Environmental Releases for Calendar Year 1994

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Office of Environmental Restoration and
Waste Management

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Hanford Company**

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**ENVIRONMENTAL RELEASES FOR
CALENDAR YEAR 1994**

ABSTRACT

This report presents data on radioactive and nonradioactive materials released into the environment during calendar year 1994 from facilities managed by the Westinghouse Hanford Company and monitored by Bechtel Hanford, Incorporated. The Westinghouse Hanford Company provides effluent monitoring services for Bechtel Hanford, Incorporated, which includes release reporting. Both summary and detailed presentations of the environmental releases are provided. When appropriate, comparisons to data from previous years are made.

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EXECUTIVE SUMMARY

This report fulfills the annual environmental release reporting requirements of U.S. Department of Energy (DOE) Orders 5484.1* and 5400.1.** This report provides supplemental information to the Hanford Site Environmental Report. The Hanford Site Environmental Report provides an update on the environmental status of the entire Hanford Site. The sitewide annual report summarizes the degree of compliance of the Hanford Site with applicable environmental regulations and informs the public about the impact of Hanford operations on the surrounding environment.

Like the Hanford Site Environmental Report, this annual report presents a summary of the environmental releases from facilities managed by the Westinghouse Hanford Company (WHC) and monitored by Bechtel Hanford, Incorporated (BHI). In addition to the summary data, this report also includes detailed data on air emissions, liquid effluents, and hazardous substances released to the environment during calendar year 1994 from these facilities.

*DOE, 1990, *Environmental Protection, Safety, and Health Protection Information Reporting Requirements*, DOE Order 5484.1, Change 7, U.S. Department of Energy, Washington, D.C.

**DOE, 1990, *General Environmental Protection Program*, DOE Order 5400.1, Change 1, U.S. Department of Energy, Washington, D.C.

As part of this executive summary, comprehensive data summaries of air emissions and liquid effluents in 1994 are displayed in Tables ES-1 through ES-5. These tables represent the following:

- **Table ES-1.** Radionuclide air emissions data (detailed data on emissions are presented in Section 2.0)
- **Table ES-2.** Data on radioactive liquid effluents discharged to the soil (detailed data on releases from individual waste streams to soil column disposal sites are presented in Section 3.0)
- **Table ES-3.** Radionuclides discharged to the Columbia River (detailed data are shown in Section 3.0)
- **Table ES-4.** Nonradioactive air emissions data (detailed information is given in Section 2.0)
- **Table ES-5.** Total Volumes and Flow Rates of 200/600 Area Liquid Effluents (detailed data are presented in Section 3.0).

Table ES-1

Release Estimates of 1994 Radionuclide Air Emissions from WHC and BHI Facilities.	
Radionuclide	Release (Ci) ^a
⁶⁰ Co	6.3 E-06
⁹⁰ Sr	1.9 E-04
¹⁰⁶ Ru	1.4 E-05
¹¹³ Sn	2.2 E-06
¹²⁵ Sb	1.6 E-06
¹²⁹ I	1.4 E-02
¹³⁴ Cs	3.2 E-07
¹³⁷ Cs	6.4 E-04
¹⁴⁷ Pm	ND
¹⁵⁴ Eu	1.7 E-06
¹⁵⁵ Eu	4.7 E-06
Uranium, recycled ^b	6.8 E-07
Uranium, depleted ^c	2.6 E08
²³⁸ Pu	1.6 E-05
^{239,240} Pu	4.4 E-04
²⁴¹ Pu	2.2 E-03
²⁴¹ Am	8.4 E-05

- a 1 Ci = 3.7 E+10 Becquerel; 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).
- b 200 West Area value determined from total uranium chemical analysis. 300 Area value determined from total alpha measurements. Assumed to be recycled uranium consisting of 34,614 Ci% ²³⁸U, 2,059 Ci% ²³⁵U, 58,551 Ci% ²³⁴U, and 4.776 Ci% ²³⁶U (99.008 Wt% ²³⁸U, 0.912 Wt% ²³⁵U, 0.009 Wt% ²³⁴U, and 0.071 Wt% ²³⁶U).
- c Determined from total alpha measurements. Assumed to be depleted uranium consisting of 63.478 Ci% ²³⁸U, 0.821 Ci% ²³⁵U, and 35.701 Ci% ²³⁴U (99.797 Wt% ²³⁸U, 0.200 Wt% ²³⁵U, and 0.003 Wt% ²³⁴U).

Table ES-2

Release Estimates of 1994 Radioactive Liquid Effluents Discharged to Soil from WHC and BHI Facilities.	
Radionuclide	Release (Ci) ^a
³ H	5.6 E+00
⁹⁰ Sr	3.3 E-01 ^b
⁹⁹ Tc	2.7 E-02
¹³⁷ Cs	5.7 E-02
Uranium, recycled ^c	3.4 E-02
Uranium, natural ^d	1.1 E-03
²³⁸ Pu	4.8 E-04
^{239,240} Pu	3.1 E-02
²⁴¹ Pu	4.3 E-03
²⁴¹ Am	1.1 E-01

- a 1 Ci = 3.7 E+10 Becquerel.
- b Value contains results from total beta measurements.
- c Determined from total uranium chemical analysis. Assumed to be recycled uranium consisting of 34.614 Ci% ²³⁸U, 2.059 Ci% ²³⁵U, 58.551 Ci% ²³⁴U, and 4.776 Ci% ²³⁶U (99.008 Wt% ²³⁸U, 0.912 Wt% ²³⁵U, 0.009 Wt% ²³⁴U, and 0.071 Wt% ²³⁶U).
- d Determined from total alpha measurements. Assumed to be natural uranium.

Table ES-3

Release Estimates of 1994 Radionuclides in Liquid Effluents Discharged to the Columbia River from WHC and BHI Facilities.	
Radionuclide	Release (Ci)
^3H	2.7 E-01
^{60}Co	1.1 E-04
^{90}Sr	1.1 E-01
^{106}Ru	7.1 E-04
^{125}Sb	4.9 E-05
^{134}Cs	2.2 E-05
^{137}Cs	1.5 E-05
^{238}Pu	1.4 E-08
$^{239/240}\text{Pu}$	2.5 E-07

Table ES-4

Release Estimates of 1994 Nonradioactive Constituents in Air Emissions from WHC and BHI Facilities.	
Constituent	Quantities (kg)
Particulates	14,613
Sulfur oxides (SO _x)	629,000
Nitrogen oxides (NO _x)	310,800
Carbon monoxide (CO)	99,920
Volatile Organic Compounds	1,270
Lead	271

Table ES-5

Total Volumes and Flow Rates of Liquid Effluents Discharged to the 200/600 Area Disposal Sites during 1993 and 1994 from WHC and BHI Facilities.							
Stream Code	EDP Code	Effluent Source	Disposal Site	Volume (L)		Flow Rate (gpm)	
				1993	1994	1993	1994
207-SL	H101	222-S Laboratory Chemical Sewer	216-S-26 Crib	6.5 E+06	6.3 E+06	3.3	3.2
207-U	H102	UO ₃ Plant Waste Water	216-U-14 Ditch	2.7 E+08	1.1 E+08	136	55.3
2904-ZA	H103	PFP Cooling Water	216-Z-20 Crib	1.0 E+08	2.7 E+07	50	13.3
ACW	H108	242-A Evaporator Cooling Water	216-B-3 Pond	7.0 E+08	1.6 E+09	350	780
ASC	H110	242-A Evaporator Steam Condensate	216-B-3 Pond	6.7 E+06	5.2 E+07	3.4	25.9
CA8	H115	241-A Tank Farm Cooling Water	216-B-3 Pond	8.8 E+08	6.5 E+08	440	327
CAR	H116	244-AR Vault Cooling Water	216-B-3 Pond	9.0 E+07	8.2 E+07	45	41.2
CBC	H117	B Plant Cooling Water	216-B-3 Pond	2.5 E+09	3.2 E+09	1300	1608
CSL	H118	PUREX Chemical Sewer	216-B-3 Pond	5.6 E+08	4.6 E+08	280	233
CWL	H119	PUREX Cooling Water	216-B-3 Pond	0.0	0.0	0	0
LWC	H120	Laundry Waste Water	216-W-LC Crib	2.6 E+07	0.0	13	0
U-17	H126	UO ₃ Plant Process Condensate	216-U-17 Crib	2.4 E+06	3.3 E+05	1.2	0.2

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LIST OF TERMS

BHI	Bechtel Hanford, Incorporated
CERCLA	<i>Comprehensive Environmental Response, Compensation, and Liability Act of 1980</i>
CFR	Code of Federal Regulations
DCG	derived concentration guide
DOE	U.S. Department of Energy
Ecology	State of Washington Department of Ecology
EDE	effective dose equivalent
EDP Code	Electronic Data Processing Code
EP	external publication
EPA	U.S. Environmental Protection Agency
FFTF	Fast Flux Test Facility
HEPA	high-efficiency particulate air (filter)
LWDF	Liquid Waste Disposal Facility
MASF	Maintenance and Storage Facility
MEI	maximally exposed individual
mrem	millirem (unit of dose)
ND	not detected
NPDES	National Pollutant Discharge Elimination System
PFP	Plutonium Finishing Plant
PSD	Prevention of Significant Deterioration
PNL	Pacific Northwest Laboratory
POTW	publicly owned treatment works (City of Richland)
ppm	parts per million
PUREX	Plutonium-Uranium Extraction
RCRA	<i>Resource Conservation and Recovery Act of 1976</i>
REDOX	Reduction-Oxidation
RL	U.S. Department of Energy, Richland Operations Office
RQ	reportable quantity
TRIGA	Test Reactor and Isotope Production, General Atomics
TRU	transuranic (waste)
UO ₃	uranium trioxide
WAC	Washington Administrative Code
WESF	Waste Encapsulation Storage Facility
WHC	Westinghouse Hanford Company

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ENVIRONMENTAL RELEASES FOR CALENDAR YEAR 1994

1.0 INTRODUCTION

The Westinghouse Hanford Company (WHC) and Bechtel Hanford, Incorporated (BHI) are responsible for monitoring radioactive and nonradioactive material released into the environment from DOE facilities at the Hanford Site. Bechtel Hanford, Incorporated has contracted WHC to perform some of its effluent monitoring duties, which includes fulfilling its annual effluent reporting requirements. This report documents the environmental releases from facilities managed by WHC and monitored by BHI during calendar year 1994. The monitored facilities are located in the 100 Areas (reactor areas), 200 Areas (separations areas), 300 and 400 Areas (research and development areas), 1100 Area (warehouses, stores, and offices), and the 600 Area (all remaining areas of the Hanford Site).

1.1 PURPOSE

This report fulfills the annual environmental release reporting requirements of U.S. Department of Energy (DOE) Orders 5484.1 and 5400.1 (DOE 1990a and DOE 1990b). This report provides supplemental information to the Hanford Site Environmental Report for Calendar Year 1994 (PNL, 1995). The Hanford Site Environmental Report provides an update on the environmental status of the entire Hanford Site. The sitewide annual report summarizes the degree of compliance of the Hanford Site with applicable environmental regulations and informs the public about the impact of Hanford operations on the surrounding environment.

Like the Hanford Site Environmental Report, this annual report presents a summary of the environmental releases from facilities managed by WHC and monitored by BHI. In addition to the summary data, this report also includes detailed data on air emissions, liquid effluents, and hazardous substances released to the environment from these facilities, during calendar year 1994.

1.2 SCOPE

This report presents information and data on liquid effluents, air emissions, and nonroutine hazardous substance releases that entered the environment in 1994 from facilities managed by WHC and monitored by BHI. When appropriate, comparisons are made to past releases.

1.3 TYPES AND LOCATIONS OF RELEASES

Radioactive liquid effluents and air emissions are released from facilities in the 100, 200, 300, and 400 Areas. Radioactive liquid effluents are discharged to the soil in the 200 and 300 Areas and to the Columbia River at the 100-N and 100-K Areas.

The major potential sources of nonradioactive air emissions of industrial origin are (1) nitrogen-oxide (NO_x) emissions from the Plutonium-Uranium Extraction (PUREX) and Uranium-TriOxide (UO_3) Plants and (2) fossil-fuel combustion emissions from powerhouse facilities in the 200 and 300 Areas. During 1994, the PUREX and UO_3 Plants did not operate and therefore did not emit any NO_x .

Waste water from the powerhouse facilities and water treatment facilities in the 200 Areas is discharged to the soil. In the 300 Areas, filter backwash from the water treatment plant is routed to a pond. Sanitary waste water is discharged to (1) the 100-N sanitary sewage lagoon or septic tanks or drain fields in the 100-B, 100-D, 100-H, and 100-K Areas, (2) several septic-tank or subsurface disposal systems in the 200 Areas, (3) a septic-tank trench system in the 300 Area, and (4) the sewage treatment plant and lagoon in the 400 Area. Solid waste from offices is buried at the Central Landfill in the 600 Area.

1.4 ENVIRONMENTAL RELEASE LIMITS AND GUIDELINES

This section presents environmental release standards. Relevant limits and guidelines for nonradioactive constituents also are included in this section. Guidelines are applicable for nonradioactive constituents when they: (1) affect the release and transport of radioactive constituents, (2) are necessary to meet any issued Federal, State, or local permit, or (3) are necessary to meet any Federal, State, or local regulations or guidelines prescribed by the U.S. Department of Energy, Richland Operations Office (RL).

1.4.1 Limits for Radioactive Releases

Concentrations of radionuclides in air emissions and liquid effluents from Hanford facilities are regulated by DOE Order 5400.5, *Radiation Protection of the Public and the Environment* (DOE 1993a) and Title 40 of the Code of Federal Regulations Part 61, Subpart H (EPA 1989). The effective dose equivalent (EDE) received by any member of the offsite public from all effluents and emissions released during routine operations at the Hanford Site is not to exceed 100 mrem/yr from continuous exposure throughout a prolonged period (5 years) and 500 mrem/yr from noncontinuous, occasional exposure. From the air pathway only, the EDE to any member of the public is not to exceed 10 mrem/yr.

The derived concentration guide (DCG) values in DOE Order 5400.5 apply at the location of actual exposure to members of the public. DCG values are used for comparison purposes only.

The Pacific Northwest Laboratory (PNL), operated for DOE by Battelle Memorial Institute, issues the annual environmental summary report for the Hanford Site (PNL 1995) as required by DOE Order 5400.1. This report assesses the radiological impact to the public resulting from all Hanford Site operations, in accordance with DOE Order 5480.1B (DOE 1993b) and DOE Order 5400.5 (DOE 1993a). The PNL report uses the release data contained in this report and the *Radionuclide Air Emissions Report for the Hanford Site Calendar Year 1994* (DOE-RL 1995) to calculate the offsite radiological dose impact. The PNL report is used to verify that Hanford Site is in compliance with the standards in DOE Order 5400.5.

1.4.2 Limits for Nonradioactive Releases

Nitrogen oxides emitted from the PUREX and the UO₃ plants are regulated in accordance with the limits defined in Prevention of Significant Deterioration Permit No. PSD-X80-14. All other nonradioactive emissions are reported annually to Ecology, as required.

The *Resource Conservation and Recovery Act of 1976* (RCRA), the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA), and WAC 173-303 also regulate nonradioactive constituents in air emissions and liquid effluents. Releases and spills of waste materials are reported immediately to appropriate Federal, State, and local agencies when required by CERCLA or WAC 173-303, section 145. Reporting to the National Response Center is required under CERCLA when the released or spilled material exceeded the reportable quantities listed in 40 CFR 302. Reporting to Ecology is required when the released or spilled material qualifies as a dangerous waste or hazardous substance and exceeds specified amounts as defined in WAC 173-303, Sections 070 to 104. This report summarizes significant releases and spills reported in 1994 from WHC and BHI facilities.

The Westinghouse Hanford Company manages nonradioactive hazardous solid waste in accordance with WAC 173-303. These wastes are kept at a permit-approved interim storage facility before eventual transport to a recycling center or to an approved offsite disposal facility. Nonradioactive, nonhazardous solid waste is handled in accordance with accepted practices for solid-waste management.

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2.0 AIR EMISSIONS

Both radioactive and nonradioactive air emissions to the atmosphere from facilities managed by WHC and monitored by BHI. Release data for each type of emission are discussed separately.

2.1 RADIONUCLIDE AIR EMISSIONS

Radionuclide air emissions generally are discharged from stacks and vents. In the 200 Areas, stacks and vents are designated by a number that has a "291" or "296" prefix, depending on their height. Stacks in the 200 Areas that are 61 m (200 ft) tall are designated by a "291" prefix. All other stacks and vents are designated by the "296" prefix. In the 100, 300, and 400 Areas, stacks and vents usually are identified by facility names.

During 1994, 84 emission points monitored by WHC and BHI were registered with the Washington State Department of Health. Information on all of these emissions points and 11 unregistered emission sources are included in this report.

2.1.1 Filtration of Radionuclide Air Emissions

The following methods are used to remove radionuclides from air emissions:

(1) high-efficiency particulate air (HEPA) filters, (2) sand filters, (3) charcoal absorbers (for iodine removal), (4) water scrubbers, (5) deep-bed fiberglass filters, (6) and fiberglass prefilters. Generally at least one stage, and often several stages, of HEPA filtration is used as the final particulate removal method before the air is discharged to the atmosphere. All in-place HEPA filters are required to have an efficiency of 99.95% in removing airborne particles larger than 0.3 μm in diameter. Filter efficiency is routinely tested. Past release data have shown that radionuclide concentrations in many emissions are below the lower limit of analytical detection.

2.1.2 Radionuclide Air Emissions

Release data on radionuclide air emissions from facilities, by area, are presented in Table 2-1. Tables 2-2 and 2-3 present data on the radionuclide air emissions from individual stacks and vents. The data consist of radionuclides detected or sampled for, average concentrations, and total activities.

Point source emissions are reported in this document when the following criteria were met during 1994: (1) emission point required continuous monitoring or periodic confirmatory measurements by 40 CFR 61 Subpart H or WAC 246-247, (2) emission point was registered with Washington State Department of Health (WDOH), (3) the emission point normally had radionuclide emissions or potentially had radionuclide emissions. Stacks or emission points not included in this report did not meet the previous criteria or were rendered inoperable (e.g. sealed off) before 1994, as indicated by the previous year's annual report.

Radionuclide air emissions from Hanford Site point sources resulted in an offsite dose to the hypothetical maximally exposed individual (MEI) of 0.0050 mrem EDE (see Figure 2-1). This dose is well below the 10 mrem/yr EDE standard imposed by the U.S. Environmental Protection Agency (EPA) on radionuclide air emissions (40 CFR 61).

Figure 2-1
Historical Effective Dose Equivalent Received by the Maximally Exposed Individual Located Offsite, from Airborne Radionuclide Emissions^a

^a Includes emissions from PNL facilities also.

In the 100 Areas, radionuclide emissions at 100-N Area remained below those reported when N Reactor operated, and the 100-K Area emissions did not change significantly from 1993. In the 200 Areas, radionuclide air emissions accounting for the greatest releases were ¹²⁹I and ²⁴¹Am via the PUREX Plant main stack and ^{239,240}Pu from PFP, PUREX Plant, and T Plant. 200 Area emissions have not changed significantly from 1993 emissions. Releases from the 300 and 400 Area facilities did not vary substantially from those reported for 1993 (DOE-RL 1994).

2.1.3 Nonradioactive Constituents in Radionuclide Air Emissions

Nitrogen-oxide emissions are released in association with processes at the PUREX and UO₃ Plants. The PUREX and UO₃ Plants did not operate in 1994, therefore, no NO_x emissions were generated or released. Release limits for NO_x were established by Prevention of Significant Deterioration Permit No. PSD-X80-14, issued by the EPA.

2.2 NONRADIOACTIVE AIR EMISSIONS

In 1994, nonradioactive air emissions were discharged from the following WHC managed facilities: (1) 200 East (284-E) powerhouse, (2) 200 West (284-W) powerhouse, and (3) the 300 Area powerhouse. Data on emissions from these sources are shown in Table 2-4. Powerhouse stack emissions were calculated using formulas established by the EPA (EPA 1990a).

Fabric-filter collection systems, called baghouses, remove particulate matter and, to a small degree, sulfur oxides (SO_x), emitted from coal-fired boilers. Baghouses are installed at the coal-fired boilers in the 200 Area's Powerhouses (284-E and 284-W) and the 300 Area (384) Powerhouse. Anytime a baghouse is bypassed (usually because of unavoidable replacement, repair, and maintenance of equipment), RL and the Washington Department of Ecology are notified through a monthly report of excess emissions.

Table 2-1

Release Estimates of 1994 Radionuclide Air Emissions from WHC and BHI Facilities.						
Radionuclide	Release, Ci ^a					
	100 Areas	200 East Area	200 West Area	300 Area	400 Area	Total
⁶⁰ Co	6.3 E-06	ND	ND	NM	NM	6.3 E-06
⁹⁰ Sr	4.7 E-05	6.5 E-05 ^b	7.5 E-05 ^b	1.6 E-06 ^b	NM	1.9 E-04 ^b
¹⁰⁶ Ru	1.4 E-05	ND	NM	NM	NM	1.4 E-05
¹¹³ Sn	ND	2.2 E-06	NM	NM	NM	2.2 E-06
¹²⁵ Sb	1.6 E-06	ND	NM	NM	NM	1.6 E-06
¹²⁹ I	NM	1.4 E-02	NM	NM	NM	1.4 E-02
¹³⁴ Cs	3.2 E-07	ND	ND	ND	NM	3.2 E-07
¹³⁷ Cs	1.0 E-04	2.9 E-04	2.7 E-04	NM	7.0 E-06 ^c	6.7 E-04 ^c
¹⁴⁷ Pm	ND	ND	ND	NM	NM	ND
¹⁵⁴ Eu	1.7 E-06	ND	ND	NM	NM	1.7 E-06
¹⁵⁵ Eu	4.7 E-06	ND	ND	NM	NM	4.7 E-06
Uranium, recycled ^d	NM	NM	6.8 E-07	3.7 E-09	NM	6.8 E-07
Uranium, depleted ^e	NM	NM	NM	2.6 E-08	NM	2.6 E-08
²³⁸ Pu	1.2 E-06	ND	1.5 E-05	NM	NM	1.6 E-05
^{239,240} Pu	7.8 E-06	3.2 E-05 ^f	3.9 E-04 ^f	4.0 E-07 ^f	2.3 E-06 ^f	4.4 E-04 ^f
²⁴¹ Pu	NM	1.8 E-04	2.0 E-03	NM	NM	2.2 E-03
²⁴¹ Am	5.6 E-06	1.2 E-05	6.6 E-05	NM	NM	8.4 E-05

Notes:

- a 1 Ci = 3.7 E+10 Becquerel; 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 results assumed to be ⁹⁰Sr for dose calculations.
- c This value includes total beta release data. Total beta results assumed to be ¹³⁷Cs for dose calculations from FFTF emissions.
- d 200 West Area value determined from total uranium chemical analysis. 300 Area value determined from total alpha measurements. Assumed to be recycled uranium consisting of 34.614 Ci% ²³⁸U, 2.059 Ci% ²³⁵U, 58.551 Ci% ²³⁴U, and 4.776 Ci% ²³⁶U (99.008 Wt% ²³⁸U, 0.912 Wt% ²³⁵U, 0.009 Wt% ²³⁴U, and 0.071 Wt% ²³⁶U).
- e Determined from total alpha measurements. Assumed to be depleted uranium consisting of 63.478 Ci% ²³⁸U, 0.821 Ci% ²³⁵U, and 35.701 Ci% ²³⁴U (99.797 Wt% ²³⁸U, 0.200 Wt% ²³⁵U, and 0.003 Wt% ²³⁴U).
- f This value includes total alpha release data. Total alpha and unspecified alpha results assumed to be ^{239/240}Pu for dose calculations.

Figure 2-2
Historical Airborne Effluent Releases of $^{239/240}\text{Pu}$

29507049.3

Figure 2-3
Historical Airborne Effluent Releases of ^{129}I

29507049.2

Table 2-2

(4 sheets)

1994 Radionuclide Air Emissions Data for Major Stacks from WHC and BHI Facilities. (major stacks have the potential of >0.1 mrem/yr EDE to nearest offsite resident) ^a						
Stack ID ^b [Facility/Contractor] (EDP Code(s))	Discharge Height (m)	Emission Control ^c (stages)	Total Flow (m ³)	Radionuclide ^d	Average Concentration (μ Ci/mL) ^e	Annual Emissions (Ci) ^e
200 East Area Stacks						
291-A-1 [PUREX/WHC] (A552,A566)	61.0	HEPA (3)	1.5 E+09	⁹⁰ Sr ¹²⁹ I ¹³⁷ Cs ¹⁴⁷ Pm ²³⁸ Pu ^{239,240} Pu ²⁴¹ Pu ²⁴¹ Am total alpha total beta	2.3 E-14 8.7 E-12 3.9 E-14 ND ND 1.9 E-14 1.2 E-13 7.3 E-15 1.3 E-14 1.7 E-13	3.4 E-05 1.3 E-02 5.9 E-05 ND ND 2.8 E-05 1.8 E-04 1.1 E-05 1.3 E-05 2.6 E-04
296-A-1 [PUREX/WHC] (A540)	20.7	HEPA (3)	6.1 E+07	^{239,240} Pu ²⁴¹ Am total alpha total beta	1.5 E-14 5.7 E-15 1.1 E-14 2.0 E-15	9.4 E-07 3.5 E-07 6.9 E-07 1.2 E-07
291-B-1 [B-Plant/WHC] (B691)	61.0	HEPA (2)	5.1 E+08	⁹⁰ Sr ¹³⁷ Cs ^{239,240} Pu total alpha total beta	3.7 E-14 4.5 E-13 2.9 E-15 1.3 E-15 7.6 E-13	1.9 E-05 2.3 E-04 1.5 E-06 6.4 E-07 3.9 E-04
296-A-22 [242-A Evaporator/WHC] (E643,E001,E002)	18.6	HEPA (2)	1.1 E+07	⁹⁰ Sr ¹⁰⁶ Ru ¹³⁷ Cs ^{239,240} Pu ²⁴¹ Am total alpha total beta	ND ND ND ND ND ND 1.2 E-14	ND ND ND ND ND ND 1.3 E-07
296-A-40 [Tank Farms/WHC] (E013,E028,E029)	4.1	HEPA (2)	2.0 E+07	⁹⁰ Sr ²⁴¹ Am total alpha total beta	1.5 E-15 NM 2.7 E-09 3.8 E-15	3.0 E-08 NM 5.4 E-09 7.6 E-08
296-A-17 296-P-26 (backup) [Tank Farms/WHC] (E059,E026,E027)	15.2	HEPA (2)	7.5 E+07	⁹⁰ Sr ¹¹³ Sn ¹²⁹ I ¹³⁷ Cs total alpha total beta	1.2 E-14 2.5 E-14 5.3 E-12 9.9 E-14 ND 9.7 E-14	9.1 E-07 1.9 E-06 4.0 E-04 7.4 E-06 ND 7.3 E-06

Table 2-2

(4 sheets)

1994 Radionuclide Air Emissions Data for Major Stacks from WHC and BHI Facilities. (major stacks have the potential of >0.1 mrem/yr EDE to nearest offsite resident) ^a						
Stack ID ^b [Facility/Contractor] (EDP Code(s))	Discharge Height (m)	Emission Control ^c (stages)	Total Flow (m ³)	Radionuclide ^d	Average Concentration (μ Ci/mL) ^e	Annual Emissions (Ci) ^e
296-A-25 [Tank Farms/WHC] (E080)	3.0	HEPA (2)	7.9 E+05	¹³⁷ Cs ^{239/240} Pu total alpha total beta	NM NM 8.9 E-15 1.0 E-12	NM NM 7.0 E-09 8.2 E-07
296-A-27 [Tank Farms/WHC] (E270,E933,E934)	3.7	HEPA (2)	1.9 E+07	⁹⁰ Sr ¹³⁷ Cs ²⁴¹ Am total alpha total beta	8.4 E-16 ND NM ND 5.2 E-14	1.6 E-08 ND NM ND 9.9 E-07
296-A-29 ^f [Tank Farms/WHC] (E901)	3.7	HEPA (2)	1.3 E+07	⁹⁰ Sr ¹³⁷ Cs ²⁴¹ Am total alpha total beta	1.5 E-15 ND NM ND 1.2 E-13	2.0 E-08 ND NM ND 1.5 E-06
296-B-28 [Tank Farms/WHC] (E886)	3.4	HEPA (2)	3.7 E+06	¹³⁷ Cs ^{239/240} Pu ²⁴¹ Am total alpha total beta	NM NM NM 3.2 E-16 1.1 E-14	NM NM NM 1.2 E-09 4.0 E-08
296-C-5 [Tank Farms/WHC] (E069)	14.6	HEPA (2)	7.2 E+07	⁹⁰ Sr ¹³⁷ Cs ^{239/240} Pu ²⁴¹ Am total alpha total beta	NM NM NM NM 3.8 E-17 2.6 E-14	NM NM NM NM 2.7 E-08 1.9 E-06
296-P-16 [Tank Farms/WHC] (E068)	4.6	HEPA (2)	5.9 E+07	⁹⁰ Sr ¹²⁹ I ^{239/240} Pu ²⁴¹ Am total alpha total beta	NM NM NM NM 4.7 E-17 3.2 E-14	NM NM NM NM 2.8 E-09 1.9 E-06
296-P-32 [Tank Farms/WHC] (E301-E399)	4.6	HEPA	1.6E+04	⁹⁰ Sr ¹³⁷ Cs ^{239/240} Pu ²⁴¹ Am total alpha total beta	NM NM NM NM 3.9 E-17 8.1 E-17	NM NM NM NM 6.2 E-13 1.3 E-12

Table 2-2

(4 sheets)

1994 Radionuclide Air Emissions Data for Major Stacks from WHC and BHI Facilities. (major stacks have the potential of >0.1 mrem/yr EDE to nearest offsite resident) ^a						
Stack ID ^b [Facility/Contractor] (EDP Code(s))	Discharge Height (m)	Emission Control ^c (stages)	Total Flow (m ³)	Radionuclide ^d	Average Concentration (μ Ci/mL) ^e	Annual Emissions (Ci) ^e
200 West Area Stacks						
291-Z-1 [PFP/WHC] (Z810)	61.0	HEPA (1-3)	3.5 E+09	²³⁸ Pu ^{239,240} Pu ²⁴¹ Pu ²⁴¹ Am total alpha total beta	4.3 E-15 8.6 E-14 5.7 E-13 1.6 E-14 8.9 E-14 4.6 E-15	1.5 E-05 3.0 E-04 2.0 E-03 5.5 E-05 3.1 E-04 1.6 E-05
296-P-23 296-P-28 (backup) [Tank Farms/WHC] (W190,W195)	4.6	HEPA (2)	1.7 E+07	¹³⁷ Cs total alpha total beta	NM 2.8 E-16 2.9 E-14	NM 4.7 E-09 4.9 E-07
296-S-15 [Tank Farms/WHC] (W111)	4.6	HEPA (2)	6.8 E+07	⁹⁰ Sr ¹³⁷ Cs ²⁴¹ Am total alpha total beta	NM NM NM 7.9 E-16 3.1 E-15	NM NM NM 5.4 E-08 2.1 E-07
296-S-22 [Tank Farms/WHC] (W880)	3.7	HEPA (2)	N/A	⁹⁰ Sr ¹³⁷ Cs ^{239/240} Pu ²⁴¹ Am total alpha total beta	(did not operate)	
296-T-18 [Tank Farms/WHC] (W882)	3.7	HEPA (2)	5.7 E+06	⁹⁰ Sr ¹³⁷ Cs ^{239/240} Pu total alpha total beta	NM NM NM 3.3 E-16 2.8 E-14	NM NM NM 1.9 E-09 1.6 E-07

Table 2-2

(4 sheets)

1994 Radionuclide Air Emissions Data for Major Stacks from WHC and BHI Facilities. (major stacks have the potential of >0.1 mrem/yr EDE to nearest offsite resident) ^a						
Stack ID ^b [Facility/Contractor] (EDP Code(s))	Discharge Height (m)	Emission Control ^c (stages)	Total Flow (m ³)	Radionuclide ^d	Average Concentration (μ Ci/mL) ^e	Annual Emissions (Ci) ^e
300 Area Stacks						
340-NT-EX [340 Waste Handling/WHC]	5.5	HEPA (2), charcoal	2.9 E+07	⁹⁰ Sr	2.6 E-16	7.4 E-09
				^{239/240} Pu	1.2 E-16	3.6 E-09
				total alpha	6.6 E-16	1.9 E-08
				total beta	2.2 E-15	6.5 E-08

Notes:

- a Determining the state of National Emission Standards for Hazardous Air Pollutants (NESHAP) Subpart H compliance for each emission point involved using nearest offsite residences, which differed from the MEI.
- b ID = Identification, i.e., the alpha-numeric designator for the respective stack or vent; WHC = Westinghouse Hanford Company; BHI = Bechtel Hanford, Inc; EDP Code = Electronic Data Processing Code.
- c Efficiencies are: $\geq 99.95\%$ for HEPA; $\geq 95\%$ for charcoal; $\geq 99.8\%$ for sand filter; 0% for no emission control.
- d Bullets, "•", identify specific radionuclide sampling and analysis required by 40 CFR 61 Subpart H.
- e $1 \mu\text{Ci/mL} = 3.7 \text{ E}+10 \text{ bq/m}^3$; 1 Curie = $3.7 \text{ E}+10$ becquerel; 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, required radionuclides, as determined from 1994 stack assessments, will be sampled and analyzed for in CY-1995.
- f A problem with the sampling system was noted in the September 1994 gaseous effluent monitoring functional checklist log, indicating that the samples from September through December may not be representative. A plot of the historical total alpha and total beta sample results do not indicate any unusual trends, such as one caused by the sample stream by-passing the filter. The reason that there is no noticeable trend in the sample data is perhaps due to the fact that the emissions from this stack have been extremely low in the last 2 years.

Table 2-3

(9 sheets)

1994 Radionuclide Air Emissions Data for Minor Stacks from WHC and BHI Facilities. (minor stacks have the potential of <0.1 mrem/yr EDE to nearest offsite resident) ^a						
Stack ID ^b [Facility/Contractor] (EDP Code)	Discharge Height (m)	Emission Control ^c	Total Flow (m ³)	Radionuclide	Average Concentration (μ Ci/mL)	Annual Emissions (Ci) ^d
100 Area Stacks						
116-N [100-N Area/BHI] (Y211, Y212, Y213)	61.3	HEPA, charcoal	1.5 E+09	⁶⁰ Co ⁹⁰ Sr ¹⁰⁶ Ru ¹⁵⁵ Eu ²³⁸ Pu ^{239/240} Pu ²⁴¹ Am total alpha total beta	3.6 E-15 1.4 E-16 3.5 E-15 2.3 E-15 4.4 E-18 2.3 E-17 1.3 E-17 2.9 E-16 2.6 E-15	5.4 E-06 2.1 E-07 5.2 E-06 3.4 E-06 6.6 E-09 3.5 E-08 1.9 E-08 4.3 E-07 3.9 E-06
105-N 14 ft [100 N Area/BHI] (Y259, Y260)	8.5	HEPA	9.5 E+07	⁹⁰ Sr ¹⁰⁶ Ru ¹²⁵ Sb ²³⁸ Pu ^{239/240} Pu ²⁴¹ Am total alpha total beta	8.8 E-17 1.0 E-14 1.2 E-15 4.2 E-18 3.3 E-17 2.2 E-17 ND ND	8.4 E-09 9.7 E-07 1.1 E-07 4.0 E-10 3.1 E-09 2.1 E-09 ND ND
107-N [100-N Area/BHI] (Y265)	12.0	HEPA	1.1 E+08	⁶⁰ Co ¹⁰⁶ Ru ¹³⁷ Cs ¹⁵⁵ Eu ²³⁸ Pu ^{239/240} Pu ²⁴¹ Am total alpha total beta	6.4 E-16 3.5 E-16 1.5 E-16 2.6 E-16 6.1 E-19 7.4 E-18 1.7 E-17 ND 7.6 E-17	7.0 E-08 3.8 E-08 1.6 E-08 2.8 E-08 6.7 E-11 8.1 E-10 1.8 E-09 ND 8.3 E-09
109-N-Z-1 [100-N Area/BHI] (Y221, Y222, Y223)	13.7	none	N/A	total alpha total beta	(did not operate)	
109-N-C-6 [100-N Area/BHI] (Y231, Y232, Y233)	13.7	none	N/A	total alpha total beta	(did not operate)	

Table 2-3

(9 sheets)

1994 Radionuclide Air Emissions Data for Minor Stacks from WHC and BHI Facilities. (minor stacks have the potential of <0.1 mrem/yr EDE to nearest offsite resident) ^a						
Stack ID ^b [Facility/Contractor] (EDP Code)	Discharge Height (m)	Emission Control ^c	Total Flow (m ³)	Radionuclide	Average Concentration (μ Ci/mL)	Annual Emissions (Ci) ^d
105-KE Basin [100-K Area/WHC] (Y241)	12.8	none	6.8 E+08	⁶⁰ Co	5.3 E-16	3.6 E-07
				⁹⁰ Sr	6.8 E-14	4.6 E-05
				¹⁰⁶ Ru	3.4 E-15	2.3 E-06
				¹²⁵ Sb	1.3 E-15	9.1 E-07
				¹³⁷ Cs	1.4 E-13	9.6 E-05
				¹⁵⁴ Eu	2.4 E-15	1.6 E-06
				¹⁵⁵ Eu	1.6 E-15	1.1 E-06
				²³⁸ Pu	1.8 E-15	1.2 E-06
				^{239/240} Pu	1.1 E-14	7.7 E-06
				²⁴¹ Am	8.2 E-15	5.6 E-06
				total alpha	2.1 E-14	1.4 E-05
				total beta	3.4 E-13	2.3 E-04
105-KW Basin [100-K Area/WHC] (Y242)	12.8	none	5.6 E+08	⁶⁰ Co	6.1 E-16	3.4 E-07
				⁹⁰ Sr	1.4 E-15	7.9 E-07
				¹⁰⁶ Ru	4.8 E-15	2.7 E-06
				¹²⁵ Sb	1.8 E-16	1.0 E-07
				¹³⁴ Cs	5.7 E-16	3.2 E-07
				¹³⁷ Cs	9.8 E-15	5.5 E-06
				¹⁵⁴ Eu	1.5 E-16	8.4 E-08
				¹⁵⁵ Eu	2.1 E-16	1.2 E-07
				²³⁸ Pu	5.2 E-18	2.9 E-09
				^{239/240} Pu	5.0 E-17	2.8 E-08
				²⁴¹ Am	3.6 E-17	2.0 E-08
				total alpha	2.3 E-15	1.3 E-06
				total beta	3.8 E-14	2.1 E-05
1706-KER -27 ft [100-K Area/WHC] (Y244)	0.9	HEPA	3.7 E+07	⁶⁰ Co	2.6 E-16	1.0 E-08
				⁹⁰ Sr	2.6 E-16	9.6 E-09
				¹²⁵ Sb	3.8 E-16	1.4 E-08
				¹⁵⁴ Eu	6.5 E-16	2.4 E-08
				¹⁵⁵ Eu	3.8 E-16	1.4 E-08
				²³⁸ Pu	1.5 E-18	5.7 E-11
				^{239/240} Pu	3.5 E-18	1.3 E-10
				²⁴¹ Am	7.0 E-18	2.6 E-10
				total alpha	1.5 E-16	5.5 E-09
				total beta	1.5 E-15	5.5 E-08

Table 2-3

(9 sheets)

1994 Radionuclide Air Emissions Data for Minor Stacks from WHC and BHI Facilities. (minor stacks have the potential of <0.1 mrem/yr EDE to nearest offsite resident) ^a						
Stack ID ^b [Facility/Contractor] (EDP Code)	Discharge Height (m)	Emission Control ^c	Total Flow (m ³)	Radionuclide	Average Concentration (μCi/mL)	Annual Emissions (Ci) ^d
1706-KE [100-K Area/WHC] (Y243)	7.6	HEPA	1.8 E+08	⁶⁰ Co ⁹⁰ Sr ¹⁰⁶ Ru ¹²⁵ Sb ²³⁸ Pu ^{239/240} Pu ²⁴¹ Am total alpha total beta	6.1 E-16 2.8 E-16 1.3 E-14 2.7 E-15 4.7 E-18 1.9 E-17 3.7 E-17 ND ND	1.1 E-07 5.1 E-08 2.4 E-06 4.8 E-07 8.4 E-10 3.5 E-09 6.6 E-09 ND ND
200 East Area Stacks						
296-A-2 [PUREX/WHC] (A547)	20.7	HEPA	5.9 E+07	^{239/240} Pu ²⁴¹ Am total alpha total beta	ND ND 3.1 E-16 ND	ND ND 1.8 E-08 ND
296-A-3 [PUREX/WHC] (A543)	24.1	HEPA	5.1 E+07	total alpha total beta	ND 6.9 E-15	ND 3.5 E-07
296-A-5A [PUREX/WHC] (A545)	17.1	HEPA	8.9 E+07	^{239/240} Pu ²⁴¹ Am total alpha total beta	ND ND 3.9 E-15 1.0 E-15	ND ND 3.5 E-07 9.0 E-08
296-A-5B [PUREX/WHC] (A546)	17.1	HEPA	1.9 E+08	^{239/240} Pu ²⁴¹ Am total alpha total beta	ND ND 1.1 E-16 ND	ND ND 2.0 E-08 ND
296-A-6 [PUREX/WHC] (A547)	20.7	HEPA	1.9 E+08	^{239/240} Pu ²⁴¹ Am total alpha total beta	4.0 E-15 ND ND ND	7.6 E-07 ND ND ND
296-A-7 [PUREX/WHC] (A548)	20.7	HEPA	2.6 E+08	^{239/240} Pu ²⁴¹ Am total alpha total beta	ND ND ND ND	ND ND ND ND
296-A-8 [PUREX/WHC] (A549)	20.7	HEPA	1.9 E+08	^{239/240} Pu ²⁴¹ Am total alpha total beta	ND ND 1.5 E-16 4.3 E-15	ND ND 2.8 E-08 8.2 E-07

Table 2-3

(9 sheets)

1994 Radionuclide Air Emissions Data for Minor Stacks from WHC and BHI Facilities. (minor stacks have the potential of <0.1 mrem/yr EDE to nearest offsite resident) ^a						
Stack ID ^b [Facility/Contractor] (EDP Code)	Discharge Height (m)	Emission Control ^c	Total Flow (m ³)	Radionuclide	Average Concentration (μ Ci/mL)	Annual Emissions (Ci) ^d
296-A-10 [PUREX/WHC] (A550)	4.6	HEPA	9.3 E+07	total alpha total beta	ND ND	ND ND
296-A-14 [PUREX/WHC] (A544)	9.1	HEPA	7.3 E+07	total alpha total beta	ND ND	ND ND
296-B-5 [B-Plant/WHC] (B686)	3.7	HEPA	1.9 E+07	total alpha total beta	ND ND	ND ND
296-B-10 [B-Plant/WHC] (B748)	22.9	HEPA	3.0 E+08	⁹⁰ Sr ¹³⁷ Cs ^{239/240} Pu total alpha total beta	1.7 E-14 8.7 E-15 8.0 E-16 ND 7.7 E-14	5.1 E-06 2.6 E-06 2.4 E-07 ND 2.3 E-05
296-B-13 [B-Plant/WHC] (B690)	3.5	HEPA	1.0 E+07	total alpha total beta	1.1 E-16 4.7 E-16	1.1 E-09 4.7 E-09
296-A-12 [Tank Farms/WHC] (E058)	45.7	HEPA	N/A	(did not operate)		
296-A-13 [Tank Farms/WHC] (E052)	38.1	HEPA	N/A	(did not operate)		
296-A-18 [Tank Farms/WHC] (E060)	4.6	HEPA	N/A	(did not operate)		
296-A-19 [Tank Farms/WHC] (E061)	4.6	HEPA	N/A	(did not operate)		
296-A-20 [Tank Farms/WHC] (E197)	7.3	HEPA	2.3 E+07	total alpha total beta	ND 1.4 E-15	ND 3.3 E-08
296-A-21 [Tank Farms/WHC] (E645)	6.7	HEPA	3.7 E+08	^{239/240} Pu ²⁴¹ Am total alpha total beta	ND ND ND ND	ND ND ND ND

Table 2-3

(9 sheets)

1994 Radionuclide Air Emissions Data for Minor Stacks from WHC and BHI Facilities. (minor stacks have the potential of <0.1 mrem/yr EDE to nearest offsite resident) ^a						
Stack ID ^b [Facility/Contractor] (EDP Code)	Discharge Height (m)	Emission Control ^c	Total Flow (m ³)	Radionuclide	Average Concentration (μCi/mL)	Annual Emissions (Ci) ^d
296-A-26 [Tank Farms/WHC] (E297)	9.4	HEPA	2.9 E+07	total alpha total beta	ND ND	ND ND
296-A-28 [Tank Farms/WHC] (E272)	3.7	HEPA	9.4 E+07	total alpha total beta	ND 2.1 E-15	ND 2.0 E-07
296-A-30 [Tank Farms/WHC] (E903)	3.7	HEPA	9.4 E+07	total alpha total beta	ND ND	ND ND
296-A-41 [Tank Farms/WHC] (E015)	8.9	HEPA	1.2 E+08	total alpha total beta	ND ND	ND ND
296-P-17 [Tank Farms/WHC] (E120)	4.6	HEPA	N/A	(did not operate)		
296-P-31 [Tank Farms/WHC] (E209)	10.0	HEPA	2.5 E+07	total alpha total beta	8.0 E-17 ND	2.0 E-09 ND
296-G-1 [Grout/WHC] (E032)	7.6	HEPA	N/A	(did not operate)		
200 West Area Stacks						
296-P-22 [Tank Farms/WHC] (W191)	4.6	HEPA	1.6 E+07	total alpha total beta	1.5 E-16 ND	2.4 E-09 ND
296-S-18 [Tank Farms/WHC] (W096)	6.7	HEPA	3.5 E+08	^{239/240} Pu ²⁴¹ Am total alpha total beta	ND ND ND 1.1 E-15	ND ND ND 3.8 E-07
296-T-17 [Tank Farms/WHC] (W117)	10.1	HEPA	3.1 E+07	total alpha total beta	ND ND	ND ND
291-S-1 [S-Plant/BHI] (S006)	61.0	sand filter	2.8 E+08	^{239/240} Pu ²⁴¹ Am total alpha total beta	ND ND 3.0 E-16 2.1 E-15	ND ND 8.4 E-08 5.8 E-07

Table 2-3

(9 sheets)

1994 Radionuclide Air Emissions Data for Minor Stacks from WHC and BHI Facilities. (minor stacks have the potential of <0.1 mrem/yr EDE to nearest offsite resident) ^a						
Stack ID ^b [Facility/Contractor] (EDP Code)	Discharge Height (m)	Emission Control ^c	Total Flow (m ³)	Radionuclide	Average Concentration (μCi/mL)	Annual Emissions (Ci) ^d
296-S-2 [S-Plant/BHI] (S032)	20.7	HEPA	1.0 E+07	total alpha total beta	ND ND	ND ND
296-S-4 [S-Plant/BHI] (S008)	20.7	HEPA	3.6 E+07	total alpha total beta	7.8 E-16 1.2 E-14	2.8 E-08 4.4 E-07
296-S-6 [S-Plant/BHI] (S004)	39.4	none	1.4 E+08	total alpha total beta	2.6 E-15 3.0 E-14	3.7 E-07 4.2 E-06
296-S-7W [S-Plant/BHI] (S017)	7.6	HEPA	1.4 E+08	^{239/240} Pu ²⁴¹ Am total alpha total beta	9.3 E-15 7.1 E-15 1.0 E-14 ND	1.3 E-06 1.0 E-06 1.4 E-06 ND
291-T-1 [T-Plant/WHC] (T785)	61.0	HEPA	4.4 E+08	⁹⁰ Sr ¹³⁷ Cs ^{239/240} Pu ²⁴¹ Am total alpha total beta	6.6 E-14 5.7 E-14 1.8 E-13 7.7 E-15 2.5 E-13 7.0 E-13	2.9 E-05 2.5 E-05 8.1 E-05 3.4 E-06 1.1 E-04 3.1 E-04
296-T-7 ^f [T-Plant/WHC] (T154)	8.5	HEPA	1.2 E+08	total alpha total beta	<5.3 E-15 <1.1 E-14	<6.4 E-07 <1.3 E-06
296-T-11 [TRUSAF/WHC] (T783)	7.6	HEPA	1.8 E+08	^{239/240} Pu ²⁴¹ Am total alpha total beta	1.6 E-15 ND 7.2 E-17 7.2 E-16	2.9 E-07 ND 1.9 E-08 1.3 E-07
296-T-12 [TRUSAF/WHC] (T784)	7.6	HEPA	1.8 E+08	^{239/240} Pu ²⁴¹ Am total alpha total beta	ND ND ND ND	ND ND ND ND
296-T-13 [T-Plant/WHC] (T786)	20.7	HEPA	3.8 E+08	^{239/240} Pu ²⁴¹ Am total alpha total beta	ND ND 8.2 E-15 1.4 E-14	ND ND 3.1 E-06 5.3 E-06
296-U-2 [UO ₃ Plant/WHC] (U133)	24.4	HEPA	1.3 E+06	Uranium total alpha total beta	1.6 E-13 1.4 E-14 4.5 E-15	2.1 E-07 1.8 E-08 5.8 E-09

Table 2-3

(9 sheets)

1994 Radionuclide Air Emissions Data for Minor Stacks from WHC and BHI Facilities. (minor stacks have the potential of <0.1 mrem/yr EDE to nearest offsite resident) ^a						
Stack ID ^b [Facility/Contractor] (EDP Code)	Discharge Height (m)	Emission Control ^c	Total Flow (m ³)	Radionuclide	Average Concentration (μ Ci/mL)	Annual Emissions (Ci) ^d
296-U-4 [UO ₃ Plant/WHC] (U777)	42.7	none	3.5 E+07	⁹⁰ Sr ¹³⁷ Cs ^{239/240} Pu ²⁴¹ Am Uranium total alpha total beta	7.7 E-15 1.6 E-12 ND ND 1.3 E-14 5.1 E-15 2.5 E-14	2.7 E-07 5.6 E-05 ND ND 4.7 E-07 1.8 E-07 8.9 E-07
296-U-13 [UO ₃ Plant/WHC] (U878)	8.2	HEPA	2.3 E+05	total alpha total beta	1.9 E-14 ND	4.3 E-09 ND
291-U-1 [U-Plant/WHC] (U771)	61.0	sand filter	3.5 E+08	⁹⁰ Sr ¹³⁷ Cs ^{239/240} Pu ²⁴¹ Am total alpha total beta	6.6 E-14 5.4 E-13 1.2 E-15 ND 1.3 E-15 5.7 E-15	2.3 E-05 1.9 E-04 4.3 E-07 ND 4.5 E-07 2.0 E-04
296-S-16 [222-S/WHC] (S264)	3.0	HEPA	2.0 E+06	total alpha total beta	4.7 E-15 1.2 E-13	9.3 E-09 2.4 E-07
296-S-21 [222-S/WHC] (S289)	11.6	HEPA	1.0 E+09	^{239/240} Pu ²⁴¹ Am total alpha total beta	ND 6.7 E-15 1.9 E-16 ND	ND 6.7 E-06 ND ND
296-W-3 [Tank Farms/WHC] (W003)	7.6	HEPA	3.0 E+07	total alpha total beta	ND ND	ND ND
296-Z-3 [PFP/WHC] (Z813)		HEPA	1.9 E+07	²³⁸ Pu ^{239/240} Pu ²⁴¹ Am total alpha total beta	4.7 E-15 5.8 E-15 ND 1.0 E-14 1.4 E-15	9.0 E-08 1.1 E-07 ND 1.9 E-07 2.6 E-08
296-Z-5 [PFP/WHC] (Z913)	4.6	HEPA	1.7 E+08	^{239/240} Pu ²⁴¹ Am total alpha total beta	ND ND ND ND	ND ND ND ND
296-Z-6 [PFP/WHC] (Z802)	0.9	HEPA	1.2 E+08	total alpha total beta	ND ND	ND ND

Table 2-3

(9 sheets)

1994 Radionuclide Air Emissions Data for Minor Stacks from WHC and BHI Facilities. (minor stacks have the potential of <0.1 mrem/yr EDE to nearest offsite resident) ^a						
Stack ID ^b [Facility/Contractor] (EDP Code)	Discharge Height (m)	Emission Control ^c	Total Flow (m ³)	Radionuclide	Average Concentration (μCi/mL)	Annual Emissions (Ci) ^d
296-Z-14 [PFP/WHC] (Z814)	6.1	HEPA	2.3 E+07	total alpha total beta	ND ND	ND ND
696-W-1 ^c [WSCF/WHC] (W010)	7.6	HEPA	N/A	(did not operate)		
696-W-2 ^c [WSCF/WHC] (W011)	9.8	HEPA	N/A	(did not operate)		
300 Area Stacks						
304-CON-EX [304 Bldg./WHC]	3.7	Cyclone Precipitation	1.4 E+05	total alpha total beta	2.6 E-14 3.9 E-14	3.7 E-09 5.5 E-09
306-E-ULAB [306-E Bldg./WHC]	20.1	HEPA	5.2 E+07	total alpha total beta	5.2 E-16 1.8 E-15	2.7 E-08 9.4 E-08
308-GL-EX [308 Bldg./WHC]	9.1	HEPA	9.2 E+06	total alpha total beta	9.1 E-16 3.4 E-15	8.4 E-09 3.1 E-08
308-ET-EX [308 Bldg./WHC]	9.1	HEPA	9.9 E+06	total alpha total beta	ND 2.5 E-15	ND 2.5 E-08
308-TRIGA [308 Bldg./WHC]	11.3	HEPA, charcoal	3.1 E+07	¹³¹ I total alpha total beta	ND 1.4 E-15 2.4 E-15	ND 4.2 E-08 7.3 E-08
EP-306W-01-V [306-W Bldg./WHC]	8.0	HEPA	2.7 E+08	total alpha total beta	3.7 E-16 2.6 E-15	1.0 E-07 7.1 E-07
EP-306W-02-V [306-W Bldg./WHC]	8.0	HEPA	3.5 E+08	total alpha total beta	4.3 E-16 2.3 E-15	1.5 E-07 8.1 E-07
EP-306W-03-V [306-W Bldg./WHC]	8.0	HEPA	3.6 E+08	total alpha total beta	8.3 E-17 4.7 E-16	3.0 E-08 1.7 E-07
EP-306W-04-S [306-W Bldg./WHC]	8.0	HEPA	2.7 E+08	total alpha total beta	3.6 E-17 1.3 E-16	9.6 E-09 3.5 E-08
340-B-BLDG [340 Bldg./WHC]	11.6	HEPA	5.7 E+06	total alpha total beta	1.0 E-15 3.7 E-15	5.9 E-09 2.1 E-08
340-DECON [340 Bldg./WHC]	3.0	HEPA	1.1 E+08	total alpha total beta	2.5 E-15 1.0 E-14	2.8 E-07 1.1 E-06
377-GEL [377 Bldg./WHC]	10.0	HEPA	1.3 E+08	total alpha total beta	5.1 E-16 2.0 E-15	6.7 E-08 2.6 E-07

Table 2-3

(9 sheets)

1994 Radionuclide Air Emissions Data for Minor Stacks from WHC and BHI Facilities. (minor stacks have the potential of <0.1 mrem/yr EDE to nearest offsite resident) ^a						
Stack ID ^b [Facility/Contractor] (EDP Code)	Discharge Height (m)	Emission Control ^c	Total Flow (m ³)	Radionuclide	Average Concentration (μ Ci/mL)	Annual Emissions (Ci) ^d
400 Area Stacks						
FFTF-CB-EX [FFTF/WHC]	14.3	none	3.6 E+08	¹³¹ I total alpha total beta	ND 1.4 E-15 5.0 E-15	ND 4.9 E-07 1.8 E-06
FFTF-RE-SB [FFTF/WHC]	6.1	none	2.1 E+08	¹³¹ I total alpha total beta	ND 7.1 E-15 2.0 E-14	ND 1.5 E-06 4.3 E-06
FFTF-HT-TR [FFTF/WHC]	8.8	none	6.2 E+07	total alpha total beta	1.9 E-15 7.1 E-15	1.2 E-07 4.4 E-07
437-MN&ST [MASF/WHC]	9.1	none	2.4 E+08	total alpha total beta	7.1 E-16 2.3 E-15	1.7 E-07 5.4 E-07

Notes:

- a Determining the state of National Emission Standards of Hazardous Air Pollutants (NESHAP) Subpart H compliance for each emission point involved using nearest residences, which differed from the MEI.
- b ID = Identification, i.e., the alpha-numeric designator for the respective stack or vent; WHC = Westinghouse Hanford Company; BHI = Bechtel Hanford, Inc.
- c Efficiencies are: $\geq 99.95\%$ for HEPA; $\geq 95\%$ for charcoal; $\geq 99.8\%$ for sand filter; 0% for no emission control.
- d 1 Curie = $3.7 \text{ E}+10$ becquerel; 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 The new Waste Sampling and Characterization Facility (WSCF) exhausters operated in 1994, however, no record samples were collected. WSCF did not accept any radioactive samples until January 1995, and as a result there was no source term for radioactive emissions in 1994.
- f Emissions estimated from periodic confirmatory measurements. The four high highest total alpha and total beta results were used to calculate average alpha and beta concentrations. This method generates an extremely conservative estimate of emissions.

Table 2-4

1994 Nonradioactive Air Emissions from WHC Facilities				
Constituent	Source			
	200 East Area Powerhouse	200 West Area Powerhouse	300 Area Powerhouse	1100 Area Heating Plant
Criteria Air Pollutants	Release, kg ^a			
Particulate matter	7.43 E+02	1.77 E+03	1.21 E+04	0.00
Nitrogen oxides	7.71 E+04	1.84 E+05	4.97 E+04	0.00
Sulfur oxides	1.13 E+05	2.68 E+05	2.48 E+05	0.00
Carbon monoxide	2.82 E+04	6.72 E+04	4.52 E+03	0.00
Lead	7.23 E+01	1.72 E+02	2.68 E+01	0.00
Volatile organic compounds	2.82 E+02	6.72 E+02	2.53 E+02	0.00
Toxic Air Pollutants	Release, kg ^a			
Antimony	0.00	0.00	6.35	0.00
Arsenic	7.73 E+01	1.84 E+02	1.58 E+01	0.00
Beryllium	1.04 E+01	2.48 E+01	0.58	0.00
Cadmium	6.13	1.46 E+01	2.92 E+01	0.00
Chromium	2.24 E+02	5.34 E+02	1.77 E+01	0.00
Cobalt	0.00	0.00	1.67 E+01	0.00
Copper	1.41 E+02	3.36 E+02	3.84 E+01	0.00
Formaldehyde	3.15 E+01	7.52 E+01	5.60 E+01	0.00
Manganese	3.09 E+02	7.38 E+02	1.02 E+01	0.00
Mercury	2.28	5.44	4.42	0.00
Nickel	1.84 E+02	4.39 E+02	3.22 E+02	0.00
Polycyclic organic matter	0.00	0.00	7.59 E+03	0.00
Selenium	2.79 E+01	6.67 E+01	5.25	0.00
Vanadium	1.93 E+01	4.59 E+01	4.18 E+02	0.00
Fuel Consumed	Total Fuel Consumption			
Coal, kg Grade 6 Oil, L	1.12 E+07	2.68 E+07	3.37 E+06	(did not operate)

a Releases calculated from EPA emission factors and based on total fuel consumption.

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3.0 LIQUID EFFLUENTS

The majority of liquid effluents released to the environment from facilities managed by WHC and monitored by BHI are discharged to the soil at the Hanford Site, with the remainder being discharged to the Columbia River. Data on the 1994 radioactive and nonradioactive liquid effluents are presented in this section.

3.1 RADIOACTIVE LIQUID EFFLUENTS

Facilities managed by WHC and monitored by BHI discharge liquid effluents potentially or normally contaminated with radionuclides to the soil or the Columbia River. The general categories of these liquid effluents are: (1) cooling water, (2) steam condensates, (3) process condensates, (4) laboratory and chemical sewer waste water, (5) filter backwash, and (7) groundwater seepage resulting from discharges to the soil.

The measured quantities of radionuclides discharged in liquid effluents to the Columbia River and to ground disposal facilities are summarized in Tables 3-1 and 3-2, respectively. Releases of specific radionuclides and total activity discharged by individual liquid effluent streams is presented in Table 3-3. Included in these tables are releases to the Columbia River adjacent to 100-N Area via groundwater seepage along the stretch of riverbank known as the N-Springs, see Figure 3-1.

Figure 3-1
Historical Liquid Effluent Releases of ^{90}Sr to the Columbia River.

In the 100-N Area, total radionuclide releases continued to be far below past releases during N-Reactor operation.

In the 200 Areas, the PUREX Plant, which has not operated since March 1990, did not discharge radionuclides in quantities significantly different than were discharged in 1993. The PUREX Plant chemical sewer waste water (CSL), can be diverted either automatically or manually to the 216-A-42 Retention Basin, which prevents the effluents from discharging to the soil. Diversion normally would occur when online radiation or pH monitors upstream of the diversion valve register potential or real upset conditions in the effluent streams. The 216-A-42 Retention Basin allows sampling and analyzing of diverted suspect effluent while it is temporarily retained there. If analysis demonstrates compliance with release limits, the effluent is discharged to the 216-B-3 Pond. If the effluent is not within applicable release limits, it can be pumped to the PUREX Plant for reprocessing. The CWL and SCD release points did not discharge liquid effluents in 1994.

The 242-A Evaporator-Crystallizer operated in 1994 to process liquid radioactive material, some effluents were discharged to the 216-B-3 Pond as a result of its operation.

In 1994, two significant upgrades to the PFP Cooling Water stream (Stream Code 2904-ZA) were completed, affecting the 216-Z-20 Crib discharge disposal site. First, in January, a closed loop cooling system was placed on-line. This upgrade replaced many of the once through cooling systems with closed loop heat exchangers, significantly reducing effluent discharges to the 216-Z-20 Crib. Many of the effluent sources producing the highest radionuclide releases were also eliminated as a result of this upgrade. The second upgrade was the addition of the 243-Z Low Level Waste Treatment Facility (LLWTF) to the PFP complex, in May of 1994. This facility is designed to remove the remaining radioactive contaminants from the 2904-Z stream. Radioactive contaminants are removed from the liquid effluent stream through the use of treatment canisters equipped with three types of filter media.

Discharges to French drains and from the two sources at T Plant are not sampled or recorded for flow. This is because the effluents are judged not to have a potential of exceeding 4% of the DCG values on a yearly average. Four percent of a DCG is equivalent to 4 mrem, which is the drinking water standard (Radiological Drinking Water Standards: U.S. Environmental Protection Agency, National Primary Drinking Water Regulations [40 CFR 141]; and State of Washington, Rules and Regulations of the State Board of Health Regarding Public Water Systems [WAC 248-54]).

In the 300 Area, radionuclide releases did not change significantly from releases in earlier years.

3.2 NONRADIOACTIVE LIQUID EFFLUENTS

3.2.1 Sanitary Sewage Discharges to the Soil

Various facilities discharged sanitary sewage. In the 100-N Area, sanitary waste water was discharged to the 100-N Sewage Lagoon and five septic tanks. In the 100-B, 100-D, 100-H, and 100-K Areas, sanitary sewage was discharged to septic tanks and drainfields. In the 200 Areas, sanitary waste water was discharged to a system of septic tanks and drainfields. Sludge was pumped from septic tanks in the 200 Areas and taken to the 100-N Sewage Lagoon for disposal. In the 300 Area, sanitary sewage was discharged to the 300 Area septic tank and trench system. In the 400 Area, sanitary sewage was discharged to a septic system.

The estimated volume of sewage discharged by area during 1994 is shown in Table 3-4. All sanitary sewer discharges are estimated by multiplying the total number of employees and subcontractors stationed in each area by 25 gal/day-person.

3.2.2 National Pollutant Discharge Elimination System Discharges From the 100 Areas

Liquid effluents discharged to the Columbia River from the 100-N and 100-K Areas are regulated by the parameters in the NPDES permit for the Hanford Site. A list of the discharge points is provided in Table 3-5. A summary of analyses performed to ensure compliance with the NPDES permit is given Table 3-6.

3.2.3 Process Water Discharges

Westinghouse Hanford Company managed facilities discharged nonhazardous waste water to the ground at the Hanford Site.

The 200 East Area Water Treatment Facility discharged waste water totalling $3.0 \text{ E}+08 \text{ L}$ ($7.9 \text{ E}+07 \text{ gal}$) to the 216-B-3 Pond. The 200 West Area Water Treatment Facility discharged waste water totalling $2.6 \text{ E}+08 \text{ L}$ ($6.8 \text{ E}+07 \text{ gal}$) to percolation ponds. 200 Area process water discharges are estimated by multiplying the total minutes in a year by their respective average flowrates. Process water discharge flowrates average 150 gal/min for the 200 East Area and 130 gal/min for the 200 West Area.

Approximately $2.9 \text{ E}+08 \text{ L}$ ($7.7 \text{ E}+07 \text{ gal}$) of nonhazardous nonradioactive liquid wastes were discharged to the 300 Area process trenches from the 300 Area Process Sewer System.

In the 400 Area, approximately $3.6 \text{ E}+07 \text{ L}$ ($9.4 \text{ E}+06 \text{ gal}$) of process nonhazardous nonradioactive waste water from the 400 Area Process Sewer drained to a process pond located north of the 400 Area. Approximately $\leq 1.7 \text{ E}+06 \text{ L}$ ($\leq 4.4 \text{ E}+05 \text{ gal}$) of liquid wastes (principally storm water) drained to 24 French drains.

Industrial facilities managed by WHC and monitored by BHI did not discharge to the City of Richland publicly owned treatment works (POTW) any waste water that could be classified as a significant industrial discharge. Significant industrial discharges are defined as those meeting any of the following criteria:

- Being subject to national pretreatment standards promulgated under Section 307 (b) or (c) of the *Clean Water Act of 1977*
- Having any of the priority toxic pollutants listed in 40 CFR 403
- Having toxic pollutants as defined in the *Clean Water Act of 1977*, Section 307
- Having a discharge flow of $1.5 \text{ E}+05 \text{ L}$ ($4.0 \text{ E}+04 \text{ gal}$) or more per average workday
- Having a flow greater than 5% of the flow of the POTW.

Such discharges are prohibited unless issued a permit by the City of Richland.

Table 3-1

Radionuclides in Liquid Effluents Discharged to Columbia River in 1994, from WHC and BHI Facilities.	
Radionuclide	Release (Ci) ^a 100 Areas
³ H	2.7 E-01
⁶⁰ Co	1.1 E-04
⁹⁰ Sr	1.1 E-01
¹⁰⁶ Ru	7.1 E-04
¹²⁵ Sb	4.9 E-05
¹³⁴ Cs	2.2 E-05
¹³⁷ Cs	1.5 E-05
²³⁸ Pu	1.4 E-08
^{239,240} Pu	2.5 E-07

a 1 Ci = 3.7E+10 Bq.

Table 3-2

Radionuclides in Liquid Effluents Discharged to Ground Disposal Facilities in 1994, from WHC and BHI Facilities.			
Radionuclide	Release (Ci) ^a		
	200 Areas	300 Area	Total
³ H	5.6	NM	5.6
⁹⁰ Sr	3.3 E-01	1.6 E-03 ^b	3.3 E-01
⁹⁹ Tc	2.7 E-02	NM	2.7 E-02
¹³⁷ Cs	5.7 E-02	NM	5.7 E-02
Uranium, recycled	3.4 E-02 ^c	NM	3.4 E-02
Uranium, natural	NM	1.1 E-03 ^d	1.1 E-03
²³⁸ Pu	4.8 E-04	NM	4.8 E-04
^{239,240} Pu	3.1 E-02	NM	3.1 E-02
²⁴¹ Pu	4.3 E-02	NM	4.3 E-02
²⁴¹ Am	1.1 E-03	NM	1.1 E-03

a 1 Ci = 3.7E+10 Bq; NM = not measured, since not required.

b ⁹⁰Sr value was determined from total beta measurements.

c Recycled uranium value determined from total uranium chemical analysis.
Recycled uranium assumed to consist of 34.614 Ci% ²³⁸U, 2.059 Ci% ²³⁵U,
58.551 Ci% ²³⁴U, and 4.776 Ci% ²³⁶U (99.008 Wt% ²³⁸U, 0.912 Wt% ²³⁵U,
0.009 Wt% ²³⁴U, and 0.071 Wt% ²³⁶U).

d Natural uranium value was determined from total alpha measurements.

Table 3-3

(5 sheets)

1994 Radionuclide Liquid Effluent Data for Individual Effluent Streams Discharged from WHC and BHI Facilities.					
Liquid Effluent Stream ^a [Contractor] (Stream Code, EDP Code)	Discharge Disposal Site	Total Flow (L)	Radionuclide	Average Concentration ($\mu\text{Ci/mL}$) ^b	Annual Release (Ci) ^b
100 Area Discharges to the Columbia River					
N-Springs [BHI] (N/A, Y101)	Columbia River	2.0 E+07	³ H	1.3 E-05	2.6 E-01
			⁶⁰ Co	5.4 E-09	1.1 E-04
			⁹⁰ Sr	5.4 E-06	1.1 E-01
			¹⁰⁶ Ru	1.3 E-08	2.6 E-04
			¹²⁵ Sb	1.9 E-09	3.9 E-05
			¹³⁷ Cs	7.6 E-10	1.5 E-05
			¹⁵⁴ Eu	2.8 E-09	5.5 E-05
			²³⁸ Pu	2.0 E-13	3.9 E-09
			^{239,240} Pu	1.2 E-11	2.5 E-07
			total alpha	2.5 E-09	4.9 E-05
			total beta	1.1 E-05	2.1 E-01
NPDES Outfall 009, 100-N 102-in. Outfall [BHI] (N/A, Y120)	Columbia River	1.2 E+07	³ H	<8.8 E-08	ND
			⁶⁰ Co	<1.6 E-09	ND
			⁹⁰ Sr	3.1 E-10	3.7 E-06
			¹²⁵ Sb	8.5 E-10	1.0 E-05
			¹³⁷ Cs	<6.8 E-10	ND
			¹⁵⁵ Eu	3.1 E-09	3.8 E-05
			²³⁸ Pu	8.7 E-13	1.0 E-08
			^{239/240} Pu	-5.9 E-13	ND
			total alpha	3.7 E-10	4.4 E-06
			total beta	3.6 E-09	4.3 E-05
NPDES Outfall 004, 100-K 1908-K Outfall [WHC] (N/A, Y130)	Columbia River	3.0 E+08	³ H	3.6 E-08	1.1 E-02
			⁶⁰ Co	-1.8 E-10	ND
			⁶⁵ Zn	4.9 E-10	1.5 E-04
			⁹⁰ Sr	9.0 E-10	2.7 E-04
			¹⁰⁶ Ru	1.5 E-09	4.5 E-04
			¹³⁴ Cs	7.3 E-11	2.2 E-05
			¹³⁷ Cs	-2.3 E-11	ND
			²³⁸ Pu	<7.7 E-14	ND
			^{239/240} Pu	<1.0 E-12	ND
			total alpha	3.8 E-10	1.1 E-04
			total beta	2.0 E-09	6.0 E-04

Table 3-3

(5 sheets)

1994 Radionuclide Liquid Effluent Data for Individual Effluent Streams Discharged from WHC and BHI Facilities.					
Liquid Effluent Stream ^a [Contractor] (Stream Code, EDP Code)	Discharge Disposal Site	Total Flow (L)	Radionuclide	Average Concentration ($\mu\text{Ci/mL}$) ^b	Annual Release (Ci) ^b
200 Area Discharges to the Ground					
222-S Laboratory Chemical Sewer [WHC] (207-SL, H101)	216-S-26 Crib	6.2 E+06	⁹⁰ Sr ¹⁰³ Ru ¹⁰⁶ Ru ¹³⁷ Cs Total Uranium ^{239/240} Pu ²⁴¹ Am total alpha total beta	5.7 E-09 <3.3 E-08 <6.1 E-07 <4.9 E-08 5.7 E-09 4.4 E-09 <9.3 E-09 1.5 E-09 6.1 E-09	3.5 E-05 ND ND ND 3.5 E-05 2.7 E-05 ND 9.4 E-06 3.8 E-05
UO ₃ Plant Waste Water [WHC] (207-U, H102)	216-U-14 Ditch	1.1 E+08	³ H ⁹⁰ Sr ⁹⁹ Tc ¹⁰³ Ru ¹⁰⁶ Ru ¹³⁷ Cs Total Uranium ^{239/240} Pu ²⁴¹ Am total alpha total beta	8.2 E-07 9.1 E-09 2.3 E-07 <3.3 E-08 <6.9 E-07 5.9 E-08 1.0 E-08 <1.9 E-08 <3.7 E-08 3.9 E-09 4.7 E-09	9.5 E-02 1.1 E-03 2.7 E-02 ND ND 6.8 E-03 1.1 E-03 ND ND 4.2 E-04 5.4 E-04
PFP Cooling Water [WHC] (2904-ZA, H103)	216-Z-20 Crib	2.8 E+07	⁹⁰ Sr ¹⁰³ Ru ¹⁰⁶ Ru ¹³⁷ Cs ²³⁸ Pu ^{239/240} Pu ²⁴¹ Pu ²⁴¹ Am total alpha total beta	1.3 E-07 <3.5 E-08 <6.1 E-07 5.3 E-08 1.4 E-08 2.3 E-08 1.5 E-07 2.3 E-08 1.8 E-08 1.3 E-08	3.6 E-03 ND ND 1.5 E-03 4.0 E-04 6.6 E-04 4.3 E-03 6.6 E-04 5.2 E-04 3.6 E-04
242-A Evaporator Cooling Water [WHC] (ACW, H108)	216-B-3 Pond	2.1 E+09	³ H ⁹⁰ Sr ¹⁰³ Ru ¹⁰⁶ Ru ¹³⁷ Cs Total Uranium ²³⁸ Pu ^{239/240} Pu ²⁴¹ Am total alpha total beta	1.6 E-06 1.3 E-07 <3.7 E-08 <6.7 E-07 <6.5 E-08 1.3 E-09 <9.0 E-09 1.0 E-08 <1.7 E-08 7.1 E-10 5.9 E-09	3.4 E+00 2.8 E-01 ND ND ND 2.8 E-03 ND 2.1 E-02 ND 1.5 E-03 1.3 E-02

Table 3-3

(5 sheets)

1994 Radionuclide Liquid Effluent Data for Individual Effluent Streams Discharged from WHC and BHI Facilities.					
Liquid Effluent Stream ^a [Contractor] (Stream Code, EDP Code)	Discharge Disposal Site	Total Flow (L)	Radionuclide	Average Concentration ($\mu\text{Ci/mL}$) ^b	Annual Release (Ci) ^b
242-A Evaporator Steam Condensate [WHC] (ASC, H110)	216-B-3 Pond	6.4 E+07	³ H ⁹⁰ Sr ¹⁰³ Ru ¹⁰⁶ Ru ¹³⁷ Cs Total Uranium ^{239/240} Pu ²⁴¹ Am total alpha total beta	1.3 E-05 8.4 E-09 <3.7 E-08 <7.0 E-07 6.9 E-08 1.5 E-09 1.5 E-08 <2.0 E-08 6.5 E-10 5.6 E-09	8.6 E-01 5.4 E-04 ND ND 4.4 E-03 9.5 E-05 9.8 E-04 ND 4.1 E-05 3.6 E-04
241-A Tank Farm Cooling Water [WHC] (CA8, H115)	216-B-3 Pond	6.5 E+08	⁹⁰ Sr ¹⁰³ Ru ¹⁰⁶ Ru ¹¹³ Sb ¹³⁷ Cs ^{239/240} Pu ²⁴¹ Am total alpha total beta	8.4 E-09 <3.7 E-08 <6.7 E-07 <6.0 E-08 6.2 E-08 <1.7 E-08 <2.5 E-08 8.2 E-10 6.2 E-09	5.5 E-03 ND ND ND 4.1 E-02 ND ND 5.4 E-04 4.1 E-03
244-AR Vault Cooling Water [WHC] (CAR, H116)	216-B-3 Pond	9.0 E+07	⁹⁰ Sr ¹⁰³ Ru ¹⁰⁶ Ru ¹³⁷ Cs ^{239/240} Pu ²⁴¹ Am total alpha total beta	9.4 E-09 <3.8 E-08 <7.3 E-07 <6.3 E-08 <1.5 E-08 <2.3 E-08 8.7 E-10 1.2 E-08	8.4 E-04 ND ND ND ND ND 7.8 E-05 1.1 E-03
B-Plant Cooling Water [WHC] (CBC, H117)	216-B-3 Pond	3.2 E+09	⁹⁰ Sr ¹⁰³ Ru ¹⁰⁶ Ru ¹³⁷ Cs ^{239/240} Pu ²⁴¹ Am total alpha total beta	8.5 E-09 <9.5 E-08 <7.1 E-08 <6.3 E-08 <2.1 E-08 3.3 E-08 1.1 E-09 5.2 E-09	2.8 E-02 ND ND ND ND 1.1 E-01 3.5 E-03 1.7 E-02

Table 3-3

(5 sheets)

1994 Radionuclide Liquid Effluent Data for Individual Effluent Streams Discharged from WHC and BHI Facilities.								
Liquid Effluent Stream ^a [Contractor] (Stream Code, EDP Code)	Discharge Disposal Site	Total Flow (L)	Radionuclide	Average Concentration (μCi/mL) ^b	Annual Release (Ci) ^b			
PUREX Chemical Sewer ^c [WHC] (CSL, H118)	216-B-3 Pond	4.7 E+08	³ H	2.7 E-06	1.2 E+00			
			⁹⁰ Sr	3.8 E-08	1.6 E-02			
			⁹⁵ Zr	<6.9 E-08	ND			
			¹⁰³ Ru	<4.5 E-08	ND			
			¹⁰⁶ Ru	<3.8 E-08	ND			
			¹³⁷ Cs	1.3 E-06	3.9 E-03			
			¹⁴⁷ Pm	<9.0 E-07	ND			
			Total Uranium	1.6 E-09	7.6 E-04			
			²³⁸ Pu	3.0 E-08	8.7 E-05			
			^{239/240} Pu	1.7 E-08	7.8 E-03			
			²⁴¹ Am	5.4 E-08	1.6 E-04			
			total alpha	3.9 E-09	1.7 E-03			
			total beta	9.0 E-08	3.8 E-02			
242-S Evaporator Steam Condensate [WHC] (RC-1, H122)	216-U-14 Ditch	0.0		N/A	N/A			
UO ₃ Plant Process Condensate [WHC] (U-17, H126)	216-U-17 Crib	4.3 E+05	³ H	1.5 E-04	6.5 E-02			
			⁹⁰ Sr	1.3 E-08	5.7 E-06			
			⁹⁹ Tc	<3.2 E-07	ND			
			¹⁰³ Ru	<1.3 E-07	ND			
			¹⁰⁶ Ru	<7.8 E-07	ND			
			¹³⁷ Cs	<6.5 E-08	ND			
			Total Uranium	1.5 E-07	6.5 E-05			
			^{239/240} Pu	<2.8 E-08	ND			
			²⁴¹ Am	5.9 E-08	2.6 E-05			
			total alpha	2.6 E-09	1.2 E-06			
			total beta	2.5 E-07	1.1 E-04			
			300 Area Discharges to the Ground					
			300 Area Process Sewer [WHC]	316-5 Trench	2.913 E+08	total alpha total beta	3.8 E-12 5.5 E-12	1.1 E-03 1.6 E-03

Notes:

a WHC = Westinghouse Hanford Company; BHI = Bechtel Hanford, Inc; EDP Code = Electronic Data Processing Code.

b 1 $\mu\text{Ci/mL}$ = 3.7 E+10 bq/m³; 1 Curie = 3.7 E+10 becquerel.

c PUREX Chemical Sewer releases include all discharges to PUREX A-42 Diversion Basin.

Table 3-4

Sanitary Sewage Discharged in 1994		
Area	Discharge ^a	
	(L/yr)	(gal/yr)
100-D	1.4 E+05	3.7 E+04
100-H	1.4 E+05	3.7 E+04
100-K	1.1 E+07	2.9 E+06
100-N	1.2 E+07	3.3 E+06
200 East	1.1 E+08	3.0 E+07
200 West	6.8 E+07	1.8 E+07
300	7.2 E+07	1.9 E+07
400	1.8 E+07	4.8 E+06

a Discharges estimated by multiplying the total number of persons assigned to each area by 25 gal./day-person.

Table 3-5

National Pollutant Discharge Elimination System (NPDES) Discharge Points	
Designation	Description
003*	181-KE Inlet Screen Backwash
004	1908-K Outfall
005*	182-N Tank Farm Overflow (36-in. raw water return)
006*	182-N Drain System (42-in. raw water return)
007*	181-N Inlet Screen Backwash
009	102-in. Outfall (raw water return)
N-Springs	100-N Riverbank Springs

* Did not discharge any effluent during 1994.

Table 3-6

Summary of National Pollutant Discharge Elimination System (NPDES) Data for 1994				
Sample Parameter		004	009	N Springs
Flow (x10 ⁶ gal/d)	Max.	3.1	0.02	*
	Avg.	0.2	0.01	*
Temperature (°F)	Max.	75	70	75
	Avg.			66
pH	Max.	7.9	7.9	7.6
	Min.	7.3	6.8	7.2
Total Suspended Solids (mg/L)	Max.	7.0	*	*
	Avg.	3.2	*	*
Oil and Grease (mg/L)	Max.	*	*	3.7
	Avg.	*	*	2.7
Iron (mg/L)	Max.	*	*	0.8
	Avg.	*	*	0.3
Ammonia (mg/L)	Max.	*	*	0.2
	Avg.	*	*	<0.03
Chromium (mg/L)	Max.	*	*	<0.06
	Avg.	*	*	<0.02
Chlorine (mg/L)	Max.	0.11	0.17	*
	Avg.	<0.03	<0.07	*

* Analysis not required.

4.0 HAZARDOUS SUBSTANCE RELEASES

A hazardous substance release requires notification to appropriate federal, state, and local authorities when established limits are exceeded. Reportable releases of hazardous substances are classified as the following two types:

- Nonroutine releases
- Continuous, routine releases.

Information for each type of release is discussed separately below.

4.1 NONROUTINE RELEASES

The following listing shows the number of nonroutine releases that occurred in 1994, distinguished by the nature of the notifications. Other nonroutine releases and spills are not discussed in this section because they were less than agency reportable limits and the levels in DOE reporting criteria (EPA 1990b, DOE 1993b).

- 34 releases were reported to a regulatory agency
- 405 non-reportable releases were recorded

4.2 ROUTINE CONTINUOUS RELEASES

Releases of hazardous substances that exceed CERCLA reportable quantities (RQ) need not be reported immediately to the National Response Center when both of the following conditions are met:

- An initial notification has been completed
- The routine releases are continuous and stable in quantity and rate.

The initial notification requirement has been satisfied concerning hazardous substances that have exceeded or have a potential to exceed an RQ. Historically only the continuous routine releases of ammonia, ammonium hydroxide, and carbon tetrachloride have posed operational difficulties in staying beneath RQs. For 1994, releases of ammonia, ammonium hydroxide, and carbon tetrachloride were below reportable quantities. Information on the routine releases of hazardous substances are presented in Table 4-1.

Table 4-1

<i>Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Continuous Release Summary for Calendar Year 1994.^a</i>					
Release Point	Substance	CERCLA RQ^b (kg [lb])	Number of Occurrences Exceeding RQ Value	Mean Release^b (kg [lb])	Largest Release (kg [lb])
296-A-24 (PUREX Plant Ammonia scrubber waste concentrator exhaust)	ammonia	45.4 (100.0)	(did not operate)		
296-A-40 (241-AP Tank Farm primary exhaust)	ammonia	45.4 (100.0)	0	0.35 (0.76)	0.6 (1.3)
296-A-27 (241-AW Tank Farm primary exhaust)	ammonia	45.4 (100.0)	0	0.30 (0.67)	0.6 (1.3)
296-A-22 (242-A Evaporator-Crystallizer process condensate)	ammonia	45.4 (100.0)	0	3.4 (7.5)	43.5 (96.0)
291-Z-1 (Plutonium Reclamation Facility)	carbon tetrachloride	4.54 (10.00)	(did not operate)		

a All quantities are for any continuous 24-hr period.

b CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980;
RQ = Reportable quantity

b Mean release is the annual quantity divided by the number of operating days in calendar year 1993.

5.0 REFERENCES

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APPENDIX A
AIR EMISSIONS AND LIQUID EFFLUENTS

APPENDIX A

AIR EMISSIONS AND LIQUID EFFLUENTS

A.1 RADIONUCLIDE AIR EMISSIONS

Radionuclide air emissions generally are discharged from stacks and vents. Sizes, shapes, and discharge paths of stacks vary depending on facility requirements at the time of the construction. Stack discharge heights range from a few meters to 61 m (200 ft), and flow rates range from less than 2,832 L/min (100 ft³/min) to more than 5.7 million L/min (200,000 ft³/min).

The following methods are used to remove radionuclides from the stack emissions: (1) high-efficiency particulate air (HEPA) filters, (2) charcoal absorbers, (3) sand filters, (4) water scrubbers, (5) fiberglass prefilters, and (6) deep-bed fiberglass filters. Generally, at least one stage of HEPA filtration is used as the final particulate emission removal method before emissions are discharged to the atmosphere. All filters are required to have an efficiency of 99.95% for removing airborne particles larger than 0.3 μm in diameter. Filter efficiency is routinely tested.

A.2 POINT SOURCE DESCRIPTIONS

A.2.1 100 Areas Facilities

The 100 Areas contain eight inactive production reactors, the N Reactor (now in transition to deactivation and decommissioning), and associated support facilities. Radionuclide air emission points at facilities in the 100-N Area and 100-K Area are described briefly below and shown respectively in Figures 1-2 and 1-3.

A.2.1.1 N Reactor. This dual-purpose reactor operated until 1987, producing electrical power for the regional energy system and plutonium for weapons production. Because further operation of the N Reactor is not anticipated, the reactor and associated facilities are now in transition to deactivation and decommissioning.

- **116-N.** This stack exhausts filtered air from the 105-N Reactor Building. Emission monitoring consists of a record sampler. In 1993 N Reactor ventilation was reconfigured such that the 105-N Basin Transfer Area emissions exhaust through the 116-N stack.
- **109-N-Z-I.** When this vent is operational, unfiltered air was released through it from 109-N Steam Generator Cells 1 through 5. Emission monitoring consisted

of a record sampler and a gross-gamma-energy monitor. This vent did not operate in 1994.

- **109-N-C-6.** When this vent is operational, unfiltered air is released through it from Steam Generator Cell 6 in the 109-N Building. Emission monitoring consisted of a record sampler and a gross-gamma-energy monitor. This vent did not operate in 1994.
- **107-N.** This vent exhausts filtered air from the 107-N Basin Recirculation Building. Emission monitoring consists of a record sampler. This emission point is not registered with WDOH.
- **105-N 14-Ft. Decontamination Room.** This stack exhausts filtered air from a small room in which radioactively contaminated tools are decontaminated. Emissions are continuously monitored by a record sampler. This emission point is not registered with WDOH.

A.2.1.2 100-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 vent exhausts unfiltered air from the fuel storage basin in the 105-KE Building. Emission monitoring consists of a record sampler.
- **105-KW.** This vent exhausts unfiltered air from the fuel storage basin in the 105-KW Building. Emission monitoring consists of a record sampler.
- **1706-KE.** This stack exhausts filtered air from the 1706-KE Laboratory. Emission monitoring consists of a record sampler.
- **1706-KER.** This vent exhausts filtered air from the basement area (approximately 8.2 m [27 feet] below grade) of the 1706-KE Laboratory. Emission monitoring consists of a record sampler.

A.2.2 200 Areas Facilities

The 200 Areas contain facilities for chemical separations, processing, and waste handling and disposal. The radionuclide air emission discharge points in the 200 East Area are shown in Figure 1-4 and those in the 200 West Area, in Figure 1-5. The PUREX Plant and related tank farm and evaporator facilities discharge volatile forms of radionuclides, specifically ^3H , ^{106}Ru , ^{125}Sb , and ^{129}I . When operating, the PUREX Plant discharged ^{85}Kr , but it has not operated fully since December 1989. No activities conducted in the 200 Areas in 1994 resulted in a discharge of ^{85}Kr .

A.2.2.1 PUREX Plant. The PUREX Plant is a nuclear-fuel reprocessing plant constructed in 1956 and operated until 1972, when it was placed on standby status. Later, needed modifications were made and the PUREX Plant resumed operations in November 1983, processing a backlog of irradiated fuel from N Reactor. The plant was placed in standby following a stabilization run that ended in March 1990. Shutdown orders were issued to PUREX in December 1992, and as a result, the plant is being deactivated.

- **291-A-1.** This stack exhausts filtered air from canyon ventilation (Cells A to M), and vessel and condenser vents. Emission monitoring consists of a record sampler, a silver zeolite cartridge, an alpha continuous air monitor (CAM), and a beta-gamma CAM.
- **296-A-1.** This stack exhausts filtered air from N and Q Cells, Product Removal rooms, and gloveboxes in these rooms. Emission monitoring consists of a record sampler and an alpha CAM.
- **296-A-2.** This stack exhausts filtered air from the west sample gallery hoods. Emission monitoring consists of a record sampler, an alpha CAM, and a beta-gamma CAM.
- **296-A-3.** This stack exhausts filtered air from hoods in the east sample gallery. Emission monitoring consists of a record sampler and a beta-gamma CAM.
- **296-A-5A and 296-A-5B.** These stacks exhaust filtered air from laboratory hoods. Emission monitoring for each stack consists of a record sampler, an alpha CAM, and a beta-gamma CAM.
- **296-A-6.** This stack exhausts filtered room air from the east sample gallery and U Cell. Emission monitoring consists of a record sampler.
- **296-A-7.** This stack exhausts filtered room air from the PUREX west sample gallery and R Cell. Emission monitoring consists of a record sampler.
- **296-A-8.** This stack exhausts filtered air from the PUREX Plant Pipe and Operating gallery and the White Room. Emission monitoring consists of a record sampler.
- **296-A-10.** This stack exhausts filtered air from storage tunnel No. 2. Emission monitoring consists of a record sampler.
- **296-A-14.** This stack exhausts filtered air from the 293-A Off-gas Treatment and Recovery Building (for nitric acid recovery). Emission monitoring consists of a record sampler.

A.2.2.2 Uranium-TriOxide Plant (UO₃ Plant). Located in the 200 Area is the Uranium-TriOxide (UO₃) Plant, which formerly produced uranium trioxide from PUREX Plant solutions. In 1972 the UO₃ Plant was shut down. Later, it was refurbished to process uranyl nitrate hexahydrate from the PUREX Plant, and was restarted in March 1984. The UO₃ Plant operated for the final time in June 1993 processing uranyl nitrate hexahydrate into the more stable compound of uranium trioxide. The plant was deactivated immediately after its final run, in 1993. In December 1994 the facility was transferred from WHC to BHI.

- **296-U-2.** This stack exhausts filtered air from the powder-handling system in the 224-UA Building of the UO₃ Plant. Emission monitoring consists of a record sampler. This stack was transferred from WHC to BHI in 1994 and blanked-off in October of 1994.
- **296-U-4.** This UO₃ Plant stack exhausts unfiltered air from the process off-gas system (vessel vent, concentrator, and calciner) on the 224-U Building. Emission monitoring consists of a record sampler. This stack was transferred from WHC to BHI in 1994 and blanked-off in December of 1994.
- **296-U-13.** This stack exhausts filtered air from the powder loadout hood. Emission monitoring consists of a record sampler and beta-gamma CAM. This stack was transferred from WHC to BHI in 1994 and blanked-off in October of 1994.

A.2.2.3 B Plant and Waste Encapsulation Storage Facility. This facility contains two major operating system areas, B Plant and the Waste Encapsulation Storage Facility (WESF). B Plant was designed and used to remove ¹³⁷Cs and ⁹⁰Sr from high-level liquid waste. At WESF, the ¹³⁷Cs and ⁹⁰Sr were converted to solid strontium fluoride and cesium chloride, doubly encapsulated, and placed in water-filled storage basins. WESF now is used to store radioactive inventories, and contains many radioactive strontium and cesium capsules. The 221-B Building contains radioactive contamination remaining from previous production campaigns that must be properly managed.

- **291-B-1.** This is the B Plant main stack, which exhausts filtered air from the B Plant canyon, the process vessel ventilation system number 1, and the 212-B and 224-B Buildings. Emission monitoring consists of a record sampler, a backup record sampler, and a beta-gamma CAM.
- **296-B-5.** This stack exhausts filtered air from the 221-BB Building, which houses the B Plant process condensate and B Plant steam condensate receiver tanks. Emission monitoring consists of a record sampler and a beta-gamma CAM.
- **296-B-10.** This stack exhausts filtered air from the 225-B Building, which is also known as WESF. Emission monitoring consists of a record sampler and a beta-gamma CAM.

- **296-B-13.** This stack exhausts filtered air from the 221-BF Condensate Effluent Discharge Facility, which houses process condensate retention ventilation. Emission monitoring consists of a record sampler and a beta-gamma CAM.

A.2.2.4 AR and CR Vaults. The AR and CR Vaults are retention and treatment facilities for high-level radioactive liquid wastes.

- **296-A-12.** This stack exhausts filtered air from the 244-AR Vault vessel ventilation system. Emission monitoring consists of a record sampler and a beta-gamma CAM. This stack did not operate in 1994.
- **296-A-13.** This stack exhausts filtered air from the 244-AR Vault canyon and cells. Emission monitoring consists of a record sampler and a beta-gamma CAM. This stack did not operate in 1994.
- **296-C-5.** This stack exhausts filtered air from the 244-CR Vault Cell and vessel ventilation. Emission monitoring consists of a record sampler and a beta-gamma CAM.

A.2.2.5 200 East Area Tank Farms (excluding the Evaporator). 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.** This stack exhausts filtered, noncondensable vapors from waste storage tanks in the 241-AY and -AZ Tank Farms. Emission monitoring consists of a record sampler, two silver-zeolite cartridge samplers for volatile radionuclides, and a beta-gamma CAM. The 296-P-26 stack serves as the backup exhauster for this emission point.
- **296-A-18.** This stack exhausts filtered air from the 241-AY-101 tank annulus. Emission monitoring consists of a record sampler. This stack did not operate in 1994 and has been inactive since September 1991.
- **296-A-19.** When this stack was operational, filtered air was released through it from the 241-AY-102 tank annulus. Emission monitoring consisted of a record sampler. This stack did not operate in 1994.
- **296-A-20.** 241-AZ Tank Annuli Exhaust. This stack exhausts filtered air from the 241-AZ-101 and -102 tank annuli. Emission monitoring consists of a record sampler.
- **296-A-25.** This stack exhausts filtered air from the catch tank at the 244-A lift station. Emission monitoring consists of a record sampler and a beta-gamma CAM.

- **296-A-26.** This stack exhausts filtered air from the waste unloading room and sump tank at the 204-AR tank. Emission monitoring consists of a record sampler and a beta-gamma CAM.
- **296-A-27.** This stack exhausts filtered air from all 241-AW tanks. Emission monitoring consists of a record sampler, two silver-zeolite cartridge samplers for volatile radionuclides, and a beta-gamma CAM.
- **296-A-28.** This stack exhausts filtered air from all tank annuli in the 241-AW tank farm. Emission monitoring consists of a record sampler and a beta-gamma CAM.
- **296-A-29.** This stack exhausts filtered air from all 241-AN tanks. Emission monitoring consists of a record sampler and a beta-gamma CAM.
- **296-A-30.** This stack exhausts filtered air from all tank annuli in the 241-AN tank farm. Emission monitoring consists of a record sampler and a beta-gamma CAM.
- **296-A-40.** This stack exhausts filtered air from all 241-AP tanks. Emission monitoring consists of a record sampler, two silver-zeolite cartridge samplers for volatile radionuclides, and a beta-gamma CAM.
- **296-A-41.** This stack exhausts filtered air from all tank annuli in the 241-AP tank farm. Emission monitoring consists of a record sampler and a beta-gamma CAM.
- **296-B-28.** This stack exhausts filtered air from the 244-BX saltwell receiver tanks and annulus. Emission monitoring consists of a record sampler, a beta-gamma CAM for the tank exhaust, and a beta-gamma CAM for the annulus exhaust.
- **296-P-16.** A portable exhauster emits filtered air via this stack from the 241C104, 241C105, and 241C106 tanks. Emission monitoring consists of a record sampler and a beta-gamma CAM.
- **296-P-17.** This portable exhauster emits filtered air from the 241A104, 241A105, and 241A106 tanks. Emission monitoring consists of a record sampler and a beta-gamma CAM. This stack did not operate in 1994.
- **296-P-32.** This is a portable exhauster for Rotary Mode Core sampling activities. This emission source exhausts filtered air from the waste tanks being core sampled. Emissions monitoring consists of a record sampler, a beta-gamma CM, and an alpha CAM.

A.2.2.6 200 East Area Evaporator. The evaporator restarted and began processing liquid waste in 1994. The evaporator is used to remove most of the water from high-level radioactive liquid waste, leaving a slurry that is pumped back to tank farms.

- **296-A-21.** This stack exhausts filtered air from the 242-A Evaporator-Crystallizer Building. Emission monitoring consists of a record sampler, an alpha CAM, and a beta-gamma CAM.
- **296-A-22.** This stack exhausts filtered air from the 242-A Evaporator-Crystallizer vessel-ventilation system. Emission monitoring consists of a record sampler, two silver-zeolite cartridge samplers for volatile radionuclides, an alpha CAM, and a beta-gamma CAM.

A.2.2.7 Grout Treatment Facility. This facility solidified low-level waste for disposal in underground vaults. The facility was placed in cold standby in 1993.

- **296-G-1.** When this stack operates air is exhausted from the GTF Air Filtration Module. Emission monitoring consists of a record sampler and a beta-gamma CAM. This stack did not operate in 1994.

A.2.2.8 209-E Critical Mass Laboratory. The building is no longer in operation. Formerly it was used for testing critical mass configurations.

- **296-P-31 (formerly 209-E).** This stack exhausts filtered building ventilation air. The particulate alpha and beta radioactivity emissions, from the building exhaust, are sampled with a record sampler.

A.2.2.9 S Plant. S Plant is another name for the Reduction-Oxidation Plant (REDOX), which is the 202-S building. The REDOX Plant was operated as a fuel-reprocessing facility until 1967 when it was shut down.

- **291-S-1.** The REDOX main stack exhausts filtered air from the REDOX canyon, vessel ventilation, and treated dissolver off-gas system. Emission monitoring consists of a record sampler and a beta-gamma CAM.
- **296-S-2.** This stack exhausts filtered air from REDOX north and south sample galleries, hoods, and product removal cage. Emission monitoring consists of a record sampler.
- **296-S-4.** This stack exhausts filtered air from the REDOX decontamination room and regulated shop and unfiltered air from the regulated tool room, low-level decontamination sink, and special work permit lobby. Emission monitoring consists of a record sampler.

- **296-S-6.** This stack exhausts air from the REDOX silo operating gallery and aqueous make-up levels. Emission monitoring consists of a record sampler.
- **296-S-7W.** This stack exhausts filtered air from the 233-S REDOX Product building, the REDOX plutonium-processing greenhouse, and process vessel ventilation and loadout area. Emission monitoring consists of a record sampler and an alpha CAM. A duplicate exhaust fan and record sampler is designated as 296-S-7E.

A.2.2.10 T Plant. T Plant is one of the original fuel reprocessing facilities. The last fuel reprocessed there was in 1956. Now the 221-T Building is used for decontaminating and repairing equipment.

- **291-T-1.** This stack exhausts filtered air from 221-T canyon and process ventilation. Emission monitoring consists of a record sampler, a beta-gamma CAM, and an alpha CAM.
- **296-T-13.** This stack exhausts filtered air from the 221-T Building and canyon ventilation. Emission monitoring consists of a record sampler and a beta-gamma CAM.
- **296-T-7.** This stack exhausts filtered air from the 2706 Building only while decontamination activities are being performed, the remaining times it is turned off. Emission monitoring consists of a record sampler and beta-gamma CAM.

A.2.2.11 TRUSAF. The 224-T 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 1970's. At that time, the 224-T Building was modified for storage of plutonium scrap in liquid and solid forms. In 1984 the facility was selected to house the transuranic waste storage and assay (TRUSAF) operation. The TRUSAF operation involves the analysis of transuranic waste to verify compliance with the Waste Isolation Pilot Plant (WIPP) waste acceptance criteria. Those containers meeting WIPP acceptance criteria are stored at 224-T pending shipment to the WIPP.

- **296-T-11.** This stack exhausts filtered air from the 224-T Building ventilation through the east part of the plenum. Emission monitoring consists of a record sampler.
- **296-T-12.** This stack exhausts filtered air from the 224-T Building ventilation through the west part of the plenum. Emission monitoring consists of a record sampler.

A.2.2.12 U Plant. U Plant was constructed as a fuel reprocessing plant but was never used for that purpose. Instead, it was used to recover uranium from bismuth-phosphate waste and

high-level radioactive wastes from tank farms. Now, however, it is a shut-down, retired facility with a few offices and shops still in use.

- **291-U-1.** This stack exhausts filtered air from U Plant and 221-U canyon ventilation. Emission monitoring consists of a record sampler and a beta-gamma CAM.

A.2.2.13 Plutonium Finishing Plant (PFP). Historically, PFP, located in the 200 West Area, recovered plutonium in the form of plutonium nitrate from plutonium scrap. Plutonium metal was also produced from recovered nitrate and plutonium nitrate received from the PUREX Plant. PFP's current mission is to stabilize and store existing inventory of plutonium compounds. In 1994, plutonium bearing compounds were converted to plutonium oxide (PuO_2) and thermally stabilized, to meet long-term storage criteria.

- **291-Z-1.** This stack exhausts filtered air from the 234-5Z, 236-Z, and 242-Z Buildings. Emission monitoring consists of a record sampler and an alpha CAM.
- **296-Z-3.** This stack exhausts filtered air from 241-Z vault sump and vessel ventilation. Emission monitoring consists of a record sampler and an alpha CAM.
- **296-Z-5.** This stack exhausts filtered air from 2736-ZB, the shipping and receiving building. Emission monitoring consists of a record sampler and an alpha CAM.
- **296-Z-6.** This stack exhausts filtered air from the 2736-ZA Building and its plutonium storage vault ventilation system. Emission monitoring consists of a record sampler and two alpha CAMs. One alpha CAM is located on each of the two ducts feeding into this stack.
- **296-Z-14.** This stack exhausts filtered air from the 232-Z Incinerator Building. Emission monitoring consists of a record sampler and two alpha CAMs.

A.2.2.14 200 West Area Tank Farms (Excluding Evaporators). Radioactive waste stored in tank farms consists of sludge and saltcake in SSTs and liquid and slurry in DSTs.

- **296-P-22.** This stack exhausts filtered air from annuli in the 241SY101, 241SY102, and 241SY103 tanks. Emission monitoring consists of a record sampler and a beta-gamma CAM.
- **296-P-23 (296-P-28 backup stack).** This stack exhausts filtered air from the 241SY101, 241SY102, and 241SY103 tanks. Emission monitoring consists of a record sampler and a beta-gamma CAM.

- **296-S-15.** This stack exhausts filtered air from tanks 241SX107 through 241SX112 and 241SX114. Emission monitoring consists of a record sampler and a beta-gamma CAM.
- **296-S-22.** This stack exhausts filtered air from the 244-S saltwell receiver tank and annulus. Emission monitoring consists of a record sampler, an alpha CAM, and a beta-gamma CAM. This stack did not operate in 1994.
- **296-T-18.** This stack exhausts filtered air from the 244-TX saltwell receiver tank and annulus. Emission monitoring consists of a record sampler, an alpha CAM, and a beta-gamma CAM.

A.2.2.15 200 West Area Evaporators. The evaporators are designed to remove most of the water from radioactive liquid waste; the resulting slurry is then routed to tank farms for storage. The 242-T Evaporator-Crystallizer has been deactivated and has been inoperable since 1986. The 242-S Evaporator-Crystallizer also did not operate in 1994, but is on standby.

- **296-S-18.** This stack exhausts filtered air from the 242-S Evaporator-Crystallizer Building. Emission monitoring consists of a record sampler and a beta-gamma CAM.
- **296-T-17.** This stack exhausts filtered air from the 242-T Evaporator-Crystallizer and cold-cell ventilation. Emission monitoring consists of a record sampler, an alpha CAM, and a beta-gamma CAM.

A.2.2.16 2724-W Laundry. This is the Protective Equipment and Decontamination Facility, also known as the 2724-W Laundry, was located in the 200 West Area. Radioactively contaminated protective clothing and equipment used by Hanford Site contractors was laundered at this facility and exhausted emissions through the 296-W-1 stack. This facility was shut down in October 1993 and decommissioned and demolished in July 1994.

- **296-W-1.** This stack exhausted air from clothes dryers and a washroom. This emission point was eliminated in 1994, when the 2724-W Building was demolished. this stack did not operate in 1994.

A.2.2.17 222-S Analytical Laboratories. The 222-S Analytical Laboratories provide chemical and radiochemical analytical support for WHC, including environmental and effluent sample analysis, research and development, and tank farm waste characterization.

- **296-S-16.** This stack exhausts filtered air from the 219-S Building and waste tanks. Emission monitoring consists of a record sampler.

- **296-S-21.** This stack exhausts filtered air from 222-S Laboratory hoods, gloveboxes, hot-cells, and room ventilation system. Emission monitoring consists of a record sampler, an alpha CAM, and a beta-gamma CAM.

A.2.2.18 Waste Sampling and Characterization Facility (WSCF). The WSCF laboratory provides low-level radiological and chemical analyses on various types of samples and sample medias. The majority of the analyzed samples are used to determine compliance with the requirements of environmental regulations and U.S. Department of Energy (DOE) Orders.

- **696-W-1.** This stack exhausts filtered air from the analytical laboratory located on the main floor of the 6266 building. Emission monitoring consists of a record air sampler. This stack is not registered with the WDOH.
- **696-W-2.** This stack exhausts filtered air from the Nuclear Spectroscopy Laboratory located in the basement of the 6266 building. Emission monitoring consists of a record sampler. This stack is not registered with the WDOH.

A.2.2.19 Waste Verification & Sampling Facility. The facility is used to verify the contents of drums received from generators. Because of limited use, it is scheduled to be transferred to the 200 West Tank Farms in 1995.

- **296-W-3.** This exhaust discharges filtered air from the 213-W building. Emission monitoring consists of a record sampler and a beta-gamma CAM.

A.2.3 300 Area Facilities

The 300 Area consists primarily of laboratories, research facilities, and a steam plant. Emission points in the 300 Area are shown in Figure 1-6.

A.2.3.1 303-C Materials Evaluation Laboratory. The building is used primarily for storage of special nuclear materials in sealed containers.

- **EP-303C-01-S.** This stack exhausts filtered building ventilation air. The exhaust is sampled for particulate alpha and beta radioactivity.

A.2.3.2 Uranium Concretion Facility. In 1994, this facility was operated in a limited capacity for preparing radioactively contaminated sludges and fines for disposal or storage. Activities performed at this facility included mixing radioactive contaminated matrices with cement and water. The facility is currently in transition to closure under RCRA regulations.

- **304-CON-EX.** This stack discharged the 304 Building's exhaust stream which was mitigated using a cyclone precipitator. This exhaust system was operational for less than 7 days in 1994. Emissions monitoring consisted of a record

sampler. The stack was also sealed off in 1994 and was not registered with the WDOH.

A.2.3.3 306-E Metal Fabrication Development Building. This building is in use for materials testing and fabrication. In the past, this building housed three separate operations; (1) a large, high-bay used for nonfueled test article fabrication for FFTF, (2) nondestructive, radiography examination in a series of shielded cells, and (3) a small depleted-uranium-powder laboratory used to fabricate insulator pellets for the FFTF fuel pins.

- **306-E-ULAB.** This stack exhausts filtered air from the Uranium Oxide Laboratories in rooms 158 and 159. The laboratories are currently shut down. Emission monitoring consists of a record sampler.

A.2.3.4 306-W Materials Development Laboratory. The building contains shops and laboratory facilities for metal-working and ceramic studies.

- **EP-306W-01-V.** This vent exhausts filtered building ventilation air. The exhaust is sampled for particulate alpha and beta radioactivity.
- **EP-306W-02-V.** This vent exhausts filtered building ventilation air. The exhaust is sampled for particulate alpha and beta radioactivity.
- **EP-306W-03-V.** This vent exhausts filtered building ventilation air. The exhaust is sampled for particulate alpha and beta radioactivity.
- **EP-306W-04-S.** This vent exhausts filtered building ventilation air from the northwest portion of the building. The exhaust is sampled for particulate alpha and beta radioactivity.

A.2.3.5 308 Fuels Development Laboratory. The 308 Laboratory was used for fabricating mixed-oxide fuel pins used by FFTF. The facility houses a shutdown swimming-pool-type Test Reactor and Isotope Production reactor by General Atomics (TRIGA) that was used in neutron radiography of the completed pins. The 308 Building is in transition to shutdown.

- **308-GL-EX.** This exhaust discharged filtered air from gloveboxes and hoods in the 308 Building. Emission monitoring consisted of a record sampler and an alpha CAM. This exhaust system was deactivated and sealed off in March 1994.
- **308-ET-EX.** This exhaust discharged filtered air from those portions of the 308 Laboratory previously associated with etching and cleaning operations, discontinued several years ago. Emission monitoring consisted of a record sampler and an alpha CAM. This exhaust system was deactivated and sealed off in March 1994.

- **308-TRIGA.** This stack discharges filtered air from the reactor hall housing the TRIGA reactor. The reactor, however, is permanently shut down and partially defueled. Emission monitoring consists of an particulate record sampler and a record sampler for volatile ^{131}I .

A.2.3.6 340 Complex. The 340 Complex houses the radioactive liquid waste and solid waste handling operations for the 300 Area. The 340-A Building contains six aboveground storage tanks for radioactive liquid waste. The east side of the 340-B building is a railcar loadout facility for shipping liquid waste to the 200 Areas. The west side of the 340-B building is a storage area for non-radioactive and radioactive solid waste.

- **340-NT-EX.** This stack exhausts filtered air from the 340 Building vault, the 340 Building vault tanks, and the 340-A Building waste tanks. Emission monitoring consists of a particulate record sampler, an alpha CAM, a beta-gamma CAM, and a record sampler for volatile ^{131}I .
- **340-B-BLDG.** This stack exhausts filtered air from the 340-B East Building. The stack exhaust system operates when railcars are housed within the facility. Emissions monitoring consists of a particulate record sampler. This stack is not registered with the WDOH.
- **340-DECON.** This stack exhausts air from the 340 Facility truck lock, operator's office, change rooms, decontamination area, and sampling hood. Emissions monitoring consist of a particulate record sampler. This stack is not registered with the WDOH.

A.2.3.7 377 Geotechnical Engineering Laboratory. This facility was formerly known as the 377 Steam Generator Facility. In 1993 the facility was renamed the 377 Geotechnical Engineering Laboratory to reflect the change in operations. The stack name was also changed from 377-SGEF to 377-GEL. The facility was formerly used for studying a steam generator that had been removed from a nuclear power plant. The steam generator was removed before 1990 and the facility was decontaminated. In 1991 and 1992, the facility was modified for use as a physical properties testing laboratory for radioactively contaminated soils and began laboratory operation in 1993.

- **377-GEL.** This stack exhausts filtered building ventilation air. The exhaust is sampled for particulate alpha and beta radioactivity.

A.2.4 400 Area Facilities

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

A.2.4.1 Fast Flux Test Facility. FFTF, located in the 400 Area, is a 400-megawatt thermal, sodium-cooled, low-pressure, high-temperature reactor plant. It was used for irradiation testing of breeder reactor fuels and materials.

- **FFTF-RE-SB.** Lower Reactor Service Building (RSB). This exhaust discharges unfiltered air from the lower level of the RSB. Emission monitoring consists of a particulate record sampler, a beta CAM, a noble gas monitor, and a record sampler for volatile ^{131}I .
- **FFTF-CB-EX.** Combined exhaust. This stack exhausts normally 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. Emission monitoring consists of an particulate record sampler, a continuous tritium monitor, a beta CAM, a noble gas monitor, and a record sampler for volatile ^{131}I . The tritium record sampler was eliminated on December 12, 1993.
- **FFTF-HT-TR.** Heat Transport System South. This exhaust discharges normally 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. Emission monitoring consists of a record sampler, a beta CAM, and a noble gas monitor.

A.2.4.2 437 MASF. The Maintenance and Storage Facility (MASF) is a multipurpose service center supporting the specialized maintenance and storage requirements of FFTF. The MASF provides the capability for sodium film removal, decontamination, repair, and storage of nonfueled components and hardware for FFTF.

- **437-MN&ST.** This exhaust discharges filtered air from the MASF. Emission monitoring consists of a record sampler and a beta CAM.

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APPENDIX B

MONITORING PROGRAM FOR AIR EMISSIONS AND LIQUID EFFLUENTS

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MONITORING PROGRAM FOR AIR EMISSIONS AND LIQUID EFFLUENTS

The WHC monitoring program for air emissions and liquid effluents comprises several activities designed to obtain and report high-quality sampling and analysis data to determine compliance with U.S. Department of Energy guidelines and federal, state, and local regulations. This program includes facilities monitored by BHI, since BHI has contracted WHC to perform effluent monitoring and reporting.

B.1 AIR EMISSION SAMPLE COLLECTION AND ANALYSIS

A representative sample of air emissions during the collection period is obtained by extracting the sample at a velocity that is as close as practicable to the stack airflow velocity and by holding the ratio of sample volume to total stack discharge volume constant within $\pm 20\%$.

The following methods are generally used to sample air emissions.

- **Record Sampler.** A stack record sampler collects radioactive emissions on a collection media, usually a particle filter, that is exchanged and evaluated least weekly, unless otherwise specified by WHC Effluent Monitoring. All particulate record samples are analyzed by the receiving laboratory for total alpha and total beta activity. Record samplers provide an indication of the amounts and concentrations of airborne radioactive material being discharged to the environment. Collection media for record samplers may vary, and is dependent on the radionuclide and chemical form of the substance being sampled. Record samplers do not utilize detectors, strip charts, nor alarms.
- **Continuous Air Monitor.** Continuous air monitors (CAMs) serve as warning devices to alert personnel to air emission releases exceeding normal operating parameters. A CAM collects particles on a filter monitored continuously by a radiation detector. The CAM filter may also be used as a backup for the record sample if necessary.

The following are the sample collection media utilized for collecting record samples.

- **Particle Filters.** Particle filters are the most common collection media used at Hanford to collect radioactive airborne particles. Filter medias for routine samples usually consist of either a membrane filter or glass fiber filter.
- **Silver-Zeolite or Charcoal Cartridges.** Silver-zeolite or charcoal cartridges are used to collect iodine and volatile forms of antimony, ruthenium, and tin.

- **Silica-Gel.** Silica-gel columns are used to collect tritium (^3H).
- **Grab Air Samples.** Grab air samples are used to collect samples of noble gases (e.g. Argon-41). A known volume of gas is collected with a sampler and then usually analyzed using a gamma-ray detector.

The PUREX and PFP facilities routinely report Plutonium-241 emissions. These emissions are calculated from facility inventories, since it can not be readily sampled and analyzed using conventional methods.

B.2 LIQUID EFFLUENT SAMPLE COLLECTION AND ANALYSIS

Liquid effluent sample collection schemes are designed to provide a representative sample of the effluent. Volume proportionality and extraction from a well-mixed stream are accomplished where practicable. Liquid effluent streams are sampled using the following: (1) weekly grab sampling, (2) batch sampling for a retention area, (3) incremental time-proportional sampling, (4) incremental flow-proportional sampling, and (5) continuous flow-proportional sampling.

Samples of the liquid effluent are collected for one month, composited, and then analyzed for total alpha and total beta activity. Specific radionuclide analyses are also performed on liquid effluent streams with a potential to exceed predetermined limits or as specified by WHC Effluent Monitoring.

B.3 DATA HANDLING

Radionuclide air and liquid effluent data received, are as follows:

- Stack record air sampler flowrates, total flow volume, and sample times.
- Stack flow rates determined via 40 CFR 60 Appendix A Methods 2 and 2A or employing mass flowmeters on the stack.
- Liquid discharge volumes.
- Sample analysis data.

These data are reviewed continually for consistency and errors. Concentration values calculated weekly, monthly, and quarterly are compared with past and present facility releases and with environmental release guides. All anomalies are investigated.

Generally, total alpha and total beta analysis results do not accurately reflect specific radionuclide emissions. However, if alpha results indicate a release concentration much less than the most restrictive limit for a specific alpha emitting radionuclide, the discharge is assumed to be within the release limits for all alpha emitters. The same methodology is employed for beta emitters. Exceptions to this methodology do exist. In liquids, results for

total beta do not include ^3H , a low-energy beta emitter, and volatile alpha and beta emitters that may be driven off with evaporation (e.g., ^{129}I and ^{210}Po). Radioactive gases and volatile radionuclides are not included in total alpha and beta analyses of air samples. Separate analyses are performed for ^3H , volatile substances, and gases when appropriate.

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