1.3 E-05	1.3 E-05

200 West Area					
EDP code	**Radionuclide or type of radioactivity**	**1st-half concentration, pCi/m³**	**2nd-half concentration, pCi/m³**	**Average concentration, pCi/m³**	**Maximum concentration, pCi/m³**
N433	total α	NA	NA	1.1 E-03	2.3 E-03
	total β	NA	NA	1.0 E-02	2.2 E-02
	^{90}Sr	4.4 E-04	ND	4.4 E-04	4.4 E-04
	^{234}U	1.1 E-05	ND	1.1 E-05	1.1 E-05
	^{235}U	3.6 E-06	ND	3.6 E-06	3.6 E-06
	^{238}U	6.8 E-06	1.1 E-05	8.9 E-05	1.1 E-05
	$^{239,240}Pu$	1.2 E-05	ND	1.2 E-05	1.2 E-05
N441	total α	NA	NA	1.1 E-03	2.3 E-03
	total β	NA	NA	1.1 E-02	2.8 E-02
	^{90}Sr	2.9 E-04	ND	2.9 E-04	2.9 E-04
	^{137}Cs	2.1 E-04	ND	2.1 E-04	2.1 E-04
	^{234}U	1.6 E-05	1.6 E-05	1.5 E-05	1.6 E-05
	^{235}U	1.5 E-056	ND	1.5 E-05	1.5 E-05
	^{238}U	2.1 E-05	8.4 E-06	1.5 E-05	2.1 E-05
	$^{239,240}Pu$	9.6 E-06	ND	9.6 E-06	9.6 E-06
N442	total α	NA	NA	1.0 E-03	2.5 E-03
	total β	NA	NA	1.1 E-02	2.2 E-02
	^{90}Sr	3.3 E-04	ND	3.3 E-04	3.3 E-04
	^{137}Cs	1.3 E-04	ND	1.3 E-04	1.3 E-04
	^{234}U	1.9 E-05	1.2 E-05	1.5 E-05	1.9 E-05
	^{235}U	1.2 E-05	ND	1.2 E-05	1.2 E-05
	^{238}U	8.3 E-06	ND	8.3 E-06	8.3 E-06
	$^{239,240}Pu$	1.7 E-05	ND	1.7 E-05	1.7-05
N449	total α	NA	NA	9.3 E-04	1.9 E-03
	total β	NA	NA	1.1 E-02	2.2 E-02
	^{90}Sr	4.2 E-04	1.3 E-04	2.7 E-04	4.2 E-04
	^{235}U	5.8 E-06	ND	5.8 E-06	5.8 E-06
	^{238}U	4.8 E-06	ND	4.8 E-06	4.8 E-06
	$^{239,240}Pu$	ND	1.3 E-05	1.3 E-05	1.3 E-05
N456	total α	NA	NA	9.7 E-04	2.3 E-03
	total β	NA	NA	1.2 E-02	2.8 E-02
	^{234}U	2.9 E-05	ND	2.9 E-05	2.9 E-05
	^{235}U	9.1 E-06	ND	9.1 E-06	9.1 E-06
	^{238}U	2.1 E-05	ND	2.1 E-05	2.1 E-05
N457	total α	NA	NA	1.0 E-03	1.9 E-03
	total β	NA	NA	1.3 E-02	3.5 E-02
	^{90}Sr	6.0 E-04	1.4 E-04	3.7 E-04	6.0 E-04
	^{234}U	2.2 E-05	1.2 E-05	1.7 E-05	2.2 E-05
	^{235}U	1.4 E-05	ND	1.4 E-05	1.4 E-05
	^{238}U	2.2 E-04	5.3 E-04	3.8 E-04	5.3 E-04
	$^{239,240}Pu$	2.5 E-05	4.3 E-05	3.4 E-05	4.32 E-05
N956	total α	NA	NA	1.1 E-03	2.3 E-03
	total β	NA	NA	1.2 E-02	3.2 E-02
	^{90}Sr	1.5 E-04	1.9 E-04	1.7 E-04	1.9 E-04
	^{137}Cs	2.5 E-04	4.9 E-04	3.7 E-04	4.9 E-04
	^{234}U	3.1 E-05	1.2 E-04	2.2 E-05	3.1 E-04
	^{235}U	2.7 E-05	ND	2.7 E-05	2.7 E-05
	^{238}U	3.1 E-05	9.8 E-06	2.0 E-05	3.1 E-05
	$^{239,240}Pu$	8.9 E-06	1.4 E-05	1.1 E-05	1.4 E-05

200 West Area					
EDP code	**Radionuclide or type of radioactivity**	**1st-half concentration, pCi/m³**	**2nd-half concentration, pCi/m³**	**Average concentration, pCi/m³**	**Maximum concentration, pCi/m³**
N963	total α	NA	NA	1.1 E-03	2.6 E-03
	total β	NA	NA	1.0 E-02	2.4 E-02
	^{90}Sr	3.6 E-04	ND	3.6 E-04	3.6 E-04
	^{234}U	1.0 E-05	1.3 E-05	1.2 E-05	1.3 E-05
	^{235}U	7.9 E-05	ND	7.9 E-05	7.9 E-05
	^{238}U	1.2 E-05	9.2 E-06	1.1 E-05	1.2 E-05
	$^{239,240}Pu$	1.2 E-05	8.5 E-06	1.0 E-05	1.2 E-05
N964	total α	NA	NA	1.0 E-03	3.1 E-03
	total β	NA	NA	1.2 E-02	3.0 E-02
	^{90}Sr	1.2 E-04	ND	1.2 E-04	1.2 E-04
	^{234}U	1.3 E-05	1.8 E-05	1.6-05	1.8 E-05
	^{235}U	4.0 E-06	5.2 E-06	4.6 E-06	5.2 E-06
	^{238}U	1.1 E-05	1.7 E-05	1.4 E-05	1.7 E-05
	$^{239,240}Pu$	1.6 E-05	1.8 E-05	1.7 E-05	1.8 E-05
N965	total α	NA	NA	1.1 E-03	2.0 E-02
	total β	NA	NA	1.2 E-02	2.3 E-02
	^{90}Sr	2.8 E-04	ND	2.8 E-04	2.8 E-04
	^{234}U	2.1 E-05	2.0 E-05	2.0 E-05	2.1 E-05
	^{235}U	1.6 E-05	5.0 E-06	1.0 E-05	1.6 E-05
	^{238}U	1.5 E-05	1.0 E-05	1.3 E-05	1.5 E-05
	$^{239,240}Pu$	1.1 E-05	1.3 E-06	1.2 E-05	1.3 E-05
N966	total α	NA	NA	1.1 E-03	2.1 E-03
	total β	NA	NA	1.2 E-02	3.1 E-02
	^{234}U	1.4 E-05	1.2 E-05	1.3 E-05	1.4 E-05
	^{235}U	5.8 E-06	5.6 E-06	5.7 E-06	5.8 E-06
	^{238}U	1.1 E-05	8.3 E-06	9.6 E-06	1.1 E-05
	$^{239,240}Pu$	3.4 E-05	2.9 E-05	3.1 E-05	3.4 E-05
N974	total α	NA	NA	1.1 E-03	2.0 E-03
	total β	NA	NA	1.2 E-02	2.4 E-02
	^{90}Sr	1.4 E-04	3.6 E-04	2.4 E-04	3.6 E-04
	^{234}U	8.8 E-05	1.0 E-05	9.4 E-06	1.0 E-05
	^{235}U	5.9 E-06	5.7 E-06	5.8 E-06	5.9 E-06
N975	total α	NA	NA	1.3 E-03	3.6 E-03
	total β	NA	NA	1.2 E-02	3.8 E-02
	^{90}Sr	1.6 E-04	1.3 E-04	1.4 E-04	1.6 E-04
	^{137}Cs	1.5 E-04	ND	1.5 E-04	1.5 E-04
	^{234}U	1.6 E-05	1.3 E-05	1.4 E-05	1.4 E-05
	^{235}U	6.9 E-06	ND	6.9 E-06	6.9 E-06
	^{238}U	7.9 E-06	1.0 E-05	8.9 E-65	1.0 E-05
	$^{239,240}Pu$	3.9 E-05	1.7 E-05	2.8 E-05	3.9 E-05
N987	total α	NA	NA	1.0 E-03	1.8 E-03
	total β	NA	NA	1.2 E-02	2.5 E-02
	^{90}Sr	5.0 E-04	2.8 E-04	3.9 E-04	5.0 E-04
	^{137}Cs	2.6 E-04	2.1 E-04	2.3 E-04	2.6 E-04
	^{234}U	2.1 E-05	1.1 E-05	1.6 E-05	2.1 E-05
	^{235}U	6.4 E-06	ND	6.4 E-06	6.4 E-06
	^{238}U	1.2 E-05	1.4 E-05	1.3 E-05	1.4 E-05
	$^{239,240}Pu$	1.5 E-05	ND	1.5 E-05	1.5 E-05

200 West Area					
EDP code	**Radionuclide or type of radioactivity**	**1st-half concentration, pCi/m³**	**2nd-half concentration, pCi/m³**	**Average concentration, pCi/m³**	**Maximum concentration, pCi/m³**
N994	total α	NA	NA	1.1 E-03	2.1 E-03
	total β	NA	NA	1.2 E-02	2.4 E-02
	^{234}U	1.5 E-05	1.0 E-05	1.3 E-05	1.5 E-05
	^{235}U	9.4 E-06	ND	9.4 E-06	9.4 E-06
	^{238}U	1.6 E-05	1.1 E-05	1.4 E-05	1.6 E-05
	$^{239,240}Pu$	ND	6.1 E-06	6.1 E-06	6.1 E-06
N981	total α	NA	NA	1.0 E-03	2.6 E-03
	total β	NA	NA	1.3 E-02	2.6 E-02
	^{90}Sr	ND	1.3 E-04	1.3 E-04	1.3 E-04
	^{234}U	1.8 E-05	1.3 E-05	1.5 E-05	1.8 E-05
	^{235}U	1.2 E-05	6.0 E-06	9.0 E-06	1.2 E-05
	^{238}U	2.2 E-05	1.0 E-05	1.6 E-05	2.2 E-05
	$^{239,240}Pu$	ND	1.8 E-05	1.8 E-05	1.8 E-05

Environmental Restoration Disposal Facility					
EDP code	**Radionuclide or type of radioactivity**	**1st-half concentration, pCi/m³**	**2nd-half concentration, pCi/m³**	**Average concentration, pCi/m³**	**Maximum concentration, pCi/m³**
N482	total α	NA	NA	9.4 E-04	2.3 E-03
	total β	NA	NA	9.6 E-03	3.4 E-02
	^{90}Sr	2.0 E-04	ND	2.0 E-04	2.0 E-04
	^{234}U	3.4 E-05	1.6 E-05	2.5 E-05	3.4 E-05
	^{235}U	1.0 E-05	5.1 E-06	7.5 E-06	1.0 E-05
	^{238}U	2.2 E-05	2.3 E-05	2.3 E-05	2.3 E-05
	$^{239,240}Pu$	9.6 E-06	4.1 E-06	6.9 E-06	9.6 E-06
N483	total α	NA	NA	1.0 E-03	1.6 E-03
	total β	NA	NA	9.0 E-03	1.5 E-02
	^{90}Sr	2.4 E-04	ND	2.4 E-04	2.4 E-04
	^{103}Ru	ND	2.2 E-04	2.2 E-04	2.2 E-04
	^{234}U	2.0 E-05	1.7 E-05	1.8 E-05	2.0 E-05
	^{235}U	5.0 E-06	9.4 E-06	7.3 E-06	9.4 E-06
	^{238}U	1.8 E-05	2.6 E-05	2.2 E-05	2.6 E-05
	$^{239,240}Pu$	4.8 E-06	ND	4.8 E-06	4.8 E-06
N484	total α	NA	NA	1.3 E-03	3.6 E-03
	total β	NA	NA	1.4 E-02	3.6 E-02
	^{234}U	3.5 E-05	1.3 E-05	2.4 E-05	3.5 E-05
	^{235}U	1.4 E-05	ND	1.4 E-05	1.4 E-05
	^{238}U	1.9 E-05	8.8 E-06	1.4 E-05	1.9 E-05
	$^{239,240}Pu$	3.4 E-06	9.5 E-06	6.5 E-06	9.5 E-06

300-FF-1 Remedial Action Project					
EDP code	**Radionuclide or type of radioactivity**	**1st-half concentration, pCi/m³**	**2nd-half concentration, pCi/m³**	**Average concentration, pCi/m³**	**Maximum concentration, pCi/m³**
N485	total α	NA	NA	1.1 E-03	2.3 E-03
	total β	NA	NA	1.4 E-02	2.4 E-02
	^{234}U	1.2 E-04	2.1 E-05	7.0 E-05	1.2 E-04
	^{235}U	6.0 E-05	ND	6.0 E-05	6.0 E-05
	^{238}U	4.7 E-05	2.0 E-05	3.4 E-05	4.7 E-05
N486	total α	NA	NA	9.9 E-04	1.7 E-03
	total β	NA	NA	1.3 E-02	2.7 E-02
	^{234}U	2.1 E-04	2.7 E-05	1.2 E-04	2.1 E-04
	^{235}U	1.0 E-04	5.5 E-06	5.3 E-05	1.0 E-04
	^{238}U	4.9 E-05	1.8 E-05	3.4 E-05	4.9 E-05
N487	total α	NA	NA	1.1 E-03	2.1 E-03
	total β	NA	NA	1.4 E-02	2.5 E-02
	^{234}U	3.7 E-04	7.7 E-05	2.2 E-04	3.7 E-04
	^{235}U	1.5 E-04	1.1 E-05	8.1 E-05	1.5 E-04
	^{238}U	1.4 E-04	7.7 E-05	1.1 E-04	1.4 E-04
N488	total α	NA	NA	1.2 E-03	2.2 E-03
	total β	NA	NA	1.3 E-02	2.2 E-02
	^{234}U	1.2 E-04	5.7 E-05	8.9 E-05	1.2 E-04
	^{235}U	1.4 E-05	4.4 E-06	9.2 E-06	1.4 E-05
	^{238}U	9.5 E-05	4.8 E-05	7.1 E-05	9.5 E-05
N489	total α	NA	NA	1.0 E-03	2.7 E-03
	total β	NA	NA	1.3 E-02	3.5 E-02
	^{137}Cs	ND	1.6 E-04	1.6 E-04	1.6 E-04
	^{234}U	8.2 E-05	4.0 E-05	6.1 E-05	8.2 E-05
	^{235}U	1.2 E-05	6.2 E-06	9.1 E-06	1.2 E-05
	^{238}U	6.8 E-05	4.9 E-05	5.8 E-05	6.8 E-05
N130	total α	NA	NA	1.0 E-03	1.6 E-03
	total β	NA	NA	2.0 E-02	2.3 E-02
	^{90}Sr	ND	1.4 E-04	1.4 E-04	1.4 E-04
	^{234}U	1.4 E-05	2.0 E-05	1.7 E-05	2.0 E-05
	^{235}U	9.6 E-06	ND	9.6 E-06	9.6 E-06
	^{238}U	8.2 E-06	1.6 E-05	1.2 E-05	1.6 E-05
	$^{239,240}Pu$	1.2 E-05	1.2 E-05	1.2 E-05	1.2 E-05

Gable Mountain Pond Project (commenced in 8/99, completed in 12/99)					
EDP code	**Radionuclide or type of radioactivity**	**1st-half concentration, pCi/m³**	**2nd-half concentration, pCi/m³**	**Average concentration, pCi/m³**	**Maximum concentration, pCi/m³**
N516	total α	NS	NA	1.7 E-03	1.7 E-03
	total β	NS	NA	9.9 E-03	1.4 E-02
	^{234}U	NS	8.5 E-05	8.5 E-05	8.5 E-05
	^{238}U	NS	6.8 E-05	6.8 E-05	6.8 E-05

Several of the ERC projects have requirements for annually reporting ambient air monitoring data obtained from samples collected at PNNL air monitoring stations. The projects and associated PNNL stations are the 100-B/C, 100-D, and 100-H Remedial Action projects (PNNL station no. 28, a.k.a. "Yakima Barricade"), the ERDF Project (PNNL station no. 11, a.k.a. "200 West SE"), and the 300-FF-1 Remedial Action project (PNNL station no. 14, a.k.a. "300 Trench"; and PNNL station no. 15, a.k.a. "300 NE"). The air monitoring data related to these locations are in Table 5-7.

Table 5-7. Ambient Air Monitoring Data for 1999
Related to Environmental Restoration Contract Projects

Location	Radionuclide or type of radioactivity	Average concentration, pCi/m^3	Maximum concentration, pCi/m^3
200 West SE	total α	5.8 E-04	1.3 E-03
	total β	1.2 E-02	2.7 E-02
	^{90}Sr	1.3 E-04	1.3 E-04
	^{234}U	1.9 E-05	2.3 E-05
	^{238}U	2.1 E-05	2.4 E-05
Yakima Barricade	total α	7.4 E-04	2.3 E-03
	total β	1.3 E-02	2.5 E-02
	^{90}Sr	5.5 E-05	5.5 E-05
	$^{239,240}Pu$	9.8 E-07	9.8 E-07
300 NE	total α	7.4 E-04	2.7 E-03
	total β	1.3 E-02	3.0 E-02
	^{3}H	4.6 E+00	1.0 E+00
	^{90}Sr	1.6 E-04	1.6 E-04
	^{234}U	7.1 E-04	8.5 E-05
	^{235}U	2.5 E-06	2.5 E-06
	^{238}U	6.9 E-05	9.2 E-05
	$^{239,240}Pu$	1.5 E-06	1.7 E-06
300 Trench	total α	7.3 E-04	2.3 E-03
	total β	1.4 E-02	3.4 E-02
	^{3}H	4.0 E+00	1.1 E+01
	^{234}U	4.1 E-05	5.8 E-05
	^{238}U	3.0 E-05	4.1 E-05

1 Ci = 1 curie = 3.7 E+10 becquerels (Bq); pCi = E-12 Ci

5.5 QUALITY ASSURANCE PROGRAM COMPLIANCE STATUS

Appendices in *NESHAP Quality Assurance Project Plan for Radionuclide Air Emissions Data* (HNF-EP-0528-3) provide 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. That document also contains the quality assurance (QA) activities related to data collection and reporting. Airborne effluent monitoring activities conducted by BHI, CHG, and FH are in accordance with federal and state regulations as well as with the documents listed below. PNNL also has a quality assurance plan implemented for facility effluent monitoring, as required by 40 CFR 61, Appendix B, Method 114. Their effluent monitoring QA plan incorporates guidance from the following documents.

The quality assurance programs described by these plans are based on the following documentation:

- 10 CFR 830.120, *Quality Assurance*
- EPA QAMS-005/80, Interim Guidelines for Preparing Quality Assurance Project Plans, (EPA 1983)
- DOE 5700.6C, *Quality Assurance*
- DOE 5400.1, *General Environmental Protection Program*
- DOE/EH-0173T, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance,* (DOE 1991)
- applicable criteria of ASME NQA-1, *Quality Assurance Requirements for Nuclear Facility Applications,* (ASME 1997).
- WHC-0536-3. 1995. *Quality Assurance Program Plan for Radionuclide Airborne Emissions Monitoring*, Westinghouse Hanford Company, Richland, Washington.

6.0 REFERENCES

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

ASME. 1989. *Quality Assurance Program for Nuclear Facilities, American Society for Testing and Material*, NQA-1-1989 Edition, New York.

Brown, R. M., G. L. Ogram, and F. S. Spencer. 1990. *Oxidation and Dispersion of HT in the Environment: The August 1986 Field Experiment at Chalk River*, Health Physics 58(2):171-181.

DOE Order 5400.1, *General Environmental Protection Program*, 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.

EPA/500/80. *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans*, U.S. Environmental Protection Agency, Washington, D.C.

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

PNL-6415, Rev. 10. 2000. *Hanford Site National Environmental Policy Act (NEPA) Characterization*, Pacific Northwest 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.

PNL-7803. 1991. *Hanford Area 1990 Population and 50-year Projection.* Pacific Northwest Laboratory, Richland, Washington.

PNNL-13117. 2000. *Hanford Site Climatological Summary 1999, with Historical Data.* Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13230. 2000. *Hanford Site Environmental Report for Calendar Year 1999.* Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13230, APP. 2. 2000. *Hanford Site Near-Facility Environmental Monitoring Data Report for Calendar Year 1999.* 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.

WHC-EP-0528-3. 1998. *Effluent Monitoring Quality Assurance Project Plan for Radioactive Airborne Emissions Data*, Westinghouse Hanford Company, Richland, Washington.

WHC-0536-3. 1995. *Quality Assurance Program Plan for Radionuclide Airborne Emissions Monitoring*, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A

DOSE MODELING AND METEOROLOGICAL DATA

This page intentionally left blank.

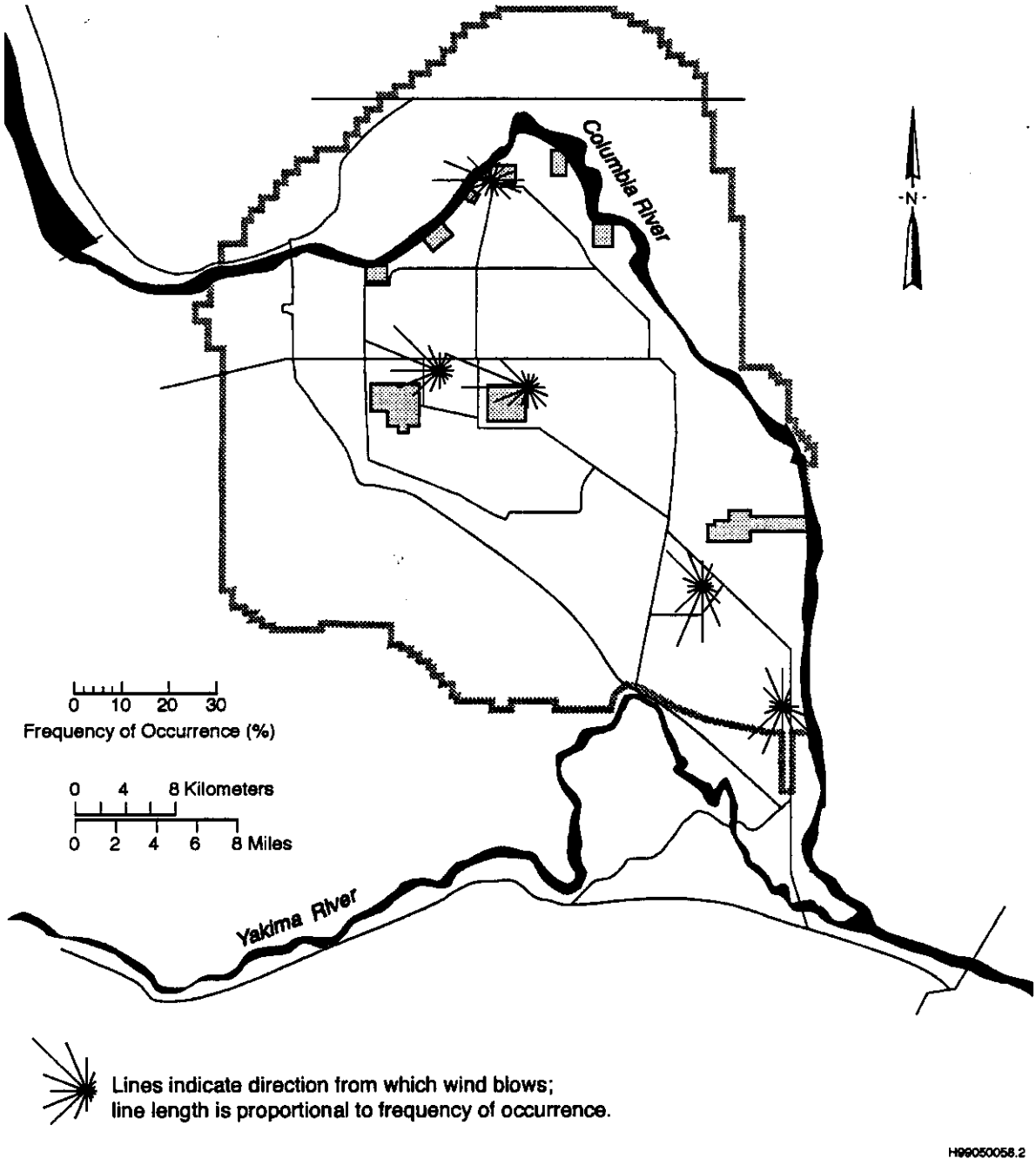


Figure A-1. Meteorological Station Map and Wind Roses for 1999.

This page intentionally left blank.

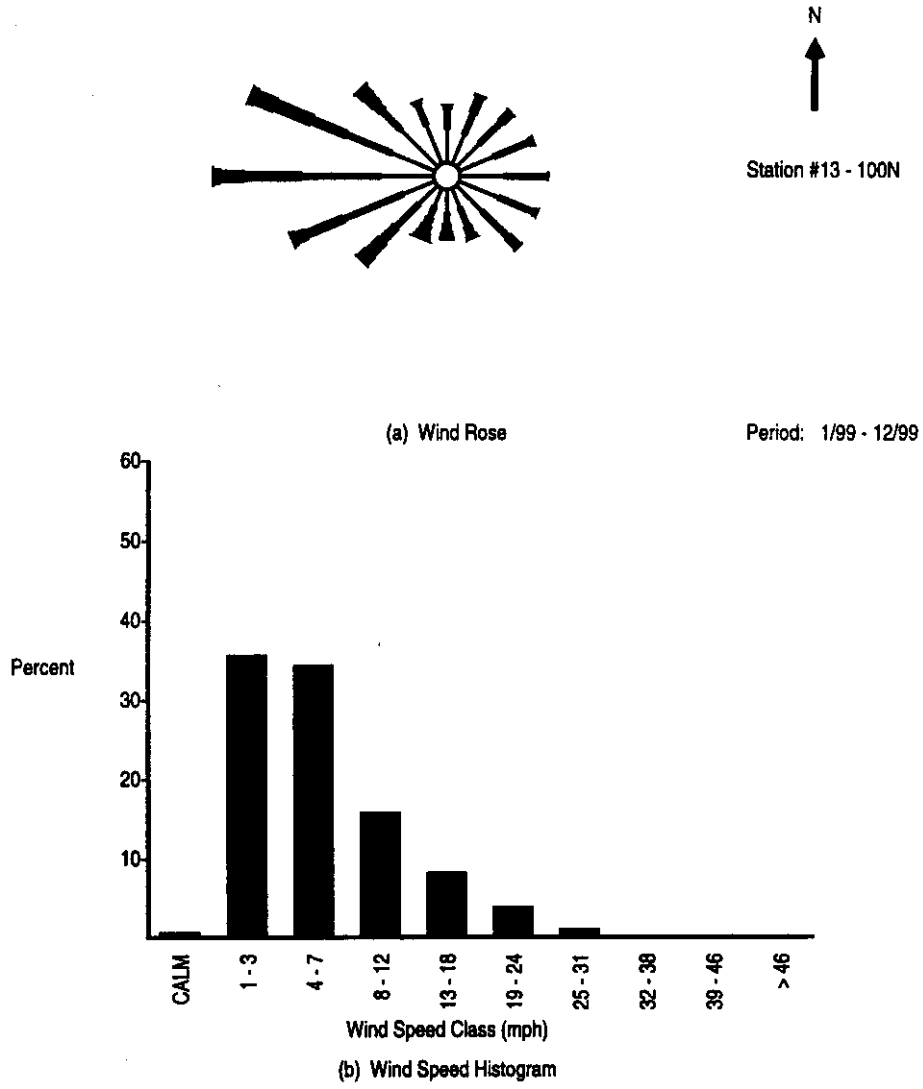


Figure A-2. 100-N Area Wind Rose and Histogram.

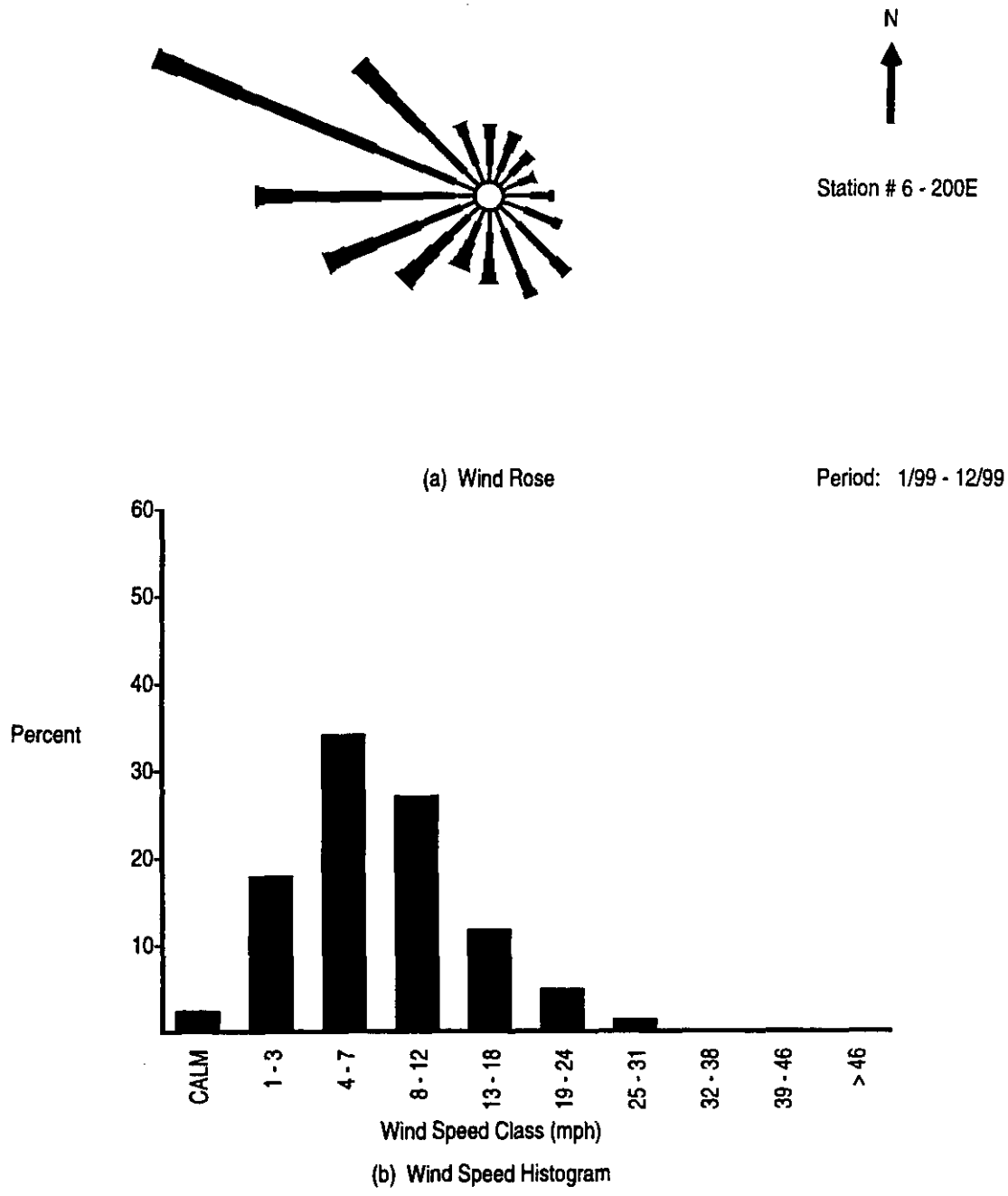


Figure A-3. 200 East Area Wind Rose and Histogram.

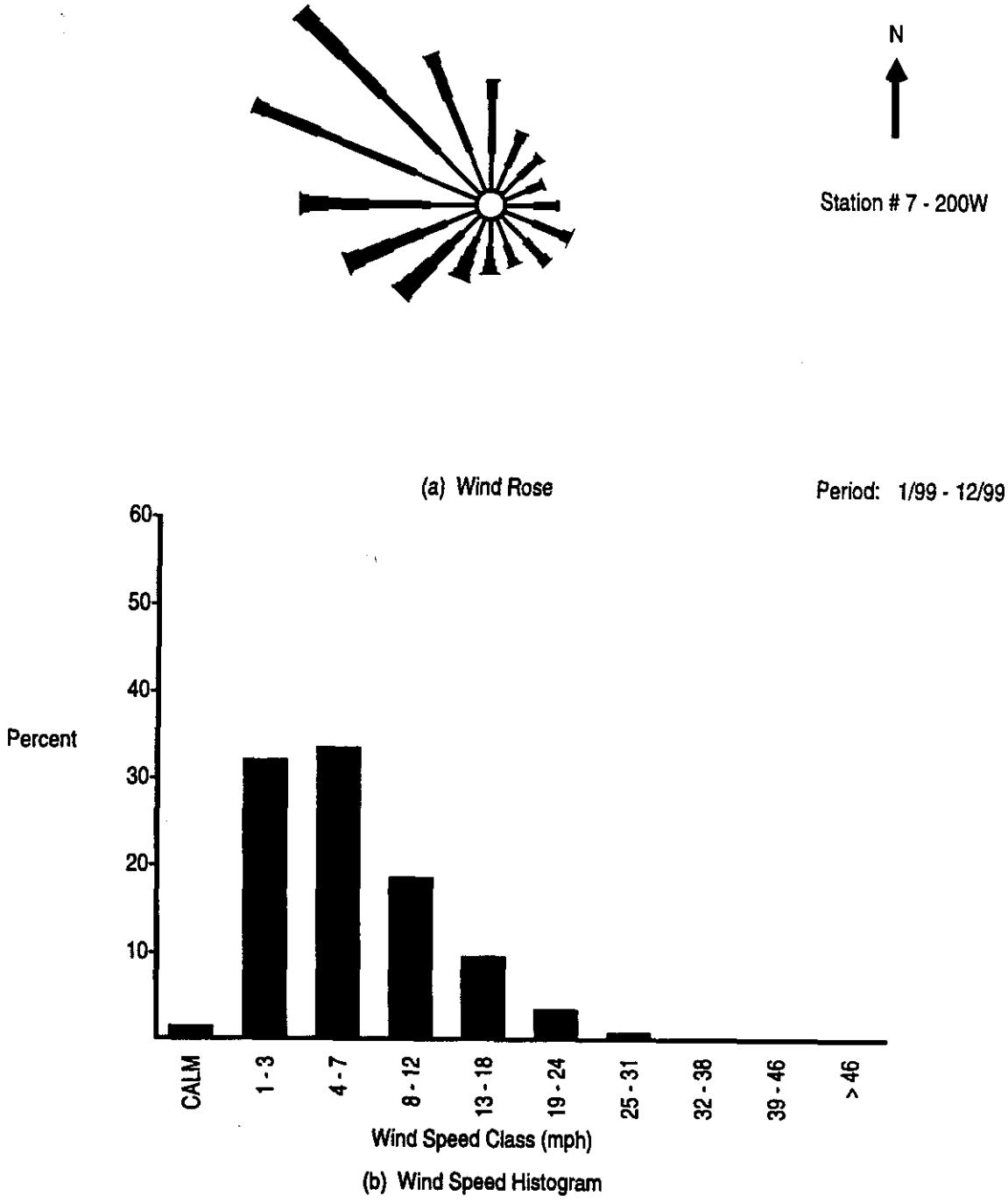


Figure A-4. 200 West Area Wind Rose and Histogram.

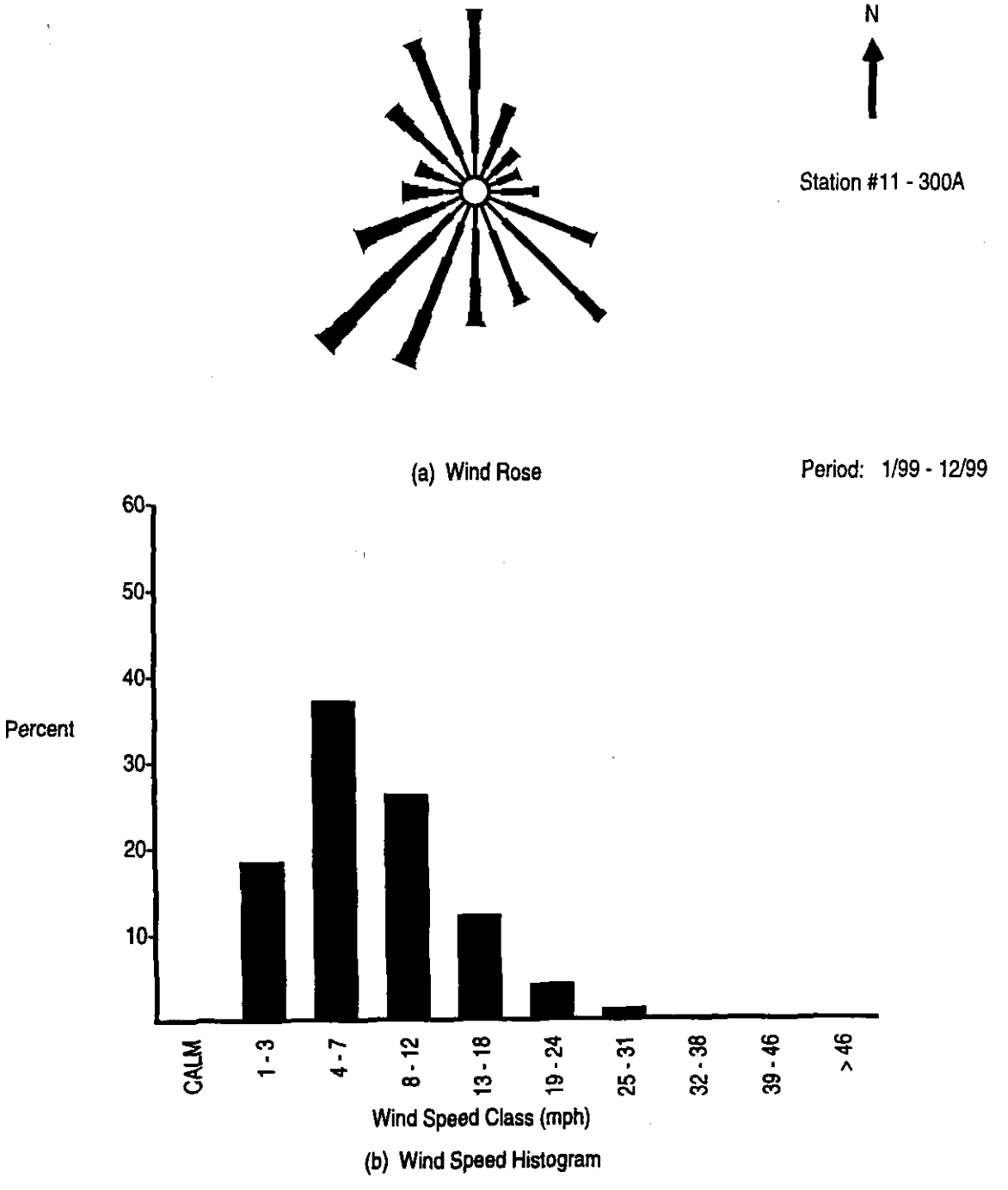


Figure A-5. 300 Area Wind Rose and Histogram.

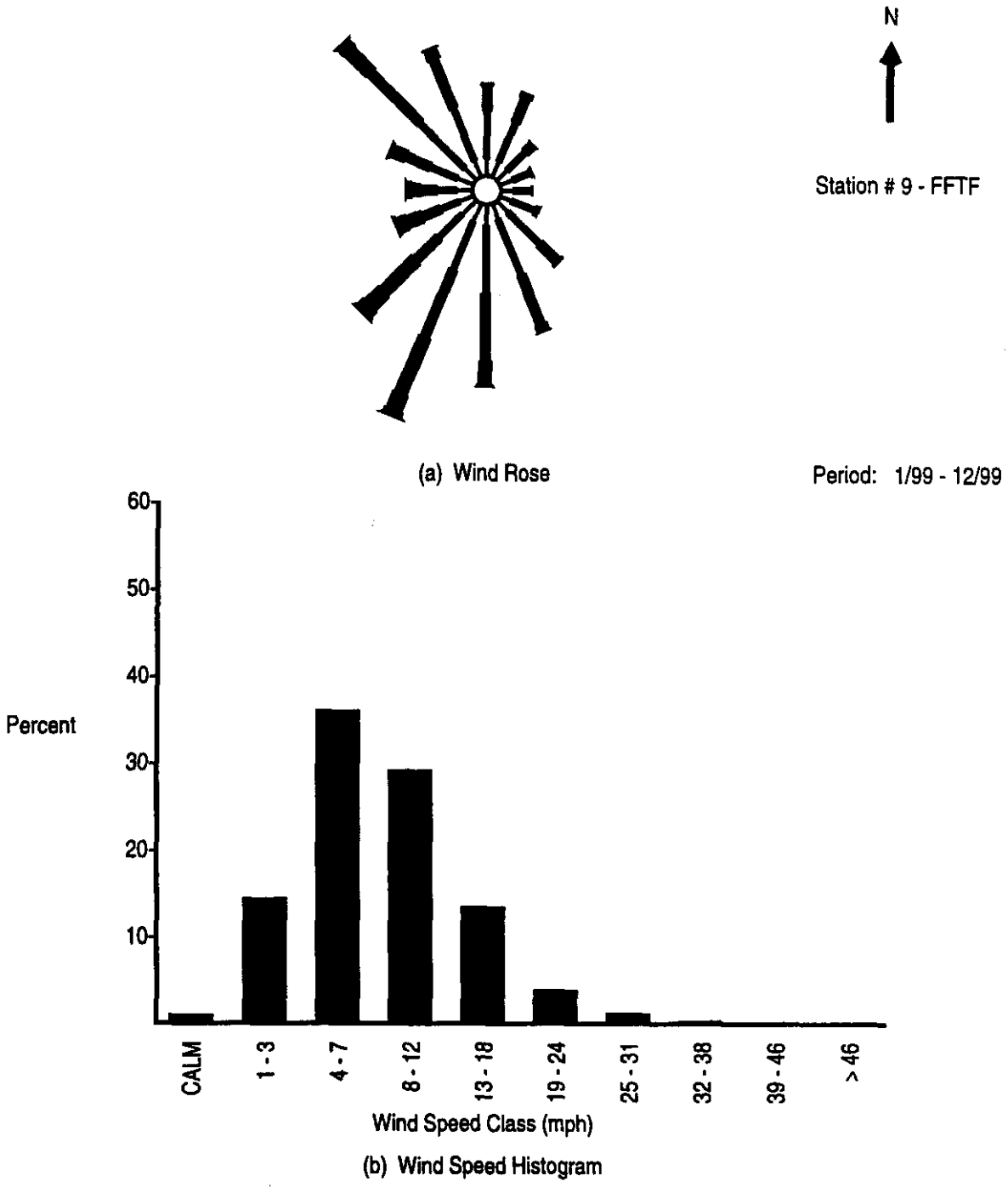


Figure A-6. 400 Wind Rose and Histogram.

Table A-1. Annual Average Dispersion Factor Around the 100-K Area During 1999 for a 10-Meter Release Height.

Dist:	0.8 km	2.4 km	4.0 km	5.6 km	7.2 km	12 km	24 km	40 km	56 km	72 km
Dir:										
N	2.73E-06	5.64E-07	2.68E-07	1.66E-07	1.16E-07	5.69E-08	2.21E-08	1.11E-08	7.12E-09	5.12E-09
NNE	2.83E-06	6.14E-07	2.95E-07	1.83E-07	1.29E-07	6.37E-08	2.49E-08	1.26E-08	8.12E-09	5.84E-09
NE	3.91E-06	8.30E-07	3.97E-07	2.46E-07	1.73E-07	8.56E-08	3.35E-08	1.70E-08	1.09E-08	7.87E-09
ENE	7.89E-06	1.75E-06	8.45E-07	5.27E-07	3.72E-07	1.85E-07	7.28E-08	3.71E-08	2.39E-08	1.73E-08
E	8.99E-06	1.93E-06	9.26E-07	5.75E-07	4.04E-07	2.00E-07	7.82E-08	3.96E-08	2.55E-08	1.84E-08
ESE	4.29E-06	8.66E-07	4.11E-07	2.54E-07	1.78E-07	8.75E-08	3.41E-08	1.73E-08	1.11E-08	7.99E-09
SE	2.80E-06	5.75E-07	2.74E-07	1.70E-07	1.19E-07	5.89E-08	2.31E-08	1.18E-08	7.58E-09	5.48E-09
SSE	1.99E-06	3.94E-07	1.87E-07	1.15E-07	8.10E-08	3.99E-08	1.57E-08	8.01E-09	5.18E-09	3.75E-09
S	1.94E-06	4.09E-07	1.97E-07	1.22E-07	8.62E-08	4.29E-08	1.70E-08	8.73E-09	5.66E-09	4.11E-09
SSW	1.81E-06	3.51E-07	1.66E-07	1.03E-07	7.21E-08	3.56E-08	1.40E-08	7.14E-09	4.62E-09	3.34E-09
SW	1.92E-06	3.96E-07	1.89E-07	1.17E-07	8.20E-08	4.04E-08	1.58E-08	8.00E-09	5.15E-09	3.72E-09
WSW	2.44E-06	5.15E-07	2.46E-07	1.53E-07	1.07E-07	5.29E-08	2.07E-08	1.05E-08	6.75E-09	4.87E-09
W	3.19E-06	6.61E-07	3.15E-07	1.95E-07	1.37E-07	6.76E-08	2.64E-08	1.34E-08	8.58E-09	6.18E-09
WNW	2.87E-06	6.11E-07	2.93E-07	1.82E-07	1.28E-07	6.33E-08	2.48E-08	1.26E-08	8.12E-09	5.85E-09
NW	2.94E-06	5.88E-07	2.78E-07	1.71E-07	1.20E-07	5.86E-08	2.27E-08	1.14E-08	7.31E-09	5.25E-09
NNW	2.74E-06	5.60E-07	2.66E-07	1.64E-07	1.15E-07	5.63E-08	2.18E-08	1.10E-08	7.05E-09	5.06E-09

Table A-2. Annual Average Dispersion Factor Around the 200 Areas During 1999 for an 89-Meter Release Height.

Dist:	0.8 km	2.4 km	4.0 km	5.6 km	7.2 km	12 km	24 km	40 km	56 km	72 km
Dir:										
N	2.04E-08	2.18E-08	1.83E-08	1.45E-08	1.17E-08	7.23E-09	3.52E-09	2.03E-09	1.41E-09	1.07E-09
NNE	2.90E-08	2.18E-08	1.77E-08	1.38E-08	1.10E-08	6.63E-09	3.18E-09	1.84E-09	1.28E-09	9.79E-10
NE	4.49E-08	3.38E-08	2.74E-08	2.15E-08	1.73E-08	1.05E-08	5.00E-09	2.84E-09	1.95E-09	1.47E-09
ENE	4.27E-08	2.72E-08	2.48E-08	2.09E-08	1.76E-08	1.16E-08	5.96E-09	3.53E-09	2.47E-09	1.88E-09
E	2.68E-08	2.31E-08	2.24E-08	1.96E-08	1.70E-08	1.18E-08	6.54E-09	4.04E-09	2.90E-09	2.25E-09
ESE	2.98E-08	3.89E-08	3.74E-08	3.21E-08	2.74E-08	1.84E-08	9.81E-09	5.93E-09	4.21E-09	3.24E-09
SE	9.73E-08	8.42E-08	7.45E-08	6.16E-08	5.14E-08	3.33E-08	1.70E-08	9.94E-09	6.92E-09	5.25E-09
SSE	8.78E-08	5.06E-08	4.13E-08	3.34E-08	2.77E-08	1.81E-08	9.56E-09	5.83E-09	4.18E-09	3.24E-09
S	1.10E-07	5.00E-08	3.69E-08	2.84E-08	2.29E-08	1.43E-08	7.28E-09	4.36E-09	3.10E-09	2.39E-09
SSW	6.36E-08	3.14E-08	2.34E-08	1.76E-08	1.38E-08	8.12E-09	3.74E-09	2.08E-09	1.41E-09	1.05E-09
SW	5.76E-08	2.46E-08	1.81E-08	1.39E-08	1.12E-08	6.82E-09	3.30E-09	1.90E-09	1.31E-09	9.87E-10
WSW	4.63E-08	2.09E-08	1.58E-08	1.22E-08	9.77E-09	6.00E-09	2.97E-09	1.74E-09	1.22E-09	9.35E-10
W	6.02E-08	2.72E-08	2.17E-08	1.70E-08	1.37E-08	8.38E-09	3.99E-09	2.26E-09	1.54E-09	1.16E-09
WNW	3.79E-08	2.43E-08	1.96E-08	1.54E-08	1.25E-08	7.68E-09	3.74E-09	2.15E-09	1.48E-09	1.12E-09
NW	2.13E-08	1.85E-08	1.53E-08	1.21E-08	9.90E-09	6.15E-09	2.96E-09	1.67E-09	1.13E-09	8.44E-10
NNW	7.03E-08	5.03E-08	4.17E-08	3.34E-08	2.73E-08	1.71E-08	8.32E-09	4.75E-09	3.26E-09	2.45E-09

Table A-3. Annual Average Dispersion Factor Around the 300 Area During 1999 for a 10-Meter Release Height.

Dist:	0.8 km	2.4 km	4.0 km	5.6 km	7.2 km	12 km	24 km	40 km	56 km	72 km
Dir:										
N	3.29E-06	6.89E-07	3.29E-07	2.03E-07	1.43E-07	7.03E-08	2.74E-08	1.38E-08	8.89E-09	6.40E-09
NNE	3.08E-06	6.09E-07	2.88E-07	1.77E-07	1.24E-07	6.06E-08	2.34E-08	1.18E-08	7.55E-09	5.42E-09
NE	3.00E-06	5.97E-07	2.83E-07	1.74E-07	1.22E-07	5.97E-08	2.31E-08	1.16E-08	7.46E-09	5.36E-09
ENE	2.24E-06	4.47E-07	2.11E-07	1.30E-07	9.11E-08	4.46E-08	1.73E-08	8.68E-09	5.56E-09	3.99E-09
E	1.85E-06	3.72E-07	1.76E-07	1.08E-07	7.58E-08	3.71E-08	1.43E-08	7.18E-09	4.59E-09	3.29E-09
ESE	2.00E-06	4.21E-07	2.01E-07	1.24E-07	8.74E-08	4.30E-08	1.67E-08	8.44E-09	5.41E-09	3.89E-09
SE	3.37E-06	7.21E-07	3.45E-07	2.14E-07	1.50E-07	7.37E-08	2.87E-08	1.45E-08	9.27E-09	6.66E-09
SSE	4.05E-06	8.55E-07	4.08E-07	2.52E-07	1.77E-07	8.67E-08	3.37E-08	1.70E-08	1.09E-08	7.80E-09
S	4.10E-06	8.58E-07	4.09E-07	2.53E-07	1.78E-07	8.74E-08	3.41E-08	1.72E-08	1.10E-08	7.94E-09
SSW	1.32E-06	2.60E-07	1.24E-07	7.63E-08	5.36E-08	2.64E-08	1.04E-08	5.27E-09	3.40E-09	2.46E-09
SW	6.85E-07	1.40E-07	6.70E-08	4.17E-08	2.94E-08	1.46E-08	5.82E-09	3.00E-09	1.96E-09	1.42E-09
WSW	5.68E-07	1.14E-07	5.46E-08	3.40E-08	2.40E-08	1.20E-08	4.78E-09	2.47E-09	1.61E-09	1.17E-09
W	8.88E-07	1.72E-07	8.23E-08	5.11E-08	3.60E-08	1.79E-08	7.13E-09	3.67E-09	2.39E-09	1.74E-09
WNW	2.76E-06	5.68E-07	2.71E-07	1.68E-07	1.18E-07	5.85E-08	2.30E-08	1.17E-08	7.54E-09	5.44E-09
NW	4.60E-06	9.76E-07	4.68E-07	2.90E-07	2.04E-07	1.01E-07	3.97E-08	2.02E-08	1.30E-08	9.38E-09
NNW	3.58E-06	7.54E-07	3.61E-07	2.24E-07	1.57E-07	7.76E-08	3.04E-08	1.54E-08	9.92E-09	7.15E-09

Table A-4. Annual Average Dispersion Factor Around the 400 Area During 1999 for a 10-Meter Release Height.

Dist:	0.8 km	2.4 km	4.0 km	5.6 km	7.2 km	12 km	24 km	40 km	56 km	72 km
Dir:										
N	3.76E-06	7.62E-07	3.62E-07	2.24E-07	1.57E-07	7.70E-08	3.00E-08	1.52E-08	9.73E-09	7.00E-09
NNE	3.88E-06	7.79E-07	3.70E-07	2.28E-07	1.60E-07	7.85E-08	3.05E-08	1.54E-08	9.88E-09	7.10E-09
NE	2.87E-06	5.68E-07	2.68E-07	1.65E-07	1.15E-07	5.64E-08	2.18E-08	1.10E-08	7.03E-09	5.05E-09
ENE	1.92E-06	3.83E-07	1.81E-07	1.12E-07	7.81E-08	3.82E-08	1.48E-08	7.42E-09	4.75E-09	3.41E-09
E	1.75E-06	3.63E-07	1.73E-07	1.07E-07	7.52E-08	3.70E-08	1.44E-08	7.27E-09	4.66E-09	3.35E-09
ESE	2.27E-06	4.54E-07	2.15E-07	1.32E-07	9.22E-08	4.50E-08	1.73E-08	8.67E-09	5.53E-09	3.96E-09
SE	3.90E-06	7.92E-07	3.75E-07	2.31E-07	1.62E-07	7.91E-08	3.06E-08	1.53E-08	9.81E-09	7.03E-09
SSE	3.10E-06	6.54E-07	3.13E-07	1.94E-07	1.37E-07	6.74E-08	2.64E-08	1.34E-08	8.61E-09	6.20E-09
S	2.26E-06	4.70E-07	2.25E-07	1.39E-07	9.80E-08	4.85E-08	1.90E-08	9.69E-09	6.25E-09	4.51E-09
SSW	1.92E-06	3.99E-07	1.91E-07	1.19E-07	8.34E-08	4.13E-08	1.63E-08	8.30E-09	5.37E-09	3.88E-09
SW	1.29E-06	2.55E-07	1.21E-07	7.49E-08	5.26E-08	2.59E-08	1.02E-08	5.17E-09	3.33E-09	2.41E-09
WSW	9.49E-07	1.94E-07	9.30E-08	5.78E-08	4.07E-08	2.02E-08	8.00E-09	4.09E-09	2.65E-09	1.92E-09
W	8.56E-07	1.72E-07	8.20E-08	5.06E-08	3.55E-08	1.74E-08	6.79E-09	3.44E-09	2.21E-09	1.60E-09
WNW	1.01E-06	2.05E-07	9.78E-08	6.06E-08	4.26E-08	2.10E-08	8.25E-09	4.20E-09	2.71E-09	1.96E-09
NW	2.02E-06	4.08E-07	1.94E-07	1.20E-07	8.39E-08	4.13E-08	1.61E-08	8.18E-09	5.27E-09	3.80E-09
NNW	3.03E-06	6.40E-07	3.07E-07	1.90E-07	1.34E-07	6.60E-08	2.59E-08	1.31E-08	8.45E-09	6.09E-09

Table A-5. Radionuclide Data Used for CAP88-PC Dose Calculations at Hanford.
(sheet 1 of 3)

Radionuclide	Clearance class	Particle size (μm)	Scavenging Coefficient (per second)	Deposition Velocity (m/s)
^{3}H	*	0.0	0.00 E+00	0.00 E+00
^{60}Co	Y	1.0	1.60 E-06	1.80 E-03
^{90}Sr	D	1.0	1.60 E-06	1.80 E-03
^{125}Sb	W	1.0	1.60 E-06	1.80 E-03
^{129}I	D	1.0	1.60 E-06	3.50 E-02
^{137}Cs	D	1.0	1.60 E-06	1.80 E-03
^{137m}Ba	D	1.0	1.60 E-06	1.80 E-03
^{154}Eu	W	1.0	1.60 E-06	1.80 E-03
^{238}Pu	Y	1.0	1.60 E-06	1.80 E-03
^{239}Pu	Y	1.0	1.60 E-06	1.80 E-03
^{241}Pu	Y	1.0	1.60 E-06	1.80 E-03
^{241}Am	W	1.0	1.60 E-06	1.80 E-03

Table A-5. Radionuclide Data Used for CAP88-PC Dose Calculations at the Hanford Site.
(sheet 2 of 3)

Radionuclide	Decay constant (per day)			Transfer coefficient	
	Radioactive[1]	Surface	Water	Milk[2]	Meat[3]
^{3}H	0.00 E+00	5.48 E-05	0.00 E+00	0.00 E+00	0.00 E+00
^{60}Co	0.00 E+00	5.48 E-05	0.00 E+00	0.00 E+00	0.00 E+00
^{90}Sr	0.00 E+00	5.48 E-05	0.00 E+00	1.50 E-03	3.00 E-04
^{125}Sb	0.00 E+00	5.48 E-05	0.00 E+00	1.00 E-04	1.00 E-03
^{129}I	0.00 E+00	5.48 E-05	0.00 E+00	1.00 E-02	7.00 E-03
^{137}Cs	0.00 E+00	5.48 E-05	0.00 E+00	7.00 E-03	2.00 E-02
^{137m}Ba	3.91 E+02	5.48 E-05	0.00 E+00	3.50 E-04	1.50 E-04
^{154}Eu	0.00 E+00	5.48 E-05	0.00 E+00	2.00 E-05	5.00 E-03
^{238}Pu	0.00 E+00	5.48 E-05	0.00 E+00	1.00 E-07	5.00 E-07
^{239}Pu	0.00 E+00	5.48 E-05	0.00 E+00	1.00 E-07	5.00 E-07
^{241}Pu	0.00 E+00	5.48 E-05	0.00 E+00	1.00 E-07	5.00 E-07
^{241}Am	0.00 E+00	5.48 E-05	0.00 E+00	4.00 E-07	3.50 E-06

[1] Effective radioactive decay constant in plume; set to zero if less than 1.0 E-2.
[2] Fraction of animal's daily intake of nuclide that appears in each liter of milk (days/L).
[3] Fraction of animal's daily intake of nuclide that appears in each kg of meat (days/kg).

Table A-5. Radionuclide Data Used for CAP88-PC Dose Calculations at the Hanford Site.
(sheet 3 of 3)

Radionuclide	Concentration uptake factor		GI uptake fraction	
	Forage[1]	Edible[2]	Inhalation	Ingestion
^{3}H	0.00 E+00	0.00 E+00	9.50 E-01	9.50 E-01
^{60}Co	2.00 E-02	3.00 E-03	5.00 E-02	3.00 E-01
^{90}Sr	2.50 E+00	1.07 E-01	3.00 E-01	3.00 E-01
^{129}I	1.50 E-01	2.14 E-02	9.50 E-01	9.50 E-01
^{125}Sb	2.00 E-01	1.28 E-02	1.00 E-02	1.00 E-01
^{137}Cs	8.00 E-02	1.28 E-02	9.50 E-01	9.50 E-01
^{137m}Ba	1.50 E-01	6.42 E-03	1.00 E-01	1.00 E-01
^{154}Eu	1.00 E-02	1.71 E-03	1.00 E-03	1.00 E-03
^{238}Pu	4.50 E-04	1.93 E-05	1.00 E-03	1.00 E-03
^{239}Pu	4.50 E-04	1.93 E-05	1.00 E-04	1.00 E-03
^{241}Pu	4.50 E-04	1.93 E-05	1.00 E-03	1.00 E-03
^{241}Am	5.50 E-03	1.07 E-04	1.00 E-03	1.00 E-03

[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-6. Exposure and Consumption Data for the Hanford Site. (sheet 1 of 2)

FOOD SOURCE FOR THE MAXIMALLY EXPOSED INDIVIDUAL

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	
Cubic centimeters/hr	9.70 E+05
SOIL PARAMETERS	
Effective surface density (kg/m2, dry weight)	
(assumes 15-cm plow layer)	2.24 E+02
BUILDUP TIMES	
For activity in soil (years)	5.00 E+01
For radionuclides deposited on groundwater (days)	1.83 E+04
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 (hr)	1.20 E+02
Transport time from animal feed-milk-man (day)	2.00 E+00
Time from slaughter to consumption (day)	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 vegetables for human consumption (kg/m^2)	2.00 E+00

Table A-6. Exposure and Consumption Data for the Hanford Site. (sheet 2 of 2)

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
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 for leafy vegetables and produce	1.00 E+00
FRACTIONS GROWN IN GARDEN OF INTEREST	
Produce ingested	1.00 E+00
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/y)	2.20 E+02
Milk ingestion (L/y)	2.70 E+02
Meat ingestion (kg/y)	9.80 E+01
Leafy vegetable ingestion (kg/y)	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-7. Hanford Site Meteorological Data — General Site Information.

HEIGHT OF LID
LIDAI = 1000 (M)

RAINFALL RATE
RR = 15.9 (CM/Y)

AVERAGE AIR TEMPERATURE
TA = 12.0 (DEG C) 285.2 (K)

SURFACE ROUGHNESS LENGTH
Z0 = 0.010 (M)

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

STABILITY E	0.073
STABILITY F	0.109
STABILITY G	0.146

DISTRIBUTION

	MSIN
U.S. Environmental Protection Agency	
Region 10	
1200 Sixth Avenue	
Seattle, WA 98101	
J. M. Leitch (5)	OAQ-107
A. J. Frankel	OAQ-107
R. W. Poeten	OAQ-107
Washington State Department of Health	
Air Emissions and Defense Waste Section	
Division of Radiation Protection	
P. O. Box 47827	
Olympia, WA 98504-7827	
A. W. Conklin (5)	
J. E. Erickson	
PMB-385	
2839 W. Kennewick Ave.	
Kennewick, WA 99336	
R. S. Acselrod	
J. C. Berkey	
G. L. Laws	
P. J. Martell	
J W. Schmidt	
Washington State Department of Ecology	
M. A. Wilson	B5-18
U.S. Department of Energy-Headquarters	
R. F. Pelletier (3)	EH-232
K. C. Duvall	EH-232
Confederated Tribes of the Umatilla Indian Reservation	
P. O. Box 638	
Pendleton, OR 97801	
J. R. Wilkinson	
Nez Perce Tribe	
Environmental Restoration and Waste Management	
P. O. Box 365	
Lapwai, ID 83540	
D. L. Powaukee	
Yakama Indian Nation	
Environmental Restoration Waste Management Program	
P.O. Box 151	
Toppenish, WA 98948	
R. Jim	

DISTRIBUTION (cont)

	MSIN
ATG, Inc. P. O. Box 969 Richland, WA 99352 Curt Cannon	
Fluor Fernald P. O. Box 538704 Cincinnati, OH 45253-8704 Tony Tetsuwari	
U.S. Department of Energy, Richland Operations Office	
D. W. Bowser	H6-60
J. B. Hall	A2-15
P. J. Krupin (5)	A2-15
J. E. Mecca	A7-50
B. M. Pangborn	A5-17
J. E. Rasmussen	A2-15
D. C. Ward	A2-15
DOE-RL Public Reading Room	H2-53
Pacific Northwest National Laboratory	
E. J. Antonio	K3-54
B. P. Atencio	P7-68
M. Y. Ballinger	BSRC
E. G. Damberg	P7-68
R. L. Dirkes	K6-75
D. L. Edwards	P7-68
B. M. Gillespie	K6-96
R. W. Hanf, Jr.	K6-75
A. K. Ikenberry	P7-79
W. J. Martin	K3-54
K. Rhoads	K3-54
S. F. Snyder	K3-54
L. H. Staven	K3-54
M. J. Sula	Sequim
H. T. Tilden II	P8-34
L. A. True	K7-68
PNNL Reference Library	P8-55
Bechtel Hanford, Inc.	
A. B. Chaloupka	T6-05
R. G. Egge	S3-21
C. J. Kemp	S3-20
R. J. Landon	H0-02
N. C. Little	T6-05
T. E. Logan	H0-09
F. V. Roeck	H0-17
J. D. Showman	T7-05

DISTRIBUTION (cont)

	MSIN
Bechtel Hanford, Inc. (cont)	
J. G. Woolard	H0-02
J. P. Zoric	X5-53
CH2M HILL Hanford Group, Inc.	
D. J. Carrell	R1-51
G. M. Crummel	R1-51
T. A. Dillfhoff	S5-03
W. T. Dixon	R1-51
D. L. Dyekman	S7-03
B. G. Erlandson	R1-51
R. D. Haggard	R1-51
J. S. Hill	R1-51
J. J. Luke	R1-51
P. C. Miller	R1-51
K. S. Tollefson	R1-51
G. T. Wells	R1-51
DynCorp Tri-Cities Services, Inc.	
B. J. Dixon	G3-26
C. J. Grando	G3-26
Lockheed Martin Services, Inc.	
Central Files	B1-07
J. N. Diven	H8-41
DPC	H6-08
EDMC (2)	H6-08
Fluor Hanford	
B. M. Barnes	T4-04
J. A. Bates	G1-30
M. W. Bowman	S6-72
H. C. Boynton	T4-52
J. B. Buckley	T4-05
J. M. Barnett	L1-05
R. J. Boom	T6-14
L. E. Borneman	G1-27
J. E. Bramson	T5-54
B. L. Curn	H6-36
N. R. Dahl	N2-57
A. K. Dasgupta	S3-28
W. E. Davis	G1-37
T. A. Dillhoff	S5-03
L. P. Diediker (30)	G1-29
D. L. Flyckt	S6-71
T P. Frazier	G1-37
R. G. Gant	X3-79
C. K. Girres	T3-01

DISTRIBUTION (cont)

	MSIN
Fluor Hanford (cont)	
W. E. Green	G1-30
E. M. Greager	G1-29
M. F. Hackworth	T4-51
D. L. Halgren	L6-04
N. A. Homan	G1-30
D. L. Johnson	L1-05
R. E. Johnson	G1-30
L. D. Kamberg	T4-04
G. J. LeBaron	S4-49
P. W. Martin	T3-04
J. K. Perry	L1-04
S. M. Price	H8-67
D. G. Ranade	G1-37
D. E. Rasmussen	L1-04
D. L. Renberger	H6-10
D. J. Rokkan (50)	G1-29
F. M. Simmons	S6-81
D. G. Saueressig	T4-04
R. W. Szelmeczka	S6-72
J. E. Turnbaugh	X3-79
G. J. Warwick	S3-25
D. J. Watson	X3-79
R. D. Weissenfels	S6-51
J. A. Winterhalder	T6-16
Waste Management Technical Services, Inc.	
J. J. Dorian	H1-11
A. R. Johnson	H5-26
B. M. Markes	H1-11
S. M. McKinney	H1-11
C. J. Perkins	H1-11