

Facility Effluent Monitoring Plan for the Plutonium Uranium Extraction Facility

D. L. Wiegand

Date Published
September 1994

Prepared for the U.S. Department of Energy
Office of Environmental Restoration and
Waste Management



Westinghouse
Hanford Company

P.O. Box 1970
Richland, Washington

Hanford Operations and Engineering Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

Approved for Public Release

MASTER

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

LEGAL DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or any third party's use or the results of such use of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

This report has been reproduced from the best available copy.
Available in paper copy and microfiche.

Available to the U.S. Department of Energy
and its contractors from
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831
(615) 576-8401

Available to the public from the U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
(703) 487-4650

Printed in the United States of America

DISCLM-1.CHP (1-91)

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

Plutonium-Uranium Extraction Plant

Prepared by:


D. L. Wiegand, Scientist
PUREX Surveillance Engineers

9-8-94
Date

Approved by:


C. D. Wollam, Manager
PUREX Surveillance Engineers

9/8/94
Date

Approved by:


D. G. Hamrick, Manager
PUREX/UO₃ Plant

9/9/94
Date

Approved by:


D. J. Cayrel, Manager
Environmental Policy

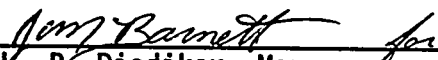
9-8-94
Date

Approved by:


D. D. Volkman, Manager
Engineering and Environmental Quality Assurance

9-8-94
Date

Approved by:

 for LPD
L. P. Diediker, Manager
Effluent Monitoring

9-8-94
Date

INFORMATION RELEASE REQUEST
PUBLIC DOCUMENT CHANGE/REVISION
(Short Form No. 1)

1. Base Document ID Number: WHC-EP-0468-2

2. Base Document Title:

Facility Effluent Monitoring Plan for the Plutonium Uranium Extraction Facility

3. Change/Revision Number: WHC-EP-0469-3

4. Change/Revision Date: 09/08/94

5. Unclassified Category:* UC - 721

6. Budget & Reporting Code:* B&R -

I verify this change/revision to the base document indicated above:

- Complies with the provisions of WHC-CM-3-4
- Contains no Limited-Use information
- Contains no classified or Applied Technology references
- Does not change the intent or meaning of the base document
- And, the base document itself is approved for public release.

7. Responsible Manager: C.D. WOLLAM

MSIN: S6-17

Telephone Number: 373-1587

C.D. Wollam
(Signature)

9/8/94
(Date)

8. Information Release Administration Specialist:**

Kathy Broz
(Signature)

9/19/94
(Date)

*Required only for full revisions transmitted to OSTI.
**Required only for full revisions.

**FACILITY EFFLUENT MONITORING PLAN FOR THE
PLUTONIUM URANIUM EXTRACTION FACILITY**

ABSTRACT

A facility effluent monitoring plan is required by the U.S. Department of Energy in DOE Order 5400.1 for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. This document is prepared using the specific guidelines identified in A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438-01**. This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements.*

This facility effluent monitoring plan shall ensure long-range integrity of the effluent monitoring systems by requiring an update whenever a new process or operation introduces new hazardous materials or significant radioactive materials. This document must be reviewed annually even if there are no operational changes, and it must be updated at a minimum of every three years.

*General Environmental Protection Program, DOE Order 5400.1, U.S. Department of Energy, Washington, D.C., 1988.

**A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438-01, Westinghouse Hanford Company, Richland, Washington, 1992.

· This page intentionally left blank. ·

CONTENTS

1.0	INTRODUCTION	1-1
1.1	POLICY	1-1
1.2	PURPOSE	1-1
1.3	SCOPE	1-1
1.4	DISCUSSION	1-3
2.0	FACILITY DESCRIPTION	2-1
2.1	BRIEF FACILITY PHYSICAL LAYOUT	2-1
2.1.1	The 202-A Building	2-1
2.1.2	203-A Pumphouse and Tank Farm	2-2
2.1.3	211-A Pumphouse and Tank Farm	2-2
2.1.4	206-A Acid Fractionator Building	2-2
2.1.5	The 293-A Building	2-2
2.1.6	Effluent-Monitoring Buildings	2-3
2.1.7	Tank 216-A-5 Calcium Carbonate Neutralization Tank	2-3
2.1.8	Railroad Tunnel	2-3
2.1.9	The 291-AE Building	2-3
2.2	BRIEF PROCESS DESCRIPTION	2-3
2.2.1	Present and Future Activities	2-4
2.3	IDENTIFICATION/CHARACTERIZATION OF POTENTIAL SOURCE TERMS	2-5
2.3.1	Gaseous Effluents	2-5
2.3.2	Liquid Effluents	2-6
3.0	APPLICABLE REGULATIONS	3-1
3.1	U.S. DEPARTMENT OF ENERGY ORDERS	3-1
3.1.1	U.S. Department of Energy Order 5400.1	3-1
3.1.2	U.S. Department of Energy Order 5400.5	3-1
3.2	FEDERAL REGULATIONS	3-1
3.2.1	Environmental Protection Agency Regulations on National Emission Standards for Hazardous Air Pollutants 40 Code of Federal Regulations 61	3-1
3.2.2	Reportable Quantities 40 Code of Federal Regulations 302	3-2
3.3	STATE REGULATIONS	3-3
3.3.1	Washington State Ambient Air Quality Standard and Emission Limits for Radionuclides WAC-173-480	3-3
3.3.2	Groundwater Protection	3-3
3.3.3	Dangerous Waste Regulations	3-3
3.4	LOCAL REGULATIONS	3-3
3.4.1	Benton, Franklin, and Walla Walla Counties Air Pollution Control Authority	3-3
3.5	AIR EMISSIONS	3-4
3.6	LIQUID EFFLUENTS	3-5
4.0	IDENTIFICATION/CHARACTERIZATION OF EFFLUENT STREAMS	4-1
4.1	IDENTIFICATION/CHARACTERIZATION OF SOURCE TERMS CONTRIBUTION TO EACH AIR EFFLUENT STREAM	4-1
4.1.1	Routine Operations	4-3
4.1.2	Upset Operating Conditions	4-3
4.1.3	Dispersion Modeling	4-4

CONTENTS (continued)

4.2	IDENTIFICATION/CHARACTERIZATION OF SOURCE TERMS CONTRIBUTING TO EACH LIQUID EFFLUENT STREAM	4-6
4.2.1	Routine Operating Conditions	4-6
4.2.2	Upset Operating Conditions	4-10
4.2.3	Waste Water Discharge Criteria	4-11
5.0	EFFLUENT POINT OF DISCHARGE DESCRIPTION	5-1
5.1	AIR EFFLUENTS	5-1
5.2	WATER EFFLUENTS	5-1
6.0	EFFLUENT MONITORING/SAMPLING SYSTEM DESIGN CRITERIA	6-1
6.1	NEW FACILITIES	6-1
6.2	EXISTING FACILITIES	6-1
6.2.1	Airborne Effluent Sampling and Monitoring System Design Criteria	6-1
6.2.2	Liquid Effluent Sampling and Monitoring System Design Criteria	6-4
7.0	CHARACTERIZATION OF CURRENT EFFLUENT MONITORING SYSTEM	7-1
7.1	AIR EFFLUENT MONITORING SYSTEM DESCRIPTION AND SPECIFICATIONS	7-1
7.1.1	Monitoring/Sampling Requirements and Criteria	7-1
7.1.2	Existing Air Effluent Monitoring/Sampling System	7-2
7.1.3	Remaining Stacks	7-3
7.1.4	Air Effluent Sampling Program	7-3
7.2	LIQUID EFFLUENT MONITORING SYSTEM DESCRIPTION AND SPECIFICATIONS	7-4
7.2.1	Monitoring/Sampling Requirements	7-4
7.2.2	CSL Effluent Monitoring/Sampling System	7-5
7.2.3	Liquid Effluents Monitoring Program	7-5
7.2.4	Liquid Effluent Sampling Program	7-6
8.0	HISTORICAL MONITORING/SAMPLING DATA FOR EFFLUENT STREAMS	8-1
8.1	AIR EFFLUENTS	8-1
8.1.1	Normal Conditions	8-1
8.1.2	Upset Conditions	8-2
8.2	LIQUID EFFLUENTS	8-2
8.2.1	Normal Conditions	8-2
8.2.2	Upset Conditions	8-2
9.0	SAMPLE ANALYSIS	9-1
9.1	ANALYTICAL LABORATORY AND PROCEDURES	9-1
9.2	SAMPLE AND DATA CHAIN OF CUSTODY	9-4
10.0	NOTIFICATION AND REPORTING REQUIREMENTS	10-1
10.1	OCCURRENCE CATEGORIZATION, NOTIFICATION, AND REPORTING	10-1
10.1.1	Occurrence Identification and Immediate Response	10-1
10.1.2	Occurrence Categorization	10-1

CONTENTS (continued)

10.2	OCCURRENCE CATEGORIZATION	10-2
10.2.1	Radioactive Releases	10-2
10.2.2	Release of Hazardous Substances/Regulated Pollutants/Oil	10-3
10.2.3	Discovery of Hazardous Material Contamination Due to DOE Operations	10-4
10.2.4	Agreement/Compliance Activities	10-5
10.2.5	Ecological Resources	10-5
10.3	FEDERAL REQUIREMENTS	10-6
10.3.1	Resource Conservation and Recovery Act of 1976	10-6
10.3.2	Comprehensive Environmental Response, Compensation and Liability Act of 1980	10-6
10.3.3	National Emission Standards for Hazardous Air Pollutants	10-6
10.4	STATE REQUIREMENTS	10-6
10.4.1	Generator Reporting	10-6
10.4.2	Facility Reporting	10-6
10.5	U.S. DEPARTMENT OF ENERGY REQUIREMENTS	10-7
10.5.1	U.S. Department of Energy Order 5400.1, Chapter II General Environmental Protection Program - Notification and Reports	10-7
10.5.2	U. S. Department of Energy Order 5484.1 Environmental Protection, Safety and Health Protection Information Reporting Requirements	10-7
11.0	INTERFACE WITH THE OPERATIONAL ENVIRONMENTAL MONITORING PROGRAM	11-1
11.1	DESCRIPTION	11-1
11.2	PURPOSE	11-1
11.3	BASIS	11-2
11.4	MEDIA SAMPLED AND ANALYSES PERFORMED	11-3
11.5	LOCATIONS	11-3
11.6	PROGRAM REVIEW	11-4
11.7	SAMPLER DESIGN	11-4
11.8	COMMUNICATION	11-4
11.9	REPORTS	11-4
12.0	QUALITY ASSURANCE	12-1
12.1	PURPOSE	12-1
12.2	OBJECTIVE	12-1
12.3	REQUIREMENTS	12-1
13.0	INTERNAL AND EXTERNAL PLAN REVIEW	13-1
14.0	COMPLIANCE ASSESSMENT	14-1
14.1	COMPLIANCE ASSESSMENT	14-1
14.1.1	Comparison of Instrument Specifications with Required Standard	14-1
14.1.2	Comparison of Instrument Specifications with Monitoring Criteria	14-1

CONTENTS (continued)

14.1.3	Comparison of Instrument Specifications with Effluent Characteristics	14-1
14.1.4	Comparison of Projected Effluent Characteristics with Historical Data	14-2
14.1.5	Comparison of Effluent Monitoring Capabilities with Regulatory and Contractor Requirements	14-2
14.2	EXEMPTIONS	14-2
14.3	SYSTEM UPGRADES REQUIRED FOR COMPLIANCE	14-2
14.4	CLEAN AIR ACT REQUIREMENTS	14-2
15.0	SUMMARY AND CONCLUSIONS	15-1
15.1	MONITORING REQUIREMENTS FOR AIR AND LIQUID EFFLUENTS	15-1
15.1.1	Monitoring Requirements for Radioactive Constituents in Air Effluents	15-1
15.1.2	Monitoring Requirements for Radioactive Constituents in Liquid Effluent	15-1
15.2	SAMPLING REQUIREMENTS FOR AIR AND LIQUID EFFLUENTS	15-1
15.2.1	Sampling Requirements for Radioactive Constituents in Air Effluents	15-1
15.2.2	Sampling Requirements for Liquid Effluents	15-1
15.3	SYSTEMS UPGRADES FOR AIR MONITORING AND LIQUID SAMPLING	15-2
15.3.1	Systems Upgrades for Air Monitoring/Sampling	15-2
15.3.2	Systems Upgrades for Liquid Sampling	15-2
16.0	ATTACHMENTS	16-1
16.1	REFERENCES	16-1

LIST OF FIGURES

2-1	Location of the Plutonium-Uranium Extraction Plant at the Hanford Site	2-8
2-2	The Plutonium-Uranium Extraction Plant Plot Plan	2-9
2-3	The 202-A Building	2-10
2-4	The Plutonium-Uranium Extraction Plant Liquid Effluents	2-11
4-1	CSL Schematic Flow Diagram	4-12
4-2	CSL Flow Diagram	4-13
5-1	Plutonium-Uranium Extraction Plant Exhaust Stacks	5-2
5-2	B Pond Location	5-3

LIST OF TABLES

3-1	Applicable Regulations and Standards	3-6
3-2	Groundwater Quality Criteria	3-10
4-1	Plutonium-Uranium Extraction Plants Stack Exhaust Data	4-14
4-2	CAP-88 Unit Dose Factors for the Offsite Hypothetical Maximally Exposed Individual Affected by Radionuclide Air Emissions from the Hanford Site in 1993	4-15
4-3	Individual Radionuclide Doses to Maximally Exposed Individual for 1993 from 291-A-1.	4-16
4-4	Individual Radionuclide Doses to Maximally Exposed Individual for 1993 from 296-A-1	4-17
4-5	Doses to the Maximally Exposed Individual From Routine Releases During Transition to Shutdown	4-17
4-6	Potential Doses to the Maximally Exposed Individual From An Unmitigated Release	4-18
4-7	Potential Individual Radionuclide Doses to the Maximally Exposed Individual From An Unmitigated Release.	4-18
4-8	Summary of PUREX Plant Liquid Effluent Qualities	4-19
4-9	List of Plutonium-Uranium Extraction Plant Chemicals	4-22
7-1	Radioactive Sampling Requirements for Plutonium-Uranium Extraction Plant During Transition to Shutdown	7-7
7-2	Monitoring/Sampling and Analysis Program for Air Effluents	7-8
7-3	Chemical Sewer Normal Operating Parameters	7-9
7-4	Sampling and Analysis Program for Chemical Sewer Stream	7-10
8-1a	Final 1990 Radionuclide Airborne Releases from 291-A-1 (A552), 200 East Area	8-3
8-1b	Radionuclide Air Emissions in 1991 from 291-A-1 (A552), 200 East Area	8-4

LIST OF TABLES (continued)

8-1c	Radionuclide Air Emissions in 1992 from 291-A-1 (A552), 200 East Area	8-5
8-1d	Radionuclide Air Emissions in 1993 from 291-A-1 (A552), 200 East Area	8-6
8-1e	Radionuclide Air Emissions in 1990 from 296-A-1 (A540), 200 East Area	8-7
8-1f	Radionuclide Air Emissions in 1991 from 296-A-1 (A540), 200 East Area	8-7
8-1g	Radionuclide Air Emissions in 1992 from 296-A-1 (A540), 200 East Area	8-8
8-1h	Radionuclide Air Emissions in 1993 from 296-A-1 (A540), 200 East Area	8-8
8-2a	Plutonium-Uranium Extraction Chemical Sewer (CSL) to 216-B-3 Pond, 200 East Area (H118) in 1990	8-9
8-2b	Plutonium-Uranium Extraction Chemical Sewer (CSL) to 216-B-3 Pond, 200 East Area (H118) in 1991	8-10
8-2c	Radionuclides in Plutonium-Uranium Extraction Plant Chemical Sewer Discharge (CSL) to 216-B-3 Pond, 200 East Area (H118) in 1992	8-11
8-2d	Radionuclides in Plutonium-Uranium Extraction Plant Chemical Sewer Discharge (CSL) to 216-B-3 Pond, 200 East Area (H118) in 1993	8-12
14-1	National Emission Standards for Hazardous Air Pollutants Requirements	14-3
14-2	National Emission Standards for Hazardous Air Pollutants Requirements	14-109

· This page intentionally left blank. ·

LIST OF TERMS

ABCASH	Automated Bar Coding of Air Samples at Hanford
AFAN	aluminum fluoride and ammonium nitrate
AMU	aqueous makeup unit
ANSI	American National Standards Institute
APCA	Air Pollution Control Authority
ASD	ammonia scrubber discharge
ASTM	American Society for Testing and Materials
BAT	best available technology
CAM	continuous air monitoring
CERCLA	<i>Comprehensive Environmental Response, Compensation, and Liability Act of 1980</i>
CFR	Code of Federal Regulations
CHI/Q	air concentration per unit source release
CSL	chemical sewer
CWL	cooling water
CY	calendar year
DCG	derived concentration guide
DOE	U.S. Department of Energy
DP	differential pressure
Ecology	Washington State Department of Ecology
EDE	effective dose equivalent
EMP	environmental monitoring plan
EOC	emergency operations center
EPA	U.S. Environmental Protection Agency
ES&H	Environmental Safety and Health
FEMP	Facility Effluent Monitoring Plan
GC/MS	gas chromatograph/mass spectrometer
HEPA	high-efficiency particulate air (filter)
HP	Health Physics
HVAC	heating, ventilation, and air conditioning
ICRP	International Commission on Radiation Protection
M/S	monitoring/sampling
MCL	maximum concentration level
MEI	maximally exposed individual
MOU	memorandum of understanding
MSDS	Material Safety Data Sheet
NESHAP	<i>National Emission Standards for Hazardous Air Pollutants</i>
NPDES	National Pollutant Discharge Elimination System
P&O	pipe and operating
PAO	Public Affairs Office
PDD	process distillate discharge
PNL	Pacific Northwest Laboratory
ppb	parts per billion
PR	product removal
PSD	prevention of significant deterioration
PUREX	Plutonium-Uranium Extraction (Plant)
QA	Quality Assurance
QAPjP	Quality Assurance Project Plan
QAPP	Quality Assurance Program Plan
RCRA	<i>Resource Conservation and Recovery Act of 1976</i>

LIST OF TERMS (continued)

RL	U.S. Department of Energy, Richland Operations Office
SALDS	State Approved Land Disposal Structure
SAP	Sampling Analysis Plan
SARA	<i>Superfund Amendments and Reauthorization Act of 1986</i>
SCD	steam condensate
SDWA	<i>Safe Drinking Water Act</i>
SQA	software quality assurance
TEDF	Treated Effluent Disposal Facility
TLD	thermal luminescent dosimeter
TSD	treatment, storage, and disposal
U/UPW	UO ₃ /U Plant Waste Water
UNH	uranyl nitrate hexahydrate
UO ₃	uranium trioxide
USC	United States Code
WAC	Washington State Administrative Code
WHC	Westinghouse Hanford Company
WPCA	Water Pollution Control Act

METRIC CONVERSION CHART

INTO METRIC		
If you know	Multiply by	To get
Length		
inches	2.54	centimeters
feet	30.48	centimeters
miles	1.6093	kilometers
Volume		
gallons	3.786	liters
cubic feet	0.02832	cubic meters
Temperature		
Fahrenheit	Subtract 32 then multiply by 5/9ths	Celsius
Pressure		
inches water	1.87	mmHg
OUT OF METRIC		
Length		
centimeters	0.3937	inches
meters	3.28	feet
kilometers	1.6093	miles
Volume		
milliliters	1.247×10^{-3}	cubic feet
liters	0.264	gallons
cubic meters	35.31	cubic feet
Temperature		
Celsius	Multiply by 9/5ths, then add 32	Fahrenheit
Weight		
grams	28.35	ounces

· This page intentionally left blank. ·

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) Order 5400.1 (DOE 1991a) requires that a Facility Effluent Monitoring Plan (FEMP) be prepared for each DOE facility that has gaseous and/or liquid effluents. Only effluents that release significant pollutants or hazardous materials are included in this order; sanitary sewer and exhausts from air heating or cooling equipment are exempt.

The Plutonium-Uranium Extraction (PUREX) Plant is transitioning into a shutdown mode. No fuel processing activities are occurring and the majority of the tanks have been emptied. One waste water discharge and eleven air exhaust stacks are active. One previous air discharge, six wall exhausters, and four previous waste water discharges have been eliminated.

1.1 POLICY

It is the policy of DOE and Westinghouse Hanford Company (WHC) to conduct effluent monitoring that is adequate to determine whether the public and environment are adequately protected during DOE operations and whether operations are in compliance with DOE and other applicable federal, state, and local radioactive and nonradioactive hazardous materials standards and requirements. It is also the policy of DOE and DOE contractors to ensure that effluent monitoring programs meet high standards of quality and credibility.

1.2 PURPOSE

This plan fulfills the requirements in DOE 5400.1 (DOE 1991a) for a FEMP to exist for each site, facility, or process that uses, generates, releases, or manages significant pollutants or radioactive or hazardous materials that could affect public and employee safety and the environment. This document is specifically intended to meet this requirement for the PUREX facility on the Hanford Site.

The purpose of the FEMP is to assess and document information used to determine if the monitoring, sampling, and controls are sufficient to protect the public and the environment and to assess whether these systems are in compliance with all federal, state, and local requirements and regulations.

1.3 SCOPE

This document includes program plans for monitoring and characterizing radioactive and nonradioactive hazardous materials discharged in DOE facility effluents. This plan includes complete documentation for both gaseous and liquid effluent monitoring systems for both radioactive and nonradioactive hazardous pollutants that could be discharged under routine and/or upset conditions.

Specific sections that detail how the FEMP is implemented and structured follow. They compose the scope of this document.

Section	Scope
2.0	This brief facility description summarizes the processes that produce the effluents and couples them with a listing of effluents.
3.0	DOE orders and federal and state regulations that establish FEMP requirements, as well as discharge criteria, are provided.
4.0	Each gaseous and liquid effluent is characterized. Routine and upset conditions are described. The discharge criteria are developed and listed.
5.0	A description of each effluent's discharge point is provided.
6.0	The design criteria for the monitoring/sampling (M/S) system are listed for both air and water effluents.
7.0	Instrument descriptions and specifications of the effluent monitoring system are provided.
8.0	Appropriate historical M/S data are summarized.
9.0	Analytical requirements are listed and coupled with sampling and sample handling procedures.
10.0	Notification and reporting requirements for routine and environmental occurrence reports and procedural changes are listed.
11.0	This section provides the interface of the FEMP with the operational environmental surveillance program.
12.0	The Quality Assurance (QA) plan governing the field activities, laboratory analysis, and recordkeeping is stated. Audits are covered.
13.0	Internal and external FEMP review requirements are provided.
14.0	Compliance assessment is summarized. Two point-by-point evaluations of the National Emission Standards for Hazardous Air Pollutants (NESHAPs) are included.
15.0	A summary is provided and conclusions are listed.
16.0	References.

1.4 DISCUSSION

The characterization of the radioactive and nonradioactive constituents in each effluent stream coupled to the regulatory framework provides the underlying rationale for the M/S programs. The method of characterization discussed in this plan identifies potential pollutants in their individual effluents. Characterization parameters are based on process knowledge and chemical and equipment use. An accurate description of the effluents point of discharge is required for emission modeling and location of end-of-the-pipe M/S stations. Both normal and upset conditions (either projected or actual) are characterized.

As stated in federal regulations (40 Code of Federal Regulations [CFR] 61, Subpart H) (EPA 1991a), when determining the potential dose from an effluent, the emission controls between the point of generation and the discharge point are not to be considered. The emission controls are to be considered when assessing the types and amounts of a pollutant actually released at the discharge point.

The effluent monitoring system must have the appropriate design criteria and technical specifications to fully characterize the effluent streams. A combination of continuous sensing, continuous or periodic sampling, and parameter specific monitoring may be used.

Proper sampling, analysis, and data recording of all effluent monitoring efforts provide defensible documentation that all appropriate discharge criteria are being met at the point of discharge.

Characterization of liquid waste pollutants is required by 40 CFR 261.3(b) (EPA 1989a). Other regulations, such as 40 CFR 61, Subpart H (EPA 1991a), provide guidance on the adequacy of gaseous effluent monitoring. However, all potential pollutants should be characterized for two reasons (1) to assess the preventive capabilities of engineered and administrative barriers and the consequences of an upset release due to failure of one of these barriers, and (2) to verify that the M/S programs address all pertinent constituents at the point of discharge.

This page intentionally left blank.

2.0 FACILITY DESCRIPTION

This section presents a brief facility and process description of the PUREX Plant. These descriptions include the following:

- Location and physical layout of the process facility
- General description of the present, past, and future activities of the process
- Identity of the waste streams.

Section 4.0, Identification/Characterization of Effluent Streams, provides further specific information on the gaseous and liquid effluents.

2.1 BRIEF FACILITY PHYSICAL LAYOUT

The PUREX Plant is a collection of buildings and facilities located in the 200 East Area of the Hanford Site, in the south-central region of Washington State (Figure 2-1). Figure 2-2 is a plot plan for the PUREX Plant. The main building, 202-A (Figure 2-3), is a heavily shielded, reinforced-concrete structure known as a canyon building. This building contains the main equipment used in the PUREX process.

Principal building and structures which have the greatest connection to gaseous and liquid effluents, are described in the following sections.

2.1.1 The 202-A Building

The 202-A Building, in which the fuels were reprocessed, is a reinforced-concrete structure 1,005 ft long, 119 ft wide at its maximum, and 100 ft high, with about 40 ft of this height below grade. The building consists of three main structural components (1) a thick-walled, concrete canyon in which the equipment for radioactive processing is contained; (2) the pipe and operating (P&O), sample, and storage galleries; and (3) a steel-and-transite annex that houses offices, process control rooms, laboratories, and the building services. The basic features and arrangement are shown by the cut-away perspective view in Figure 2-3. The portion of the canyon below grade is subdivided into a row of process equipment cells paralleled by a ventilation air tunnel and a pipe tunnel through which intercell solution transfers are made. The air tunnel exhausts the ventilation air from the cells to the main ventilation filters and stack.

Running nearly the full length of the canyon building, above the cells and pipe trench, is a craneway for three gantry-type maintenance cranes. These cranes are used to handle cell cover blocks, remotely remove and replace process cell equipment, and charge irradiated fuel into the dissolvers.

The galleries contain service piping to the cells, samplers for obtaining process samples, and electrical switchgear.

The service section, next to the galleries, consists of two separate annexes. The larger annex contains the maintenance shops, offices, lunchroom, locker room, radiation zone entry lobby (SWP lobby), blower room, a switchgear room, compressor room, central control room, and the aqueous makeup unit (AMU) area. The smaller annex contains the analytical laboratory, the headend control room, and a switchgear room.

2.1.2 203-A Pumphouse and Tank Farm

The 203-A Pumphouse contains instruments for measuring the volumes of solutions contained in the 203-A tank farm, and pumps and piping to receive and transfer the solutions in the tank farm. The tank farm stores aqueous uranium solutions and recycled nitric acid from the Uranium Trioxide (UO_3) Plant. The tank farm includes sampling equipment, as well as loading and unloading equipment for the tank trucks and cars used to transfer solutions between the PUREX Plant and the UO_3 Plant. This area is called out in Figure 2-2 as the 203-A Storage Area.

2.1.3 211-A Pumphouse and Tank Farm

The 211-A Pumphouse is located in the midst of the 211-A Tank Farm. The pumphouse contains pumps used to transfer the chemicals stored in the tank farm. The pumphouse also contains ion-exchange columns and ancillary equipment previously used to produce demineralized water from sanitary (potable) water. The 211-A Tank Farm stored bulk uncontaminated liquid chemicals for use in the PUREX process. The chemicals stored included 57 wt% nitric acid, 93 wt% sulfuric acid, 50 wt% sodium hydroxide, 45 wt% potassium hydroxide, as well as demineralized water, normal paraffin hydrocarbon, tributyl phosphate, aluminum nitrate, and an aqueous mixture of ammonium fluoride and ammonium nitrate. All of the bulk chemicals except sodium hydroxide have been removed. This area is called out in Figure 2-2 as the 211-A Demineralizer Building.

2.1.4 206-A Acid Fractionator Building

The 206-A Building is a reinforced concrete structure located adjacent to the 202-A Building. It houses the vacuum fractionator and associated equipment. The vacuum fractionator concentrated recovered nitric acid. The heat transfer piping in the vacuum fractionator was a major contributor to the PUREX Plant Chemical Sewer (CSL) waste stream during operation. During shutdown conditions there is no discharge from the fractionator to the CSL. This building is called out in Figure 2-2 as the 206-A Fractionator.

2.1.5 The 293-A Building

The 293-A Building houses the backup facility, which removed nitrogen oxides from the dissolver off-gas stream converting them to nitric acid. The nitric acid was then recycled into the PUREX process via the 206-A Building. This process does not operate during shutdown conditions.

2.1.6 Effluent-Monitoring Buildings

Several small buildings and other enclosures contain equipment needed to monitor various liquid and gaseous effluent streams. The 295-XX Buildings house M/S equipment for the waste water streams. The 292-XX Buildings house M/S equipment for the gaseous effluent streams. Additional stack sampling equipment is located in small enclosures (cabinets) near the exhaust stacks.

2.1.7 Tank 216-A-5 Calcium Carbonate Neutralization Tank

This tank contains calcium carbonate (crushed limestone), which ensures that the Process Distillate Discharge (PDD) would not exceed the 2.0 pH limit if upstream neutralization systems did not perform as expected. This tank, like the PDD, is not in service during transition to shutdown. Re-use of this tank or the PDD are not anticipated.

2.1.8 Railroad Tunnel

The railroad tunnel received irradiated fuel and large pieces of equipment that have been transported to PUREX via railcars. The railroad tunnel enters the north side of the east end of Building 202-A, continues through the building, then exits on the south side of the building where it connects to the storage tunnels. The storage tunnels are two parallel, earth-covered tunnels that contain railroad tracks. The storage tunnels are isolated from the railroad tunnel by water fillable doors. The tunnels contain failed equipment (loaded on railroad cars) that is contaminated with high levels of radioactivity or too bulky for immediate burial. Storage of the equipment allows the radioactivity to decay to less dangerous levels. During transition to shutdown, PUREX will not receive railcar fuel shipments, however, aluminum clad fuel and a few fuel slugs from the dissolver cell floors may be shipped out of PUREX via railcars.

2.1.9 The 291-AE Building

Building 291-AE is an above-grade concrete structure which houses the No. 4 high efficiency particulate air (HEPA) filter system. The No. 4 filter consists of 10 parallel banks of two-stage, HEPA filters for final filtration of the canyon exhaust system. Instrumentation to detect pressure drop across each stage and gamma radiation at the first stage is part of the filter system.

2.2 BRIEF PROCESS DESCRIPTION

The PUREX Plant separates useable actinides from fission products in irradiated nuclear fuel. Briefly, the process consists of dissolving the fuel and then separating the actinides using liquid-liquid solvent extraction. The driving forces for the separations consist of concentration changes, temperature changes, and chemical additions. The PUREX Plant has been the source of five liquid effluent streams, which are mostly by-products of the

chemical separation processes. These liquid effluent streams are the Chemical Sewer (CSL), the Steam Condensate (SCD), the Process Distillate Discharge (PDD), the Ammonia Scrubber Discharge (ASD), and the Cooling Water (CWL) streams. The PUREX Plant has been the source of 11 principal gaseous effluent streams that resulted from the control of process vapors/gases and potential contamination. Of the 11 PUREX stacks, only 10 discharge at any one time; see Section 4.1.1, Stacks 296-A-5A and 296-A-5B. There are also six minor gaseous effluent streams that result from building ventilation of noncontaminated, normally occupied areas. Approximately 50 exhaust points are exempt from regulation, such as lavatory, office, and lunch room exhausts.

One of the stacks, 296-A-24, was deactivated in early 1990, leaving 10 principal streams. The six wall exhausters (296-A-33 through 296-A-38) were blanked off in early 1993, eliminating these minor effluent streams. During the transition to shutdown, the remaining gaseous effluents will continue. Continuous air flow through the process areas will ensure control of trace quantities of contamination. Of the five liquid effluent streams, the ASD, PDD, SCD, and CWL have been eliminated. Residual flow through the heat exchange equipment and heating, ventilation, and air conditioning (HVAC) systems will maintain some discharge (primarily building heating and cooling) from the CSL, but at a reduced rate.

2.2.1 Present and Future Activities

PUREX is continuing activities in the transition to shutdown to place the facility in a safe and environmentally secure configuration. Some of the major activities included in this transition are the consolidation of the ventilation systems, contaminated acid disposal, fuel disposition, canyon flushing, contaminated solvent disposal, operation of the F11 concentrator, and N-Cell cleanout.

PUREX recovered approximately 200,000 gallons of low specific activity nitric acid from NO_x absorption in the PUREX process and from the 1993 UO₂ campaign. As part of deactivation activities, PUREX plans to ship the acid to British Nuclear Fuels Ltd (BNFL) in England for use in their nuclear reprocessing program.

Approximately 3.4 MTU of irradiated fuel elements will be shipped to K Basin per the PUREX/UO₃ Project Management Plan (WHC-SP-1011D).

Elimination of the fire foam system was made possible by the removal of approximately 21,000 gallons of slightly contaminated PUREX solvent from the 202-A building.

Work is ongoing in the Plutonium Oxide Conversion Facility (N-Cell) disassembling and decontaminating process equipment housed within the gloveboxes. Equipment and piping will be removed by bagging out through gloveports and the gloveboxes will be decontaminated and a fixative agent applied to the surfaces.

Approximately 250,000 gallons of low-level non-dangerous waste remain at the PUREX plant with approximately 100,000 gallons of waste being generated from flushes of the canyon vessels and piping. Most of this low-level non-dangerous waste will be used as a dilution medium for the disposal of the

metal solution in tanks D5 and E6; the metal solution was recovered from transition-to-standby cleanout activities. The remaining waste may be evaporated by the F11 concentrator.

PUREX will also consolidate the four ventilation systems into one by cascading air from one ventilation system to another. This will reduce the volume of air discharged and the number of stack monitoring stations needed following PUREX deactivation. Final discharge of all air will be through the main stack via the canyon.

2.3 IDENTIFICATION/CHARACTERIZATION OF POTENTIAL SOURCE TERMS

Source terms for effluents from the PUREX Plant depend on the building or process they originate from and whether the plant is operating or in shutdown mode. This document has been written to address the current shutdown status of PUREX.

2.3.1 Gaseous Effluents

The contributors to a gaseous effluent are linked by physical location and are not related to a specific process. The PUREX Plant has 10 sources of major air effluents with the potential to release radioactive and nonradioactive constituents. The six minor wall exhausters were blanked off in the Spring of 1993.

The PUREX main exhaust stack (291-A-1) exhausts the offgas from a number of sources:

- Vapor from the dissolvers when they are operating
- Vent gases from the nitric acid absorber (T-XB) when dissolvers are operating
- Vent gases from the condenser on the nitric acid absorber E-F5 when operating
- Gases from the vessel vent system when operating
- Gases from the condenser vent system when operating
- Building ventilation air.

The Product Removal (PR) Room Stack (296-A-1) exhausts air from the following areas:

- PR room and hoods
- N cell hoods
- Q cell
- PR corridor
- Hot shop lobby.

Stack 296-A-2 exhausts sampler hoods from the west end of the sample gallery.

Stack 296-A-3 exhausts sampler hoods from the east end of the sample gallery.

Stacks 296-A-5A and 296-A-5B, at the west and east laboratory, do not operate concurrently; only one is operational at any given time. These stacks exhaust the PUREX analytical laboratory and are considered to be a single release point in this document.

The 296-A-6 Stack exhausts room air from the east end of the sample gallery and from U cell.

The 296-A-7 Stack exhausts room air from the west end of the sample gallery and from R cell.

The 296-A-8 Stack exhausts room air from the west end of the P&O gallery, including the white room.

The 296-A-10 Stack exhausts room air from the No. 2 storage tunnel. This tunnel contains used equipment, as discussed in Section 2.1.8.

The 296-A-14 Stack exhausts room air from the 293-A backup facility. This building contains two absorption columns for nitric acid recovery from the dissolver offgases.

Fuel decladding operations resulted in the formation of gaseous ammonia in certain D-Cell, E-Cell, and F-Cell vessels. The 296-A-24 Stack provided filtered exhaust for these vessels. This stack is no longer operating.

2.3.2 Liquid Effluents

Removal of the protective cladding from the fuel, the first step in fuel dissolution, produces large quantities of gaseous ammonia. This ammonia is scrubbed from the off-gas with water to prevent the release of ammonia to the air and to alleviate the explosion hazard that the ammonia would otherwise present. The resulting ammonia solution, contaminated with radionuclides from the fuel, is then boiled. The radionuclides are concentrated in the bottoms, which are sent to UGS. Before 1987, the resulting ammonia-bearing condensate stream was released as the ASD. In the current shutdown mode, the ASD stream does not exist and is mentioned as historical fact only.

Concentration changes within the PUREX process solutions are provided by dilution with water or acid and by removal of water and sometimes nitric acid by boiling. Chemical additions to the process solutions add water, which must be removed in the concentration stages. Although most of the water that is boiled out of solutions is reused in dilution stages, there is some excess water that requires disposal. This water is the source of the PDD. Because PUREX is in a shutdown mode and not processing, the PDD stream does not exist and is mentioned as historical fact only.

Boiling process solutions and condensing the resulting vapors require the use of steam and cooling water. These processes produce steam condensate and warm water as effluents. Changing the temperatures of process solutions to drive the separations produces more steam condensate and warm water. This steam condensate and warm water constitute most of the liquid effluents from PUREX, namely the CWL, SCD, and most of the CSL stream. The CWL and SCD have been blanked off and the remaining contributors rerouted to the CSL.

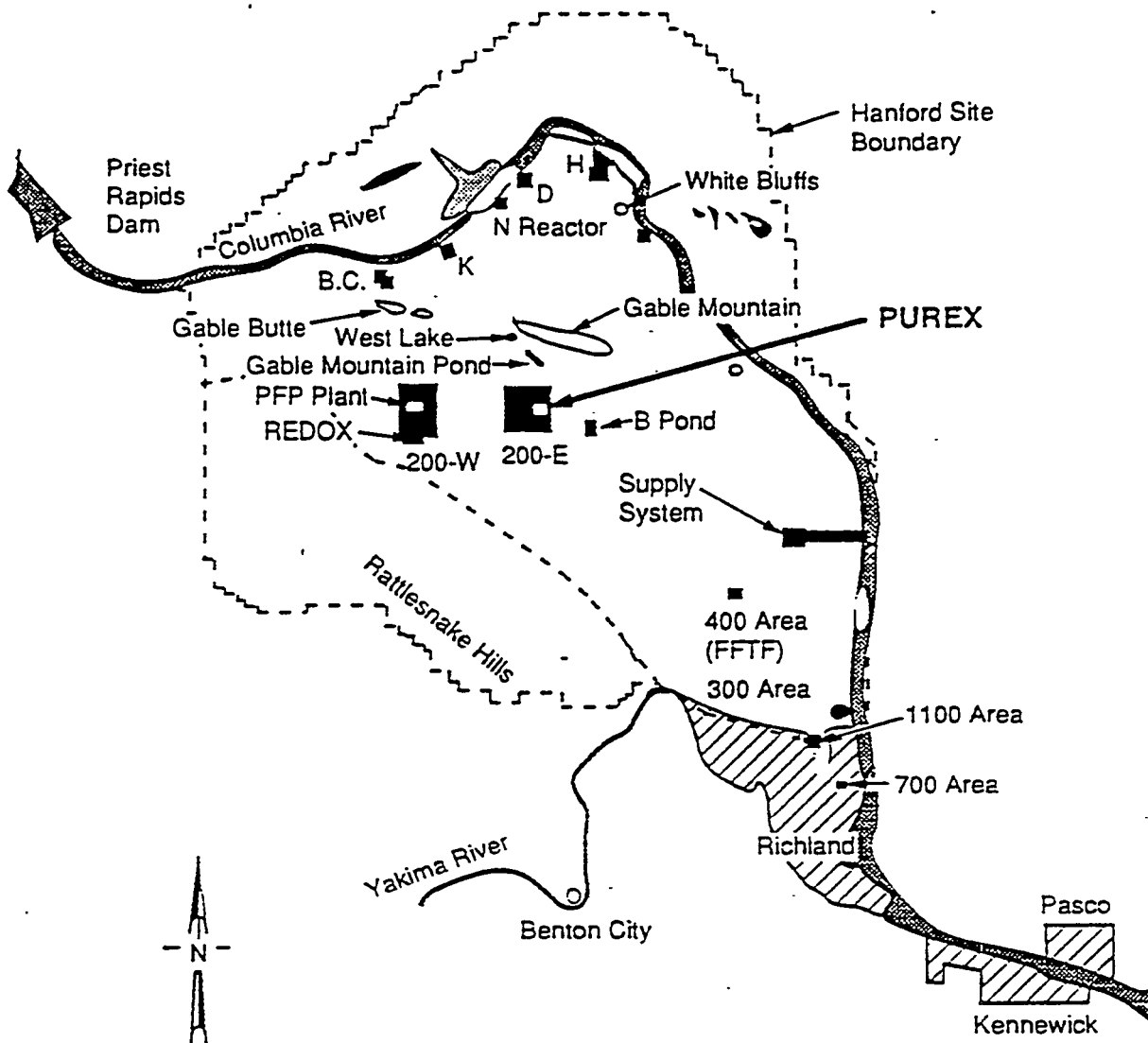
Ventilation, heating, water services, and room drainage contribute to the remainder of the CSL. Room drainage consists of waste water from shower rooms, water coolers, housekeeping, air compressors, steam, water, and occasional chemical leaks. To minimize the potential for chemical leaks during transition to shutdown, nonessential chemical headers have been emptied. Most chemicals which are not needed for shutdown have been or are being removed from the plant. Condensed noncontact heating steam to operate the F-11 concentrator will be routed to the CSL via the 216-A-42 Retention Basin.

Figure 2-4 shows the PUREX Plant liquid effluent system. Within the operating history of PUREX, the various waste water streams have been discharged to several ponds and cribs as follows.

<u>Stream</u>	<u>Discharged to</u>
PDD	216-A-5, 216-A-10, and 216-A-45 Cribs
SCD	216-A-30 and 216-A-37-2 Cribs, occasionally 216-B-3 Pond
ASD	216-A-36B Crib, UGS
CSL, CWL	216-B-3C and 216-B-3 Ponds, CWL sometimes to 216-A-25 Gable Mt. Pond

During the existing shutdown mode, the PDD, ASD, SCD, and CWL waste streams are eliminated. The potential for contamination via the CSL waste stream will be eliminated after the recommended best available technology (BAT) to control effluent quality is implemented in accordance with DOE Order 5400.5 (DOE 1990a). The BAT for the CSL includes eventual routing to the Treated Effluent Disposal Facility (TEDF).

Figure 2-1. Location of the Plutonium-Uranium Extraction Plant at the Hanford Site.



28905055.72M

Figure 2-2. The Plutonium-Uranium Extraction Plant Plot Plan.

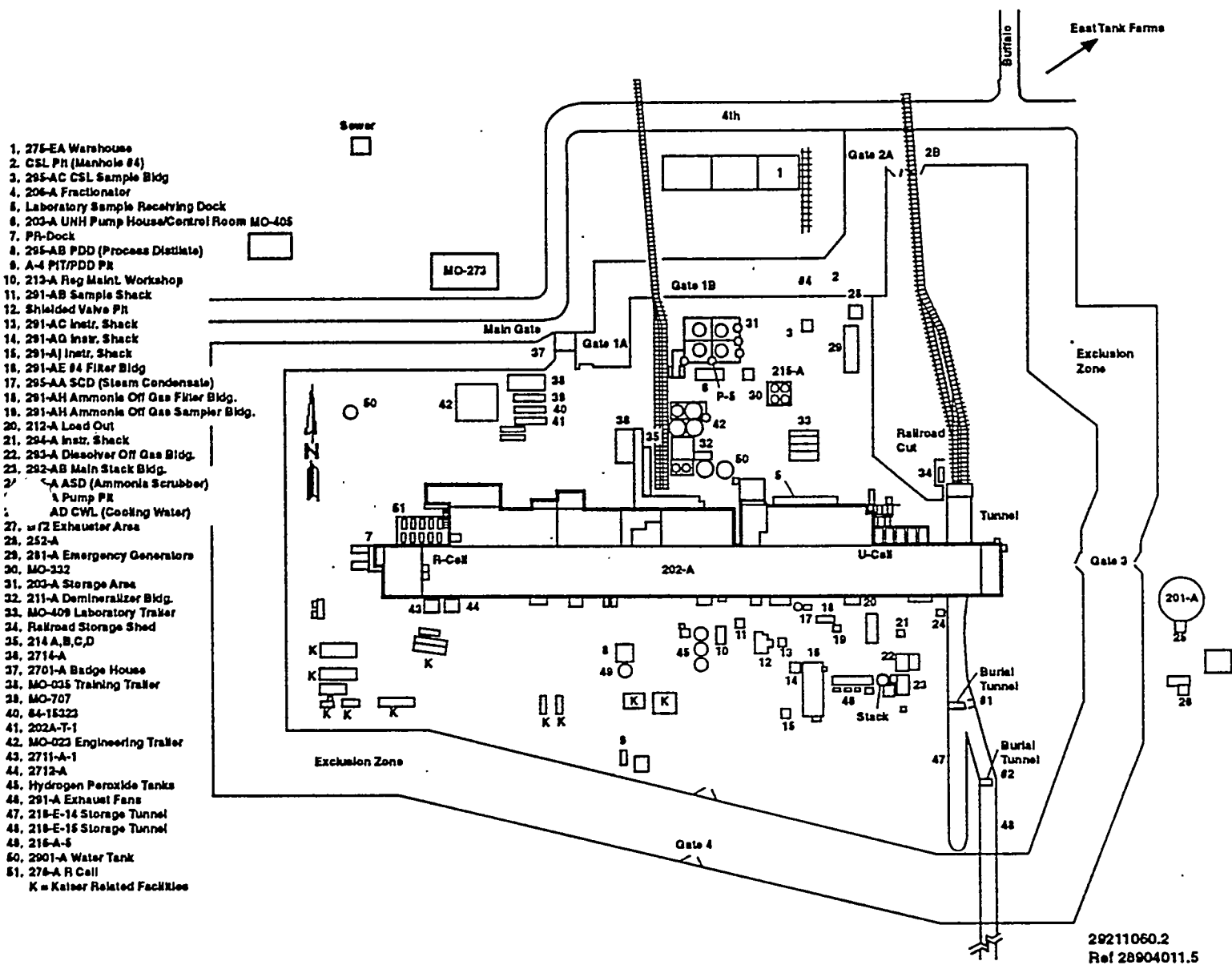


Figure 2-3. The 202-A Building.

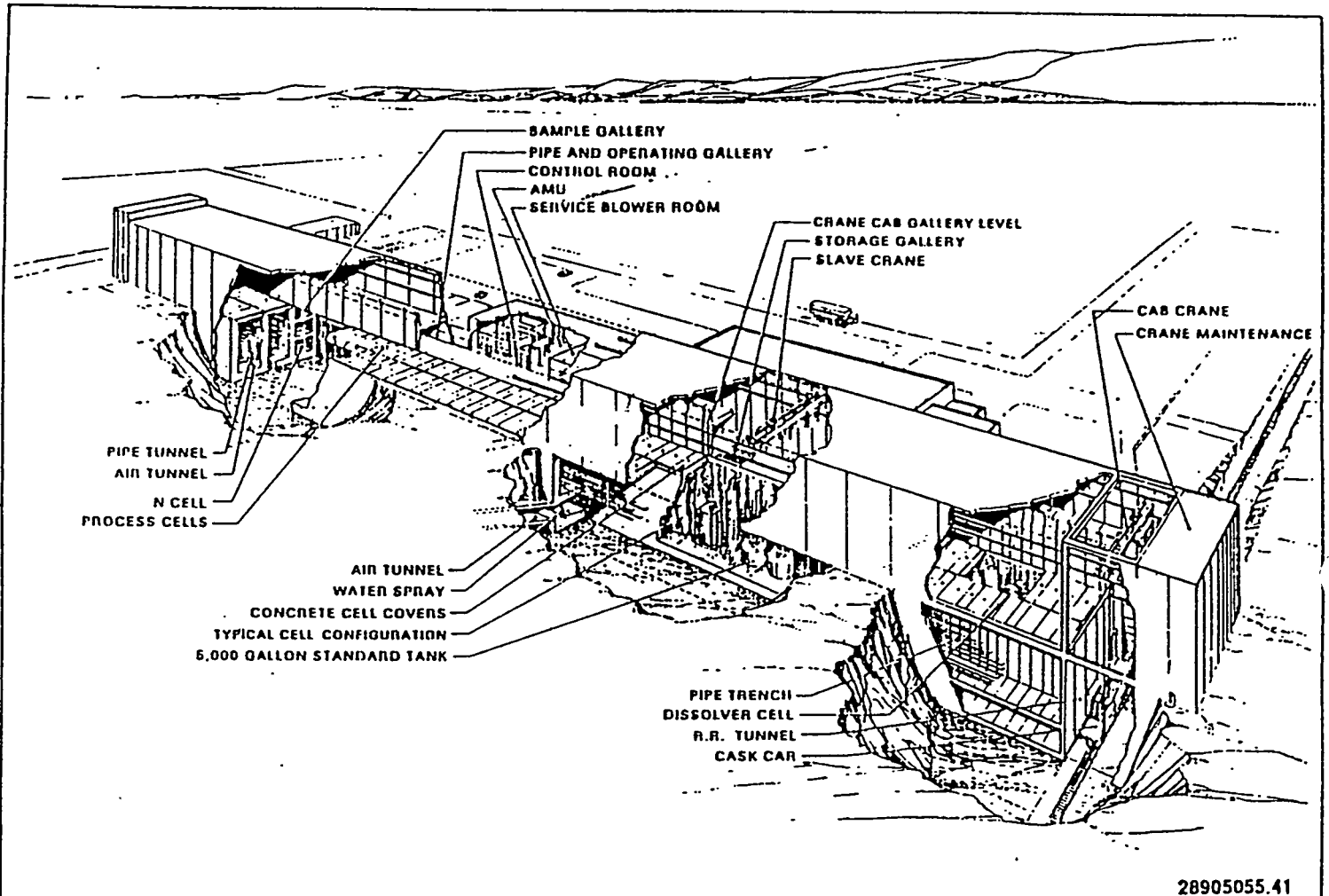
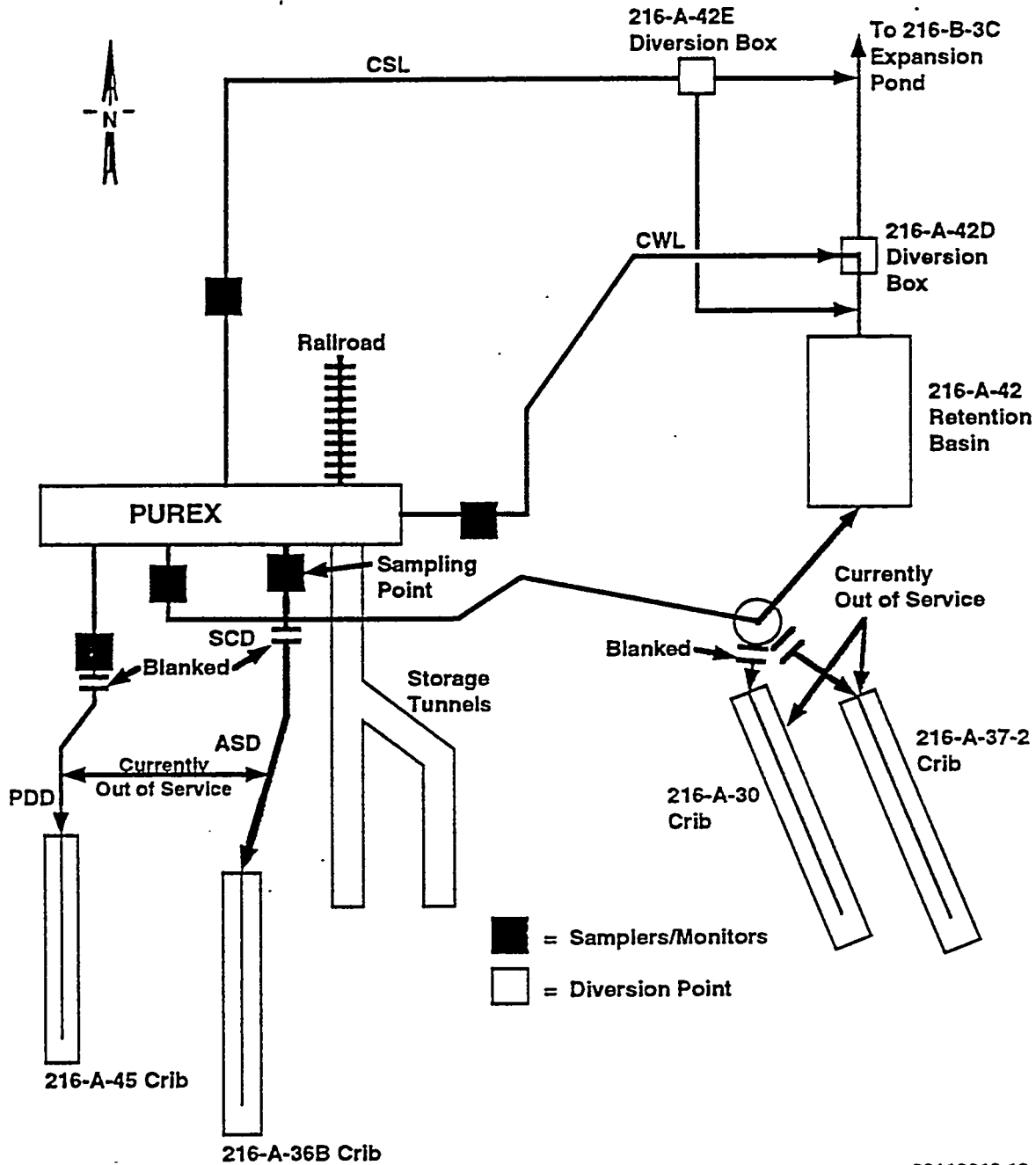


Figure 2-4. The Plutonium-Uranium Extraction Plant Liquid Effluents.



29110019.13

. This page intentionally left blank. .

3.0 APPLICABLE REGULATIONS

Conditions and requirements for monitoring existing or potential releases of radioactive and other chemicals to the environment are contained in DOE orders and federal, state, and local laws and regulations. Table 3-1 gives a brief summary of the regulations and standards applicable to this FEMP.

3.1 U.S DEPARTMENT OF ENERGY ORDERS

3.1.1 U.S. Department of Energy Order 5400.1

The DOE Order 5400.1, *General Environmental Protection Program* (DOE 1991a), requires a written environmental monitoring plan for each site, facility, or process that uses, generates, releases, or manages significant pollutants or hazardous materials. The plan must include the rationale and design criteria for the monitoring program, as well as describe the extent and frequency of the monitoring analysis. The plan also must contain Quality Assurance (QA) requirements, program implementation procedures, directions for preparation and implementation of reports, and directions for identification and discussion of effluent monitoring and environmental surveillance.

The effluent monitoring portion of the plan must verify compliance with applicable regulations and DOE orders. It also should evaluate the effectiveness of treatment; identify potential environmental problems; evaluate the need for remedial action or mitigation measures; support permit revision and/or reissuance; and detect, characterize, and report unplanned releases.

3.1.2 U.S. Department of Energy Order 5400.5

The DOE Order 5400.5 (DOE 1990a) requires a monitoring plan that complies with the requirements of DOE Order 5400.1. Compliance with the requirements of DOE Order 5400.5 may be demonstrated based on calculations from monitoring and surveillance programs information.

3.2 FEDERAL REGULATIONS

3.2.1 Environmental Protection Agency Regulations on National Emission Standards for Hazardous Air Pollutants 40 Code of Federal Regulations 61

Subpart H, "National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities," establishes exposure limits and monitoring requirements. The exposure limits, for members of the public, from radionuclide emissions is an effective dose equivalent (EDE) not to exceed 10 mrem/yr. Compliance with this standard is measured by calculating the highest EDE where a person resides or abides using an EPA-approved method.

Emissions of radionuclides must be measured at all release points that have a potential to discharge radionuclides into the air in quantities that could cause an EDE in excess of 1 percent of the standard. Effluent streams shall be directly monitored continuously with an in-line detector or representative samples of the effluent stream shall be withdrawn continuously from the sampling site following the guidance presented in American National Standards Institute (ANSI) N13.1 (ANSI 1969). The requirements for continuous sampling are applicable to batch processes when the unit is in operation. Periodic sampling (grab samples) may be used only with EPA's prior approval. Such approval may be granted in cases where continuous sampling is not practical and radionuclide emission rates are relatively constant. In such cases, grab samples shall be collected with sufficient frequency to provide a representative sample of the emissions.

To determine whether a release point is subject to emission measurement requirements, it is necessary to evaluate the potential for radionuclide emissions for that release point. In evaluating the potential of a release point to discharge radionuclides into the air, the estimated radionuclide release rates shall be based on the discharge of the effluent stream that would result if all pollution control equipment did not exist, but the facility operations were otherwise normal.

If the EDE caused by all emissions is less than 1 percent of the standard, the facility is exempt from the EPA monitoring requirements. All radionuclides that could contribute greater than 10 percent of the potential EDE for a release point shall be measured individually. With prior EPA approval, DOE may determine these emissions through alternative procedures. For other release points that have a potential to release radionuclides into the air, periodic confirmatory measurements shall be made to verify low emissions.

3.2.2 Reportable Quantities 40 Code of Federal Regulations 302

The regulations in 40 CFR 302 (EPA 1991b) designate hazardous substances and identify reportable quantities and notification requirements for releases of these hazardous substances under the *Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980* and the *Safe Drinking Water Act*, as amended.

Any unpermitted release of any of these designated hazardous substances must be reported. Therefore, if the possibility exists for a facility to release any of the designated substances, waste streams must be monitored for their presence and monitoring practices must be provided in a FEMP.

3.3 STATE REGULATIONS

3.3.1 Washington State Ambient Air Quality Standard and Emission Limits for Radionuclides WAC-173-480

Although the standard for Washington (WAC 1986) establishes a 25 mrem/yr effective dose equivalent for public exposure to radionuclide emissions, facilities must comply with the most restrictive of federal, state or local law. Therefore, the exposure limit that must be complied with is 10 mrem/yr; however, compliance is calculated at the point of maximum annual air concentration in an unrestricted area where any member of the public may be located (fence boundary).

3.3.2 Groundwater Protection

Radionuclides are defined as hazardous air pollutants, so they also will be construed to be hazardous in liquid effluent, without any specific listing of individual radionuclides as a hazardous substance under water pollution control laws.

The *Water Quality Standards For Groundwaters of the State of Washington* (WAC 1987) protect groundwater to the level of drinking water standards. These standards limit exposures to gross alpha, gross beta, tritium, ⁹⁰Sr, and ²²⁶Ra, ²²⁸Ra (Table 3-2). For radionuclides that are not specifically listed, exposures are limited by the federal standard to an effective dose equivalent not to exceed 4 mrem/yr.

3.3.3 Dangerous Waste Regulations

Any release of a dangerous waste or hazardous substance [as designated by Washington (State) Administration Code (WAC) (WAC 1991a)] to the environment, except permitted releases, must be reported. Waste streams that have the potential to contain dangerous waste constituents must be monitored accordingly.

3.4 LOCAL REGULATIONS

3.4.1 Benton, Franklin, and Walla Walla Counties Air Pollution Control Authority

The local air pollution control authority has jurisdiction over all air emissions except radionuclide emissions in the Benton, Franklin, and Walla Walla county areas, including the Hanford Site. Currently, there are no local standards more restrictive than the previously mentioned state and federal limits; therefore state and federal standards apply.

3.5 AIR EMISSIONS

The DOE Order 5400.5 (DOE 1990a) provides requirements for the monitoring of radioactive and nonradioactive airborne effluents from DOE facilities at the Hanford Site. This order states that DOE-controlled facilities must comply with 40 CFR 61 (EPA 1991a).

Additional EPA requirements on hazardous substances are contained in 40 CFR Part 302.A. This regulation provides information on reportable quantities of nonradioactive hazardous substances. Unlisted hazardous substances designated by 40 CFR Part 302.4 are regulated in accordance with the EPA toxicity of the contaminant.

In Washington State, airborne effluents are regulated by the Department of Ecology through regulations in the WAC, Title 173, Chapters 173-400 through 173-490, as amended, pursuant to the Washington Clean Air Act (RCW, Title 70, Public Health and Safety Chapter 94, as amended). General regulations for air pollution sources are presented in WAC 173-400, including emission standards for sources emitting hazardous air pollutants found in WAC 173-400-075.

The WAC 246-247, *Radiation Protection Air Emissions* (WAC 1991b), specifies new source review, notification, registration, and permitting requirements associated with any source of radioactive air emissions in Washington State, including those on the Hanford Site. One requirement listed in WAC 246-247 is the semiannual (twice yearly) reporting of emissions from each registered stack or vent on site. By agreement with the Washington State Department of Health, only annual reporting is required.

The WAC 173-480, *Ambient Radionuclides* (WAC 1991c), defines maximum allowable levels for radionuclides in the ambient air and defines required levels for control of emissions.

While both the WAC 246-247 and 173-480 list outdated maximum EDE standards, each contains a caveat stating that more stringent federal standards take precedence over the EDE standard specified by the WAC. Therefore, each effectively endorses the 10 mrem/yr EDE standard of 40 CFR 61, Subpart H.

In Washington State, airborne effluents are regulated by the *Washington Clean Air Act of 1967*. General regulations for air pollution sources are presented in WAC 173-400, including emission standards for sources emitting hazardous air pollutants in WAC 173-400-075. New sources for toxic air pollutants are presented in WAC 173-460. State regulations pertaining specifically to radioactive airborne effluents are found in WAC 246-247 and WAC 173-480, and are more restrictive in most cases than the Federal requirements.

Regulations, including DOE orders, state that DOE facilities must comply with the requirements set forth in the National Emission Standards for Hazardous Air Pollutants (NESHAP). Other regulations [e.g., 40 CFR 52, "Approval and Promulgation of Implementation Plans" (EPA 1991c); and DOE Orders 5400.1 (DOE 1991a), 5400.5 (DOE 1990a), DOE/EH-0173T (DOE 1991b), and 5484.1 (DOE 1983) state that DOE facilities must comply with the applicable requirements set forth in the *Clear Air Act*.

3.6 LIQUID EFFLUENTS

Requirements limiting the exposure of the public to radioactive materials from DOE-controlled activities through the drinking water pathway are presented in DOE Order 5400.5, Chapter II, Paragraph 1.d. The radiological criteria of the public community drinking water standards of 40 CFR Part 141, "National Interim Primary Drinking Water Regulations" (EPA 1991d), are applicable to Steam and Water Utilities Operation 200 East and West Operations as the providers of potable water to the site under the *Safe Drinking Water Act*. It is the policy of DOE to provide an equivalent level of protection for all persons consuming water from a drinking water supply operated by, or for, the DOE. These systems shall not cause any persons consuming the water to receive an EDE greater than 4 mrem/yr, excluding naturally occurring radionuclides. In addition, DOE facility operators shall ensure that the liquid effluents from DOE activities shall not cause private or public drinking water systems downstream of the facility discharge to exceed the drinking water radiological limits of 40 CFR Part 141.

Depending on where a liquid effluent (waste water) is discharged, certain regulations apply. These regulations are implemented through issuance of permits by federal, state, and/or local agencies. It is the responsibility of the facility, through the Richland Operations Office (RL), to apply for the permit appropriate to the effluent being discharged. Before applying for any permits, the applicant must know the source of waste water discharges and where the waste water is being discharged to. The following regulations apply based on where the waste water is discharged.

1. The 40 CFR 261(4)(b)(6) (EPA 1991b) provides a hazardous waste exclusion for fly ash, bottom ash, slag waste, and flue gas emissions control waste generated primarily from combustion of gas or other fossil fuel.
2. Washington State controls discharges to groundwater and surface water of the state, under WAC 173-216 (WAC 1991d), and issues permits for such discharges. A permit of this type would be necessary for any discharges to land that could infiltrate to groundwater.

Each type of discharge permit identified will typically contain discharge limitations and monitoring requirements. However, the limitations and monitoring requirements will vary depending on the source and type of waste water being discharged. For instance, discharges to a publicly owned treatment works will be subject to pretreatment standards based on the production process that generated the waste water for those processes categorized by the EPA. Categorical processes are identified in 40 CFR 401-471 (EPA 1991e). Specific limitations, monitoring, and reporting requirements have been promulgated for each categorical process. In addition to EPA's requirements, the state and local waste water treatment agencies may impose additional limitations, monitoring, and reporting requirements.

Table 3-1. Applicable Regulations and Standards. (3 sheets)

Agency/originator	Regulation no.	HA	HL	RA	RL	Summary/Application
U.S. Department of Energy (DOE), Washington, D.C.	DOE Order 5400.1, 1988 General Environmental Protection Program	X	X	X	X	Outlines effluent monitoring requirements
	DOE Order 5400.5, 1990 Radiation Protection of the Public and Environment			X	X	Protects public/environment from radiation associated with DOE operations
	DOE Order 5480.4, 1989 Environmental Protection, Safety, and Health Protection Standards	X	X	X	X	Sets requirements for the application of the mandatory environmental protection, safety, and health (ES&H) standards; lists reference ES&H standards
	DOE Order 5484.1, 1981 Environmental Protection, Safety, and Health Protection Information Reporting Requirements	X	X	X	X	Sets requirements for reporting information having environmental protection, safety and health protection significance
	DOE Order 5820.2A, 1988 Radioactive Waste Management	X	X	X	X	Sets radioactive waste management requirements
	DOE/EH-0173T, January 1991 Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance			X	X	Provides guidance for effluent sampling and monitoring.
	40 CFR 61, 1989 National Emission Standards for Hazardous Air Pollutants	X		X		Sets national emission standards for hazardous air pollutants (NESHAP)
U.S. Environmental Protection Agency (EPA), Washington, D.C.	40 CFR 61, 1989 Subpart A General Provisions	X				Regulates hazardous pollutants
	40 CFR 61, 1989 Subpart H National Emission Standards for Emissions of Radionuclides other than Radon from Department of Energy Facilities			X		Sets emissions standards/monitoring requirements for radionuclides
	40 CFR 70 State Operating Permit Program	X		X		Requires air operating permit programs for states; Washington State Program regulated under WAC 175-401
	40 CFR 122, 1983 EPA Administered Permit Programs: The National Pollutant Discharge Elimination System		X			Governs release of nonradioactive liquids
	40 CFR 141.16, 1989 Safe Drinking Water Act (National Interim Primary Drinking Water Regulations)		X		X	Sets maximum contaminant levels in public water systems

Table 3-1. Applicable Regulations and Standards. (3 sheets)

Agency/originator	Regulation no.	HA	HL	RA	RL	Summary/Application
EPA (Cont'd)	40 CFR 191, 1985 Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes				X	Regulates radioactive waste disposal
	40 CFR 261, 1989 Identification and Listing of Hazardous Waste		X			Identifies and lists hazardous wastes
	40 CFR 302.4, 1980 Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA): Designation, Reportable Quantities and Notification	X	X	X	X	Designates hazardous materials, reportable quantities, notification process
	40 CFR 355, 1987 Superfund Amendments and Reauthorization Act of 1986 (SARA): Emergency Planning and Notification	X	X			Identifies threshold planning quantities for extremely hazardous substances
	40 CFR 403-471, 1990b Effluent Guidelines Standards		X			Sets pretreatment standards for waste water discharge to owned lands publicly.
American National Standards Institute, (ANSI) New York, New York	N 13.1* - 1969 Guidance to Sampling Airborne Radioactive Materials in Nuclear Facilities			X		Sets standards for effluent monitoring systems
	N 42.18*, 1974 Specification and Performance of On-site Instrumentation for Continuously Monitoring Radioactivity in Effluents			X	X	Recommendations for the selection of instrumentation for the monitoring of radioactive effluents
Washington State Department of Ecology, (Ecology) Olympia, Washington	WAC 173-216, 1991 State Waste Discharge Permit Program		X			Governs discharges to ground and surface waters
	WAC 173-220, 1988 National Pollutant Discharge Elimination system Permit		X		X	Governs waste water discharges to navigable waterways; controls NPDES permit process
	WAC 173-240, 1990 Submission of Plans and Reports for Construction of Waste Water Facilities		X			Controls release of nonradioactive liquids
	WAC 173-303, 1989 Dangerous Waste Regulations		X			Regulates dangerous wastes; prohibits direct release to soil columns
	WAC 173-400, 1976 General Regulations for Air Pollution Sources	X				Sets emissions standards for hazardous air pollutants
	WAC 173-401 Air Operating Permit Program	X		X		Establishes an operating permit for hazardous (regulated) air pollutants, including radionuclides

Table 3-1. Applicable Regulations and Standards. (3 sheets)

Agency/originator	Regulation no.	HA	HL	RA	RL	Summary/Application
Ecology (Cont'd)	WAC 173-460, 1991 Control for New Sources of Toxic Air Pollutants	X				Sets standards for new sources of taps
	WAC 173-480, 1991 Washington State Ambient Air Quality Standard and Emission Limits for Radionuclides	X		X		Endorses the 10 mrem/yr EDE-EPA standards (40 CFR 61, Subpart H)
Washington State Department of Health, Olympia, Washington	WAC 246-247, 1991 Radiation Protection - Air Emissions	X		X		Sets standards for registration, permitting, notification, new sources, review, monitoring, and reports.
Benton-Franklin Walla-Walla Counties Air Pollution Control Authority, (APCA) Richland, Washington	General Regulation 80-7/Proposed Regulation	X				Regulates air quality

HA = hazardous airborne.

HL = hazardous liquid.

RA = radioactive airborne.

RL = radioactive liquid

*Refers to standards that are referenced in the DOE and EPA regulations.

Discharges to a navigable waterway also will be subject to certain standards based on the industrial process that generated the waste water; certain additional limitations are typically imposed in the National Pollutant Discharge Elimination System (NPDES) permit. In all cases, the specific pollutants to be monitored and the frequency of monitoring and reporting will be based on the applicable regulations and the language of the permit.

Table 3-2. Groundwater Quality Criteria. (5 sheets)

Contaminant	Criterion	
I. Primary and Secondary Contaminants and Radionuclides		
A. Primary Contaminants		
Barium ^a	1.0	mg/L
Cadmium ^a	0.01	mg/L
Chromium ^a	0.05	mg/L
Lead ^a	0.05	mg/L
Mercury ^a	0.002	mg/L
Selenium ^a	0.01	mg/L
Silver ^a	0.05	mg/L
Fluoride	4	mg/L
Nitrate (as N)	10	mg/L
Endrin	0.0002	mg/L
Methoxychlor	0.1	mg/L
1,1,1-Trichloroethane	0.20	mg/L
2-4D	0.10	mg/L
2,4,5-TP Silvex	0.01	mg/L
Total Coliform Bacteria	1/100	mL
B. Secondary Contaminants		
Copper ^a	1.0	mg/L
Iron ^a	0.30	mg/L
Manganese ^a	0.05	mg/L
Zinc ^a	5.0	mg/L
Chloride	250	mg/L
Sulfate	250	mg/L
Total Dissolved Solids	500	mg/L
Foaming Agents	0.5	mg/L
pH	6.5-8.5	
Corrosivity	noncorrosive	

Table 3-2. Groundwater Quality Criteria. (5 sheets)

Contaminant	Criterion	
B. Secondary Contaminants (Cont'd)		
Color	15 color units	
Odor	3 threshold odor units	
C. Radionuclides		
Gross Alpha Particle Activity	15	pCi/L
Gross Beta Particle Radioactivity		
Gross Beta Activity	50	pCi/L
Tritium	20,000	pCi/L
Strontium-90	8	pCi/L
Radium 226 & 228	5	pCi/L
Radium-226	3	pCi/L
II. Carcinogens		
Acrylamide	0.02	µg/L
Acrylonitrile	0.07	µg/L
Aldrin	0.005	µg/L
Aniline	14	µg/L
Aramite	3	µg/L
Arsenic ^a	0.05	µg/L
Azobenzene	0.7	µg/L
Benzene	1.0	µg/L
Benzidine	0.0004	µg/l
Benzo(a)pyrene	0.008	µg/L
Benzotrichloride	0.007	µg/L
Benzyl chloride	0.5	µg/L
Bis(chloroethyl)ether	0.07	µg/L
Bis(chloromethyl)ether	0.0004	µg/L
Bis(2-ethylhexyl) phthalate	6.0	µg/L
Bromodichloromethane	0.3	µg/L
Bromoform	5	µg/L

Table 3-2. Groundwater Quality Criteria. (5 sheets)

Contaminant	Criterion	
II. Carcinogens (Cont'd)		
Carbazole	5	µg/L
Carbon tetrachloride	0.3	µg/L
Chlordane	0.06	µg/L
Chlorodibromomethane	0.5	µg/L
Chloroform	7.0	µg/L
4 Chloro-2-methyl aniline	0.1	µg/L
4 Chloro-2-methyl analine hydrochloride	0.2	µg/L
o-Chloronitrobenzene	3	µg/L
p-Chloronitrobenzene	5	µg/L
Chlorthalonil	30	µg/L
Diallate	1	µg/L
DDT (includes DDE and DDD)	0.3	µg/L
1,2 Dibromoethane	0.001	µg/L
1,4 Dichlorobenzene	4	µg/L
3,3' Dichlorobenzidine	0.2	µg/L
1,1 Dichloroethane	1.0	µg/L
1,2 Dichloroethane (ethylene chloride)	0.5	µg/L
1,2 Dichloropropane	0.6	µg/L
1,3 Dichloropropene	0.2	µg/L
Dichlorvos	0.3	µg/L
Dieldrin	0.005	µg/L
3,3' Dimethoxybenzidine	6	µg/L
3,3 Dimethylbenzidine	0.007	µg/L
1,2 Dimethylhydrazine	60	µg/L
2,4 Dinitrotoluene	0.1	µg/L
2,6 Dinitrotoluene	0.1	µg/L
1,4 Dioxane	7.0	µg/L
1,2 Diphenylhydrazine	0.09	µg/L
Direct Black 38	0.009	µg/L

Table 3-2. Groundwater Quality Criteria. (5 sheets)

Contaminant	Criterion	
II. Carcinogens (Cont'd)		
Direct Blue 6	0.009	µg/L
Direct Brown 95	0.009	µg/L
Epichlorohydrin	8	µg/L
Ethyl acrylate	2	µg/L
Ethylene dibromide	0.001	µg/L
Ethylene thiourea	2	µg/L
Folpet	20	µg/L
Furazolidone	0.02	µg/L
Furium	0.002	µg/L
Furmecyclox	3	µg/L
Heptachlor	0.02	µg/L
Heptachlor Epoxide	0.009	µg/L
Hexachlorobenzene	0.05	µg/L
Hexachlorocyclohexane (alpha)	0.001	µg/L
Hexachlorocyclohexane (technical)	0.05	µg/L
Hexachlorodibenzo-p-dioxin, mix	0.00001	µg/L
Hydrazine/Hydrazine sulfat	0.03	µg/L
Lindane	0.06	µg/L
2 Methoxy-5-nitroaniline	2	µg/L
2 Methylaniline	0.2	µg/L
2 Methylaniline hydrochloride	0.5	µg/L
4,4' Methylene bis(N,N'- dimethyl) aniline	2	µg/L
Methylene chloride (dichloromethane)	5	µg/L
Mirex	0.05	µg/L
Nitrofurazone	0.06	µg/L
N-Nitrosodiethanolamine	0.03	µg/L
N-Nitrosodiethylamine	0.0005	µg/L
N-Nitrosodimethylamine	0.002	µg/L

Table 3-2. Groundwater Quality Criteria. (5 sheets)

Contaminant	Criterion	
II. Carcinogens (Cont'd)		
N-Nitrosodiphenylamine	17	µg/L
N-Nitroso-di-n-propylamine	0.01	µg/L
N-Nitrosopyrrolidine	0.04	µg/L
N-Nitroso-di-n-butylamine	0.02	µg/L
N-Nitroso-N-methylethylamine	0.004	µg/L
Polyaromatic Hydrocarbons (PAH)	0.01	µg/L
Polybrominated Biphenyls (PBBs)	0.01	µg/L
Polychlorinated Biphenyls (PCBs)	0.01	µg/L
o-Phenylenediamine	0.005	µg/L
Propylene oxide	0.01	µg/L
2,3,7,8-Tetrachlorodibenzo-p-dioxin	0.0000006	µg/L
Tetrachloroethylene (perchloroethylene)	0.8	µg/L
p,α,α,α-Tetrachlorotoluene	0.004	µg/L
2,4 Toluenediamine	0.002	µg/L
o-Toluidine	0.2	µg/L
Toxaphene	0.08	µg/L
Trichloroethylene	3	µg/L
2,4,6-Trichlorophenol	4	µg/L
Trimethyl phosphate	2	µg/L
Vinyl chloride	0.02	µg/L

^aMetals are measured as total metals.

mg/L = milligrams/liter.

mL = milliliter

pCi/l = pico Curie/liter.

$\mu\text{g/L}$ = micrograms/liter.

4.0 IDENTIFICATION/CHARACTERIZATION OF EFFLUENT STREAMS

This section addresses the chemical and radiological composition of PUREX effluents. A description of the gaseous effluents is followed by a brief discussion of their routine and upset operating conditions. Water effluents are similarly described.

4.1 IDENTIFICATION/CHARACTERIZATION OF SOURCE TERMS CONTRIBUTION TO EACH AIR EFFLUENT STREAM

The PUREX Plant has 10 sources of major air effluent streams with a potential for contamination. Characterization of the effluents is based on 1993 concentration and flow data. These are representative of standby or transition to shutdown conditions. The characterizations that follow are taken from the *Effluent Monitoring Plan PUREX Gaseous Effluents* (WHC 1988a).

291-A-1 - Main Building Exhaust Stack

The point of discharge is a 61 m (200 ft) tall stack, located south of the PUREX building. In 1993, the typical flow rate was between 40 and 64 m³/s (83,900 and 137,000 ft³/min); the average flow rate was 49 m³/s (104,000 ft³/min). In 1993, the exhaust contained on the average 1.1×10^{-12} $\mu\text{Ci/mL}$ radioactivity. During the current transition to shutdown, flow rates are typically 100,000 ft³/min.

During 1985 and 1986 the annual releases of NO_x from the main stack were 168 and 147 metric tons (185 and 162 tons), respectively. This was well below the 385 metric tons (424 tons) permitted by the Prevention of Significant Deterioration (PSD) permit.

296-A-1 - Product Removal Room Exhaust

The point of discharge for the exhaust from PR room and hoods, Q-cell rooms and hoods, Np loadout hoods, and N-Cell hoods, is Stack 296-A-1. It is located on the north side of the northwest corner of the PUREX building. Its height is 23 m (74 ft) above grade.

The 296-A-1 Stack had an average flow of 2.4 m³/s (5,030 ft³/min). The range of flow was 1.7 to 3.3 m³/s (3,600 to 7,050 ft³/min). The exhaust contained 3.9×10^{-14} $\mu\text{Ci/mL}$ of radioactivity during 1993.

296-A-2 - West Sample Gallery Hood Exhaust

The 296-A-2 Stack exhausts the hoods in the west half of the PUREX sample gallery. It is located at the southwest corner of the PUREX building. Its height is 24 m (78 ft) above grade.

The 296-A-2 Stack had an average flow of $2.2 \text{ m}^3/\text{s}$ ($4,700 \text{ ft}^3/\text{min}$). The range of flow is 1.9 to $2.8 \text{ m}^3/\text{s}$ ($3,900$ to $5,900 \text{ ft}^3/\text{min}$). The exhaust contained no radioactivity detectable above background based on data from 1993.

296-A-3 - East Sample Hood Exhaust

The 296-A-3 Stack exhausts the hoods in the east half of the PUREX sample gallery. It is located at the northeast corner of the 202-A Building and its height above grade is 23 m (74 ft).

Average flow for this stack was $1.3 \text{ m}^3/\text{s}$ ($2,840 \text{ ft}^3/\text{min}$), while the range was 0.08 to $2.0 \text{ m}^3/\text{s}$ (166 to $4,210 \text{ ft}^3/\text{min}$). The exhaust contained no radioactivity detectable above background based on 1993 data.

296-A-5A and 296-A-5B - West and East Analytical Laboratory Exhausts

Stacks 296-A-5A and 296-A-5B alternate weekly in exhausting the PUREX analytical laboratory. The stacks are located on the north side of the 202-A Building above the analytical laboratory. Their heights are 27 m (89 ft) above grade.

The flow through Stacks 296-A-5A and 296-A-5B normally ranges from 4.2 to $8.8 \text{ m}^3/\text{s}$ ($9,000$ to $18,600 \text{ ft}^3/\text{min}$). Their average flow rate was $8.6 \text{ m}^3/\text{sec}$ ($18,360 \text{ ft}^3/\text{min}$). The exhaust from Stack 296-A-5A had an activity of $6.5 \text{ E-16 } \mu\text{Ci/mL}$, and stack 296-A-5B had an activity of $1.7 \text{ E-16 } \mu\text{Ci/mL}$ based on 1993 data. The combined average was $4.1 \text{ E-16 } \mu\text{Ci/mL}$.

296-A-6 - East Sample Gallery and U-Cell Stack

The 296-A-6 Stack is located on the north side of the 202-A Building near the east corner. The stack extends 3.0 m (10 ft) above the top of the building. Its height is 22.6 m (74 ft) above grade level. The 296-A-6 Stack exhausts the east half of the sample gallery and U Cell (nitric acid recovery cell).

The 296-A-6 Stack had an average flow of $6.0 \text{ m}^3/\text{s}$ ($12,800 \text{ ft}^3/\text{min}$). The range of flow was 5.3 to $7.3 \text{ m}^3/\text{s}$ ($11,200$ to $15,500 \text{ ft}^3/\text{min}$). The exhaust contained no radioactivity detectable above background according to data from 1993.

296-A-7 - West Sample Gallery and R-Cell Exhaust

The 296-A-7 Stack is located on the west wall of the 202-A Building near the southwest corner. The height of the stack is 23 m (74 ft) above grade [3 m (10 ft) above the top of the building]. It exhausts the west half of the sample gallery and R-Cell (second cycle solvent treatment).

The 296-A-7 Stack had an average flow of $8.5 \text{ m}^3/\text{s}$ ($18,000 \text{ ft}^3/\text{min}$), with a range of 8.0 to $9.2 \text{ m}^3/\text{s}$ ($16,900$ to $19,400 \text{ ft}^3/\text{min}$). The exhaust contained no radioactivity detectable above background based on data from 1993.

296-A-8 - White Room Exhaust

The 296-A-8 Stack is located at the northwest corner of the 202-A Building. It extends to 10.4 m (34 ft) above grade level. This stack exhausts the west end of the P&O Gallery.

The 296-A-8 Stack had an average flow of $4.3 \text{ m}^3/\text{s}$ ($9,060 \text{ ft}^3/\text{min}$). The range of flow was 3.4 to $5.0 \text{ m}^3/\text{s}$ ($7,290$ to $10,500 \text{ ft}^3/\text{min}$). The exhaust contained no radioactivity detectable above background based on data from 1993.

296-A-10 - Storage Tunnel No. 2 Exhaust

The 296-A-10 Stack is located about 640 m ($2,100 \text{ ft}$) south of the 202-A Building. It is 6 m (20 ft) high. This stack exhausts the used equipment storage tunnel.

The 296-A-10 Stack had an average flow of $2.6 \text{ m}^3/\text{s}$ ($5,550 \text{ ft}^3/\text{min}$). The exhaust contained no radioactivity detectable above background based on 1993 data.

296-A-14 - Back-up Facility Exhaust (Building 293-A)

The 293-A Building exhaust fan is located on the mezzanine roof. The stack rises 3 m (10 ft) above the top of the 293-A Building for a stack height of 7.47 m ($24 \text{ ft } 6 \text{ in}$). The 296-A-14 Stack exhausts the 293-A Building, which contains two absorption columns that recovered nitric acid from the dissolver off-gases. The dissolvers are not in operation.

Flow through the 296-A-14 Stack averaged $2.3 \text{ m}^3/\text{s}$ ($4,920 \text{ ft}^3/\text{min}$). The exhaust contained no radioactivity detectable above background based on 1993 data.

4.1.1 Routine Operations

The ventilation systems will continue to exhaust the same areas of the PUREX Plant as described in Chapter 2.0. However, since the PUREX Plant has been shutdown (i.e., no processing), the source radionuclides that might be vented have been reduced, and the effluent concentrations are expected to continue to decrease.

4.1.2 Upset Operating Conditions

The *Effluent Monitoring Plan for PUREX Gaseous Effluents*, (WHC 1988a) describes upset conditions for each stack. However, these conditions are based upon the PUREX process being active in the plant and are therefore no longer applicable. In the shutdown mode, upset operating conditions could

involve failure of a single engineered barrier, which is taken to be a failure of the HEPA filtration. Filtration is provided for all of the gas streams. A HEPA filter failure is modeled in Section 4.1.3.2.

4.1.3 Dispersion Modeling

Only radiological emissions are present in the PUREX air effluent during the transition to shutdown mode of operation. The CAP-88 computer code calculates dose commitments that result from the air transport of radionuclides released from the effluent discharge points above the PUREX Plant.

CAP-88 is approved by the EPA for demonstrating compliance with the NESHAPs (EPA 1991a) standard for radiological releases. CAP-88 computes the radiation exposure to the maximally exposed individual (MEI) via the ingestion, inhalation, air-immersion (exposure resulting from being inside plume of radiation), and groundshine (exposure resulting from deposited radioactive particles) pathways. CAP-88 incorporates dose conversion factors from the International Commission on Radiological Protection (ICRP) 26/30 methodology. Resulting doses are a 50-year committed effective dose equivalent. The magnitude of exposure via any of the aforementioned pathways is strongly related to the distance between the source and receptor.

CAP-88 utilizes a Gaussian plume methodology for dispersing air contaminants to downwind locations. Because of the low temperatures of the PUREX stacks, CAP-88 calculates plume rise solely from stack exhaust momentum. During transport, the plume undergoes a reduction in air concentration, not only through dispersion, but also from plume depletion processes.

These processes include radioactive decay, precipitation, scavenging, and dry deposition. Because of the long half-lives of the radionuclides released and the relatively dry climate in eastern Washington State, only the dry deposition removal process has an appreciable effect on the resulting downwind air concentration.

A total of 11 air effluent stacks contribute nearly all of the airborne radionuclide releases from the PUREX Plant (WHC 1988a). Each stack possesses its own unique stack characteristics, including stack height above the ground, stack diameter, and exhaust velocity or flow rate. Stack characteristics are used to assess the plume rise and determine the final height of release of the plume. Air effluents are released at room temperature; as such, plume rises are not thermally driven. Table 4-1 summarizes the characteristics of the 11 PUREX exhaust stacks.

The emission points used for modeling purposes are centered on each of the major Hanford Site operating areas that released radionuclides to the atmosphere. For the PUREX Facility, located in the 200 East Area, the reference point was the meteorology tower located approximately midway between the 200 East and 200 West Areas. This location was chosen to represent emissions from the 200 Areas because it lies between two major groups of

facilities that account for the bulk of stack releases. A farm at Ringold, Washington, was determined to be the best location to use in the compliance analysis. Table 4-2 (WHC-EP-0498, 1991) shows the 200 East Area unit dose conversion factors for the Offsite Hypothetical MEI used to calculate the EDE.

4.1.3.1 Routine Release Dose Assessment. During normal operations in shutdown mode at PUREX, only small quantities of radionuclides are released from the exhaust stacks (Tables 4-3 and 4-4). The maximally exposed individual used for the Hanford Site dose calculations is located approximately 16 km (10 mi) East of the PUREX Facility, based on a hypothetical release point at the Hanford Meteorology Station.

An effective dose equivalent of 0.001 mrem was assessed for the MEI location as a result of releases from all ten operating PUREX stacks. This total dose is well below the EPA annual dose criterion (EPA 1991a) of 10 mrem to the MEI via the air pathway. This total dose is intended to be used for total-facility, emission-compliance purposes but not for monitoring requirements.

Table 4-5 summarizes the individual stack contributions to the MEI dose from each PUREX stack. As noted in Table 4-5, any stack with an individual dose greater than the EPA standard of 0.1 mrem/yr (1 percent of 10 mrem/yr) is required to have "continuous radiation monitoring." This continuous radiation monitoring is an EPA designation but is fully met by continuous sampling with periodic analysis. The greatest dose from any PUREX stack effluent is from the main stack (291-A-1), which independently contributes a dose of 0.001 mrem to the MEI. This dose is well below the 0.1 mrem annual dose standard.

The MEI dose resulted primarily from the ingestion and inhalation of ^{129}I that originated from the canyon exhaust stack (291-A-1) at PUREX. Because all stack doses are below the 0.1 mrem annual dose standard, specific radionuclide analysis is not required.

4.1.3.2 Upset Release Dose Assessment. Applicable EPA regulations (EPA 1991a) require that a dose to the MEI be calculated from an unmitigated release. An unmitigated release occurs in the case of an upset in which all air pollution control equipment fails (or is considered to have been removed). At PUREX, this means a dose that results from the unfiltered flow from each of the stack effluents described in Table 4-6. Monitoring of the effluent stream is not made upstream of the HEPA filters. Consequently, the increase in effluent radionuclides due to filter removal is based on an evaluation of filter efficiencies and the particulate removal processes.

Stack 291-A-1 (the main stack) and Stack 296-A-1 exhaust through several stages of HEPA filters. The remaining stacks utilize a single stage of HEPA filtration. A conservative increase in particulate effluent due to filter removal is 3.0×10^3 for those stacks. With concurrence from EPA, this single factor was used for particulate removal efficiency for all stacks.

The iodine emission control equipment, the silver reactors of the dissolver offgas system, are neither needed nor in service during the transition to shutdown. Since there is no increase in radioactive iodine emissions due to bypass of pollution control equipment, the unmitigated

release factor is 1.0. There is no effective pollution control equipment for the other volatile emissions (tritium and ^{14}C), so their unmitigated release factors are also 1.0.

The dose calculated for the MEI is directly proportional to the amount of radioactive material released. Because all particulate releases are increased by the same amount in a given stack, the resulting unmitigated dose is the MEI dose increased by a unmitigated release factor of 3.0×10^3 for particulates and 1.0 for volatiles.

Table 4-6 summarizes the contributions to the unmitigated MEI dose from each PUREX stack during transition to shutdown. As noted in Table 4-6, any stack with an individual annual dose greater than the EPA standard of 0.1 mrem/yr is required to have a minimum of continuous sampling and subsequent analysis. The main stack and product removal (PR) stack (296-A-1) both have potential unmitigated dose consequences that are in excess of this standard.

The unmitigated MEI dose would result primarily from the ingestion and inhalation of ^{241}Am originating from the main stack at PUREX. The unmitigated MEI dose from the PR stack would result primarily from the ingestion and inhalation of ^{241}Am and $^{239,240}\text{Pu}$. Table 4-7 summarizes the most significant radionuclides and their dose contributions to the MEI. Any radionuclide that contributes 10 percent of the dose from a release point which could exceed the EPA annual dose standard of .1 mrem must be measured. One radionuclide from the main stack (^{241}Am) and two radionuclides from the PR stack (^{241}Am and $^{239,240}\text{Pu}$) exceed this standard and will require measurement. Air monitoring requirements are discussed in more detail in Section 7.1.

4.2 IDENTIFICATION/CHARACTERIZATION OF SOURCE TERMS CONTRIBUTING TO EACH LIQUID EFFLUENT STREAM

PUREX water effluents are described in detail in a series of stream-specific reports (WHC 1990a), which describe PUREX liquid effluents during operating mode. The points of discharge and compositions for the CSL are given in Table 4-8. The composition data given in Table 4-8 are for the upper limits of the 90 percent confidence interval as given in the stream-specific reports. These compositions are higher than anticipated for transition to shutdown conditions. Table 4-8 also indicates the average flow rate, point of discharge and stream-specific report number for each stream.

The following sections describe the only remaining liquid effluent from the PUREX Plant, the CSL.

4.2.1 Routine Operating Conditions

The CSL collects waste water from the nonradiologically controlled service areas of the PUREX Plant (the 202-A Building and supporting facilities). Most of these streams are essentially clean, consisting of steam condensate from ventilation air heaters, water cooler drains, shower drains,

and assorted floor drains. The floor drains, especially in the P&O gallery, AMU, and 211-A Building, have a potential for chemical contamination (Figure 4-1).

The water in the streams which contribute to the CSL originates in three utilities provided to the PUREX Plant by the powerhouse: raw water, sanitary water, and steam. During operation, the PUREX Plant generates a fourth utility, demineralized water, which contributes slightly to the CSL. The schematic flow diagram of the CSL is shown in Figure 4-1.

Untreated Columbia River water is referred to as raw water. It is used in cooling process vessels and as a source for other water utility streams. Raw water may contain some corrosion products from the piping used in its transport.

Sanitary water (potable water) is obtained from raw water via a two stage process. First, particulates are settled and removed, with the help of aluminum sulfate (alum). Second, bacteria and organic debris are oxidized by the addition of chlorine. Consequently, sanitary water contains elevated levels of aluminum, sulfate, chloride, hypochlorite, carbonate, and organic chlorides, such as trichloromethane (chloroform).

The powerhouse produces steam by boiling steam make-up water, derived from sanitary water. The steam make-up water is first softened to replace calcium and magnesium ions with sodium ions. Additionally, hypochlorite is reduced to chloride and corrosion inhibitors are added. Of these corrosion inhibitors, Filmeen* contains volatile substances that can be carried over into the steam. According to the manufacturer, Filmeen contains both fatty amines and organic acids. The material safety data sheet (MSDS) for this product does not list chemical ingredients. It does, however, state that the product does not contain EPA hazardous constituents.

The following contribute to the PUREX Plant CSL waste stream (Figure 4-2).

- Floor drains in the 202-A P&O gallery (only if diverted to PUREX Plant CSL from their normal routing to storage tanks in U-cell and to the F-cell sump). The routing of the P&O Gallery floor drains to the CSL is a minor modification to the normal configuration used for housekeeping. This modification adds 200 East Area raw water and dirt that has been tracked into the building from outside.
- The 618-1 and 618-2 flash tanks contain spray water and steam condensate from steam traps located in the P&O gallery and the AMU. The 618-1 flash tank is outside the 202-A Building near the east end of the facility. The 618-2 flash tank is in the AMU.

* Filmeen is a trademark of Dearborn, a division of W. R. Grace Co.

- Cooling water from the three fractionator condensers and steam condensate from the fractionator reboiler in the 206-A Building. When the PUREX Plant is processing, this contributor accounts for most of the CSL flow. During transition to shutdown there is no effluent from this contributor.
- The sink drain from the battery room, and the floor and sink drains from the instrument shop and maintenance shop in the 202-A building. Westinghouse Hanford has an aggressive program to prevent the improper disposal of dangerous wastes generated in these areas.
- Drains from nonradioactive clothing changerooms in the PUREX Plant laboratory (202-A Building).
- Shower drains from the two shower rooms. In addition to sanitary water, these drains contribute dirt washed from personnel and surfactants.
- Air scrubber effluent from the ventilation air supply systems in the 202-A Building.
- Laboratory and process water stills condensate and still bottoms in the 202-A Building.
- Floor drains from the air compressor, process blower, and service blower rooms in the 202-A Building.
- Cooling water and condensate from the air compressors. This cooling water is normally provided by the sanitary water system. Raw water can also be used.
- Steam condensates from the blower rooms in the 202-A Building.
- Overflows from various demineralized water storage tanks (Tk-223 in the 202-A Building and Tk-30 in the 211-A Area).
- Floor drains from the 211-A Pumphouse.
- Sumps from the 203-A Area, via Tk-P1, are used to collect sump waste (mostly rainwater). This is sampled to verify that it meets release limits before discharge to the PUREX Plant CSL. Standard plant operating procedures ensure that chemical spills and radioactive liquids are not routed to the CSL, but are ultimately discharged to underground storage.
- Office area heater condensate from the 202-A Building and the 271-AB Building.
- Raw water [about 113.5 liter/min (30 gal/min)] used to continuously flush the CSL header line from its origin at the northwest corner of the PUREX Plant complex.

- Overflow from the emergency water supply tank (TK-2901A). The sanitary water feed [approximately 95 liter/min (25 gal/min)] to this tank is left running to maintain residual chlorine levels, ensure that the tank is full, and (in winter) provide protection against freezing.
- Nonhazardous wastewater condensate from the F11 Concentrator.
- N-Cell transfer vacuum pump seal water.

There is also a remote possibility for any of the chemicals handled within the AMU in the 202-A Building to escape from established spill barriers and enter the PUREX Plant CSL. See Table 4-9 for a partial list of chemicals previously used in the PUREX Plant. Most excess chemicals have been removed from the facility.

Project CK0081 installed an extensive chemical collection and reuse system in the AMU in 1987. The collection pipes merge into a common discharge line on the north side of the Plant. Only the sink drains, the electric water cooler drain, and the overflows and drains from the sugar tank and demineralized water tank feed directly into the CSL header. The floor drains can be routed through valves into the PUREX Plant CSL header, but normally flow into a catch tank. The remaining overflows and drains flow into a system of catch tanks to collect the chemicals for reuse. (The overflow lines from the catch tanks do, however, feed into the CSL header. To date, there has not been an overflow of chemicals into the catch tanks, much less an overflow from the catch tanks into the CSL.)

Data compiled in the CSL Stream-Specific Report were obtained during ion exchanger regeneration (5 samples) and during routine operation (6 samples). The evaluation contained in the stream specific report indicated that the CSL waste water stream did not contain any dangerous wastes, as defined in WAC 173-303-070 (WAC 1991a). A full discussion of the chemicals detected in the samples, the reported concentrations of these chemicals, analytical detection limits, and the pertinent regulatory limits are contained in the stream-specific report (WHC 1990a, Addendum 2).

The ventilation scrub water contributor is produced by the wet scrubbing process for ventilation air. Air from outside the 202-A Building is brought in contact with sanitary water to remove dust from the air and to cool the air. Several microbiocides are added to the water in the air scrubbers: Dearcide* 730 (198 g [7 avoirdupois oz]/mo/scrubber), Dearcide* 722 (0.3 L [10 fluid oz]/mo/scrubber), and Dearcide* 717 (0.3 L [10 fluid oz]/mo/scrubber).

These microbiocides are added to the air scrubber to prevent the growth of harmful microorganisms in the scrub water. These additives increase the chloride concentration and also add tin to the system. The flow of ventilation scrub water is estimated to range from 0.2 to 3.0 L (0.05 to 0.8 gal)/min, with an average of 0.8 L (0.2 gal)/min.

*Dearcide is a registered trademark of W. R. Grace and Company.

There are three water demineralizers in the 211-A Building that contributed water to the CSL intermittently during regeneration. The demineralizers converted sanitary water to the pure demineralized water required by the PUREX process. Each consists of two ion-exchange columns: one for cations and one for anions. The regeneration process used sulfuric acid and sodium hydroxide which released contaminants removed from the sanitary water feed by the demineralizer. Use of the demineralizers is not anticipated during transition to shutdown.

Project B-669 (recently installed) provided a three-chamber pH control system for the effluent from the 211-A Building. This effluent was composed of leakage from pipes and pumps in the building, seal water drainage from certain pumps, and demineralizer regeneration waste. In addition to the cations and anions removed from the sanitary water (the demineralizer feed), the regenerant contained sodium hydroxide (NaOH), sulfuric acid (H_2SO_4), sodium hydrogen sulfate (NaHSO_4), and sodium sulfate (Na_2SO_4) at different times. The anionic and cationic demineralizers were regenerated together to maximize the amount of neutral Na_2SO_4 produced, while minimizing the amounts of the acidic (H_2SO_4 , NaHSO_4) and basic (NaOH) species released. Use of this system is not anticipated during transition to shutdown.

The CSL was a highly variable stream. The vacuum fractionator effluent, which accounted for approximately 80 percent of the stream, normally flowed only during the PUREX Plant operation and contributed little, if any, contamination. The CSL is now a much more consistent stream during transition to shutdown.

The CSL flow rate is dependent upon process activities; the flow rates reported in the stream-specific report ranged from 4.7×10^7 to 1.23×10^8 L/mo (WHC 1990a). The *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) requires that the CSL flowrate be maintained at less than 600 gpm (1×10^8 L/mo) on a monthly average after June 1992. The CSL will continue to be discharged to the 216-B-3C Expansion Pond, until June 1995 when connection to the TEDF is complete.

4.2.2 Upset Operating Conditions

The CSL could become contaminated during upset conditions. After most contributors to the CSL have combined, the CSL flows through Manhole 4. A flowmeter in Manhole 4 measures the flow rate of the CSL. A continuously operating sample pump located in Manhole 4 transfers a small stream from the CSL into the 295-AC Sample Shack, where the stream is monitored for pH and radiation. This stream also supplies a grab sampler (used for taking the characterization samples) and a flow proportional sampler used for providing a record. The radiation monitor is sensitive to gamma radiation and automatically diverts the CSL to the 216-A-42 Retention Basin when the count rate exceeds the alarm limit. Standard plant operating procedures require manual diversion of the CSL if the pH drops below 3 or exceeds 11. The current pH alarm settings are 5 and 10.

4.2.3 Waste Water Discharge Criteria

Currently, the CSL is discharged to the 216-B-3C Expansion Pond. *Environmental Compliance*, WHC-CM-7-5 (WHC 1993a) contains the acceptance criteria for the Expansion Pond. All water effluent currently flowing to ponds or cribs will cease by 1995 when water must be discharged to a State Approved Land Disposal Structure (SALDS).

The CSL will be discharged to a SALDS in June 1995. The discharge criteria for PUREX waste water effluents then become the acceptance criteria for a SALDS. These criteria are currently being negotiated and will be included in the State Waste Discharge Permit.

Based on WAC guidance, WAC 173-303 (WAC 1991a), an effluent will be considered acceptable for soil column discharge if it is below the following criteria (WHC 1990a-g, 1991a, 1993b):

- Primary Maximum Contaminant Levels (MCL),
- Secondary MCL,
- proposed MCL, and
- WAC groundwater quality enforcement limits.

Acceptance criteria for a SALDs are the same as acceptance criteria for the TEDF. The TEDF will not be designed or permitted to accept any effluent that is considered to be a dangerous waste under WAC 173-303 (WAC 1991a).

To be acceptable for discharge to the SALDS, the radionuclide content of each waste stream will be required to meet the intent of the State's groundwater standards and limit annual public exposure to an effective dose equivalent not to exceed 4 mrem/yr. The effective dose equivalent of 4 mrem/year is equal to 4% of the derived concentration guide (DCG) (DOE 1990a).

Figure 4-1. Simplified Schematic Flow Diagram of the CSL.

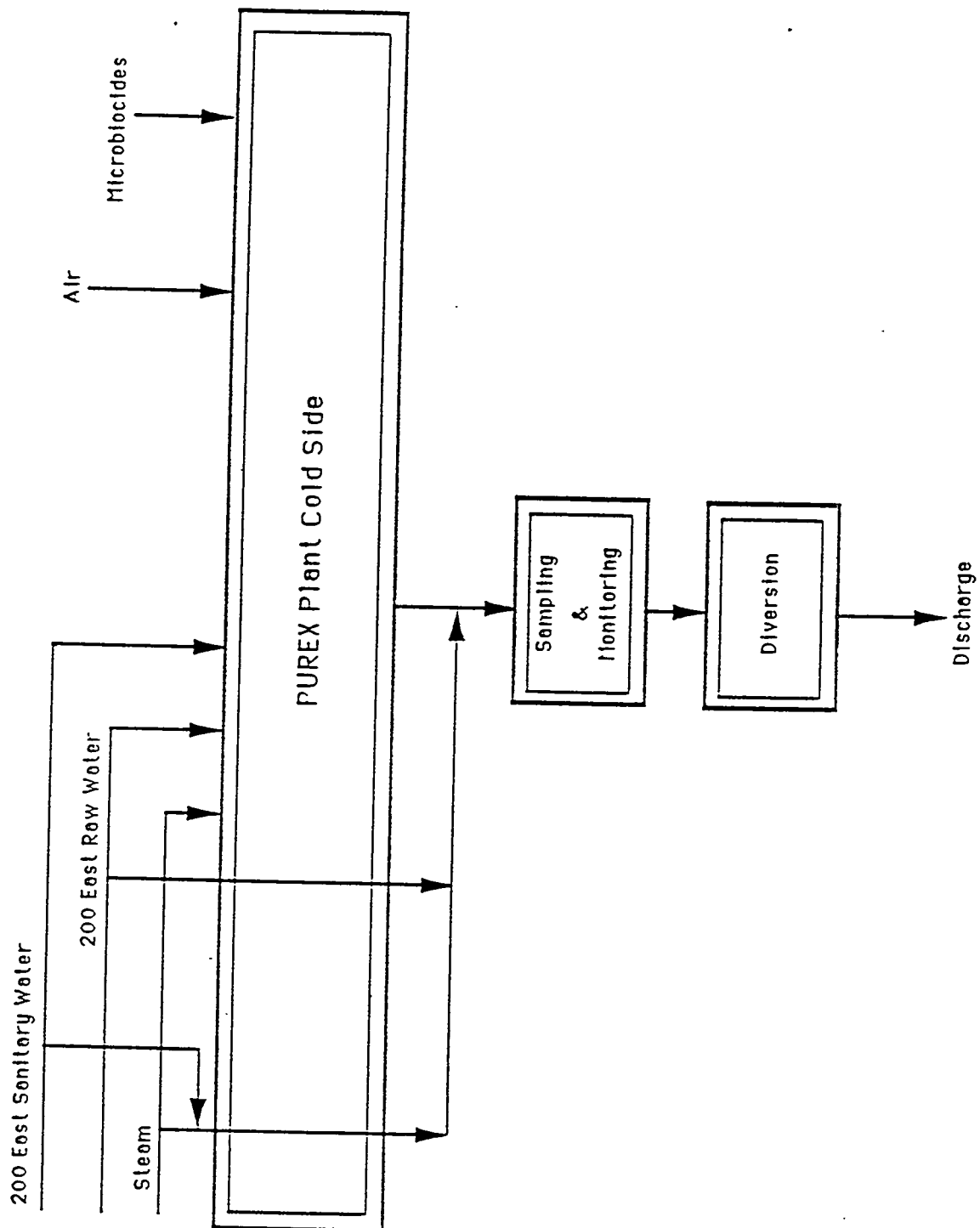


Table 4-1. Plutonium-Uranium Extraction Plants Stack Exhaust Data

Stack reference	Height		Stack diameter		Outlet diameter		Average flow ²		Temperature	
	(ft)	(m)	(ft)	(m)	(ft)	(m)	(cfm)	(m ³ /s)	(°C)	(°K)
291-A-1	200	61.0	7.0	2.13	7.0	2.13	1.2E+05	56.14	30	303
296-A-1	74	22.6	2.0	0.61	1.8	0.53	4100	2.21	25	298
296-A-2	78	23.8	1.7	0.51	1.3	0.41	4100	2.21	25	298
296-A-3	74	22.6	1.7	0.51	1.3	0.41	2900	1.37	25	298
296-A-5A ¹	89	27.1	3.5	1.07	3.0	0.91	18000	8.50	25	298
296-A-5B ¹	89	27.1	3.5	1.07	3.5	1.07	18000	8.50	25	298
296-A-6	74	22.6	3.3	1.02	2.8	0.84	15000	6.47	25	298
296-A-7	78	23.8	3.7	1.12	3.3	1.02	19000	8.82	25	298
296-A-8	34	10.4	3.3	1.02	3.3	1.02	10000	4.91	25	298
296-A-10	20	6.1	2.3	0.71	2.3	0.71	5400	2.56	25	298
296-A-14	42	12.8	2.0	0.61	2.0	0.61	5300	2.48	25	287

¹Stack 5A and 5B do not operate concurrently; only one is operational at any given time.

²Average flow from 1988 to 1993.

Table 4-2. CAP-88 Unit Dose Factors for the Offsite Hypothetical
Maximally Exposed Individual Affected by Radionuclide Air
Emissions from the Hanford Site (WHC-EP-0498, 1991).

Release Location▶	200 East Area
Release Height▶	89 m
MEI ^a Location▶	10 mi (16 km) E
Radionuclide▼	Effective Dose Equivalent (mrem/Ci-yr)
³ H	5.42 E-06
⁶⁰ Co	7.94 E-03
⁹⁰ Sr	1.20 E-02
¹⁰⁶ Ru	5.71 E-03
¹²⁵ Sb	1.14 E-03
¹²⁹ I	1.84 E-01
¹³⁷ Cs	6.54 E-03
¹⁴⁷ Pm	3.11 E-04
²¹² Pb	9.42 E-04 ^b
²³⁴ U	8.72 E-01
²³⁵ U	8.10 E-01
²³⁶ U	8.26 E-01
²³⁸ U	7.77 E-01
²³⁸ Pu	2.19 E+00
²³⁹ , ²⁴⁰ Pu	2.37 E+00
²⁴¹ Pu	3.76 E-02
²⁴¹ Am	3.59 E+00

^aMEI = Maximally exposed individual.

^bDose for this radionuclide is the result of ingrowth from the parent.

Table 4-3. Individual Radionuclide Doses to Maximally Exposed Individual for 1993 from 291-A-1.

Radionuclide	Release (Ci)	EDE mrem/yr
⁹⁰ Sr	4.9 E-05	5.9 E-07
⁹⁵ Zr*	<1.8 E-05	<1.3 E-08
⁹⁵ Nb*	<1.1 E-05	<5.3 E-09
¹⁰³ Ru*	<6.2 E-05	<2.4 E-08
¹⁰⁶ Ru	3.6 E-04	2.1 E-06
¹¹³ Sn*	<7.5 E-05	<2.4 E-08
¹²⁵ Sb*	<4.4 E-04	<5.0 E-07
¹²⁹ I	4.8 E-03	8.8 E-04
¹³¹ I*	<5.3 E-06	<5.6 E-08
¹³⁴ Cs*	<9.5 E-06	<8.1 E-08
¹³⁷ Cs	1.4 E-04	9.2 E-07
¹⁴⁷ Pm	1.1 E-04	3.4 E-08
²¹² Pb	9.7 E-04	9.1 E-07
²²⁰ Rn	1.2 E+01	--
²³⁸ Pu	3.2 E-06	7.0 E-06
²³⁹ , ²⁴⁰ Pu	4.9 E-06	1.2 E-05
²⁴¹ Pu	3.3 E-05	1.2 E-06
²⁴¹ Am	2.7 E-05	9.7 E-05
Total		1.0 E-03

* - Releases calculated using minimum detection limits (MDL) based on annual average concentrations.

Table 4-4. Individual Radionuclide Doses to Maximally Exposed Individual for 1993 from 296-A-1.

Radionuclide	Release (Ci)	Average Concentration ($\mu\text{Ci}/\text{ml}$)	$\mu\text{Ci}/\text{ml}$ Peak	EDE mrem/yr
$^{239}, ^{240}\text{Pu}$	2.0 E-06	2.8 E-14	5.6 E-14	5.0 E-06
^{241}Am	8.4 E-07	1.1 E-14	1.9 E-14	3.0 E-06
Total EDE				8.0 E-06

Table 4-5. Doses to the Maximally Exposed Individual From Routine Releases During Transition to Shutdown.

Stack reference	Effective dose equivalent (mrem)	Stack contribution to MEI dose (%)
291-A-1	1.0 E-03	99.0
296-A-1	8.0 E-06	0.8
296-A-2*	<2.3 E-07	0.0
296-A-3	1.1 E-07	0.0
296-A-5A/5B*	<2.3 E-06	0.2
296-A-6*	<4.6 E-08	0.0
296-A-7	4.3 E-07	0.0
296-A-8	3.4 E-08	0.0
296-A-10*	<3.0 E-07	0.0
291-A-14*	<2.9 E-07	0.0
Total	<1.0 E-03	100.0

* - Calculated using minimum detection limits (MDL) for total alpha and beta based on annual average concentrations. Assuming ^{239}Pu and ^{90}Sr for alpha and beta respectively.

Table 4-6. Potential Doses to the Maximally Exposed Individual From An Unmitigated Release.

Stack Reference		Effective Dose Equivalent (mrem)	Unmitigated Release Factor (3000) ⁿ	Unmitigated Effective Dose Equivalent (mrem)	Dose Standard* for Required Monitoring (mrem)
291-A-1	Volatiles	8.8 E-04	(3000) ⁰	8.8 E-04	
	Particulates	1.2 E-04	(3000) ³	3.2 E+06	
	Total	1.0 E-03	--	3.2 E+06	1.0 E-01
296-A-1		8.0 E-06	(3000) ³	2.2 E+05	1.0 E-01
296-A-2		<2.3 E-07	(3000) ¹	<6.9 E-04	1.0 E-01
296-A-3		1.1 E-07	(3000) ¹	3.3 E-04	1.0 E-01
296-A-5A/5B		<2.3 E-06	(3000) ¹	<6.9 E-03	1.0 E-01
296-A-6		<4.6 E-08	(3000) ¹	<1.4 E-04	1.0 E-01
296-A-7		4.3 E-07	(3000) ¹	1.4 E-03	1.0 E-01
296-A-8		3.4 E-08	(3000) ¹	1.0 E-04	1.0 E-01
296-A-10		<3.0 E-07	(3000) ¹	<9.0 E-04	1.0 E-01
296-A-14		<2.9 E-07	(3000) ¹	<8.7 E-04	1.0 E-01

*Dose standard for total radioactivity effluent monitoring from
40 CFR 61, Subpart H.

n = Number of HEPA filtration stages

Table 4-7. Potential Individual Radionuclide Doses to the Maximally Exposed Individual From An Unmitigated Release.

PUREX Stack	Radionuclide	EDE Contribution mrem/yr	Contribution to Stack Total %
291-A-1	²⁴¹ Am	2.6 E+06	78
296-A-1	^{239,240} Pu	8.3 E+04	63
	²⁴¹ Am	1.4 E+05	37

Table 4-8. Summary of PUREX Plant Liquid Effluent Qualities¹. (3 sheets)

Analyte	CSL ² Routine
Inorganic Compounds - Metals ³	
Aluminum	341
Antimony	
Arsenic	
Barium	34
Beryllium	
Boron	22
Cadmium	
Calcium	1.9E+04
Chromium	
Copper	40
Iron	443
Lead	6
Magnesium	4,350
Manganese	30
Mercury	0.1
Nickel	
Potassium	740
Selenium	
Silicon	2,910
Silver	
Sodium	2,160
Strontium	95
Thallium	
Uranium	0.6
Zinc	25
Inorganic Compounds - Ionic Species ³	
Ammonium	63
Chloride	1.8E+03
Cyanide	

Table 4-8. Summary of PUREX Plant Liquid Effluent Qualities¹. (3 sheets)

Analyte	CSL ² Routine
Inorganic Compounds - Ionic Species ³ (Cont'd)	
Fluoride	154
Fluoride (IC) ²	
Fluoride (ISE) ²	
Nitrate	588
Nitrate	
Sulfate	1.3E+04
Organic Compounds ³	
Acetone	
1-Butanol	
2-Butanone	
Butylated	
Hydroxytoluene	10
Chloroform	
Dibutyl phosphate	
Dichloromethane	
Tributylphosphate	
Other Parameters ^c	
Alkalinity	6.6E+04
Conductivity (uS)	158
pH (standard units)	7.8
TDS ²	6.5E+04
Temperature (°C)	28
TOC ²	
Total Carbon	1.5E+04
TOX ² (as Cl)	99
Radionuclides ^d	
Total Alpha	1
Total Beta	2
Radium (226 + 228)	<1.9E-01

Table 4-8. Summary of PUREX Plant Liquid Effluent Qualities¹. (3 sheets)

Analyte	CSL ² Routine
Radionuclides ^d (Cont'd)	
Gross uranium-natural	4.9E+02
³ H	4.9E+02
¹⁴ C	4.28E+00
⁹⁰ Sr	
¹²⁹ I	
¹³⁷ Cs	4.6E-01
¹⁴⁴ Ce/Pr	
¹⁴⁷ Pm	
²³⁴ U	1.9E-01
²³⁸ Pu	1.6E-02
²³⁸ U	1.6E-01
^{239,240} Pu	5.3E-01
^{239,240} U	
²⁴¹ Am	2.0E-01
Stream Specific Report WHC-EP-0342 Addendum Number	Addendum 2
Approximate Average Flow Rate (Liters/month)	7.7E+07
Estimated Flow Rate for PUREX Shutdown L/month	5.0E+07

¹Analyte concentrations represented by the 90 percent confidence interval limit (the upper limit of the one-tailed 90 percent confidence interval for all data sets) as reported in the appropriate stream specific report. When a 90 percent confidence interval limit was not calculated, the maximum observed result is listed.

²Abbreviations used:

CSL = chemical sewer

TDS = total dissolved solids

TOC = total organic carbon

TOX = total organic halides

IC = fluoride analysis using ion chromatography technique

ISE = fluoride analysis using ion-specific electrode technique.

³Effluent concentrations expressed as micrograms per liter unless indicated otherwise.

Table 4-9. List of Plutonium-Uranium Extraction Plant Chemicals.

Aluminum nitrate	Potassium fluoride
Antifoam (DOW 110)	Potassium permanganate
Cadmium nitrate	Silver nitrate
*Cleaning surfactants	Sodium carbonate
Ferric nitrate	*Sodium hydroxide
Ferrous sulfamate	*Sodium nitrite
Hydrazine	Sodium nitrate
Hydrogen peroxide	Sodium thiosulfate
Hydroxylamine nitrate	Sugar (sucrose)
Ion exchange resins	Sulfamic acid
Nitric acid	Sulfuric acid
Normal paraffin hydrocarbon	Tartaric acid
Oxalic acid	Tributyl phosphate
Potassium hydroxide	

*May still be used at PUREX.

5.0 EFFLUENT POINT OF DISCHARGE DESCRIPTION

This section describes the point of discharge for both the air and liquid effluents. Additional information on air and water effluents, and sampling systems and operations, are contained in Sections 4.0 and 7.0

5.1 AIR EFFLUENTS

The 10 major air effluent streams, the associated stack dimensions, and the flow velocities and temperatures have been summarized in Table 4-1. The location of each stack is shown in Figure 5-1. Additional information on each air effluent discharge is given in Section 4.1.

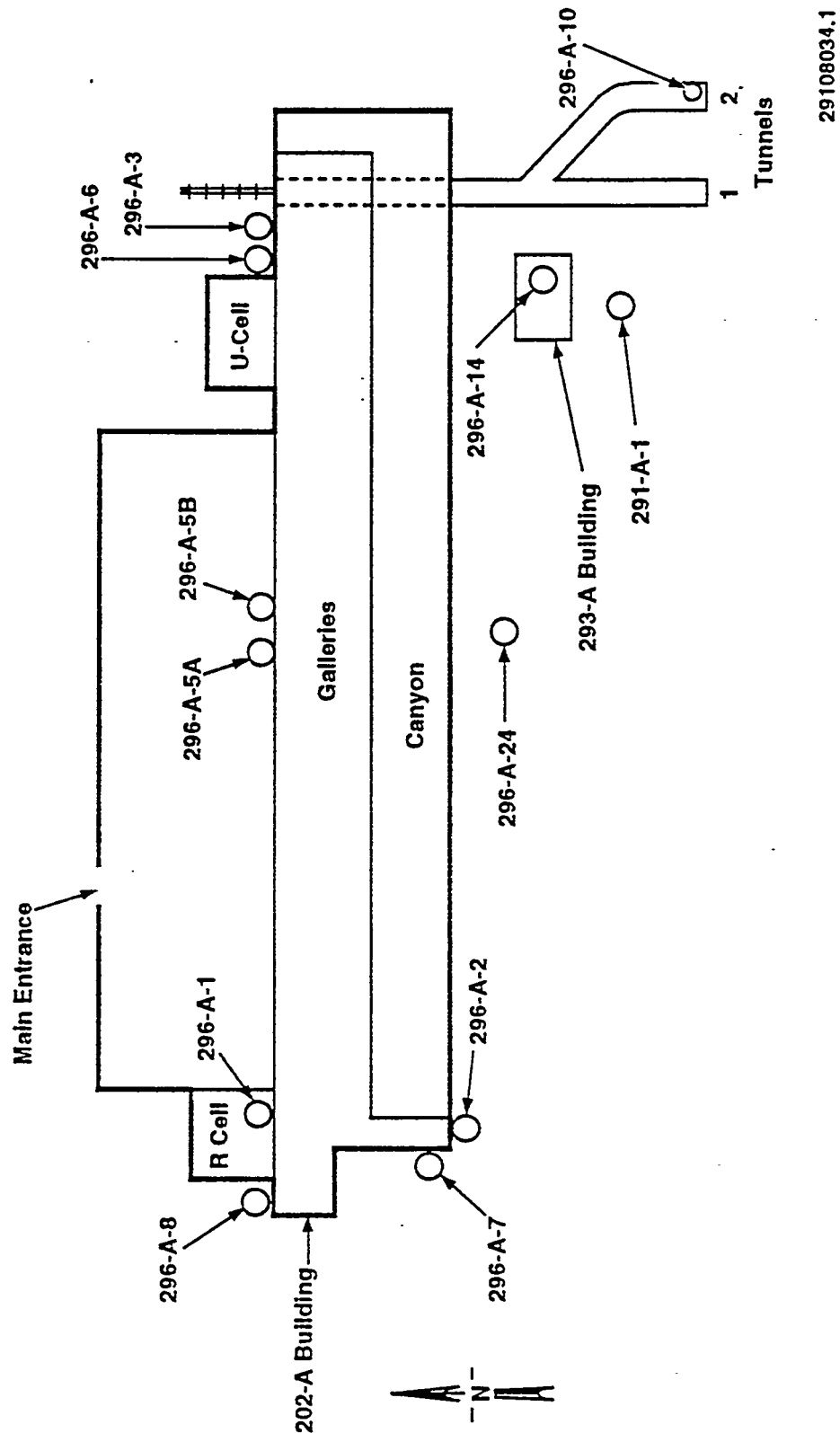
5.2 WATER EFFLUENTS

The only remaining water effluent from the PUREX Plant, the CSL, discharges into the 216-B-3C Expansion Pond (until June 1995 when connection into TEDF is complete). Under the Tri-Party Agreement, this discharge is limited to no more than 38 L/s (600 gal/min) average on a monthly basis.

Prior to March 1994, the B Pond system was comprised of four interconnected unlined earthen ponds, designated as 216-B-3, 216-B-3A, 216-B-3B, and 216-B-3C. These ponds were placed into service in 1945, 1983, 1984, and 1985, respectively. In March 1994, the 216-B-3 Main Pond was taken out of service and interim stabilized. The 216-B-3A Pond was also removed from service during early 1994. The 216-B-3B Pond remains out of service. Figure 5-2 shows the location of the B Ponds in relation to adjacent facilities and groundwater monitoring wells.

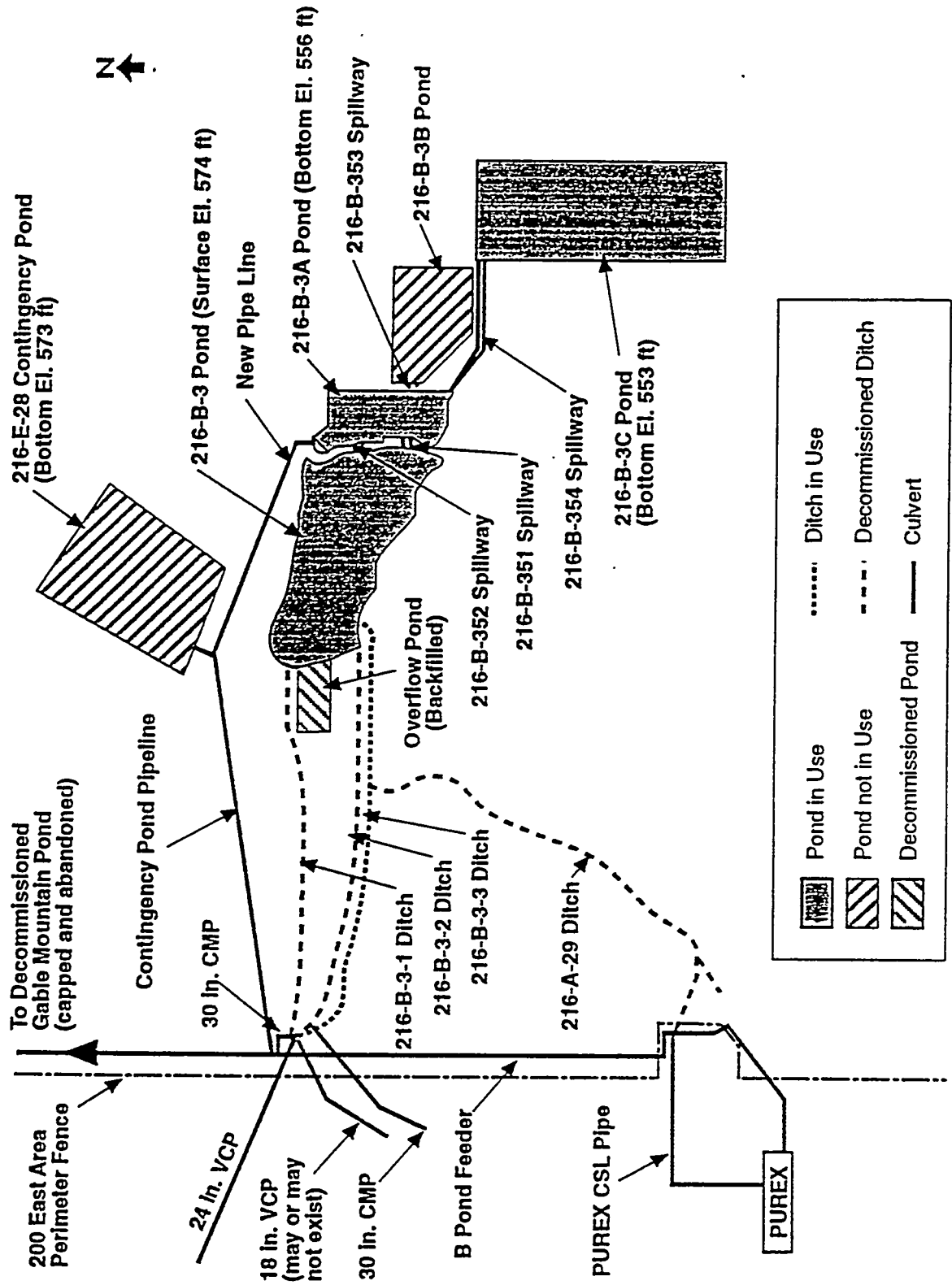
The 216-B-3C Expansion Pond is the only remaining B pond in service. The 216-B-3C Pond has a surface area of 170,000 m² and has a maximum capacity depth of about 1.2 m (4 ft). The 216-B-3C Expansion Pond has a series of nine trenches that are approximately 1.2 m (4 ft) in depth and provide additional infiltration capacity.

Figure 5-1. Plutonium-Uranium Extraction Plant Exhaust Stacks.



29108034.1

Figure 5-2. B Pond Location.



29206011.1

· This page intentionally left blank. ·

6.0 EFFLUENT MONITORING/SAMPLING SYSTEM DESIGN CRITERIA

Airborne and liquid radionuclide concentration monitoring requirements at PUREX are met by sampling and analysis. Airborne chemical monitoring requirements are met through the use of real-time monitors. The design criteria for a system of equipment states the functional requirements that must be met.

6.1 NEW FACILITIES

Project W-049H (TEDF) will install a local control unit (LCU) near the PUREX 295-AC Sample Shack to monitor the chemical sewer discharges. The LCU will contain instrumentation which will transmit pH, beta/gamma, and flow data from the LCU to Project W-049H central control room.

6.2 EXISTING FACILITIES

The equipment used to create both the air and liquid monitor/sample systems for the PUREX Plant is to meet the following common design criteria: the equipment must be accurate, rugged, and low maintenance.

6.2.1 Airborne Effluent Sampling and Monitoring System Design Criteria

Airborne effluent sampling is required of all gaseous release points with the potential to emit artificial radionuclides. Monitoring also is required of all gaseous release points with the potential to emit ammonia or oxides of nitrogen (NO_x). Because the PUREX Plant only produces ammonia and NO_x when it is processing, there is currently no requirement for ammonia or NO_x monitoring.

Additional specific criteria that apply to the air effluents are the requirements to accomplish the following:

- Sense pressure drop across the HEPA filters
- Take continuous air samples with isokinetic sampling probes, filter holders, and vacuum pumps
- Detect and alarm upon a loss of ventilation flow in any individual effluent.

Design criteria were developed for generic stack sampler/monitor systems to provide system design and operating capabilities as required in current DOE orders and directives, ANSI guidelines, and Rockwell Hanford Operations Environmental Protection Standards. Design criteria were published in RHO-CD-1092, *200 Area Stack Sampler-Monitor Systems Upgrade: Generic Systems Applications*. These criteria were further developed in 1984 as part of an upgrade of 200 Area stack systems and were published in SD-WM-CR-016, *FY 1985 200 Area Stack Sampler/Monitor Systems Upgrade*.

The design criteria specify that whenever the stack flow rate varies routinely by more than ± 20 percent, a stack effluent flow-rate monitor with flow-totalizing capability shall be provided. The following are also specified in the design criteria:

- The stack flow-rate monitoring system shall have a flow-rate sensing element located within the stack in a location that will not interfere with the effluent sample extraction probes. The flow-rate transmitter shall provide an electrical signal that is proportional to the stack flow rate, thus controlling a flow-rate indicator and totalizer.
- Flow-probe sensing lines shall be protected from condensation of moisture.
- Should the stack flow rate not vary routinely by ± 20 percent, periodic flow-rate measurements shall be conducted to verify this condition.
- For continuous releases, the flow measurements are required to be within 10 percent of span of the flow rate recording instrument. Instrument span should be adjusted to best fit maximum potential flow.
- The sample extraction probes within the stacks shall follow, in general, design guidelines as presented in ANSI N13.1, 1969, *Guide to Sampling Airborne Radioactive Materials in a Nuclear Facility* (ANSI 1969). Sample probes shall be designed to provide a near-isokinetic representative sample extraction based on the average stack velocity.
- The average stack velocity shall be determined from velocity profile measurements taken at or near the point of sample extraction.
- Sample probes shall be located a minimum of five duct diameters downstream and two duct diameters upstream of major flow disturbance points in the exhaust stack, unless the suitability of an alternate location can be demonstrated through repeatable flow profile measurements.
- Sample extraction probes shall be flange mounted to the stack to facilitate periodic removal, inspection, and cleaning activities.
- Sample transport lines shall extend from the probe connection flange to the instrument cabinet located near the stack. Sample transport lines shall be selected and installed in a manner designed to minimize particle loss attributed to gravity settling, turbulent impaction, and electrostatic effects. Sample transport line runs, bends, and tube transitions shall be minimized to the extent practical. Sample transport line bend radii shall be at least ten times the inside diameter of the transport line. Provisions shall be made to inhibit condensation of moisture within sample transport lines. Sample transport lines shall be supported to minimize wind-induced vibration effects.

- Generic system assemblies shall be selected to provide fixed-filter-head record sampling and airborne radiation monitoring capabilities. The type of airborne radiation monitoring required is site specific and shall be appropriate for the radionuclides normally expected in exhaust stack effluents.
- The record sample airstream shall be routed through a 47-mm filter to obtain a buildup sample for laboratory analysis. The record sampling system shall have sample flow-rate indicating and totalizing capabilities. A flow-rate regulator shall be provided to maintain a constant flow rate through the collection filter assembly to compensate for filter-loading effects. Audible and visible alarm signals indicating low sample flow shall be provided locally and to an area subject to frequent or continuous occupancy. The record sample flow rates shall be of sufficient size to provide optimum samples for laboratory analyses.
- The continuous air monitor (CAM) system shall have flow rate indicating and regulating capabilities. A flow-rate regulator shall be provided to maintain a constant flow rate through the collection filter assembly to compensate for filter loading effects. The CAM system shall have local readout count-rate meters with strip chart recording capability to a remote area where alarms are to be located. Audible and visible alarms including, but not limited to, high airborne radiation, instrument malfunction, and low sample flow indications, shall be provided locally and in an area subject to frequent or continuous occupancy.
- Monitoring systems shall have the capability to alarm at the time-integrated equivalent concentration equal to 4-hour release at 5,000 times the DCG-Public as noted in Appendix A of WHC-CM-7-5, *Environmental Compliance Manual* (WHC 1993a). Monitoring systems shall alarm at release concentrations as low as possible without resulting in an excessive number of alarms caused by normal fluctuations in background or normal fluctuations in releases.
- The stack sampler/monitor system shall operate continuously using the same emergency power backup capabilities as the stack blower fan(s). An elapsed time meter shall be ganged with stack blower-fan operation to provide a measure of exhaust stack operation times. The record sample vacuum pump shall be ganged to exhaust fan operation via a switched receptacle in the system cabinet. The CAM vacuum pump will operate continuously via the unswitched receptacle in the cabinet.
- Particular attention shall be given to the maintainability, testability, and, therefore, reliability of CAM systems. Failure annunciation shall be provided, and the CAM system shall be checked periodically to verify total system response.
- Independent vacuum pumps shall be provided for each loop of the system. Redundant vacuum systems need not be furnished, but failure annunciation (low flow rates) shall be provided and checked periodically to demonstrate operability.

- All gaseous effluent sampling and monitoring system equipment shall be protected from, or resistant to, environmental conditions that may cause damage to the equipment or operation thereof. Routine maintenance shall be performed. Performance evaluations of CAM instrumentation against a known standard shall be done periodically.

6.2.2 Liquid Effluent Sampling and Monitoring System Design Criteria

Liquid radionuclide sampling is required for all released liquid effluents which have the potential to exceed a sum of the fractions of the derived concentration guide (DCG) of 0.04 $\mu\text{Ci/ml}$. Sampling is also required for liquid effluents discharged to surface waters with settleable solids exceeding 5 pCi/g alpha or 50 pCi/g beta/gamma emitting radionuclides. The samples are required to be representative: either grab samples of well-mixed batch releases or proportional samples of continuous releases.

6.2.2.1 Liquid Effluent Monitoring/Sampling General Design Criteria. The general design criteria for liquid effluent sampling and monitoring systems are presented in WHC-CM-4-9, *Radiological Design*, Section 10.0, Rev. 3, "Sampling and Monitoring," (WHC 1991a). For sampling systems, the following criteria apply:

- Sampling systems shall be provided for all liquid effluents that have a potential for exceeding concentrations equivalent to the Drinking Water Standards contained in 40 CFR 141 (EPA 1991d).
- Sampling systems shall be designed to take a representative sample of the effluent stream. The sample location shall be as close to the environmental discharge point as practical and downstream of the effluent control systems. The sampler should sample only what is discharged to the environment. Samples of a stream diverted from environmental discharge should not be combined with the samples of the discharged effluent.
- For continuous releases, the flow measurements are required to be within 10 percent of span of the flow rate recording instrument. Instrument span should be adjusted to best fit maximum potential flow.
- Automatic samplers should operate on a flow-proportional basis as controlled by a flow measurement system. The flow-metering device should be equipped with a flow totalizer for recording total effluent volume released from a given source.
- Sampling probes should be suspended in the water so as not to pick up particulate matter from the bottom or top of the stream, pond, or basin.
- The sampler should have a sufficiently high transport velocity to ensure accurate collection and transport of suspended solids to the sample collector. Lengths of sample tubing should be minimized.

- The sampling system should ensure that no unsampled releases occur as a result of power failure.
- The sampler should be equipped to minimize cross contamination by sample line flushing or other methods.
- For a batch discharge system, mechanical mixing or other design should ensure reasonable homogeneity of a batch before sampling. The system should have the means for accurate determinations of batch volumes to permit volume-weighted compositing of grab (taken at random) as opposed to continuous, samples.

For monitoring and diversion system, the following criteria apply:

- Monitoring systems shall be provided for all discharged liquid effluents that have the potential for exceeding four times the applicable administrative control limits in WHC-CM-7-5, *Environmental Compliance Manual* (WHC 1993a).
- Monitoring shall be provided for each radionuclide with the potential for exceeding the values above specified values, unless an increase in one radionuclide concentration is accompanied by proportional increases in another type.
- Monitoring systems should be placed upstream from diversion systems and downstream from effluent treatment systems.
- Monitors should have distinguishable, audible, and visible high-radiation alarms capable of alarming in an area subject to frequent or continuous occupancy.
- Monitors should have distinguishable, audible, and visible detector-failure alarms capable of alarming in an area subject to frequent or continuous occupancy. The monitoring system electronics should include a low-count alarm. This module monitors the count rate provided by the electronics and alarms if the count rate drops below a selected level. This acts as a failure alarm for the system components.
- Monitors should have distinguishable, audible, and visible loss-of-sample alarms capable of alarming in an area subject to frequent or continuous occupancy.
- Monitors should have distinguishable capability to transmit a real-time measurement to a remote location.
- Accessibility and maintainability should be considered with respect to the system and configuration to accommodate periodic in-place calibration and maintenance.
- A diversion and retention system shall be coupled with the monitoring system if the potential exists for exceeding the limits contained in WHC-CM-7-5, *Westinghouse Hanford Company Environmental Compliance Manual* (WHC 1993a).

- Retention capacity shall be sufficient to retain the volume of liquid that exceeds the applicable limits based on a safety analysis postulated upset. The retention basin should be covered.
- It should be possible to flush or decontaminate the monitor if a buildup of contamination raises the background radiation levels.

Delivery of a representative portion of the effluent stream to the sampler or monitor depends on the design of the transport line. The following are guidelines for the design of sampler or monitor system transport lines.

- The sampler and monitor should be located as far upstream as practical.
- Traps should be avoided and uphill runs kept as short as practical upstream of the sampler or monitor.
- Grab sample valves, throttling valves, and flow alarms should be downstream of the sampler and monitor.
- To reduce the number of fittings needed, tubing should be used instead of piping. Sample tubing should be as short as practical, have as few valves and bends as possible, and contain no traps.
- Transport velocity in systems with horizontal or uphill runs should be 61 cm/s (2 ft/s) or greater to ensure transport of suspended solids.
- If a heat exchanger is used, it should be sized to maintain the desired transport velocity and, if practical, the sample should flow downhill.
- The sampler should be upstream of the monitor if both units are on the same transport line.
- The sampler should be separate or separable from the monitor. The two capabilities may be on the same system if either can be isolated by maintenance bypass loops.

7.0 CHARACTERIZATION OF CURRENT EFFLUENT MONITORING SYSTEM

Monitoring and Sampling systems must be capable of verifying compliance with the discharge criteria for the specific effluent stream. Air M/S requirements are well defined in NESHAPs (40 CFR 61, Subpart H) (EPA 1991a). Currently, liquid effluent M/S requirements are used to verify compliance with discharge criteria for effluents discharged to 216-B-3C Expansion Pond. After 1995, liquid effluents must meet the more restrictive SALDS criteria. Monitoring and Sampling of the air and liquid effluents will be conducted in accordance with WHC-CM-7-5 (WHC 1993a).

7.1 AIR EFFLUENT MONITORING SYSTEM DESCRIPTION AND SPECIFICATIONS

7.1.1 Monitoring/Sampling Requirements and Criteria

As a result of the dose analysis presented in Section 4.0 specific air M/S requirements have been identified for each of the 11 PUREX stacks. Monitoring requirements fall into two types, "continuous radiation monitoring" [as defined by EPA (EPA 1991a); this is fully met by continuous sampling and periodic analysis] and selective radionuclide monitoring. Continuous air monitoring requires filter analyses for total alpha and/or total beta radioactivity. Selective radionuclide monitoring analyzes the filters for specific radionuclide air concentrations.

Continuous monitoring does not imply a real-time monitoring plan, but rather a system that samples continuously so that variations in effluent concentrations are accurately represented by analysis. A continuous air sampler which draws air through and deposits particulates on a filter is an example. Both alpha and beta emitters are present in all PUREX stack effluents.

Stack monitoring requirements are discussed below. Table 7-1 summarizes the results of the dose analysis.

- Stacks 291-A-1 and 296-A-1 will require radiation monitoring (EPA definition).
- Stacks 291-A-1 and 296-A-1 will require continuous total alpha/beta monitoring (EPA 1989a).
- The main stack, 291-A-1, will require radionuclide selective analysis for ^{241}Am . The product removal (PR) stack, 296-A-1, will require radionuclide selective analysis for $^{239,240}\text{Pu}$ and ^{241}Am .
- The other nine stacks in Table 7-1 require only periodic monitoring to verify compliance during transition to shutdown operations at PUREX.
- No stack at PUREX requires monitoring for nonradiological hazardous or EPA criteria pollutants during the transition to shutdown. Monitoring for NO_x will be required if activities producing it are started during the transition to shutdown.

7.1.2 Existing Air Effluent Monitoring/Sampling System

The descriptions of the air effluent M/S program and associated equipment used at the PUREX Plant are compiled from information included in existing effluent monitoring documents (WHC 1988a) and engineering drawings (WHC 1988b, 1988c, 1990c, 1990d, 1990e).

7.1.2.1 291-A-1 Stack Monitoring/Sampling Description. Multipoint sample probes are located at three elevations on the main stack; 18 m, 22.5 m, and 27 m (60, 74, and 88 ft). There are two sample probes at each location. Two of the six probes, one each at 18 and 22.5 m (60 and 74 ft), are used for effluent sampling record purposes. The remaining probes lead to monitors or samplers used for process control or to samplers which are not required during transition to shutdown conditions. Each of the record samplers consists of a filter through which a near-isokinetic (± 20 percent) sample is pulled. Automatic flow controllers maintain the near-isokinetic sampling conditions.

The particulate filters from the record sampling unit are removed biweekly and transferred to the 222-S Laboratory for radiochemical analyses. The samples are analyzed biweekly for gross alpha and beta and composited quarterly for specific radionuclide analyses. As of June 1994, sample times were increased from one week to two weeks to obtain more sample for more sensitive laboratory analysis.

7.1.2.2 296-A-1 Stack Monitoring/Sampling Description. Multipoint sampling probes for the record sampler and alpha CAM are located at two elevations on the PR stack; 14m and 16.5m (46 and 54 ft) above grade. Samples are removed from the gas stream by stack sampling probe SSP-V28A-1 and routed to the record sampler. As with Stack 291-A-1, particles are collected on a filter within the sampler. An Annubar probe (multipoint probe) is located 15m (50 ft) above grade on the PR stack and continuously measures the flow through the stack. Flow through the system is manually adjusted, when needed, to maintain a near-isokinetic sampling condition.

The particulate filters from the record sampler are removed biweekly and transferred to the 222-S Laboratory for radiochemical analyses. The samples are analyzed biweekly for gross alpha and beta and composited quarterly for specific radionuclide analyses. As of June 1994, sample times were increased from one week to two weeks to obtain more sample for more sensitive laboratory analysis.

7.1.2.3 Monitoring/Sampling Specifications and Deficiencies. Currently, the 291-A-1 and 296-A-1 stacks are continuously sampled for particulate radioactivity and monitored for flow rate.

A sampling probe provides the capability for analysis of all required radionuclides. The current design, location, and number of sample probes on the main stack and PR stack are in compliance with ANSI N13.1-1969 (ANSI 1969). The current stack sampling system uses the best available technology and provides adequate assessment of stack emissions based on historical sample analysis data. The sampling system is well documented.

Additional QA documentation is not available to address all the requirements of 40 CFR 61 (EPA 1991). However, many of the QA elements are addressed in the *Quality Assurance Program Plan for Radionuclide Airborne Emissions Monitoring*, WHC-EP-0536-1 (WHC 1993).

7.1.3 Remaining Stacks

Based on EPA criteria (EPA 1991a), continuous monitoring for the remaining PUREX stacks is not required. However, periodic effluent sampling should be maintained to verify the low radionuclide air releases.

7.1.4 Air Effluent Sampling Program

The gaseous effluent in the main stack (291-A-1) and PR stack (296-A-1) shall be continuously sampled and periodically analyzed for total alpha and beta radiation and specific radionuclides as the means to provide the required sensitivity. Air samples from 291-A-1 will be analyzed for ^{241}Am and samples from 296-A-1 will be analyzed for ^{241}Am and $^{239,240}\text{Pu}$. The M/S program for air effluents is included in Table 7-2. Air sampling shall comply with the criteria provided in applicable WHC manuals and procedures. Stack flow measurements shall comply with the criteria provided by the EPA (EPA 1991a).

Stack 291-A-1

Air sampling equipment is located at the 18 m and 22.5 m (60 ft and 74 ft) levels of the main stack. Samples are removed from the airstream by stack sampling probes SSP-V19-1 and SSP-V18-2 and routed to record samplers. Particles are collected on filters within the samplers. Flow through the system is monitored and controlled by flow controllers to ensure near-isokinetic sampling.

The particulate filters from the record sampling unit will be removed biweekly and transferred to a laboratory for radiochemical analyses. These analyses will include ^{241}Am determinations. Samples are analyzed biweekly for gross alpha and beta and composited quarterly for specific radionuclide analyses. As of June 1994, sample times were increased from one week to two weeks to obtain more sample for more sensitive laboratory analysis.

Stack 296-A-1

Samples are removed from the airstream by stack sampling probe SSP-V28A-1 and routed to a record sampler. Particles are collected on a filter within the sampler. This system is capable of near isokinetic sampling, but requires manual adjustment when stack flow conditions change. The stack flow conditions are usually constant.

The particulate filter from the record sampling unit will be removed biweekly and transferred to a laboratory for radiochemical analysis. The analyses will include ^{239}Pu and ^{241}Am determinations. Samples are analyzed biweekly for gross alpha and beta and composited quarterly for specific radionuclide analyses. As of June 1994, sample times were increased from one week to two weeks to obtain more sample for more sensitive laboratory analysis.

7.2 LIQUID EFFLUENT MONITORING SYSTEM DESCRIPTION AND SPECIFICATIONS

The descriptions of the liquid effluent M/S program and associated equipment used at the PUREX Plant are compiled from information included in existing monitoring documents (WHC 1990a, 1990g) and engineering drawings (WHC 1990b, 1990e, and 1990f).

7.2.1 Monitoring/Sampling Requirements

The concentration of contaminants in the CSL must meet current regulatory requirements. After June 1995, more restrictive SALDS criteria must be met. The discharge criteria for PUREX waste water effluents will be the acceptance criteria for the SALDS. These criteria are currently being negotiated and will be included in the State Waste Discharge Permit. The discharge criteria however, will meet all applicable federal and state standards for water quality.

7.2.1.1 Monitoring/Diversion Interface. Now, the only mitigating control on effluent discharge from the PUREX Plant is in-line monitoring with the capability for automatic diversion to the concrete-lined retention basin. However, the existing monitoring system does not appear to be adequate for detecting releases that exceed the discharge criteria.

Because of the difference between detection and release limits, it is possible to exceed the annual release limits without detection. The detection limits of the continuous effluent monitors that are used to activate the diversion controls are 3 to 5 orders of magnitude greater than the most restrictive limits established in Section 4.2.3. Weekly process control samples will identify releases greater than annual limits, and provide for timely response to releases greater than annual limits but less than alarm sensitivity. Past upset conditions have typically produced releases an order of magnitude greater than alarm limits.

In addition, the CSL is not monitored continuously for pure beta emitters, such as strontium, which have extremely low release limits and are difficult to quantify in aqueous solutions. Transit time from the point of monitoring to the point of diversion exceeds the response time of the monitors, so all upset flow is diverted.

7.2.1.2 Monitoring/Sampling Criteria. During routine operations of the PUREX Plant, the contaminant concentrations in the CSL were below the most restrictive of the applicable federal and state standards for water quality. The contaminant concentrations are also expected to meet the intent of the state's groundwater protection standards while the plant is in a shutdown mode. The M/S activities will be performed to show continuing compliance with applicable WAC/EPA regulations and appropriate discharge criteria.

The existing monitoring instrumentation lacks the sensitivity to detect radionuclides in liquid effluents at the concentrations of current discharge limits and therefore for SALDS acceptance criteria. Furthermore, instrumentation that can attain these sensitivities is not commercially available, nor is it likely that this type of instrumentation will be developed in the near future. As a result, instrument monitoring will be

useful only for detecting and quantifying upset releases. Data for establishing environmental baseline conditions and determining compliance status will be collected by sampling and analysis.

The sampling strategy must include provisions for correcting the deficiencies noted in this section. Uniformity and consistency must be incorporated in the sampling and analysis plan to ensure that the database acceptability of PUREX liquid effluent for disposal at the SALDS. A new sampling and analysis plan will be written to reflect the new sampling requirements for discharge to SALDS. The sampling criteria are summarized below and are presented in more detail in Sections 10.2 and 10.3.

7.2.2 CSL Effluent Monitoring/Sampling System

7.2.2.1 CSL Monitoring/Sampling Description. The CSL monitoring equipment is located in the 295-AC Building and includes continuous pH, gamma radiation, and flow monitoring. Excursions above or below pH limits and beta/gamma radiation alarm limits and flow rates below set limits trigger alarms in the central control room. The radiation alarm triggers automatic diversion of the CSL to 216-A-42 Retention Basin and collection of verification samples. Samples are collected from the sample tank weekly for analysis. On a monthly basis, the weekly samples are combined in a flow proportional composite for environmental release records.

7.2.2.2 CSL Monitoring/Sampling Specifications. Table 7-3 describes the normal operating parameters for the CSL stream.

7.2.2.3 CSL Monitoring/Sampling Deficiencies. The minimum detection limits for ^{241}Am , ^{239}Pu , and ^{240}Pu , which should be equal to 4 percent of the DCG are not currently met. The current detection limits at the 222-S Laboratory are $5.0 \times 10^{-7} \mu\text{Ci/ml}$ for Plutonium and $1.2 \times 10^{-7} \mu\text{Ci/ml}$ for Americium (WHC 1990g). However, after connection to TEDF, PUREX CSL samples will be analyzed at the Waste Sampling and Characterization Facility (WSCF). Improved detection limits are expected for compliance with discharge criteria to SALDS. Revised detection limits, based on 4 percent of the DCG of $1.2 \times 10^{-7} \mu\text{Ci/ml}$ for both, are required. Although recommended, the monitoring systems for both radioactive and nonradioactive liquid discharges have no source of backup power in a power failure (WHC 1990g). Current procedures increase sampling and analysis in a power failure to ensure that unsampled releases do not occur.

7.2.3 Liquid Effluents Monitoring Program

The currently available alpha and beta/gamma monitoring equipment is inadequate for determining compliance with discharge criteria. As a result, real-time liquid effluent monitoring will not be required for the PUREX Plant. Until more sensitive equipment is developed and procured, compliance with discharge criteria shall be determined by sampling methodology as provided by DOE.

7.2.4 Liquid Effluent Sampling Program

The sampling program for liquid effluents shall include composite and grab sampling methods. Samples shall be analyzed for major cations, major anions, pH, metals, volatile organic chemicals, and extractable organic chemicals. The sampling and analytical plan is summarized in Table 7-4.

7.2.4.1 CSL Effluent Stream. The CSL composite sampling equipment is located in the 295-AC Building. During stream operation, a 7-day composite sample shall be collected weekly and recomposited monthly for radiochemical and metal analyses in accordance with WHC-CM-7-5 (WHC 1993a). In addition, the pH of the CSL stream shall be determined from each weekly composite sample.

7.2.4.2 Diverted Effluent. Upon receipt of a high radiation alarm from the CSL gamma monitor, an additional sample shall be collected using the equipment provided for verification sampling of the CSL.

Samples collected during and immediately after the high radiation alarm event shall be analyzed for radionuclides. After a diversion, the 216-A-42 Basin will be recirculated and sampled according to procedure. Assuming the initial sample results meet acceptable criteria, the basin will be pumped to the 216-B-3C Expansion Pond, or SALDS after June 1995. Before the basin is emptied, additional samples will be taken for environmental release recordkeeping.

Table 7-1. Radioactive Sampling Requirements for Plutonium-Uranium Extraction Plant During Transition to Shutdown.

Stack	Sampling/Analysis Requirements*	
	Total alpha/beta	Selective radionuclide(s)
291-A-1	Yes	²⁴¹ Am
296-A-1	Yes	^{239,240} Pu, ²⁴¹ Am
296-A-2	No	None
296-A-3	No	None
296-A-5A/5B	No	None
296-A-6	No	None
296-A-7	No	None
296-A-8	No	None
296-A-10	No	None
296-A-14	No	None

*Based on 40 CFR 61

Table 7-2. Monitoring/Sampling and Analysis Program for Air Effluents.

Monitor/Sample location	Analytes	Sample frequency	Type of event	Equipment type
Stack 291-A-1				
RM-V19-3 (60-ft)	Alpha, beta	Continuous	M	CPRM
SPL-V18-1 (74-ft)	²⁴¹ Am	Biweekly	S	Record Sampler
SPL-V19-1 (60-ft)	²⁴¹ Am	Biweekly	S	Record Sampler
Stack 296-A-1				
RAN-V29A-1-1 (54-ft)	Alpha	Continuous	M	CAM
SPL-V28A-1 (46-ft)	^{239,240} Pu, ²⁴¹ Am	Biweekly	S	Record Sampler

CPRM = Continuous particulate radiation monitor

CAM = Continuous air monitor

Table 7-3. Chemical Sewer Normal Operating Parameters.

Parameter	Measurement unit	Parameter range		Monitor identification
		Low value	High value	
Gamma	cpm	0	6,500	RR-W20-2-1
pH	Standard units	5.0	11.0	NE-W20-19-1
Total alpha	$\mu\text{Ci/ml}$	0	2.0 E-5	Laboratory analyses
Total beta	$\mu\text{Ci/ml}$	0	1.2 E-6	Laboratory analyses
^3H	$\mu\text{Ci/ml}$	0	1.2 E-2	Laboratory analyses
^{90}Sr	$\mu\text{Ci/ml}$	0	1.2 E-2	Laboratory analyses
^{137}Cs	$\mu\text{Ci/ml}$	0	8.0 E-5	Laboratory analyses
Flow	L/min	1	2,300	FR-W20-1-1

Table 7-4. Sampling and Analysis Program for Chemical Sewer Stream.

Sample location	Waste stream	Analytes	Sample frequency	Sample type	Analytical technique
295-AC	CSL	pH, Metals, Radionuclides	Monthly	C	Liquid Scintillation, ICP
295-AC	Diverted Effluent	Radionuclides	During and immediately after high radiation alarm. More samples will be taken if deemed necessary.	G,C	Liquid Scintillation

C = Composite

G = Grab

ICP = Inductively-coupled plasma atomic emission spectroscopy

8.0 HISTORICAL MONITORING/SAMPLING DATA FOR EFFLUENT STREAMS

8.1 AIR EFFLUENTS

8.1.1 Normal Conditions

Historical air effluent M/S data have been assembled in annual reports. These reports typically record the routine releases, unusual occurrences (i.e., upset conditions), sample points, analytical data sheets, instrument calibration records and other information. The last ten annual reports are listed below, but only the recent reports present data collected during transition to shutdown conditions.

Annual Reports

- RHO, 1985, *Rockwell Hanford Operations Annual and Environmental Surveillance Report for 1985*, RHO-HS-SR-85-13P, Rockwell Hanford Operations, Richland, Washington.
- RHO, 1986, *Rockwell Hanford Operations Annual and Environmental Surveillance Report for 1986*, RHO-HS-SR-86-13P, Rockwell Hanford Operations, Richland, Washington.
- WHC, 1987, *Westinghouse Hanford Company Environmental Surveillance Report for 1987*, WHC-EP-0145, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1987, *Westinghouse Hanford Company Effluent Discharge and Solid Waste Management Report for Calendar Year 1987: 200/600 Areas*, WHC-EP-0141, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1988, *Westinghouse Hanford Company Effluent Discharge and Solid Waste Management Report for Calendar Year 1988: 200/600 Areas*, WHC-EP-0141-1, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1989, *Westinghouse Hanford Company Effluent Discharge and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas*, WHC-EP-0141-2, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1992, *Environmental Releases for Calendar Year 1990*, WHC-EP-0527, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1992, *Environmental Releases for Calendar Year 1991*, WHC-EP-0527-1, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1993, *Environmental Releases for Calendar Year 1992*, WHC-EP-0527-2, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1994, *Environmental Releases for Calendar Year 1993*, WHC-EP-0527-3, Westinghouse Hanford Company, Richland, Washington.

Pertinent information on the historical gaseous effluent monitoring may also be found in the following:

WHC, 1990, *Effluent Monitoring Plan PUREX Gaseous Effluents*, SD-CP-EMP-004, Westinghouse Hanford Company, Richland, Washington.

Tables 8-1a through h show Radioactive Airborne Effluent Releases for calendar years 1990, 1991, 1992, and 1993 for the PUREX 291-A-1 Main Stack and 296-A-1 Product Removal Stack.

8.1.2 Upset Conditions

Section 4.1.3 describes the upset operating conditions of each stack.

8.2 LIQUID EFFLUENTS

8.2.1 Normal Conditions

Historical liquid M/S data have been assembled in various reports. The four Effluent Releases and Solid Waste Management Reports for 1987, 1988, 1989, and 1990 given in Section 8.1.1 list much of this information. Routine operations and releases, upsets, sample points, analytical data sheets and other information are typically recorded. The following reports contain additional historical data and transition to shutdown data.

WHC, 1990, *PUREX Liquid Effluent Monitoring Plan*, WHC-SD-CP-EMP-006, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990, *Stream Specific Reports*, WHC-EP-0342, Addendum 1-33, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990, Addendum 2, *PUREX Plant Chemical Sewer Stream-Specific Report*, WHC-EP-0342, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990, Addendum 5, *PUREX Plant Steam Condensate Stream-Specific Report*, WHC-EP-0342, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990, Addendum 12, *PUREX Plant Process Condensate Stream-Specific Report*, WHC-EP-0342, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990, Addendum 14, *PUREX Plant Ammonia Scrubber Condensate Stream-Specific Report*, WHC-EP-0342, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990, Addendum 20, *PUREX Plant Cooling Water Stream-Specific Report*, WHC-EP-0342, Westinghouse Hanford Company, Richland, Washington.

Monitoring data for the PUREX CSL for release to 216-B-3 Pond is presented in Tables 8-2a through d for calendar years 1990, 1991, 1992, 1993 respectively.

8.2.2 Upset Conditions

Section 4.2.3 describes upset operating conditions of each liquid discharge.

Table 8-1a. Final 1990 Radionuclide Airborne Releases
from 291-A-1 (A552), 200 East Area.

Radionuclide	Release (Ci)	Average Concentration ($\mu\text{Ci}/\text{ml}$)
^3H	1.7 E+01	1.0 E-08
^{14}C	5.7 E-01	3.5 E-10
$^{85}\text{Kr}^a$	5.7 E+03	3.6 E-06
^{90}Sr	1.2 E-03	7.3 E-13
^{95}Zr	ND	<1.9 E-14
^{95}Nb	ND	<9.8 E-15
^{103}Ru	4.2 E-05	2.6 E-14
^{106}Ru	1.4 E-03	8.6 E-13
^{113}Sn	2.4 E-04	1.5 E-13
^{125}Sb	1.5 E-03	9.0 E-13
^{129}I	1.1 E-01	6.6 E-11
^{131}I	1.4 E-03	8.6 E-13
^{134}Cs	ND	<1.0 E-14
^{137}Cs	2.1 E-05	1.3 E-14
^{144}Ce	ND	<9.7 E-14
^{147}Pm	1.9 E-04	1.2 E-13
^{212}Pb	2.9 E-02	1.8 E-11
^{220}Rn	3.6 E+02	2.2 E-07
^{238}Pu	2.1 E-06	1.3 E-15
$^{239}, ^{240}\text{Pu}$	3.2 E-05	1.9 E-14
^{241}Pu	1.6 E-04	1.0 E-13
^{241}Am	3.8 E-06	2.4 E-15

^aThe release of value and concentration for ^{85}Kr are calculated from the plant inventory and stack flow, respectively; it is not measured effluent.

ND = None detected

Table 8-1b. Radionuclide Air Emissions in 1991 from
291-A-1 (A552), 200 East Area.

Radionuclide	Release (Ci)	Average concentration ($\mu\text{Ci}/\text{ml}$)
^3H	1.0 E-00	7.6 E-10
^{14}C	8.1 E-02	6.1 E-11
^{90}Sr	7.9 E-04	6.0 E-13
^{95}Zr	ND	<1.8 E-14
^{95}Nb	ND	<1.1 E-14
^{103}Ru	ND	<2.0 E-13
^{106}Ru	2.8 E-03	2.1 E-12
^{113}Sn	ND	<2.3 E-13
^{125}Sb	ND	<1.5 E-12
^{129}I	4.8 E-02	3.6 E-11
^{131}I	ND	<1.8 E-13
^{134}Cs	ND	<9.6 E-15
^{137}Cs	3.0 E-03	2.2 E-12
^{144}Ce	2.3 E-04	1.8 E-13
^{147}Pm	6.5 E-04	4.9 E-13
^{212}Pb	2.7 E-03	2.0 E-12
^{220}Rn	3.3 E+01	2.5 E-08
^{238}Pu	3.2 E-06	2.4 E-15
$^{239}, ^{240}\text{Pu}$	3.8 E-05	2.8 E-14
^{241}Pu	2.9 E-04	2.2 E-13
^{241}Am	3.5 E-04	2.6 E-13

ND = None detected

Table 8-1c. Radionuclide Air Emissions in 1992 from
291-A-1 (A552), 200 East Area.

Radionuclide	Release (Ci)	Average concentration ($\mu\text{Ci}/\text{ml}$)
^{90}Sr	3.3 E-04	1.4 E-13
^{95}Zr	ND	<3.8 E-14
^{95}Nb	ND	<2.3 E-14
^{103}Ru	ND	<1.1 E-13
^{106}Ru	ND	<1.3 E-12
^{113}Sn	ND	<1.2 E-13
^{125}Sb	ND	<2.0 E-12
^{129}I	2.7 E-02	1.5 E-11
^{131}I	ND	<2.2 E-13
^{134}Cs	ND	<2.1 E-14
^{137}Cs	1.6 E-03	7.1 E-13
^{144}Ce	ND	<1.9 E-13
^{147}Pm	1.7 E-04	7.5 E-14
^{212}Pb	2.7 E-03	1.2 E-12
^{220}Rn	3.4 E+01	1.5 E-08
^{238}Pu	1.3 E-05	5.7 E-15
$^{239}, ^{240}\text{Pu}$	2.2 E-05	9.7 E-15
^{241}Pu	4.7 E-04	2.0 E-13
^{241}Am	1.3 E-04	5.7 E-14
Total α	1.4 E-04	6.0 E-14
Total β	1.6 E-03	7.2 E-13

ND = None detected

Table 8-1d. Radionuclide Air Emissions in 1993 from
291-A-1 (A552), 200 East Area.

Radionuclide	Release (Ci)	Average concentration ($\mu\text{Ci}/\text{ml}$)
^{90}Sr	4.9 E-05	3.2 E-14
^{95}Zr	ND	<1.2 E-14
^{95}Nb	ND	<7.1 E-15
^{103}Ru	ND	<4.1 E-14
^{106}Ru	3.6 E-04	2.4 E-13
^{113}Sn	ND	<5.0 E-14
^{125}Sb	ND	<2.9 E-13
^{129}I	4.8 E-03	3.2 E-12
^{131}I	ND	<3.5 E-14
^{134}Cs	ND	<6.3 E-15
^{137}Cs	1.4 E-04	9.2 E-14
^{147}Pm	1.1 E-04	7.2 E-14
^{212}Pb	9.7 E-04	6.4 E-13
^{220}Rn	1.2 E+01	7.9 E-09
^{238}Pu	3.2 E-06	2.1 E-15
$^{239}, ^{240}\text{Pu}$	4.9 E-06	3.2 E-15
^{241}Pu	3.3 E-05	2.2 E-14
^{241}Am	2.7 E-05	1.7 E-14
Total α	2.9 E-05	1.9 E-14
Total β	3.7 E-04	2.4 E-13

ND = None detected

Table 8-1e. Radionuclide Air Emissions in 1990 from
296-A-1 (A540), 200 East Area.

Radionuclide	Release (Ci)	Average concentration ($\mu\text{Ci}/\text{ml}$)
$^{239}, ^{240}\text{Pu}$	1.9 E-06	2.2 E-14
^{241}Am	9.5 E-07	1.1 E-14
Gross α	2.8 E-06	3.1 E-14
Gross β	ND	<2.3 E-15

ND = None detected

Table 8-1f. Radionuclide Air Emissions in 1991 from
296-A-1 (A540), 200 East Area.

Radionuclide	Release (Ci)	Average concentration ($\mu\text{Ci}/\text{ml}$)
$^{239}, ^{240}\text{Pu}$	1.7 E-06	2.4 E-14
^{241}Am	7.4 E-07	1.1 E-14
Total α	1.5 E-06	2.2 E-14
Total β	ND	<1.7 E-15

ND = None detected

Table 8-1g. Radionuclide Air Emissions in 1992 from
296-A-1 (A540), 200 East Area.

Radionuclide	Release (Ci)	Average concentration (μ Ci/ml)
^{239, 240} Pu	1.0 E-06	1.2 E-14
²⁴¹ Pu	7.1 E-06	8.2 E-14
²⁴¹ Am	3.5 E-07	4.0 E-15
Total α	9.7 E-07	1.1 E-14
Total β	ND	<3.1 E-15

ND = None detected

Table 8-1h. Radionuclide Air Emissions in 1993 from
296-A-1 (A540), 200 East Area.

Radionuclide	Release (Ci)	Average concentration (μ Ci/ml)
^{239, 240} Pu	2.1 E-06	2.8 E-14
²⁴¹ Am	8.4 E-07	1.1 E-14
Total α	2.3 E-06	3.1 E-14
Total β	3.4 E-07	4.5 E-15

ND = None detected

Table 8-2a. Plutonium-Uranium Extraction Chemical Sewer (CSL) to 216-B-3 Pond, 200 East Area (H118) in 1990.

Radionuclide	Release (Ci)	Average concentration ($\mu\text{Ci/ml}$)
^3H	5.6 E-01	7.6 E-07
^{90}Sr	1.3 E-02	1.7 E-08
^{103}Ru	2.2 E-02	3.0 E-08
^{106}Ru	3.8 E-02	5.2 E-08
^{137}Cs	4.8 E-02	6.5 E-08
^{147}Pm	ND	<9.0 E-07
$^{239}, ^{240}\text{Pu}$	8.2 E-03	1.1 E-08
^{241}Am	1.6 E-02	2.2 E-08
Gross α	2.3 E-03	3.2 E-09
Gross β	6.5 E-03	8.8 E-09
Volume	7.4 E+08 L	

ND = None detected

Table 8-2b. Plutonium-Uranium Extraction Chemical Sewer (CSL) to 216-B-3 Pond, 200 East Area (H118) in 1991.

Radionuclide	Release (Ci)	Average concentration ($\mu\text{Ci}/\text{ml}$)
^3H	4.1 E-01	5.1 E-07
^{90}Sr	1.5 E-02	2.4 E-08
^{103}Ru	ND	<3.7 E-08
^{137}Cs	5.0 E-02	6.2 E-08
^{147}Pm	ND	<9.0 E-07
$^{239}, ^{240}\text{Pu}$	1.9 E-02	2.3 E-08
^{241}Am	2.6 E-02	3.2 E-08
Gross α	2.0 E-03	2.4 E-09
Gross β	3.9 E-03	4.7 E-09
Volume	8.2 E+08 L	

ND = None detected

Table 8-2c. Radionuclides in Plutonium-Uranium Extraction Plant Chemical Sewer Discharge (CSL) to 216-B-3 Pond, 200 East Area (H118) in 1992.

Radionuclide	Release (Ci)	Average Concentration ($\mu\text{Ci}/\text{ml}$)
^3H	3.4 E-01	6.4 E-07
^{90}Sr	7.2 E-03	1.3 E-08
^{137}Cs	1.4 E-01	2.6 E-07
^{147}Pm	ND	<9.0 E-07
$^{239}, ^{240}\text{Pu}$	ND	<3.3 E-08
^{241}Am	ND	<2.8 E-08
Gross α	5.3 E-04	1.0 E-09
Gross β	4.2 E-03	7.9 E-09
Volume	5.3 E+08 L (1.4 E+08 gal)	

ND = None detected

Table 8-2d. Radionuclides in Plutonium-Uranium Extraction Plant Chemical Sewer Discharge (CSL) to 216-B-3 Pond, 200 East Area (H118) in 1993.

Radionuclide	Release (Ci)	Average Concentration ($\mu\text{Ci}/\text{ml}$)
^3H	4.1 E-01	7.4 E-07
^{90}Sr	6.8 E-03	1.2 E-08
^{137}Cs	ND	<4.1 E-08
^{147}Pm	ND	<9.0 E-07
$^{239}, ^{240}\text{Pu}$	1.2 E-02	2.2 E-08
^{241}Am	ND	<2.8 E-08
Gross α	9.7 E-04	1.8 E-09
Gross β	5.2 E-03	9.3 E-09
Volume	5.5 E+08 L (1.5 E+08 gal)	

ND = None detected

9.0 SAMPLE ANALYSIS

9.1 ANALYTICAL LABORATORY AND PROCEDURES

Requirements for the development, issuance, and control of instructions and procedures within the Analytical Laboratories are covered by WHC-CM-5-4, *Analytical Chemistry Services Laboratories Operating Instructions* (WHC 1993c). This procedure is an administrative procedure which provides guidance on how to write, review, and control analytical procedures and other supporting procedures used within the analytical laboratories.

The analytical laboratories presently have over 1,000 procedures that define operations. These procedures, individually numbered and controlled, are divided into six categories as shown below:

1. **LA Series - Analytical Procedures.** These procedures cover a specific analysis or analysis type for each sample.
2. **LO Series - Operating Procedures.** These procedures provide guidance for all laboratory operations supporting analytical techniques. This would include such operations as packaging and shipping.
3. **LE Series - Essential Materials Procedures.** These procedures cover the analysis of supplies, chemicals, and metals, using industry standard analyses such as American Society for Testing and Materials (ASTM) procedures.
4. **LR Series - Reagent Procedures.** These procedures provide guidance for the preparation, dilution and storage of standards and reagents used in specific Analytical Procedures (LA Series).
5. **LC Series - Computer Operation Procedures.** These procedures cover the use of database systems and computer operations associated with specific analysis techniques.
6. **LQ Series.** These procedures cover the techniques used for QC guidance, calibration and verification of analysis techniques and analytical systems.

Each Analytical Procedure (LA Series) covers a specific analysis for a variety of sample types. The procedures are individually numbered, issued, and controlled by the Procedure Control group. Each procedure is a controlled document and contains the following information:

- Title
- Author
- Issued by
- Laboratory manager
- Release date
- Review date
- Document number
- Revision/Modification
- Page number.

Each procedure contains the following generic sections as applicable to the specific analysis technique:

- Summary
- Limitations
- Application
- Safety
- Reagents
- Equipment
- Standards
- Procedure steps
- Calculations
- Discussion
- References.

Additional requirements are defined in *PUREX/UO₃ Plant Administration*, WHC-CM-5-9 (WHC 1993b). These procedures define operations not covered by existing codes and standards and contain all necessary requirements for qualifying personnel, procedures, and/or equipment to conduct processes in a timely, competent manner. Analytical Laboratory operating instructions also cover the preparation, documentation, and control of individual procedures.

Quality Assurance requirements for the Analytical Laboratory procedures are defined by the following documents:

- WHC-CM-4-2, *Westinghouse Quality Assurance Manual* (WHC 1988e)
- WHC-CM-5-9, *PUREX/UO₃ Plant Administration* (WHC 1993b)

The 222-S Laboratory on the Hanford Site has one program plan and two project plans to address applicable quality requirements related to sample analysis. These plans are as follows:

- WHC-SD-CP-QAPP-003, *Quality Assurance Program Plan for the Chemical Analyses of Environmental Samples* (WHC 1991a)
- WHC-SD-QAPP-001, *Analytical Chemistry Services Laboratories Quality Assurance Plan* (WHC 1989a)
- WHC-SD-CP-QAPP-002, *Quality Assurance Project Plan for the Chemical Analysis of Highly Radioactive Mixed Waste Samples in Support of Environmental Activities on the Hanford Site* (WHC 1989b).

The *Resources Conservation and Recovery Act of 1976* (RCRA) protocol for liquid effluent sampling, associated with the liquid effluent study, is not part of the FEMPs. The QA requirements for the sampling analysis plans (SAP) associated with the liquid effluent study are identified in the latest version of the WHC-SD-WM-QAPP-011, *Liquid Effluent Sampling Quality Assurance Program Plan* (WHC 1992b).

Details of the analytical laboratory and analytical procedures are discussed in the 222-S Laboratory FEMP.

The analytical and laboratory procedure for the FEMP activities are identified in *Quality Assurance Project Plan for Facility Effluent Monitoring Plan* (WHC 1992c). General requirements for laboratory procedures, data analyses, and statistical treatment are addressed in the Quality Assurance Project Plan (QAPJP).

The following elements are contained in the 222-S Laboratory Analytical Procedures (identified in QAPJP, WHC-EP-0446 [WHC 1992c], Table 8-1).

- Procedures preventing cross contamination
- Documentation of methods
- Gamma emitting radionuclides
- Calibration
- Handling of samples
- Analysis method and capabilities
- Gross alpha, beta, and gamma measurements
- Direct gamma-ray spectrometry
- Beta counters
- Alpha-energy analysis
- Radiochemical separation procedures
- Reporting of results
- Counter calibration
- Intercalibration of equipment and procedures
- Counter background
- Quality assurance
- Summary of data and statistical treatment requirements
- Variability of effluent and environmental data
- Summarization of data and testing for outliers
- Treatment of significant figures
- Parent-decay product relationships

- Comparisons to regulatory or administrative control standards and control data
- Quality assurance

9.2 SAMPLE AND DATA CHAIN OF CUSTODY

Sample identification is initiated by the operations group taking the sample. Sampling personnel use the chain of custody form and log in system to provide sample identification. Sample custody is transferred when the properly marked sample is received by the analytical laboratory.

Sample chain of custody within the Analytical Laboratory is covered by WHC-CM-5-4, *Analytical Chemistry Services Laboratories Operating Instructions* (WHC 1993c) and individual analytical laboratory procedures.

The PUREX Facility has a chain-of-custody procedure for gaseous effluents as described in WHC-IP-0718, Section 3.3.3, Rev. 0 (WHC 1993h). For liquid effluents, the chain-of-custody procedure is described in the plant operating procedure PO-080-315.

Because the Hanford Site has 33 separate discharges, the Tri-Party Agreement has established milestones as part of the Liquid Effluent Study program for compliance plans of liquid discharges to land that could infiltrate to groundwater (WAC 1990). Sampling and analysis plans (SAP) are required for each Hanford Site liquid effluent stream. A SAP for PUREX, *PUREX CSL Sampling and Analysis Plan* was prepared in September 1991 (WHC 1991c). The SAP describes the sampling, analysis, and related activities required under the Tri-Party Agreement for PUREX liquid effluent streams.

Sampling was performed according to the SAP. The SAPs have been prepared pursuant to the Tri-Party Agreement (WAC 1990) and are available for review.

10.0 NOTIFICATION AND REPORTING REQUIREMENTS

Notification and reporting requirements are imposed by federal and state law as well as by DOE orders. Because DOE and EPA documents are periodically updated, the current requirements should be obtained from the latest CFR and DOE order. This section is to serve as a guideline for general notification and reporting requirements and as a reference to the sources where specific information may be found for federal, state, and DOE requirements.

10.1 OCCURRENCE CATEGORIZATION, NOTIFICATION, AND REPORTING

Notifications and reporting of specific events related to environmental releases and/or events involving effluents and/or hazardous materials shall be made in accordance with DOE Orders 5400.1 (DOE 1991a) and 5000.3B (1993). Implementing the orders is accomplished via *Management Requirements and Procedures Manual*. Specific implementation, where required, is included in the appropriate facility's "Occurrence Categorization, Notification, and Reporting" procedure. Implementing environmental limits and requirements is found in the *Environmental Compliance Manual*, WHC-CM-7-5 (WHC 1993a).

10.1.1 Occurrence Identification and Immediate Response

Each employee shall identify events and conditions and shall promptly notify management of such occurrences.

- a. Call 911 if immediate help such as fire, ambulance, or patrol is required.
- b. Call 373-3800 (the Patrol Operations Center) if assistance other than fire, ambulance, or patrol is required.
- c. After requesting necessary outside assistance, the employee shall notify his or her supervisor, who shall notify the facility manager, the building emergency director, and the Occurrence Notification Center (376-2900).

Operations personnel shall take appropriate immediate action to stabilize or return the facility/operation to a safe condition. Actions taken in response to nonroutine releases, as evidenced by high sample results from liquid and gaseous effluent sampling, are documented in *PUREX/UO₂ Plant Administration*, WHC-CM-5-9 (WHC 1993b).

The oversight organizations shall notify their DOE Field Office, Richland, counterparts of the event after receiving notifications from, and discussing the event with, the facility manager.

10.1.2 Occurrence Categorization

Occurrences (environmental) shall be categorized as soon as practical using the specific criteria listed in Section 10.2 for radioactive and

hazardous materials release. These categorizations should be made within 2 hours of identification. Occurrences shall be categorized by their seriousness; if categorization is not clear, the occurrence shall be categorized initially at the higher level being considered. The occurrence categorization shall then be either evaluated, maintained, or lowered as information becomes available.

10.2 OCCURRENCE CATEGORIZATION

The following criteria for categorization of occurrences are established in WHC-CM-1-3, *Identifying and Resolving Unreviewed Safety Questions* (WHC 1989d), which implements the requirements contained in DOE Order 5000.3B (DOE 1993).

10.2.1 Radioactive Releases

10.2.1.1 Emergency.

- Any release of radionuclide material to controlled or uncontrolled areas in concentration which, if averaged over 24-hour period, would exceed 5 times the respective reportable quantities specified for such materials in 40 CFR 302 (EPA 1991b). Note: This event must also meet the criteria for classified emergency in accordance with *Emergency Plan*, WHC-CM-4-1 (WHC 1989e), and/or facility specific emergency action levels.

10.2.1.2 Unusual Occurrence.

- Release of a radionuclide material that exceeds a federally permitted release by the amount of a CERCLA reportable quantity or, where no federally permitted release exists, the release exceeds the reportable quantity.
- Release of radionuclide material that violates environmental requirements in federal permits, federal regulations, or DOE standards.
- Release below emergency levels which requires immediate (less than 4 hours) reporting to Federal regulatory authorities or triggers specific action levels for an outside agency.

10.2.1.3 Off-Normal.

- Any release of radionuclide material to controlled or uncontrolled areas that is not part of a normal monitored release and exceeds 50 percent of a CERCLA reportable quantity specified for such material in accordance with 40 CFR 302 (EPA 1991b).
- Any controlled release of radionuclide material that occurs as a monitored part of normal operations which exceeds what historical data and/or analysis show is expected as a result of normal operations.

- Any monitored facility or site boundary where exposure of concentrations exceed what historical data and/or analysis show is expected as a result of normal operations.
- Any detection of a radionuclide in a sanitary or storm sewer, waste or process stream, or any holding points where such a material is not expected.
- Any controlled, uncontrolled, or accidental release which is not classified as an unusual occurrence but which will be reported in writing to state/local agencies in a format other than routine monthly or quarterly reports. Note: This does not include routine offsite distribution of notification reports.

10.2.2 Release of Hazardous Substances/Regulated Pollutants/Oil

10.2.2.1 Emergency.

- Any actual or potential release of material to the environment that results in, or could result in, significant off-site consequences (e.g., need to relocate people, major wildlife kills, major wetland degradation, major aquifer contamination, need to secure downstream water supply intakes, etc.). Note: This event must also meet the criteria for classified emergency in accordance with WHC-CM-4-1 (WHC 1989e), and/or facility specific emergency action levels.
- Any release of hazardous substances or regulated pollutants in concentrations which exceed 5 times the respective reportable quantities specified for such materials in 40 CFR 302 EPA (1991b). Note: This event must also meet the criteria for classified emergency in accordance with WHC-CM-4-1 (WHC 1989e), and/or facility specific emergency action levels.

10.2.2.2 Unusual Occurrence.

- Release of a hazardous substance or regulated pollutant that exceeds a CERCLA reportable quantity in accordance with 40 CFR 302 (EPA 1991b) or exceeds a federally permitted release by a reportable quantity.
- Release of a hazardous substance, regulated pollutant, or oil that violates environmental requirements in federal permits, federal regulations, or DOE standards.
- Release below emergency levels that requires immediate (less than 4 hours) reporting to federal regulatory agencies or triggers specific levels for an outside federal agency.
- Any release of 100 gallons or more of oil.

10.2.2.3 Off-Normal.

- Release of a hazardous substance or regulated pollutant to controlled or uncontrolled areas that is not part of a normal, monitored release and exceeds 50 percent of a CERCLA reportable quantity as specified for such material in accordance with 40 CFR 302 (EPA 1991b).
- Any release of oil less than unusual occurrence levels but greater than 10 gallons.
- Any detection of a toxic or hazardous substance in a sanitary or storm sewer, waste or process stream, or any holding points where such a material is not expected.
- Any controlled, uncontrolled, or accidental release which is not classified as an unusual occurrence but which will be reported in writing to state/local agencies in a format other than routine monthly or quarterly reports. Note: This does not include routine offsite distribution of notification reports.
- Any controlled release of hazardous/regulated material that occurs as a monitored part of normal operations which exceeds what historical data and/or analysis shows is expected as a result of normal operations.
- Any general environmental monitoring where concentration increases to a level which exceeds what historical data and/or analysis shows is expected as a result of normal operations.

10.2.3 Discovery of Hazardous Material Contamination Due to DOE Operations

10.2.3.1 Emergency.

- Discovery of contamination that results or could result in significant consequences (i.e. exceeding safe exposure limits to workers or public). Note: This event must also meet the criteria for classified emergency in accordance with WHC-CM-4-1 (WHC 1989e) and/or facility specific emergency action levels.
- Discovery of onsite or offsite hazardous material contamination in concentrations that exceed 5 times the respective reportable quantities specified for such materials in 40 CFR 302 (EPA 1991b). Note: This event must also meet the criteria for classified emergency in accordance with WHC-CM-4-1 (WHC 1989e) and/or facility specific emergency action levels.

10.2.3.2 Unusual Occurrence.

- Discovery of on-site or off-site contamination due to DOE operations which does not represent an immediate threat to the public, that exceeds a reportable quantity for such materials in accordance with 40 CFR 302 (EPA 1991b).
- Any discovery of groundwater contamination that is not part of an existing plume previously identified either in an annual report or in any CERCLA/RCRA activity or report.

10.2.3.3 Off-Normal.

- Discovery of onsite contamination attributable to DOE operations that exceeds 50 percent of a reportable quantity for such material in accordance with 40 CFR 302 (EPA 1991b).

10.2.4 Agreement/Compliance Activities

10.2.4.1 Unusual Occurrence.

- Any agreement, compliance, remediation, or permit-mandated activity for which formal notification has been received from the relevant regulatory agency that a site plan is not satisfactory, or that a site is considered to be in noncompliance with schedules or requirements. Note: Formal notification must be received by WHC in writing.
- Any occurrence under any agreement or compliance area that requires notification of an outside regulatory agency within 4 hours or less, or triggers an outside regulatory agency action level, or otherwise indicates specific interest/concern from such agencies. Note: This does not include notifications made for radionuclide/hazardous material releases that are less than 50 percent of the reportable quantity as specified in 40 CFR 302 (EPA 1991b).

10.2.4.2 Off-Normal.

- Any occurrence under any agreement or compliance area that will be reported in writing to outside agencies in a format other than routine monthly or quarterly reports. Note: This does not include routine offsite distribution of notification reports.

10.2.5 Ecological Resources

10.2.5.1 Unusual Occurrence.

- Any occurrence causing significant impact to any ecological resource for which the DOE is a trustee (i.e. destruction of a critical habitat, damage to an historical/archeological site, or damage to wetlands).

10.3 FEDERAL REQUIREMENTS

10.3.1 Resource Conservation and Recovery Act of 1976

The RCRA requires biennial reports to be submitted to the regional administrator of EPA. The 40 CFR 262, Subpart D (EPA 1988a), sets forth the reporting requirements for generators of hazardous waste that ship waste offsite, or store, treat, or dispose of hazardous waste onsite.

Owners or operators of treatment, storage, or disposal (TSD) facilities must comply with the reporting requirements contained in 40 CFR 264, Subpart E (EPA 1988b) and 40 CFR 265, Subpart E (EPA 1988c).

10.3.2 Comprehensive Environmental Response, Compensation and Liability Act of 1980

The 40 CFR 302 (EPA 1991b) contains reportable quantities and notification requirements for releases of hazardous substances as designated by CERCLA and the *Safe Drinking Water Act*.

10.3.3 National Emission Standards for Hazardous Air Pollutants

Compliance and reporting requirements for DOE facilities emitting radionuclides other than Radon are contained in 40 CFR 61, Subpart H (EPA 1991a). The NESHAP requires that an annual report be submitted to EPA headquarters and the appropriate regional office.

10.4 STATE REQUIREMENTS

10.4.1 Generator Reporting

Generator reporting requirements are found in WAC 173-303-220 (WAC 1991e). The State requires that annual reports covering the preceding year be submitted by March 1 to Ecology.

10.4.2 Facility Reporting

Owners or operators of TSD facilities are also required to prepare and submit annual reports. These must be submitted by March 1 and cover facility activities for the previous year. The specific content requirements are specified in WAC 173-303-390 (WAC 1991e).

Effluents produced by PUREX while in transition to shutdown do not contain hazardous or dangerous wastes; therefore, PUREX operations are not subject to RCRA or WAC 173 reporting requirements. WHC would only have to

comply with the above federal and state reporting requirements in the event that the facility operations were to change, and discharges (either liquid or gaseous) from the PUREX facility contained a hazardous or dangerous components.

10.5 U.S. DEPARTMENT OF ENERGY REQUIREMENTS

10.5.1 U.S. Department of Energy Order 5400.1, Chapter II General Environmental Protection Program - Notification and Reports

Consistent with the notification requirements contained in DOE Orders 5484.1 (DOE 1983), 5000.3B (DOE 1993) and the DOE 5500 series, field organizations shall notify the Emergency Operations Center (EOC) of the significant nonroutine releases of any pollutant or hazardous substance.

All DOE facilities that conduct significant environmental protection programs shall prepare an annual site environmental report. Annual summary reports on environmental occurrences shall be included in the annual site environmental report. Suggested content and format for the annual site environmental report are contained in DOE Order 5400.1 (DOE 1991a).

The DOE Order 5400.1 also requires that a radioactive effluent and onsite discharge data report, covering the previous calendar year be submitted to the Waste Information Systems Branch, EG&G Idaho, in Idaho Falls, Idaho 83415, by April 1. Unplanned releases of radioactive material in effluents, whether onsite or offsite, shall also be reported. The content and forms to be used for these reports are contained in DOE Order 5400.1, Chapter II.

10.5.2 U. S. Department of Energy Order 5484.1 Environmental Protection, Safety and Health Protection Information Reporting Requirements

Annual radiation exposure reports for the preceding calendar year are required to be submitted to the System Safety Development Center by March 31. Content and form requirements are in Chapter IV of this order.

The DOE Order 5484.1 also requires radiation exposures of individuals that exceed the specified limits in one calendar quarter to be reported in the form of a memorandum to the Operational and Environmental Safety Division. Radiation exposure limits are listed in Chapter II of this order.

Events that occur in the facility and adversely affect operations, personnel safety, or DOE requirements should receive a thorough investigation and an investigation report should be prepared. The DOE Order 5484.1 (DOE 1983) sets forth occurrences requiring investigation as well as the investigation requirements as determined by the severity of the occurrence, investigation report format, and content outlines.

The RL Order 5484.1 contains the following requirements for the implementation of DOE Order 5484.1 at the Hanford Site. Contractors shall, at a minimum, make oral notification to the appropriate RL program division or office, to the Public Affairs Office (PAO), and to Safety and Quality Assurance (SQA) or the SQA duty officer as soon as it is apparent that an incident may meet the criteria of a Type A or Type B occurrence. A listing of occurrences requiring a Type A or Type B investigation is contained in Chapter I of DOE Order 5484.1.

Contractors are required to verbally notify responsible SQA environmental protection officials within 24 hours of becoming aware of any of the following occurrences:

- Violation of applicable federal, state, or local pollution control standards and requirements
- Any noncompliance with the terms and/or conditions of an existing National Pollutant Discharge Elimination System (NPDES) permit, PSD permit, or any other environmental protection based permit or formal agreement with an applicable regulatory body
- Any gaseous or liquid radiological effluent releases which exceed DOE requirements and/or contractor specific radiological release concentration guides.

11.0 INTERFACE WITH THE OPERATIONAL ENVIRONMENTAL MONITORING PROGRAM

11.1 DESCRIPTION

The sitewide Environmental Monitoring Plan (EMP), as described in the FEMP Management Plan (WHC 1991g), consists of two distinct but related components; environmental surveillance conducted by PNL and effluent monitoring conducted by WHC. The responsibilities for these two portions of the EMP are delineated in a Memorandum of Understanding (MOU 1989). Environmental surveillance, conducted by PNL, consists of surveillance of all environmental parameters to demonstrate compliance with regulations. Effluent monitoring includes both in-line and facility effluent monitoring as well as near-field (near-facility) operational environmental monitoring. Projected EDEs, reported in this FEMP, are the products of in-line effluent monitoring. Near-field monitoring is required by section 5.4, "Environmental Monitoring," *Environmental Compliance Manual* (WHC 1993), and procedures described in *Operational Environmental Monitoring* (WHC 1992d).

11.2 PURPOSE

The purpose of the Operational Environmental Monitoring Program (OEMP) is to provide facility-specific environmental monitoring to protect the environment adjacent to facilities under the responsibility of WHC and assure compliance with WHC requirements and local, state, and federal environmental regulations.

The objectives of the OEMP are to evaluate the following:

- Compliance with DOE, EPA, Ecology, WDOH, and internal WHC environmental radiation protection requirements and guides
- Performance of radioactive waste confinement systems
- Trends of radioactive materials in the environment at and adjacent to nuclear facilities and waste disposal sites.

Specifically, the OEMP is developed to:

- Monitor all inactive, existing, and new low-level waste (LLW) disposal sites to assess both radiological and nonradiological hazards (DOE Order 5820.2A).
- Determine the effectiveness of effluent treatment and controls in reducing effluents and emissions (DOE/EH-0173T, Page 1-1, Par. 1) (DOE/EV/1830-T5).
- Detect and quantify unplanned releases (DOE/EH-0173T, Page 1-1, Par. 2) (40 CFR 302) (WAC 173-303-145) (DOE 5000.3B) (DOE 5484.1).

- Monitor fugitive emissions and diffuse sources from contaminated areas for compliance with NESHAP (40 CFR 61), (DOE/EH-0173T, Pg. 3-4, 3.3.2), Toxic Air Emissions Inventory (40 CFR 265, Subparts AA & B13), State Operating Permit Program (40 CFR 70), and Source Registration (WAC 246-247).
- Monitor all surplus facilities before decontaminating or decommissioning (DOE Order 5820.2A).
- Monitor new and existing sites, processes, and facilities for potential impacts and releases (DOE Order 5484.1 and DOE/EH-0173T).
- Monitor and assess radioactive contamination and potential exposure to employees and the public (DOE Orders 5400.1 & 5400.5).

The purpose and justification for the OEMP is contained in WHC-CM-7-4, *Operational Environmental Monitoring*, WHC-CM-7-5, *Environmental Compliance*. The primary justification for the OEMP include the following:

- The OEMP provides a level of assurance to WHC that the effluent and contamination controls for the various facilities and waste sites are effective.
- The OEMP monitors a diversity of operations, activities, and programs managed by several different WHC organizations. Accordingly, the program direction and integration function performed by Environmental Engineering Studies (EES) is needed to assure program consistency, technical quality, and cost effectiveness.
- A secondary aspect of the OEMP is additional assurance beyond that provided by the Occupational Health and Safety Program that it is "OK" to work onsite and for visitors to safely tour the site.

11.3 BASIS

Near-field environmental surveillance is conducted to (1) monitor employee protection; (2) monitor environmental protection; and (3) ensure compliance with local, State, and Federal regulations. Compliance with parts of the following DOE orders, 40 CFRs, and WACs are addressed through this activity.

- DOE Order 5000.3B, *Occurrence Reporting and Processing of Operational Information*
- DOE Order 5400.1, *General Environmental Protection Program*
- DOE Order 5400.5, *Radiation Protection of the Public and the Environment*
- Order 5484.1, *Protection, Safety, and Health Protection Information Reporting System*

- Order 5820.2A, *Radioactive Waste Management*
- DOE/EH-0173T, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*
- DOE/1830-T5, *A guide to Reducing Radiation Exposure as Low as Reasonably Achievable (ALARA)*
- 40 CFR 61, "National Emission Standards for Hazardous Air Pollutants"
- 40 CFR 70, "State Operating Permit Programs"
- 40 CFR 265, Subpart AA and B13, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities"
- 40 CFR 302, "Designation, Reportable Quantities, and Notification"
- WAC 173-303-145, "Dangerous Waste Regulations (Spills and Discharges)"
- WAC 246-247, "Radiation Protection--Air Emissions."

11.4 MEDIA SAMPLED AND ANALYSES PERFORMED

Procedure protocols for sampling, analysis, data handling, and reporting are specified in WHC-CM-7-4. Media include ambient air, surface water, groundwater, external radiation dose, soil, sediment, vegetation, and animals at or near active and inactive facilities and/or waste sites. Parameters monitored include the following, as needed: pH, water temperature, radionuclides, radiation exposure, and hazardous constituents. Animals that are not contaminated, as determined by a field instrument survey, are released to a nonhazardous environment.

11.5 LOCATIONS

Samples are collected from known or suspected effluent pathways (e.g., downwind of potential releases, liquid streams, or proximal to release points). To avoid duplication, WHC relies on existing sample locations where PNL has previously established sample sites (e.g., air samplers in the 300 Area). There are 38 air samplers (4 in the 100 Area and 34 in the 200/600 Areas), 35 surface water sample sites (22 in the 100 Area and 13 in the 200/600 Areas), 110 groundwater monitoring wells (20 in the 100 Area, 89 in the 200/600 Areas, and 1 in the 300/400 Areas), 299 external radiation monitor points (182 survey points and 41 thermoluminescent dosimeter (TLD) sites in the 100 Area, 61 TLD sites in the 200/600 Areas, and 15 TLD sites in the 300/400 Areas), 157 soil sample sites (32 in the 100 Area, 110 in the 200/600 Areas, and 15 in the 300/400 Areas), and 95 vegetation sample sites (40 in the 100 Area, 40 in the 200/600 Areas, and 15 in the 300/400 Areas). Animal samples are collected at or near facilities and/or waste sites. Specific locations of sample sites are found in WHC-CM-7-4.

Surveys to detect surface radiological contamination, scheduled in WHC-SP-0098-5, are conducted near and on liquid waste disposal sites (e.g., cribs, trenches, drains, retention basin perimeters, pond perimeters, and ditch banks), solid waste disposal sites (e.g., burial grounds and trenches), unplanned release sites, tank farm perimeters, stabilized waste disposal sites, roads, and firebreaks in the Operations Areas. There are 391 sites in the Operations Areas (100 in the 100 Area, 273 in the 200/600 Areas, and 18 in the 300/400 Areas) where radiological surveys are conducted.

11.6 PROGRAM REVIEW

The near-field (operational environmental) monitoring program will be reviewed at least annually to determine that the appropriate effluents are being monitored and that the monitor locations are in position to best determine potential releases.

11.7 SAMPLER DESIGN

Sampler design (e.g., air monitors) will be reviewed at least biannually to determine equipment efficiency and compliance with current EPA and industry (e.g., ANSI and American Society for Testing and Materials [ASTM]) standards.

11.8 COMMUNICATION

The operations and engineering contractor and the research and development contractor will compare and communicate results of their respective monitoring programs at least quarterly and as soon as possible under upset conditions.

11.9 REPORTS

Results of the near-field operational environmental monitoring program are published in *Environmental Releases for Calendar Year 1992*, WHC-EP-0527-2 (WHC 1993d), and *WHC Operational Environmental Annual Report Calendar Year 1992*, WHC-EP-0573-1 (WHC 1993). The radionuclide values in these reports are expressed in curies, or portions thereof, for each radionuclide per unit weight of sample (e.g., picocuries per gram) or in field instrument values (e.g., counts per minute). Values are reported in this manner, rather than EDE, which is calculated as the summation of the products of the dose equivalent received by specified tissues of the body and a tissue-specific weighting factor.

12.0 QUALITY ASSURANCE

12.1 PURPOSE

The QAPjP (WHC 1992c) describes the QA requirements associated with implementing FEMPs. The plan identifies the FEMP activities and assigns the appropriate QA requirements defined by the WHC *Quality Assurance Manual*, WHC-CM-4-2 (WHC 1993e). The QAPjP shall be consistent with the requirements in DOE 5700.6C "Quality Assurance" (DOE 1991d). In addition, QA requirements in 40 CFR 61 (EPA 1990a), Appendix B, Method 114 shall be considered when performing monitoring calculations and establishing monitoring systems for airborne emissions.

12.2 OBJECTIVE

The plan was to provide a documented QA plan describing QA requirements for facilities implementing the FEMPs.

12.3 REQUIREMENTS

A QAPjP (WHC 1992c) has been developed to implement the overall QA program requirements defined by WHC-CM-4-2 (WHC 1993e) and 40 CFR 61, Method 114, Appendix B (EPA 1991a). The QAPjP applies specifically to the field activities, laboratory analyses, and continuous monitoring performed for all FEMPs by WHC. Plans and procedures referenced in the QAPjP are available for regulatory review upon request by the direction of the Westinghouse Hanford Effluent and Emission Monitoring manager. A QAPjP for Radioactive Airborne Emissions Monitoring (WHC 1993f), was prepared to address the QA elements of 40 CFR 61 and was submitted to the EPA.

· This page intentionally left blank. ·

13.0 INTERNAL AND EXTERNAL PLAN REVIEW

The DOE Order 5400.1, *General Environmental Protection Program* (DOE 1991a), Chapter IV.4 requires the facility effluent monitoring plan be reviewed annually and updated every 3 years. The FEMP should be reviewed and updated as necessary after each major change or modification in the facility processes, facility structure, ventilation and liquid collection systems, monitoring equipment, or waste treatment, or for a significant change to the safety analysis reports. In addition, EPA regulations require that records on the results of radioactive airborne emissions monitoring be maintained onsite for 5 years. Operations management shall maintain records of reports on measurements of stack particulates or other nonradioactive hazardous pollutant emissions for 3 years.

Facility operators will have to certify on a semiannual basis that no changes in operations that would require new testing have occurred. Although the report is based on the calendar year, the emission limits apply to any period of 12 consecutive months. Westinghouse Hanford Effluent and Emissions Monitoring prepares an annual effluent discharge report for each area on the Hanford Site to cover both airborne and liquid release pathways. In addition, a report on the air emissions and compliance to the NESHAP is prepared by Effluent and Emission Monitoring and submitted to EPA as well as to DOE Headquarters.

Facility management is required to obtain the Effluent and Emission Monitoring function's approval for all changes to the FEMPs, including those generated in the annual review and update. In addition, the FEMP shall be reviewed by QA and Regulatory Analysis.

Contractor management is responsible for assigning appropriate personnel to perform the reviews, assessments, and approvals as required, and for maintaining this documentation. The DOE may require additional reviews, as necessary, to ensure program integrity.

· This page intentionally left blank. ·

14.0 COMPLIANCE ASSESSMENT

A comparison of M/S system capabilities with regulatory and other requirements was conducted to determine which areas were not in compliance. This section summarizes that comparison. A detailed point-by-point evaluation of the NESHAP requirements (EPA 1991a) is included in Tables 14-1 and 14-2.

14.1 COMPLIANCE ASSESSMENT

14.1.1 Comparison of Instrument Specifications with Required Standard

The existing air effluent M/S system of near-isokinetic continuous sampling with periodic analysis of the resultant samples complies with 40 CFR 61, Subpart H. Laboratory analysis and chain-of-custody procedures are adequate to maintain sample accuracy and reliability. QA elements are addressed in the *Quality Assurance Program Plan for Radionuclide Airborne Emissions Monitoring*, WHC-EP-0536-1, (WHC 1993).

Current water effluents are periodically sampled and analyzed. This technique meets established standards for discharge to the 216-B-3C Expansion Pond. Future discharge to SALDS will be under a negotiated permit. Comparison to as-yet-to-be-defined discharge criteria, which are the result of the negotiation process, is not possible.

14.1.2 Comparison of Instrument Specifications with Monitoring Criteria

The current air monitoring systems with its capability of continuous, near-isokinetic sampling followed by periodic analyses achieve full compliance with monitoring criteria. Water effluent monitoring criteria of flow, pH and chemical composition are also fully met by the existing M/S system.

14.1.3 Comparison of Instrument Specifications with Effluent Characteristics

Existing monitoring equipment for both the air and water effluent streams have the capability to accurately characterize the stream's general parameters such as flow rate, loss of flow, temperature, and pH. These general parameters are also appropriate to indicate changes in the effluents. Laboratory analysis can be selected to characterize any desired effluent parameter.

14.1.4 Comparison of Projected Effluent Characteristics with Historical Data

Historical data used to project effluent characteristics throughout this FEMP reflect the current transition to shutdown conditions at PUREX. Projected emissions characteristics should remain the same as the most recent historical data, which reflect projected transition to shutdown conditions.

14.1.5 Comparison of Effluent Monitoring Capabilities with Regulatory and Contractor Requirements

Effluent monitoring capabilities for both the air and water discharges meet both regulatory and WHC requirements, with the exception noted in Section 14.1.1.

14.2 EXEMPTIONS

No current or pending exemptions have been identified.

14.3 SYSTEM UPGRADES REQUIRED FOR COMPLIANCE

No system upgrades are currently required.

14.4 CLEAN AIR ACT REQUIREMENTS

The NESHAP requirements are discussed in Table 14-1 for the main stack and Table 14-2 for the PR stack. (NOTE: Tables 14-1 and 14-2 blocks not filled in are either not applicable or covered in explanatory remarks.)

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
40 CFR 61, Subpart H [61.90-61.97], National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities			

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
61.92 Standard Emissions of radionuclides to the ambient air from Department of Energy facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/yr.		Yes	Dose calculations for atmospheric radionuclide releases from the Hanford Site for calendar year (CY) 1990 were performed by Pacific Northwest Laboratory (PNL) using the approved U.S. Environmental Protection Agency (EPA) CAP-88 computer model. Emissions from discharge points in the Hanford Site 100, 200, 300, 400, and 600 areas were calculated based on results of analyses of continuous and periodic sampling conducted at the discharge points. These calculated emissions were provided for inclusion in the CAP-88 model by area and by individual facility for those facilities having the potential to contribute more than 10% of the Hanford Site total or to result in an impact of greater than 0.1 mrem per year to the maximally exposed individual (MEI). Also included in the assessment of offsite dose modeling are the measured radioactive emissions from all Hanford Site stacks that have routine monitoring performed. Record sampling systems have been installed on all stacks and vents that use exhaust fans to discharge air that may potentially carry airborne radioactivity. Estimation of activity from ingrowth of long-lived radioactive progeny is not included in the CAP-88 model; therefore, the Hanford Site GENII code (Napier et al. 1988) was used to supplement the CAP-88 dose calculations. When the dose to the MEI located in the Ringold area was calculated, the EDE from combined Hanford Site radioactive airborne emissions was shown to be 9.3E-03 mrem. This value was reported in the annual air emissions report prepared for the Hanford Site (RL 1991).

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
61.93 Emission monitoring and test procedures (a) To determine compliance, radionuclide emissions shall be determined and effective dose equivalent values for the maximally exposed offsite individual calculated using EPA approved sampling procedures, computer models CAP-88 or AIRDOS-PC, or other procedures for which EPA has granted prior approval.		Yes	Dose calculations for atmospheric radionuclide releases from the Hanford Site for CY 1990 were performed by PNL using the approved EPA CAP-88 computer model. Emissions from discharge points in the Hanford Site 100, 200, 300, 400, and 600 areas were calculated based on results of analyses of continuous and periodic sampling conducted at the discharge points. These calculated emissions were provided for inclusion in the CAP-88 model by area and by individual facility for those facilities having the potential to contribute more than 10% of the Hanford Site total or to result in an impact of >0.1 mrem/yr to the maximally exposed individual. Activity estimates from ingrowth of long-lived radioactive progeny is not included in the CAP-88 model; therefore, the Hanford Site GENII code (Napier et al. 1988) was used to supplement the CAP-88 dose calculations. When the dose to the maximally exposed individual located in the Ringold area was calculated, the EDE from combined Hanford Site radioactive airborne emissions was shown to be 9.3E-03 mrem. This value was reported in the annual air emissions report prepared for the Hanford Site (RL 1991).
(b) Stacks shall be measured in accordance with the following requirements or other procedures for which EPA has granted prior approval: (1) Effluent flow rate measurements shall be made using the following: (i) Reference Method 2 of Appendix A to part 60 for large stacks.	Drawing H-2-55021 (WHC 1992a).	No	Based on the above drawing, the velocity measuring location used by Hanford Site Vent and Balance personnel has a cross-sectional area sufficient to be considered a large stack; therefore, Reference Method 2 applies.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
(ii) Reference Method 2A of Appendix A to part 60 for small stacks. (iii) Frequency of measurements shall depend on the variability of the effluent flow rate. For variable flow rates, continuous or frequent flow rate measurements shall be made. For relatively constant flow rates only periodic measurements are necessary.		Equivalent	Due to the frequent fluctuations in stack flow rate, Reference Method 2 is not used. Instead, the flow is measured continuously, as described in Section 4.3.7 of Method 114.
(2) Radionuclides shall be directly monitored or extracted, collected and measured using the following: (i) Reference Method 1 of Appendix A part 60 shall be used to select monitoring or sampling sites.	See point-by-point comparison with Method 1, Section 2.1.	Yes	
(ii) The effluent stream shall be directly monitored continuously with an inline detector or representative samples of the effluent stream shall be withdrawn continuously from the sampling site following the guidance of ANSI N13.1-1969 (including Appendix A of ANSI N13.1).	See point-by-point comparison with ANSI N13.1.	Yes	
(iii) Radionuclides shall be collected and measured using procedures based on the principles of measurement described in Appendix B, Method 114 [of part 61]. Other methods must have prior approval from EPA.	See point-by-point comparison with Method 114.	Yes	
(iv) A QA program meeting Appendix B, Method 114 [of part 61] shall be conducted.	See point-by-point comparison with Method 114.	Yes	

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
(3) When impractical to measure as in (b)(1) or to monitor or sample as in (b)(2), see this section for further requirements. (4) (i) Measurements shall be made at all release points which have a potential to discharge radionuclides into the air in quantities which could cause an effective dose equivalent (EDE) in excess of 1% of the standard. All radionuclides which could contribute >10% of the EDE shall be measured. For other release points with potential to release radionuclides, periodic confirmatory measurements shall be made.		Yes	WHC-IP-0178 indicates that this stack should be measured.
(ii) In evaluating the potential of a release point to discharge radionuclides into the air, for the purpose of this section, the estimated rad release rates shall be based on the discharge of the effluent stream that would result if all pollution control equipment did not exist, but the facility operations were otherwise normal.	FEMP	Yes	Offsite dose calculations were performed on all stacks (registered with the Washington Department of Health under Permit FF-01) without pollution control equipment and using the PNL unit dose conversions. A total of seven Hanford Site stacks exceeded the 0.1-mrem criterion and will require continuous monitoring in accordance with provisions of 40 CFR 61.93(b).

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
(5) Environmental measurements of rad air concentrations at critical receptor locations may be used instead of air dispersion calculations if: (i) Air at point of measurement shall be continuously sampled. (ii) Major contributing radionuclides to the EDE must be collected and measured. (iii) Rad concentrations causing an EDE of 10% of the standard shall be readily detectable and distinguishable from background. (iv) Net measured rad concentrations shall be compared to the concentration levels in Table 2 of App. E [part 61] to determine compliance with the standard. In the case of multiple rads, compliance is demonstrated if the value for all rad is less than the concentration levels in Table 2, and the sum of the fractions that result when each measured concentration value is divided by the value in Table 2 for each rad is >1. (v) A program for quality assurance shall be conducted meeting the requirements of App. B, Method 114 [part 61]. (vi) Use of environmental measurements to demonstrate compliance with the standard if subject to prior approval of EPA.		Not applicable.	Air dispersion calculations are performed.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
61.94 Compliance and reporting. (a) Compliance with this standard shall be determined by calculating the highest EDE to any member of the public at any offsite point where there is a residence, school, business, or office. Each facility shall submit an annual report to both EPA HQ and Regional by June 30, which includes monitoring results and dose calculations required by 61.43 (a) for the previous calendar year.		Yes	The Ringold location was chosen several years ago as the area where the offsite dose from all air pathways would be the highest for the MEI for the Hanford Site. The selection of Ringold was made because nearly all of the dose from air releases in recent years has been contributed by radionuclides from the Plutonium-Uranium Extraction (PUREX) plant stack. The Ringold area is the closest farming area to the PUREX Plant, and it realistically matches the assumption that the MEI diet consists of 100% home-grown food. The Ringold area has historically been capable of producing all of the items in the MEI diet with the possible exception of cereal grain. The Ringold area lies very nearly in the path of the prevailing winds from the 200 East area. The atmospheric dispersion factor (X/Q) at Ringold is historically within 10% to 20% of the maximum offsite X/Q value associated with 200 Areas releases. The maximum value usually occurs in an adjacent sector where there is no farming. The U.S. Department of Energy Field Office, Richland (RL), provided the annual report for CY 1990 (RL 1991) to U.S. Department of Energy, Headquarters; EPA, Region X, personnel; and Washington Department of Health personnel in compliance with the regulatory deadline.
(b) The annual report shall also include:		Yes	(Future annual reports will also address the following requirements.)
(1) Name and location of facility.	RL-91-10, Pages 1-6 through 1-29. The Hanford site summary is discussed on Pages 1-1 through 1-5.	Yes	

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
(2) List of radioactive materials used at the facility.	RL-91-10, Table 2-1 on Pages 2-2 through 2-13.	Yes	Refer to explanatory remarks for 40 CFR 61.93(b)(4)(i) above.
(3) Description of handling and processing of rad materials at the facility.	RL-91-10, Pages 1-6 through 1-29.	Yes	
(4) List of the stacks and vents (or other points where radioactive materials are released to the atmosphere.	RL-91-10, Pages 1-6 through 1-29.	Yes	
(5) A description of the effluent controls that are used on each stack vent of release point, and an estimate of the efficiency of each control device.	RL-91-10, Table 2-1 on Pages 2-2 through 2-13.	Yes	
(6) Distances from the points of release to the nearest residence, school, business or office and the nearest farms producing vegetables, milk, and meat.	RL-91-10, Tables 3-2, 3-3, in Section 3.	Yes	These tables show the CAP-88 Dose Estimates for the Offsite Individual at Ringold Exposed to Radionuclide Emissions from Hanford Site During 1990. Please also refer to explanatory remarks for 40 CFR 61.94 above.
(7) The values used for all other input parameters for the computer models (meteorological data) and the source of these data.	RL-91-10. Input parameters are shown in Table 2-1, Pages 2-2 through 2-13. Annual average dispersion factors around the 100, 200, 300, and 400 Areas during 1990 are given in Tables 3-5 through 3-8.	Yes	These tables use site-specific measurements of the occurrence frequencies for wind speed, wind direction, and atmospheric stability. The products of the dispersion models are annual average dispersion factors (X/g', in units of Ci/m ³ per Ci/s or s/m') that, when combined with annual average release rates, will predict average radionuclide air concentrations for the year.
(8) A brief description of all construction and modifications which were completed in the calendar year for which the report is prepared, but for which the requirement to apply for approval to construct or modify was waived under 61.96.	RL-91-10, Section 3.5.2, discusses an "Application For Approval of Construction of the In Situ Vitrification Project."	Yes	

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
(2) Each report shall be signed and dated by a corporate officer or public official in charge of the facility and containing a declaration of belief of accuracy and truth of the report.	RL-91-10, page 3-13, signed by John D. Wagoner, Manager, RL.	Yes	
(c) If the facility is not in compliance with the emission limits of 61.96 in the calendar year, reporting the information in (b) [above] must be done on a monthly basis starting immediately following the noncompliance annual report. Monthly reports shall also include:		Yes	Draft PUREX Plant Stack Monitoring Regulatory Comparisons for Stack 291-A-1 shows that this stack is in compliance.
(1) Controls or other changes installed to bring the facility into compliance. (2) If the facility is under a judicial or administrative enforcement decree, the report will describe the facility performance under the terms of the decree. (d) If this information is classified, it will be made available to EPA separately and handled in accordance with regulations.		Not applicable	This information is not classified.
61.95 Recordkeeping requirements. All facilities must maintain records documenting the source of input parameters including the results of all measurements, calculations, analytical methods, and procedure for determining EDE. Sufficient information to allow an independent auditor to verify the accuracy should be kept. The records must be kept at the site for at least five years and must be made available upon request to an authorized representative.		Yes	All records and data used in the generation and verification of regulatory reports are controlled in accordance with WHC-CH-4-2, QR 4.0, "Document Control," and QR 17.0, "Quality Assurance Records."

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
61.96 Applications to construct or modify. In addition to construction as defined under 40 CFR 61 A, any fabrication, erection or installation of a new building or structure within a facility that emits radionuclides is also defined as new construction for purposes of 40 CFR 61 A. (b) Application for approval [61.07] or notification of startup [61.09] does not need to be filed for any new construction or modification if the EDE caused by all emissions from the new construction or modification is less than 1% of the standard of 61.92. EDE shall be calculated using the source term derived from Appendix D as input to dispersion described in 61.93. A facility is eligible for this exemption only if it is in compliance based on its last annual report. (c) Conditions to approvals granted under 61.08 will not contain requirements for post approval reporting on operating conditions beyond those specified in 61.94.		Not applicable	
61.97 Exemption from the reporting and testing requirements of 40 CFR 61.10. All facilities designated under subpart H are exempt from the reporting requirements of 40 CFR 61.10.			

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
40 CFR 60, APPENDIX A, REFERENCE METHOD 2, DETERMINATION OF STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE (TYPE S PITOT TUBE)			Due to frequent fluctuations in stack flow rate, Reference Method 2 is not used for demonstrating compliance. Instead, the flow is measured continuously, as described in Section 4.3.7 of Method 114. Pitot traverses are performed as a check on the accuracy of the continuous flow instrumentation.
1.0 Principle and Applicability 1.1 Principle. The average gas velocity in a stack is determined from the gas density and from measurement of the average velocity head with a Type S (Stausscheibe or reverse type) pitot tube.	7-GN-56 (WHC 1991c).		Average gas velocity is determined by averaging the results of exhaust duct traverses which have been conducted using a standard pitot tube and typically an Air Electronics Limited MP Series 4 Autozero Digital Micromanometer (see description of this latter instrument in Section 2.2 below). Procedure 7-GN-56 indicates that traverse locations are determined in accordance with Section 9 of the American Industrial Hygiene Association Industrial Ventilation manual rather than EPA Method 1.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
1.2 Applicability. This method is applicable for measurement of the average velocity of a gas stream and for quantifying gas flow. This procedure is not applicable at measurement sites which fail to meet the criteria of Method 1, Section 2.1. Also, the method cannot be used for direct measurement in cyclonic or swirling gas streams; Section 2.4 of Method 1 shows how to determine cyclonic or swirling flow conditions. When unacceptable conditions exist, alternative procedures, subject to the approval of the Administrator, U.S. Environmental Protection Agency, must be employed to make accurate flow rate determinations; examples of such alternative procedures are: (1) to install straightening vanes; (2) to calculate the total volumetric flow rate stoichiometrically; or (3) to move to another measurement site at which the flow is acceptable.			At the traverse location used by Vent and Balance the duct cross section is a 66 in. by 83 in. rectangle with an equivalent diameter of 6 ft. The distance between the nearest upstream and downstream disturbances is less than 50 ft. The eight- and two-diameter criterion of Method 1, Section 2.1, is, therefore, not met.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.0 Apparatus Specifications for the apparatus are given below. Any other apparatus that has been demonstrated (subject to approval of the Administrator) to be capable of meeting the specifications will be considered acceptable. 2.1 Type S Pitot Tube. The Type S pitot tube (Figure 2-1) shall be made of metal tubing (e.g., stainless steel). It is recommended that the external tubing diameter (dimension Dt Figure 2-2b) be between 0.48 and 0.95 centimeter (3/16 and 3/8 inch). There shall be an equal distance from the base of each leg of the pitot tube to its face-opening plane (dimensions PA and PB Figure 2-2b); it is recommended that this distance be between 1.05 and 1.50 times the external tubing diameter. The face openings of the pitot tube shall, preferably, be aligned as shown in Figure 2-2; however, slight misalignments of the openings are permissible (see Figure 2-3). The Type S pitot tube shall have a known coefficient, determined as outlined in Section 4. An identification number shall be assigned to the pitot tube; this number shall be permanently marked or engraved on the body of the tube.			

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
(2.1 continued) A standard pitot tube may be used instead of a Type S, provided that it meets the specifications of Sections 2.7 and 4.2: note, however, that the static and impact pressure holes of standard pitot tubes are susceptible to plugging in particulate-laden gas streams. Therefore, whenever a standard pitot tube is used to perform a traverse adequate proof must be furnished that the openings of the pitot tube have not plugged up during the traverse period; this can be done by taking a velocity head ΔP reading at the final traverse point, cleaning out the impact and static holes of the standard pitot tube by "back-purging" with pressurized air, and then taking another ΔP reading. If the ΔP readings made before and after the air purge are the same (± 5 percent), the traverse is acceptable. Otherwise, reject the run. Note that if ΔP at the final traverse point is unsuitably low, another point may be selected. If "back-purging" at regular intervals is part of the procedure, then comparative ΔP readings shall be taken, as above, for the last two back purges at which suitably high ΔP readings are observed.	7-GN-56		The standard pitot tube is used in conjunction with a digital micromanometer to determine stack velocities. Document 7-GN-56 does not reference procedures used to prove that pitot tube openings have plugged during velocity measurements, however, because the measurement locations are positioned downstream from high-efficiency particulate air (HEPA) filter banks, it is unlikely that plugging of tube openings occurs. Consideration will be given to modifying the procedures to include a pressure differential measurement after the last traverse.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.2 Differential Pressure Gauge. An inclined manometer or equivalent device is used. Most sampling trains are equipped with a 10-in. (water column) inclined-vertical manometer, having 0.01-in. H₂O divisions on the 0- to 1-in. inclined scale, and 0.1-in. H₂O divisions on the 1- to 10-in. vertical scale. This type of manometer (or other gauge of equivalent sensitivity) is satisfactory for the measurement of ΔP values as low as 1.3 mm (0.05 in.) H₂O. However, a differential pressure gauge of greater sensitivity shall be used (subject to the approval of the Administrator), if any of the following is found to be true: (1) the arithmetic average of all ΔP readings at the traverse points in the stack is less than 1.3 mm (0.05 in.) H₂O; (2) for traverses of 12 or more points, more than 10 percent of the individual ΔP readings are below 1.3 mm (0.05 in.) H₂O; (3) for traverses of fewer than 12 points, more than one ΔP reading is below 1.3 mm (0.05 in.) H₂O. Citation 18 in Section 6 describes commercially available instrumentation for the measurement of low-range gas velocities. As an alternative to criteria (1) through (3) above, the following calculation may be performed to determine the necessity of using a more sensitive differential pressure gauge: (see equation 40 CFR Pt. 60 App. A, Meth. 2, page 645) If T is greater than 1.05, the velocity head data are unacceptable and a more sensitive differential pressure gauge must be used.			

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
(2.2 continued) NOTE: If differential pressure gauges other than inclined manometers are used (e.g., magnetic gauges) their calibration must be checked after each test series. To check the calibration of a differential pressure gauge, compare ΔP readings of the gauge with those of a gauge-oil manometer at a minimum of three points, approximately representing the range of ΔP values in the stack. If, at each point, the values of ΔP as read by the differential pressure gauge and gauge-oil manometer agree to within 5 percent, the differential pressure gauge shall be considered to be in proper calibration. Otherwise, the test series shall either be voided, or procedures to adjust the measured ΔP values and final results shall be used subject to the approval of the Administrator.	7-GN-56 and manufacturer's product literature.		An Air Neutronics MP Series 4 Autozero Digital Micromanometer (Air Neutronics Limited) is typically used to determine differential pressure and flow velocity. This instrument consists of a differential capacitance transducer and internal electronics that allow the instrument to calculate and display corrected velocity readings directly from pitot tube probes. Dynamic pressure signals from pitot static and total head tubes are automatically corrected within the instrument and displayed in feet per minute. The instrument is capable of resolving pressure to 0.001 in. H₂O (according to manufacturer's literature). Procedure 7-GN-56 requires that the instrument carry a current calibration sticker, traceable to NIST. No post-test series comparison against a gauge-oil manometer is indicated in Procedure 7-GN-56.
2.3 Temperature Gauge. A thermocouple, liquid-filled bulb thermometer, bimetallic thermometer, mercury-in-glass thermometer, or other gauge, capable of measuring temperature to within 1.5 percent of the minimum absolute stack temperature shall be used. The temperature gauge shall be attached to the pitot tube such that the sensor tip does not touch any metal; the gauge shall be in an interference-free arrangement with respect to the pitot tube face openings (see Figure 2-1 and also Figure 2-7 in Section 4). Alternate positions may be used if the pitot tube-temperature gauge system is calibrated according to the procedure of Section 4, provided that a difference of not more than 1 percent in the average velocity measurement is introduced, the temperature gauge need not be attached to the pitot tube; this alternative is subject to the approval of the Administrator.	7-GN-56		Temperatures are not measured. The density program internal to the micromanometer described above is used to compensate for temperature. Depending on process conditions, the correction to reported velocity values derived from the actual measurement of stack gas temperatures may be minimal.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.4 Pressure Probe and Gauge. A piezometer tube and mercury- or water-filled U-tube manometer capable of measuring stack pressure to within 2.5 mm (0.1 in.) Hg is used. The static tap of a standard type pitot tube or one leg of a Type S pitot tube with the face opening planes positioned parallel to the gas flow may also be used as the pressure probe.	7-GH-56		The static tap of a standard pitot tube is used to measure stack pressure.
2.5 Barometer. A mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg) may be used. In many cases, the barometric reading may be obtained from a nearby National Weather Service station, in which case the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and the sampling point shall be applied at a rate of minus 2.5 mm (0.1 in.) Hg per 30-meter (100 foot) elevation increase or vice-versa for elevation decrease.	7-GH-56		Barometric pressures are not measured. The density program internal to the micromanometer is set for standard conditions (70 °F and 29.92 in. mercury). This introduces minimal error provided the temperature of the air stream varies no more than 30 °F from standard air, the altitude of the site does not exceed 1,000 ft above sea level, or the moisture content of the air is 0.02 lb/lb of dry air or less.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.5 Alternative Measurement Site Selection Procedure. This alternative applies to sources where measurement locations are less than 2 equivalent stack or duct diameters downstream or less than one-half duct diameter upstream from a flow disturbance. The alternative should be limited to ducts larger than 24 in. in diameter where blockage and wall effects are minimal. A directional flow-sensing probe is used to measure pitch and yaw angles of the gas flow at 40 or more traverse points; the resultant angle is calculated and compared with acceptable criteria for mean and standard deviation. NOTE: Both the pitch and yaw angles are measured from a line passing through the traverse point and parallel to the stack axis. The pitch angle is the angle of the gas flow component in the plane that INCLUDES the traverse line and is parallel to the stack axis. The yaw angle is the angle of the gas flow component in the plane PERPENDICULAR to the traverse line at the traverse point and is measured from the line passing through the traverse point and parallel to the stack axis.			Not applicable. The measurement site is more than two equivalent duct diameters downstream and one-half equivalent duct diameter upstream from the nearest disturbances.
2.6 Gas Density Determination Equipment. Method 3 equipment, if needed (see Section 3.6), to determine the stack gas dry molecular weight, and Reference Method 4 or Method 5 equipment for moisture content determination; other methods may be used subject to approval of the Administrator.	7-GN-56		Stack gas moisture content is not determined. Depending on process conditions, however, the correction to reported velocity values derived from the actual measurement of both stack dry molecular weight and moisture content may be minimal. The PUREX Plant is presently transitioning to shutdown and moisture content will be minimal.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.7 Calibration Pitot Tube. When calibration of the Type S pitot tube is necessary (see Section 4), a standard pitot tube is used as a reference. The standard pitot tube shall, preferably, have a known coefficient, obtained either (1) directly from the National Bureau of Standards, Route 270, Quince Orchard Road, Gaithersburg, Maryland, or (2) by calibration against another standard pitot tube with an NBS-traceable coefficient. Alternatively, a standard pitot tube designed according to the criteria given in 2.7.1 through 2.7.5 below and illustrated in Figure 2-4 (see also Citations 7, 8, and 17 in Section 6) may be used. Pitot tubes designed according to these specifications will have baseline coefficients of about 0.99 ± 0.01 .	7-GN-56		Not applicable, since the Type S pitot tube is not used to measure velocity.
2.7.1 Hemispherical (shown in Figure 2-4), ellipsoidal, or conical tip.	Manufacturer's print 72-000031-00 (F. W. Dwyer Manufacturing Company, Michigan City, Indiana).		The standard pitot tubes used are procured commercially from sources such as F. W. Dwyer Manufacturing Company. They are constructed to standards outlined in Section 2.7 and contain hemispherical tips.
2.7.2 A minimum of six diameters straight run (based upon D, the external diameter of the tube) between the tip and the static pressure holes.	Manufacturer's print 72-000031-00 (F. W. Dwyer Manufacturing Company, Michigan City, Indiana).		A minimum of six diameters straight run between tip and static pressure holes is provided.
2.7.3 A minimum of eight diameters straight run between the static pressure holes and the centerline of the external tube, following the 90 degree bend.	Manufacturer's print 72-000031-00 (F. W. Dwyer Manufacturing Company, Michigan City, Indiana).		A minimum of eight diameters straight run between the static pressure holes and the centerline of the external tube is provided.
2.7.4 Static pressure holes of equal size (approximately 0.1 D), equally spaced in a piezometer ring configuration.	Manufacturer's print 72-000031-00 (F. W. Dwyer Manufacturing Company, Michigan City, Indiana).		The above criteria are met by the manufacturer.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.7.5 Ninety degree bend, with curved or mitered junction.	Manufacturer's print 72-000031-00 (F. W. Dwyer Manufacturing Company, Michigan City, Indiana).		The above criteria are met by the manufacturer.
2.8 Differential Pressure Gauge for Type S Pitot Tube Calibration. An inclined manometer or equivalent is used. If the single-velocity calibration technique is employed (see Section 4.1.2.3), the calibration differential pressure gauge shall be readable to the nearest 0.13 mm H ₂ O (0.005 in. H ₂ O). For multivelocity calibration, the gauge shall be readable to the nearest 0.13 mm H ₂ O (0.005 in. H ₂ O) for ΔP values between 1.3 and 25 mm H ₂ O (0.05 and 1.0 in. H ₂ O), and to the nearest 1.3 mm H ₂ O (0.05 in. H ₂ O) for ΔP values above 25 mm H ₂ O (1.0 in. H ₂ O). A special, more sensitive gauge will be required to read ΔP values below 1.3 mm H ₂ O [0.05 in. H ₂ O] (see Citation 18 in Section 6).	7-GN-56		Not applicable. The Type S pitot tube is not used.
3.0 Procedure Procedures described in these sections shall be used to determine the stack velocity when the Type S pitot tube is used.	7-GN-56		Not applicable. The Type S pitot tube is not used.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.1 Set up the apparatus as shown in Figure 2-1. Capillary tubing or surge tanks installed between the manometer and pitot tube may be used to dampen ΔP fluctuations. It is recommended, but not required, that a pretest leak-check be conducted, as follows: (1) blow through the pitot impact opening until at least 7.6 cm (3 in.) H_2O velocity pressure registers on the manometer; then, close off the impact opening. The pressure shall remain stable for at least 15 seconds; (2) do the same for the static pressure side, except using suction to obtain the minimum of 7.6 cm (3 in.) H_2O. Other leak check procedures, subject to the approval of the Administrator, may be used. 3.2 Level and zero the manometer. Because the manometer level and zero may drift due to vibrations and temperature changes, make periodic checks during the traverse. Record all necessary data as shown in the example data sheet (Figure 2-5). 3.3 Measure the velocity head and temperature at the traverse points specified by Method 1. Ensure that the proper differential pressure gauge is being used for the range of ΔP values encountered (see Section 2.2). If it is necessary to change to a more sensitive gauge, do so, and remeasure the ΔP and temperature readings at each traverse point. Conduct a post-test leak-check (mandatory), as described in Section 3.1 above, to validate the traverse run. 3.4 Measure the static pressure in the stack. One reading is usually adequate. 3.5 Determine the atmospheric pressure.			

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.6 Determine the stack gas dry molecular weight. For combustion processes or processes that emit essentially CO ₂ , O ₂ , CO and N ₂ , use Method 3. For processes emitting essentially air, an analysis need not be conducted; use a dry molecular weight of 29.0. For other processes, other methods, subject to the approval of the Administrator, must be used.			
3.7 Obtain the moisture content from Reference Method 4 (or equivalent) or from Method 5.			
3.8 Determine the cross-sectional area of the stack or duct at the sampling location. Whenever possible, physically measure the stack dimensions rather than using blueprints.			

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.1 Type S Pitot Tube. Before its initial use, carefully examine the Type S pitot tube in top, side, and end views to verify that the face openings of the tube are aligned within the specifications illustrated in Figure 2-2 or 2-3. The pitot tube shall not be used if it fails to meet these alignment specifications. After verifying the face opening alignment, measure and record the following dimensions of the pitot tube: (a) the external tubing diameter (dimension D_t, Figure 2-2b); and (b) the base-to-opening plane distances (dimensions $P_{A'}$ and $P_{B'}$, Figure 2-2b). If D_t is between 0.48 and 0.95 cm (3/16 and 3/8 in.) and if $P_{A'}$ and $P_{B'}$ are equal and between 1.05 and 1.50 in., there are two possible options: (1) the pitot tube may be calibrated according to the procedure outlined in Sections 4.1.2 through 4.1.5 below, or (2) a baseline (isolated tube) coefficient value of 0.84 may be assigned to the pitot tube. Note, however, that if the pitot tube is part of an assembly, calibration may still be required, despite knowledge of the baseline coefficient value (see Section 4.1.1). If D_t, $P_{A'}$, and $P_{B'}$ are outside the specified limits, the pitot tube must be calibrated as outlined in 4.1.2 through 4.1.5 below.	7-GN-56		Not applicable.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.1.1 Type S Pitot Tube Assemblies. During sample and velocity traverses, the isolated Type S pitot tube is not always used; in many instances, the pitot tube is used in combination with other source-sampling components (thermocouple, sampling probe, nozzle) as part of an "assembly." The presence of other sampling components can sometimes affect the baseline value of the Type S pitot tube coefficient (Citation 9 in Section 6); therefore an assigned (or otherwise known) baseline coefficient value may or may not be valid for a given assembly. The baseline and assembly coefficient values will be identical only when the relative placement of the components in the assembly is such that aerodynamic interference effects are eliminated. Figures 2-6 through 2-8 illustrate interference-free component arrangements for Type S pitot tubes having external tubing diameters between 0.48 and 0.95 cm (3/16 and 3/8 in.). Type S pitot tube assemblies that fail to meet any or all of the specifications of Figures 2-6 through 2-8 shall be calibrated according to the procedure outlined in Sections 4.1.2 through 4.1.5 below, and prior to calibration, the values of the intercomponent spacings (pitot-nozzle, pitot-thermocouple, pitot-probe sheath) shall be measured and recorded. NOTE: Do not use any Type S pitot tube assembly which is constructed such that the impact pressure opening plane of the pitot tube is below the entry plane of the nozzle (see Figure 2-6b).			

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.1.2 Calibration Setup. If the Type S Pitot tube is to be calibrated, one leg of the tube shall be permanently marked A, and the other, B. Calibration shall be done in a flow system having the following essential design features: 4.1.2.1 The flowing gas stream must be confined to a duct of definite cross-sectional area, either circular or rectangular. For circular cross-sections, the minimum duct diameter shall be 30.5 cm (12 in.); for rectangular cross-sections, the width (shorter side) shall be at least 25.4 cm (10 in.).			

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.1.2.2 The cross-sectional area of the calibration duct must be constant over a distance of 10 or more duct diameters. For a rectangular cross-section, use an equivalent diameter, calculated from the following equation, to determine the number of duct diameters: $D_e = \frac{2LW}{(L+W)}$ 2-1 Where: D_e = Equivalent diameter L = Length W = Width To ensure the presence of stable, fully developed flow patterns at the calibration site, or "test section," the site must be located at least eight diameters downstream and two diameters upstream from the nearest disturbances. NOTE: The eight- and two-diameter criteria are not absolute; other test section locations may be used (subject to approval of the Administrator), provided that the flow at the test site is stable and demonstrably parallel to the duct axis.			

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.1.2.3 The flow system shall have the capacity to generate a test-section velocity around 915 m/min (3,000 ft/min). This velocity must be constant with time to guarantee steady flow during calibration. Note that Type S pitot tube coefficients obtained by single-velocity calibration at 915 m/min (3,000 ft/min) will generally be valid to within ± 3 percent for the measurement of velocities above 305 m/min (1,000 ft/min) and to within ± 5 to 6 percent for the measurement of velocities between 180 and 305 m/min (600 and 1000 ft/min). If a more precise correlation between C_p and velocity is desired, the flow system shall have the capacity to generate at least four distinct time-invariant test-section velocities covering the velocity range from 180 and 1,525 m/min (600 to 5,000 ft/min), and calibration data shall be taken at regular velocity intervals over this range (see Citations 9 and 14 in Section 6 for details).			
4.1.2.4 Two entry ports, one each for the standard and Type S pitot tubes, shall be cut in the test section; the standard pitot entry port shall be located slightly downstream of the Type S port, so that the standard and Type S impact openings will lie in the same cross-sectional plane during calibration. To facilitate alignment of the pitot tubes during calibration, it is advisable that the test section be constructed of plexiglass or some other transparent material.			

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.1.3 Calibration Procedure. Note that this procedure is a general one and must not be used without first referring to the special considerations presented in Section 4.1.5. Note also that this procedure applies only to single-velocity calibration. To obtain calibration data for the A and B sides of the Type S pitot tube, proceed as follows: 4.1.3.1 Make sure that the manometer is properly filled and that the oil is free from contamination and is of the proper density. Inspect and leak-check all pitot lines; repair or replace if necessary. 4.1.3.2 Level and zero the manometer. Turn on the fan and allow the flow to stabilize. Seal the Type S entry port.			

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.1.3.3 Ensure that the manometer is level and zeroed. Position the standard pitot tube at the calibration point (determined as outlined in Section 4.1.5.1), and align the tube so that its tip is pointed directly into the flow. Particular care should be taken in aligning the tube to avoid yaw and pitch angles. Make sure that the entry port surrounding the tube is properly sealed. 4.1.3.4 Read ΔP and record its value in a data table similar to the one shown in Figure 2-9. Remove the standard pitot tube from the duct and disconnect it from the manometer. Seal the standard entry port. 4.1.3.5 Connect the Type S pitot tube to the manometer. Open the Type S entry port. Check the manometer level and zero. Insert and align the Type S pitot tube so that its A side impact opening is at the same point as was the standard pitot tube and is pointed directly into the flow. Make sure that the entry port surrounding the tube is properly sealed.			
4.1.3.6 Read ΔP, and enter its value in the data table. Remove the Type S pitot tube from the duct and disconnect it from the manometer. 4.1.3.7 Repeat steps 4.1.3.3 through 4.1.3.6 above until three pairs of ΔP readings have been obtained. 4.1.3.8 Repeat steps 4.1.3.3 through 4.1.3.7 above for the B side of the Type S pitot tube. 4.1.3.9 Perform calculations, as described in Section 4.1.4 below.			

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.1.4 Calculations. 4.1.4.1 For each of the six pairs of ΔP readings (i.e., three from side A and three from side B) obtained in Section 4.1.3 above, calculate the value of the Type S pitot tube coefficient as follows: $C_{p(s)} = C_{p(std)} \sqrt{\frac{\Delta P_{std}}{\Delta P_s}} \quad 2-2$ where: $C_{p(s)}$ = Type S Pitot tube coefficient $C_{p(std)}$ = Standard Pitot tube coefficient: use 0.99 if the coefficient is unknown and the tube is designed according to the criteria of Sections 2.7.1 to 2.7.5 of this method. ΔP_{std} = Velocity head measured by the standard pitot tube, cm H₂O (in. H₂O) ΔP_s = Velocity head measured by the Type S pitot tube, cm H₂O (in. H₂O) 4.1.4.2 Calculate C_p (side A), the mean A side coefficient, and C_p (side B), the mean B side coefficient; calculate the difference between these two average values.			

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.1.4.3 Calculate the deviation of each of the three A-side values of $C_p(s)$ from C_p (side A), and the deviation of each B-side value of $C_p(s)$ from C_p (side B). Use the following equation: $Deviation = C_{p(s)} - \overline{C_p}(A \text{ or } B)$ 4.1.4.4 Calculate α, the average deviation from the mean, for both the A and B sides of the pitot tube. Use the following equation: $\alpha (side A \text{ or } B) = \frac{\sum_1^3 C_{p(s)} - \overline{C_p}(A \text{ or } B) }{3}$ 4.1.4.5 Use the Type S pitot tube only if the values of α (side A) and α (side B) are less than or equal to 0.01 and if the absolute value of the difference between $C_p(A)$ and $C_p(B)$ is 0.01 or less.			

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.1.5 Special considerations. 4.1.5.1 Selection of calibration point. 4.1.5.1.1 When an isolated Type S pitot tube is calibrated, select a calibration point at or near the center of the duct, and follow the procedures outlined in Section 4.1.3 and 4.1.4 above. The Type S pitot coefficients so obtained, i.e., C_p (side A) and C_p (side B), will be valid, as long as either: (1) the isolated pitot tube is used; or (2) the pitot tube is used with other components (nozzle, thermocouple, sample probe) in an arrangement that is free from aerodynamic interference effects (see Figures 2-6 through 2-8). 4.1.5.1.2 For Type S pitot tube-thermocouple combinations (without sample probe), select a calibration point at or near the center of the duct, and follow the procedures outlined in Sections 4.1.3 and 4.1.4 above. The coefficients so obtained will be valid so long as the pitot tube-thermocouple combination is used by itself or with other components in an interference-free arrangement (Figures 2-6 and 2-8).			
4.1.5.1.3 For assemblies with sample probes, the calibration point should be located at or near the center of the duct; however, insertion of a probe sheath into a small duct may cause significant cross-sectional area blockage and yield incorrect coefficient values (Citation 9 in Section 6). Therefore, to minimize the blockage effect, the calibration point may be a few inches off-center if necessary. The actual blockage effect will be negligible when the theoretical blockage, as determined by a projected-area model of the probe sheath, is 2 percent or less of the duct cross-sectional area for assemblies without external sheaths (Figure 2-10a), and 3 percent or less for assemblies with external sheaths (Figure 2-10b).			

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.1.5.2 For those probe assemblies in which pitot tube-nozzle interference is a factor (i.e., those in which the pitot-nozzle separation distance fails to meet the specification illustrated in Figure 2-6a), the value of $C_p(s)$ depends upon the amount of free space between the tube and nozzle, and therefore is a function of nozzle size. In these instances, separate calibrations shall be performed with each of the commonly used nozzle sizes in place. Note that the single-velocity calibration technique is acceptable for this purpose, even though the larger nozzle sizes (>0.635 cm or $1/4$ in.) are not ordinarily used for isokinetic sampling at velocities around 915 m/min (3,000 ft/min), which is the calibration velocity; note also that it is not necessary to draw an isokinetic sample during calibration (see Citation 19 in Section 6).			
4.1.5.3 For a probe assembly constructed such that its pitot tube is always used in the same orientation, only one side of the pitot tube need be calibrated (the side which will face the flow). The pitot tube must still meet the alignment specifications of Figures 2-2 or 2-3, however, and must have an average deviation (σ) value of 0.01 or less (see Section 4.1.4.4).			

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.1.6 Field Use and Recalibration. 4.1.6.1 Field Use. 4.1.6.1.1 When a Type S pitot tube (isolated tube or assembly) is used in the field, the appropriate coefficient value (whether assigned or obtained by calibration) shall be used to perform velocity calculations. For calibrated Type S pitot tubes, the A side coefficient shall be used when the A side of the tube faces the flow, and the B side coefficient shall be used when the B side faces the flow; alternatively, the arithmetic average of the A and B side coefficient values may be used, irrespective of which side faces the flow.			
4.1.6.1.2 When a probe assembly is used to sample a small duct (12 to 36 in. in diameter), the probe sheath sometimes blocks a significant part of the duct cross-section, causing a reduction in the effective value of $C_p(s)$. Consult Citation 9 in Section 6 for details. Conventional pitot-sampling probe assemblies are not recommended for use in ducts having inside diameters smaller than 12 inches (Citation 16 in Section 6).			
4.1.6.2 Recalibration. 4.1.6.2.1 Isolated Pitot tubes. After each field use, the pitot tube shall be carefully reexamined in top, side, and end views. If the pitot face openings are still aligned within the specifications illustrated in Figures 2-2 or 2-3, it can be assumed that the baseline coefficient of the pitot tube has not changed. If, however, the tube has been damaged to the extent that it no longer meets the specifications of Figures 2-2 or 2-3, the damage shall either be repaired to restore proper alignment of the face openings or the tube shall be discarded.			

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.1.6.2.2 Pitot tube Assemblies. After each field use, check the face opening alignment of the pitot tube, as in Section 4.1.6.2.1; also, remeasure the intercomponent spacings of the assembly. If the intercomponent spacings have not changed and the face opening alignment is acceptable, it can be assumed that the coefficient of the assembly has not changed. If the face opening alignment is no longer within the specifications of Figures 2-2 or 2-3, either repair the damage or replace the pitot tube (calibrating the new assembly, if necessary). If the intercomponent spacings have changed, restore the original spacings or recalibrate the assembly.			
4.2 Standard pitot tube (if applicable). If a standard pitot tube is used for the velocity traverse, the tube shall be constructed according to the criteria of Section 2.7 and shall be assigned a baseline coefficient value of 0.99. If the standard pitot tube is used as part of the assembly, the tube shall be in an interference-free arrangement (subject to the approval of the Administrator).	7-GN-56 and manufacturer's product literature.		The standard pitot tube used for velocity traverses meets the criteria of Section 2.7. It is used in conjunction with a digital micromanometer. The tube coefficient (undetermined) is an integral part of the internal program used by the micromanometer to determine the pressure differential and flow velocity.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3 Temperature Gauges. After each field use, calibrate dial thermometers, liquid-filled bulb thermometers, thermocouple-potentiometer systems, and other gauges at a temperature within 10 percent of the average absolute stack temperature. For temperatures up to 405° C (761° F) use an ASTM mercury-in-glass reference thermometer, or equivalent, as a reference; alternatively, either a reference thermocouple and potentiometer (calibrated by NBS) or thermometric fixed points, e.g., ice bath and boiling water (corrected for barometric pressure) may be used. For temperatures above 405° C (761° F), use an NBS-calibrated reference thermocouple-potentiometer system or an alternate reference, subject to the approval of the Administrator. If, during calibration, the absolute temperatures measured with the gauge being calibrated and the reference gauge agree within 1.5 percent, the temperature data taken in the field shall be considered valid. Otherwise, the pollutant emission test shall either be considered invalid or adjustments (if appropriate) of the test results shall be made, subject to the approval of the Administrator.	7-GN-56		No temperature-measuring devices are used.
4.4 Barometer. Calibrate the barometer used against a mercury barometer.	7-GN-56		No barometric-pressure-measuring devices are used.
5.0 Calculations Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation. 5.1 Nomenclature. See 40 CFR Pt. 60 App. A, Meth. 2, page 657 and 658 for details).	7-GN-56 and manufacturer's product literature.		The density program internal to the digital micromanometer is used to determine stack gas velocities, which are recorded on datasheets and averaged. The volumetric flow rate is determined from the average flow velocity and sampling duct cross-sectional area.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
40 CFR 60, Appendix A, Method 1, Sample and Velocity Traverses for Stationary Sources 1.0 Principle and Applicability 1.1 Principle. To aid in the representative measurement of pollutant emissions and/or total volumetric flow rate from a stationary source, a measurement site where the effluent stream is flowing in a known direction is selected, and the cross-section of the stack is divided into a number of equal areas. A traverse point is then located within each of these equal areas. 1.2 Applicability. This method is applicable to flowing gas streams in ducts, stacks, and flues. The method cannot be used when: (1) flow is cyclonic or swirling (see Section 2.4);			This method applies. See Section 2.1 below. The elevations of the sample ports are 18, 23, and 27 m (60, 74, and 88 ft) above grade, the location of the last major flow disturbance. The top of the stack is 61 m (200 ft) above the base. The sample ports are approximately 8.6, 10.6, and 12.6 diameters downstream the last major disturbance. The sample ports are approximately 20, 18, and 16 diameters upstream of the next major disturbance.
(2) a stack is smaller than about 0.30 meter (12 in.) in diameter, or 0.071 m² (113 in.²) cross-sectional area; or	Duct Diameter: Sheets 9 and 12 from Blue Print File 8264	Yes	The duct diameter is 2.1 m (7 ft).
(3) the measurement site is less than two stack or duct diameters downstream or less than a half diameter upstream from a flow disturbance.	Sample Point Positions: Drawing H-2-96794 Duct Diameter: Sheets 9 and 12 from Blue Print File 8264	Yes	The elevations of the sample ports are 18, 23, and 27 m (60, 74, and 88 ft) above grade, the location of the last major flow disturbance. The top of the stack is 61 m (200 ft) above the base. The duct diameter is 2.1 m (7 ft). The sample ports are approximately 8.6, 10.6, and 12.6 diameters downstream the last major disturbance. The sample ports are approximately 20, 18, and 16 diameters upstream of the next major disturbance.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
The requirements of this method must be considered before construction of a new facility from which emissions will be measured; failure to do so may require subsequent alterations to the stack or deviation from the standard procedure. Cases involving variants are subject to approval by the Administrator, U.S. Environmental Protection Agency.			
2.0 Procedure 2.1 Selection of Measurement Site. Sampling or velocity measurement is performed at a site located at least eight stack or duct diameters downstream and two diameters upstream from any flow disturbance such as a bend, expansion, or contraction in the stack, or from a visible flame. If necessary, an alternative location may be selected, at a position at least two stack or duct diameters downstream and a half diameter upstream from any flow disturbance. For a rectangular cross section, an equivalent diameter (D_e) shall be calculated from the following equation to determine the upstream and downstream distances: $D_e = \frac{2LW}{L+W}$ $L+W$ where L = length W = width. An alternative procedure is available for determining the acceptability of a measurement location not meeting the criteria above. This procedure, determination of gas flow angles at the sampling points and comparing the results with acceptability criteria, is described in Section 2.5.	Sample Point Positions: Drawing H-2-96794 Duct Diameter: Sheets 9 and 12 from Blue Print File 8264	Yes	The elevations of the sample ports are 18, 23, and 27 m (60, 74, and 88 ft) above the base of the stack. The top of the stack is 6.1 m (200 ft) above the base. The duct diameter is 2.1 m (7 ft). The sample ports are approximately 8.6, 10.6, and 12.6 diameters downstream the last major disturbance. The sample ports are approximately 20, 18, and 16 diameters upstream of the next major disturbance.
2.2 Determining the Number of Traverse Points.			This method is required for determining the sample site, not the number of points in a traverse. Samples are collected by rake, not traverse.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.2.1 Particulate traverses. When the eight- and two-diameter criterion can be met, the minimum number of traverse points shall be: (1) twelve, for circular or rectangular stacks with diameters (or equivalent diameters) greater than 0.61 meter (24 in.);			Eight- and two-diameter criteria met. Samples are collected by a 16-port rake, not traverse. Sample rake is described in comparison to ANSI M13.1-1969, Section A3.2 (ANSI 1969).
(2) eight, for circular stacks with diameters between 0.30 and 0.61 meter (12-24 in.);		Not applicable	The duct diameter is greater than 0.61 m (24 in.).
(3) nine, for rectangular stacks with equivalent diameters between 0.30 and 0.61 meter (12-24 in.).		Not applicable	This stack is circular, not rectangular.
When the eight- and two-diameter criterion cannot be met, the minimum number of traverse points is determined from Figure 1-1. Before referring to the figure, however, determine the distances from the chosen measurement site to the nearest upstream and downstream disturbances, and divide each distance by the stack diameter or equivalent diameter, to determine the distance in terms of the number of duct diameters. Then, determine from Figure 1-1 the minimum number of traverse points that corresponds: (1) to the number of duct diameters upstream; and (2) to the number of diameters downstream. Select the higher of the two minimum numbers of traverse points, or a greater value, so that for circular stacks the number is a multiple of 4, and for rectangular stacks, the number is one of those shown in Table 1-1.		Not applicable	Eight and two criterion met.
2.2.2 Velocity (Non-Particulate) Traverses. When velocity or volumetric flow rate is to be determined (but not particulate matter), the same procedure as that for particulate traverses (Section 2.2.1) is followed, except that Figure 1-2 may be used instead of Figure 1-1.		Not applicable	Velocity is measured by multipoint probe, not by traverse. NOTE: Velocity probe is discussed in Method 114 Comparison, Section 4.3.7.
2.3 Cross-sectional Layout and Location of Traverse Points.		Not applicable	Not applicable. Method 1 is used for determining the sample site, not the number of points in a velocity traverse. Velocity is measured by multipoint probe, not by traverse.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.3.1 Circular Stacks. Locate the traverse points on two perpendicular diameters according to Table 1-2 and the example shown on Figure 1-3. Any equation (for examples, see Citations 2 and 3 in the Bibliography) that gives the same values as those in Table 1-2 may be used in lieu of Table 1-2. For particulate traverses, one of the diameters must be in a plane containing the greatest expected concentration variation, e.g., after bends, one diameter shall be in the plane of the bend. This requirement becomes less critical as the distance from the disturbance increases; therefore, other diameter locations may be used, subject to approval of the Administrator. In addition for stacks having diameters greater than 0.61 m (24 in.) no traverse points shall be located within 2.5 centimeters (1.00 in.) of the stack walls; and for stack diameters equal to or less than 0.61 m (24 in.), no traverse points shall be located within 1.3 cm (0.50 in.) of the stack walls. To meet these criteria, observe the procedures given below.		Not applicable	Method 1 is used for determining the sample site, not the number of points in a traverse.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.3.1.1 Stacks With Diameters Greater Than 0.61 m (24 in.). When any of the traverse points as located in Section 2.3.1 fall within 2.5 cm (1.00 in.) of the stack walls, relocate them away from the stack walls to: (1) a distance of 2.5 cm (1.00 in.); or (2) a distance equal to the nozzle inside diameter, whichever is larger. These relocated traverse points (on each end of a diameter) shall be the "adjusted" traverse points. Whenever two successive traverse points are combined to form a single adjusted traverse point, treat the adjusted point as two separate traverse points, both in the sampling (or velocity measurement) procedure, and in recording the data. 2.3.1.2 Stacks With Diameters Equal to or Less Than 0.61 m (24 in.). Follow the procedure in Section 2.3.1.1, noting only that any "adjusted" points should be relocated away from the stack walls to: (1) a distance of 1.3 cm (0.50 in.); or (2) a distance equal to the nozzle inside diameter, whichever is larger.		Not applicable	The diameter of this stack [0.81 m (7 ft)] is greater than 0.61 m (24 in.).

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.3.2 Rectangular Stacks. Determine the number of traverse points as explained in Sections 2.1 and 2.2 of this method. From Table 1-1, determine the grid configuration. Divide the stack cross-section into as many equal rectangular elemental areas as traverse points, and then locate a traverse point at the centroid of each equal area according to the example in Figure 1-4. If the tester desires to use more than the minimum number of traverse points, expand the "minimum number of traverse points" matrix (see Table 1-1) by adding the extra traverse points along one or the other or both legs of the matrix; the final matrix need not be balanced. For example, if a 4x3 "minimum number of points" matrix were expanded to 36 points, the final matrix could be 9x4 or 12x3, and would not necessarily have to be 6x6. After constructing the final matrix, divide the stack cross-section into as many equal rectangular, elemental areas as traverse points, and locate a traverse point at the centroid of each equal area. The situation of traverse points being too close to the stack walls is not expected to arise with rectangular stacks. If this problem should ever arise, the Administrator must be contacted for resolution of the matter.		Not applicable	The stack is circular, not rectangular.
2.4 Verification of Absence of Cyclonic Flow. In most stationary sources, the direction of stack gas flow is essentially parallel to the stack walls. However, cyclonic flow may exist (1) after such devices as cyclones and inertial demisters following venturi scrubbers, or		Yes	There are no cyclones or inertial demisters following venturi scrubbers on this system.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
(2) in stacks having tangential inlets or other duct configurations which tend to induce swirling; in these instances, the presence or absence of cyclonic flow at the sampling location must be determined. The following techniques are acceptable for this determination.	Drawing H-2-55019K Rev 2	Yes	This stack does not have a tangential inlet or other duct configuration that tends to induce swirling.
Level and zero the manometer. Connect a Type S pitot tube to the manometer. Position the Type S pitot tube at each traverse point, in succession, so that the planes of the face openings of the pitot tube are perpendicular to the stack cross-sectional plane; when the Type S pitot tube is in this position, it is at "0° reference." Note the differential pressure (ΔP) reading at each traverse point. If a null (zero) pitot reading is obtained at 0° reference at a given traverse point, an acceptable flow condition exists at that point. If the pitot reading is not zero at 0° reference, rotate the pitot tube (up to $\pm 90^\circ$ yaw angle), until a null reading is obtained. Carefully determine and record the value of the rotation angle (α) to the nearest degree. After the null technique has been applied at each traverse point, calculate the average of the absolute values of α; assign α values of 0° to those points for which no rotation was required, and include these in the overall average. If the average value of α is greater than 20°, the overall flow condition in the stack is unacceptable and alternative methodology, subject to the approval of the Administrator, must be used to perform accurate sample and velocity traverses. The alternative procedure described in Section 2.5 may be used to determine the rotation angles in lieu of the procedure described above.		Not applicable	Because there are no cyclones, inertial demisters following venturi scrubbers, tangential inlets, or other duct configuration that tend to induce swirling, there is no need to determine the presence or absence of cyclonic flow.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.5 Alternative Measurement Site Selection Procedure. This alternative applies to sources where measurement locations are less than 2 equivalent stack or duct diameters downstream or less than 1/2 duct diameter upstream from a flow disturbance. The alternative should be limited to ducts larger than 24 in. in diameter where blockage and wall effects are minimal. A directional flow sensing probe is used to measure pitch and yaw angles of the gas flow at 40 or more traverse points; the resultant angle is calculated and compared with acceptable criteria for mean and standard deviation. NOTE: Both the pitch and yaw angles are measured from a line passing through the traverse point and parallel to the stack axis. The pitch angle is the angle of the gas flow component in the plane that INCLUDES the traverse line and is parallel to the stack axis. The yaw angle is the angle of the gas flow component in the plane PERPENDICULAR to the traverse line at the traverse point and is measured from the line passing through the traverse point and parallel to the stack axis.	Sample Point Positions: Drawing H-2-96794 Duct Diameter: Sheets 9 and 12 from Blue Print File 8264	Not applicable	The selected site is greater than 2 diameters downstream and 1/2 diameter upstream from a flow disturbance.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.5.1 Apparatus. 2.5.1.1 Directional Probe. Any directional probe, such as United Sensor Type DA Three-Dimensional Directional Probe, capable of measuring both the pitch and yaw angles of gas flows is acceptable. (NOTE: Mention of trade name or specific products does not constitute endorsement by the U.S. Environmental Protection Agency.) Assign an identification number to the directional probe, and permanently mark or engrave the number on the body of the probe. The pressure holes or directional probes are susceptible to plugging when used in particulate-laden gas streams. Therefore, a system for cleaning the pressure holes by "backpurging" with pressurized air is required.		Not applicable	See 2.5, above.
2.5.1.2 Differential Pressure Gauges. Inclined manometers, U-tube manometers, or other differential pressure gauges (e.g., magnetic gauges) that meet the specifications described in Method 2, section 2.2. NOTE: If the differential pressure gauge produces both negative and positive readings, then both negative and positive pressure readings shall be calibrated at a minimum of three points as specified in Method 2, section 2.2.		Not applicable	See 2.5, above.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.5.2 Traverse Points. Use a minimum of 40 traverse points for circular ducts and 42 points for rectangular ducts for the gas flow angle determinations. Follow section 2.3 and Table 1-1 or 1-2 for the location and layout of the traverse points. If the measurement location is determined to be acceptable according to the criteria in this alternative procedure, use the same traverse point number and locations for sampling and velocity measurements.		Not applicable	See 2.5, above.
2.5.3 Measurement Procedure. 2.5.3.1 Prepare the directional probe and differential pressure gauges as recommended by the manufacturer. Capillary tubing or surge tanks may be used to dampen pressure fluctuations. It is recommended, but not required, that a pretest leak check be conducted. To perform a leak check, pressurize or use suction on the impact opening until a reading of at least 7.6 cm (3 in.) H ₂ O registers on the differential pressure gauge, then plug the impact opening. The pressure of a leak-free system will remain stable for at least 15 seconds.		Not applicable	See 2.5, above.
2.5.3.2 Level and zero the manometers. Since the manometer level and zero may drift because of vibrations and temperature changes, periodically check the level and zero during the traverse.		Not applicable	See 2.5, above.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.5.3.3 Position the probe at the appropriate locations in the gas stream, and rotate until zero deflection is indicated for the yaw angle pressure gauge. Determine and record the yaw angle. Record the pressure gauge readings for the pitch angle, and determine the pitch angle from the calibration curve. Repeat this procedure for each traverse point. Complete a "back-purge" of the pressure lines and the impact openings prior to measurements of each traverse point. A post-test check as described in section 2.5.3.1 is required. If the criteria for a leak-free system are not met, repair the equipment, and repeat the flow angle measurements.		Not applicable	See 2.5, above.
2.5.4 Calculate the resultant angle at each traverse point, the average resultant angle, and the standard deviation using the following equations. Complete the calculation retaining at least one extra significant figure beyond that of the acquired data. Round the values after the final calculations.		Not applicable	See 2.5, above.
2.5.4.1 Calculate the resultant angle at each traverse point:		Not applicable	See 2.5, above.
2.5.5 The measurement location is acceptable if $R \leq 20^\circ$ and $S_d \leq 10^\circ$.		Not applicable	See 2.5, above.
2.5.6 Calibration. Use a flow system as described in Sections 4.1.2.1 and 4.1.2.2 of Method 2. In addition, the flow system shall have the capacity to generate two test-section velocities: one between 365 and 730 m/min (1200 and 2400 ft/min) and one between 730 and 1100 m/min (2400 and 3610 ft/min).		Not applicable	See 2.5, above.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.5.6.1 Cut two entry ports in the test section. The axes through the entry ports shall be perpendicular to each other and intersect in the centroid of the test section. The ports should be elongated slots parallel to the axis of the test section and of sufficient length to allow measurement of pitch angles while maintaining the pitot head position at the test-section centroid. To facilitate alignment of the directional probe during calibration, the test section should be constructed of plexiglass or some other transparent material. All calibration measurement should be made at the same point in the test section, preferably at the centroid of the test-section.		Not applicable	See 2.5, above.
2.5.6.2 To ensure that the gas flow is parallel to the central axis of the test section, follow the procedure in Section 2.4 for cyclonic flow determination to measure the gas flow angles at the centroid of the test section from two test ports located 90° apart. The gas flow angle measured in each port must be $\pm 2^\circ$ of 0°. Straightening vanes should be installed, if necessary, to meet this criterion.		Not applicable	See 2.5, above.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.5.6.3 Pitch Angle Calibration. Performs a calibration traverse according to the manufacturer's recommended protocol in 5° increments for angles from -60° to +60° at one velocity in each of the two ranges specified above. Average the pressure ratio values obtained for each angle in the two flow ranges, and plot a calibration curve with the average values of the pressure ratio (or other suitable measurement factor as recommended by the manufacturer) versus the pitch angle. Draw a smooth line through the data points. Plot also the data values for each traverse point. Determine the differences between the measured data values and the angle from the calibration curve at the same pressure ratio. The difference at each comparison must be within 2° for angles between 0° and 40° and within 3° for angles between 40° and 60°.		Not applicable	See 2.5, above.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.5.6.4 Yaw Angle Calibration. Mark the three-dimensional probe to allow the determination of the yaw position of the probe. This is usually a line extending the length of the probe and aligned with the impact opening. To determine the accuracy of measurements of the yaw angle, only the zero or null position need be calibrated as follows. Place the directional probe in the test section, and rotate the probe until the zero position is found. With a protractor or other angle measuring device, measure the angle indicated by the yaw angle indicator on the three-dimensional probe. This should be within 2° of 0°. Repeat this measurement for any other points along the length of the pitot where yaw angle measurements could be read in order to account for variations in the pitot markings used to indicate pitot head positions.		Not applicable	See 2.5, above.
ANSI M13.1-1969, Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities			
4.2.1.2 Sampling point should be a minimum of five diameters (or 5 times the major dimension for rectangular ducts) downstream from abrupt changes in flow direction or prominent transitions.	Sample Point Positions: Drawing H-2-96794 Rev 2 Duct Diameter: Sheets 9 and 12 from Blue Print File 8264	Yes	The elevations of the sample ports are 18, 23, and 27 m (60, 74, and 88 ft) above grade, which corresponds to the last major flow disturbance in the stack. The duct diameter is 2.1 m (7 ft). The sample ports are therefore approximately 8.6, 10.6, and 12.6 diameters above the last major disturbance.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.2.2 Samples should be representative with respect to physical and chemical composition of airstream.	H-2-96794	Yes	Sample points are a minimum of 8 duct diameters downstream from the last contributor and are believed to be representative. Particle size studies are currently under way. This study is under the direction of the Effluent and Emissions Monitoring.
4.3.1 Sensitivity and accuracy of the analytical or counting method will determine the minimum volume of air which must be sampled to obtain the requisite accuracy and precision of results.		Yes	Analytical or counting method is adjusted to provide requisite accuracy and precision.
4.3.2 If possible, the sample should be large enough to permit 1/10 the permissible level to be determined with reliability.	WHC-EP-0141 shows that the PUREX Plant releases are below 1/10 of the permissible level. WHC-IP-0718, Section 3.3.2, facility specific controlled procedure to be issued.	Yes	The frequency of the record sample filter and silver zeolite cartridge exchange follows: • If at all possible, record air samples are left running for a full 168-hour (7-day) week, to ensure a representative sample. • The silver zeolite cartridges are exchanged as follows: - When the cartridges have been in the sample holder for 1 week. - When radiation readings indicate a buildup of greater than 16 mR/hour within the last 8 hours. - When requested by operations management.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
5.2.2 Airborne particulate matter should be evaluated and characterized at regular intervals and before any anticipated process change.			Particulate matter is sampled continuously with sample filters removed at the frequency discussed above. The particulate size distribution has not been measured for this stack. Planning is under way for measurements that will generate these data.
5.2.2.1 Appropriate filtration should be chosen for sampling.		Yes	The Gelman Versapor™ 3000 filter medium is an acrylic copolymer membrane supported by a nonwoven nylon fabric. The manufacturer rates the efficiency of this medium at 91% for 0.3 µm aerosol. The manufacturer recently tested 24 samples from eight rolls in two lots with a 0.3-µm di-octyl phthalate (DOP) aerosol per American Society for Testing and Materials D 2986-71. The measured average efficiency was 95.8%, and the standard deviation was 1.6%. (This corresponds to a lower 90% confidence limit of 93.5% for a single filter.) The manufacturer does not recommend this product for flow rates greater than 52 L/min-cm² or for temperatures above 275 °F.
5.2.2.1.7 Filter holders and support should be chosen for proper chemical compatibility, mechanical strength, sealing, and ease of operation in changing filters. Sample air movers should have the capability of delivering the necessary air flow against the resistance of the sampling system. Proper location and choice of flow measurement device and flow rate control is important.	H-2-96780, Sheet 1.	Yes	Stainless steel sample holders have been used in the past. A design has been released to replace these with aluminum sample holders. The sample holders are easily screwed apart and have a sealing ring to ensure that all the gas flows through the filter. The sample flow measurement and control systems ensure that the air mover provides adequate air flow through the sampler. These systems are located downstream of the sample collection media (filters and silver zeolite cartridges) to prevent degradation of the sample.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
5.3 Airborne radioactive gases or volatile materials should be sampled by an appropriate method if present.		Yes	No irradiated fuel has been introduced into the PUREX Plant for several years. No dissolutions have been performed since late 1989. Gaseous sampling systems had shown that the levels of ^3H and ^{14}C had fallen to levels at or below the analytical detection limit, which were well below environmental release and monitoring limits. Consequently, sampling for these radionuclides is no longer required or performed. The release of other radioactive gases decreased more rapidly than for these radionuclides. Consequently, there is no need for gaseous radionuclide sampling.
A1. Minimization of the length and bends of sample delivery lines will contribute to representative sampling.			(No response requested.)
A2. The distance from the last upstream disturbance to the point of sample extraction should be a minimum of five and preferably ten or more duct diameters downstream. Sampling from a vertical run avoids stratification due to gravity settling. Sampling as far downstream as possible avoids most transient variation in airstream quality.	Sample Point Positions: Drawing H-2-96794 Rev. 2 Duct Diameter: Sheets 9 and 12 from Blue Print File 8264	Yes	The elevations of the sample ports are 18, 23, and 27 m (60, 76, and 88 ft) above the base of the stack, which is the location of the last major disturbance. The duct diameter is 2.1 m (7 ft). The sample ports are therefore approximately 8.6, 10.6, and 12.6 diameters above the last major disturbance.
A3.1 Velocity and flow distribution should be known for the sampling point, and particle and gaseous composition should be representative.	DOE/RL-90-34 Blue Print File-8264-SH-9	YES	The Reynold's number of the stack is approximately 2,000,000, which is solidly in the turbulent regime. Since there are no sources of cyclonic flow, the flow pattern can be described as well developed turbulent.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS																														
A3.2 A multiple number of withdrawal points each representing approximately equal areas based on the duct or stack dimensions is desirable.	H-2-65648	Yes	The rake that has been used for the record sample has sixteen inlet ports, spaced symmetrically about the center line of the stack. The ports are arranged to collect air from the approximate centers of equal-area semi-annuli. (For an annulus, the "center" is half way between the inner and outer radii of an annulus.) The table compares the actual and ideal locations of the inlet ports, and also lists the difference. The positions are measured from the center of the stack. The tolerance on the actual dimensions is 0.3 cm. Old 16-point rake (still used for record sample) <table><thead><tr><th colspan="2">Metric (cm)</th><th>Metric (cm)</th></tr><tr><th>Actual</th><th>Ideal</th><th>Difference</th></tr></thead><tbody><tr><td>18.80</td><td>18.859</td><td>0.06</td></tr><tr><td>45.72</td><td>45.529</td><td>0.19</td></tr><tr><td>59.44</td><td>59.334</td><td>0.10</td></tr><tr><td>70.36</td><td>70.381</td><td>0.02</td></tr><tr><td>80.01</td><td>79.886</td><td>0.12</td></tr><tr><td>88.39</td><td>88.363</td><td>0.03</td></tr><tr><td>96.01</td><td>96.089</td><td>0.08</td></tr><tr><td>103.12</td><td>103.235</td><td>0.11</td></tr></tbody></table>	Metric (cm)		Metric (cm)	Actual	Ideal	Difference	18.80	18.859	0.06	45.72	45.529	0.19	59.44	59.334	0.10	70.36	70.381	0.02	80.01	79.886	0.12	88.39	88.363	0.03	96.01	96.089	0.08	103.12	103.235	0.11
Metric (cm)		Metric (cm)																															
Actual	Ideal	Difference																															
18.80	18.859	0.06																															
45.72	45.529	0.19																															
59.44	59.334	0.10																															
70.36	70.381	0.02																															
80.01	79.886	0.12																															
88.39	88.363	0.03																															
96.01	96.089	0.08																															
103.12	103.235	0.11																															

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS																								
A3.2 A multiple number of withdrawal points each representing approximately equal areas based on the duct or stack dimensions is desirable. (CONTINUED)	H-2-96792 H-2-96793	Yes	The new sample rakes (all the sampling systems except the record sample) are designed to collect samples from the approximate centers of equal-area annuli in the stack. (For an annulus, the "center" is half way between the inner and outer radii of an annulus.) The table below compares the actual and ideal locations of the inlet ports, and also lists the difference in inches. The positions are measured from the center of the stack, in the direction away from the liner penetration. The limits for the locations of the new probes should therefore be: <table><tr><th>SI (cm)</th><th>SI (cm)</th><th>SI (cm)</th></tr><tr><th>Actual</th><th>Ideal</th><th>Difference</th></tr><tr><td>-101.60</td><td>-102.032</td><td>-0.43</td></tr><tr><td>-81.28</td><td>-81.269</td><td>0.01</td></tr><tr><td>-50.80</td><td>-52.572</td><td>-1.77</td></tr><tr><td>0.00</td><td>0.000</td><td>0.00</td></tr><tr><td>68.58</td><td>68.513</td><td>-0.07</td></tr><tr><td>91.44</td><td>92.244</td><td>0.80</td></tr></table>	SI (cm)	SI (cm)	SI (cm)	Actual	Ideal	Difference	-101.60	-102.032	-0.43	-81.28	-81.269	0.01	-50.80	-52.572	-1.77	0.00	0.000	0.00	68.58	68.513	-0.07	91.44	92.244	0.80
SI (cm)	SI (cm)	SI (cm)																									
Actual	Ideal	Difference																									
-101.60	-102.032	-0.43																									
-81.28	-81.269	0.01																									
-50.80	-52.572	-1.77																									
0.00	0.000	0.00																									
68.58	68.513	-0.07																									
91.44	92.244	0.80																									
A3.3 The velocity distribution across the duct or stack should be known in order to establish isokinetic flow and representative sample points.	DOE/RL-90-34 Blue Print File-8264-SH-9	Yes	The Reynold's number of the stack is approximately 2,000,000, which is solidly in the turbulent regime. Since there are no sources of cyclonic flow, the flow pattern can be described as well developed turbulent. Sample flow rate is adjusted to maintain isokinetic in sample rake, see Method 114 Comparison, Sections 4.3.6 and 4.3.7.																								

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
A3.4 Sampling probe configuration is recommended by figures in this standard, with minimum radius bends and precisely tapered probe end edges.	H-2-96792 H-2-96793 H-2-65648	Yes	The 291-A-1 samplers use multipoint probes, as described in Figure A5 of ANSI NF3.1-1969. The sample inlets are arranged over equal annular areas for all but the record sampler, for which equal semiannular areas are used. Figure A5 calls out a length as approximately five times the diameter and the radius of the bend as more than five times the diameter. For the upper and lower 8-point probes, the diameter is 0.305 in., and the length and radius are both 1.875 in., for a ratio of approximately 6.2. For the middle eight-point probes, the diameter is 0.35 in., and the length and radius are both 2.0 in., for a ratio of approximately 6.6. For the 16-point sample probe, the length and radius are 2.0 in., and the diameters are 0.180 in., 0.194 in., and 0.245 in. The corresponding ratios are 11.1, 10.3, and 8.16.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
B1. Sampling line length should be kept to a minimum length. An estimate of the fraction of particles deposited in sampling lines under various conditions should be made using the experimental data presented in this appendix.	DOE/RL-90-34 p.22 H-2-96794 H-2-65648 Sheet 1	Yes	Using the lowest sample probe location for the record sample minimizes sample line length. Using the methodology of Appendix B, assuming a 2µm particle size and a particle density of 5kg/l, 44% of the particles are estimated to be deposited in the sample line. This estimate does not include resuspension. It is believed that resuspension occurs because there are no indications that the lines are plugging. Furthermore, preliminary results from a line loss study on another stack indicates that more large particles exit long sample lines than enter them. This observation is consistent with the view that deposited particles resuspend after agglomerating on the wall of the sample line.
B3 Velocities must be kept high enough to avoid appreciable losses by Brownian diffusion.	DOE/RL-90-34 p.22 H-2-65648 Sheet 1	Yes	The sample flow has a Reynold's number of approximately 8,000.
B5 Elbows in sampling lines should be avoided if at all possible. When required, the bend radius of the elbow should be as long as practical, and design flow rates through any line containing an elbow should be kept low. When possible, the sampler installation should allow for probe removal in order to evaluate the losses in the probe entry elbow and to permit cleaning.	H-2-96794	Yes	There are no unnecessary bends. The first bend (in the sample probe) meets the criteria of Appendix A. The second has a radius approximately ten times larger than the largest radius for which the Appendix presents data. The only obstacle to removal of the probe is its extreme height above the ground. This height is mandated by this American National Standards Institute (ANSI) standard.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
40 CFR 61, Appendix B, Method 114, Test Methods for Measuring Radionuclide Emissions from Stationary Sources 2.1 Radionuclides as Particulates. The extracted effluent stream is passed through a filter media to remove the particulates. The filter must have a high efficiency for removal of sub-micron particles. The guidance in ANSI M13.1-1969 shall be followed in using filter media to collect particulates (incorporated by reference-see § 61.18).	See point-by-point comparison with ANSI M13.1-1969.	Yes	The Gelman Versapor TM 3000 filter medium is an acrylic copolymer membrane supported by a nonwoven nylon fabric. The manufacturer rates the efficiency of this medium at 91% for 0.3-µm aerosol. The manufacturer recently tested 24 samples with a 0.3-µm DOP aerosol per ASTM D 2986-71. The measured average efficiency was 95.8%, and the standard deviation was 1.6%, which supports the rated efficiency (see Section 5.2.2.1).
2.2 Radionuclides as Gases. 2.2.1 The Radionuclide Tritium (H-3). Tritium in the form of water vapor is collected from the extracted effluent sample by sorption, condensation or dissolution techniques. Appropriate collectors may include silica gel, molecular sieves, and ethylene glycol or water bubblers. Tritium in the gaseous form may be measured directly in the sample stream using Method B-1, collected as a gas sample or may be oxidized using a metal catalyst to tritiated water and collected as described above.		Not applicable	No irradiated fuel has been introduced into the PUREX Plant for several years. No dissolutions have been performed since late 1989. Gaseous sampling systems have shown that the levels of ³ H and ¹⁴ C have fallen to levels at or below the analytical detection limit, which were well below environmental release and monitoring limits. Consequently, sampling for these radionuclides is no longer required or performed.
2.2.2 Radionuclides of Iodine. Iodine is collected from an extracted sample by sorption or dissolution techniques. Appropriate collectors may include charcoal, impregnated charcoal, metal zeolite and caustic solutions.		Yes	No irradiated fuel has been introduced into the PUREX Plant for several years. No dissolutions have been performed since late 1989. Furthermore, concentrations of radioiodine in any fuel available for processing have decayed to such a low level that there is no longer any requirement to monitor for iodine. Nevertheless, sampling for iodine continues at this time but may be discontinued in the near future. After flowing through the Gelman VersaporTM 3000 filter, the gas sample flows through two silver zeolite cartridges to capture iodine.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.2.3 Radionuclides of Argon, Krypton and Xenon. Radionuclides of these elements are either measured directly by an in-line or off-line monitor, or are collected from the extracted sample by low temperature sorption techniques. Appropriate sorbers may include charcoal or metal zeolite.		Not applicable	No irradiated fuel has been introduced into the PUREX Plant for several years. No dissolutions have been performed since late 1989. The levels of ^3H and ^{14}C had fallen to levels at or below the analytical detection limit. The release of other radioactive gases decreased even more rapidly. Consequently, there is no need for gaseous radionuclide sampling.
2.2.4 Radionuclides of Oxygen, Carbon, Nitrogen and Radon. Radionuclides of these elements are measured directly using an in-line or off-line monitor. Radionuclides of carbon in the form of carbon dioxide may be collected by dissolution in caustic solutions.		Not applicable	There is no longer a need for gaseous radionuclide sampling (see Sections 2.2.1 through 2.2.3, above).

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.0 Radionuclide Analysis Methods A series of methods based on "principles of measurement" are described which are applicable to the analysis of radionuclides collected from airborne effluent streams at stationary sources. These methods are applicable only under the conditions stated and within the limitations described. Some methods specify that only a single radionuclide be present in the sample or the chemically separated sample. This condition should be interpreted to mean that no other radionuclides are present in quantities which would interfere with the measurement. Also identified (Table 1) are methods for a selected list of radionuclides. The listed radionuclides are those which are most commonly used and which have the greatest potential for causing dose to members of the public. Use of methods based on principles of measurement other than those described in this section must be approved in advance of use by the Administrator. For radionuclides not listed in Table 1, any of the described methods may be used provided the user can demonstrate that the applicability conditions of the method have been met. The type of method applicable to the analysis of a radionuclide is dependent upon the type of radiation emitted, i.e., alpha, beta or gamma. Therefore, the methods described below are grouped according to principles of measurements for the analysis of alpha, beta and gamma emitting radionuclides.			

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.1 Methods for Alpha Emitting Radionuclides 3.1.1 Method A-1, Radiochemistry-Alpha Spectrometry. Principle: The element of interest is separated from other elements, and from the sample matrix using radiochemical techniques. The procedure may involve precipitation, ion exchange, or solvent extraction. Carriers (elements chemically similar to the element of interest) may be used. The element is deposited on a planchet in a very thin film by electrodeposition or by coprecipitation on a very small amount of carrier, such as lanthanum fluoride. The deposited element is then counted with an alpha spectrometer. The activity of the nuclide of interest is measured by the number of alpha counts in the appropriate energy region. A correction for chemical yield and counting efficiency is made using a standardized radioactive nuclide (tracer) of the same element. If a radioactive tracer is not available for the element of interest, a predetermined chemical yield factor may be used. Applicability: This method is applicable for determining the activity of any alpha-emitting radionuclide, regardless of what other radionuclides are present in the sample provided the chemical separation step produces a very thin sample and removes all other radionuclides which could interfere in the spectral region of interest. APHA-605(2), ASTM-D-3972(13).	LA-549-112 LA-943-123 LA-542-101 LA-508-051	Yes	Our method involves dissolution (LA-549-112), chemical separation (LA-943-123), electrodeposition (LA-542-101), followed by alpha spectrometry (LA-508-051) (WHC 1992g). It meets all the requirements of the EPA-suggested method. This is used for analyzing ^{241}Am, ^{239}Pu, and ^{243}Am in the air filter samples. The activities of these radionuclides are determined by direct comparison with the recoveries of (National Institute of Standards and Technology (NIST) traceable) ^{243}Am and ^{239}Pu tracers.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.1.2 Method A-2, Radiochemistry-Alpha Counting. Principle: The element of interest is separated from other elements, and from the sample matrix using radiochemistry. The procedure may involve precipitation, ion exchange, or solvent extraction. Carriers (elements chemically similar to the element of interest) may be used. The element is deposited on a planchet in a thin film and counted with a alpha counter. A correction for chemical yield (if necessary) is made. The alpha count rate measures the total activity of all emitting radionuclides of the separated element. Applicability: This method is applicable for the measurement of any alpha-emitting radionuclide, provided no other alpha emitting radionuclide is present in the separated sample. It may also be applicable for determining compliance, when other radionuclides of the separated element are present, provided that the calculated emission rate is assigned to the radionuclide which could be present in the sample that has the highest dose conversion factor. IDO-12096(18).		Not applicable	Because the tracer technique is used in the separation process, this method is not used for air filter analysis.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.1.3 Method A-3, Direct Alpha Spectrometry. Principles: The sample, collected on a suitable filter, is counted directly on an alpha spectrometer. The sample must be thin enough and collected on the surface of the filter so that any absorption of alpha particle energy in the sample or the filter, which would degrade the spectrum, is minimal. Applicability: This method is applicable to simple mixtures of alpha emitting radionuclides and only when the amount of particulates collected on the filter paper are relatively small and the alpha spectra is adequately resolved. Resolutions should be 50 keV (FHM) or better, ASTM-D-3084(16).	LO-150-133 LA-508-110 LA-508-051	Not applicable	Our method follows the procedure LO-150-133, then LA-508-110 for total alpha counts, and finally LA-508-051 for alpha spectrometry (WHC 1992g). It partially meets the requirements of the EPA method. This method is usually used for emergency air samples. The sample is counted on the alpha counter of known efficiency to obtain the total alpha counts. In the alpha energy analysis (AEA), the relative peak fractions of different alpha emitters identified in the sample are determined. The peak fractions are then used to correct the total alpha counts and thus determine the activities of individual alpha radionuclides present in the sample.
3.1.4 Method A-4, Direct Alpha Counting (Gross alpha determination). Principles: The sample, collected on a suitable filter, is counted with an alpha counter. The sample must be thin enough so that self-absorption is not significant and the filter must be of such a nature that the particles are retained on the surface. Applicability: Gross alpha determination may be used to measure emissions of specific radionuclides only (1) when it is known that the sample contains only a single radionuclide, or the identity and isotopic ratio of the radionuclides in the sample are well known, and (2) measurements using either Method A-1, A-2 or A-5 have shown that this method provides a reasonably accurate measurement of the emission rate. Gross alpha measurements are applicable to unidentified mixtures of radionuclides only for the purposes and under the conditions described in section 3.7. Apha-601(3), ASTM-D-1943(10).	LA-508-110 LA-508-114	Yes	Our method follows the procedure LA-508-110 or LA-508-114 (WHC 1992g). It meets all of the requirements stated in the EPA-suggested method.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.1.5 Method A-5, Chemical Determination of Uranium. Uranium: Uranium may be measured chemically by either colorimetry or fluorometry. In both procedures, the sample is dissolved, the uranium is oxidized to the hexavalent form and extracted into a suitable solvent. Impurities are removed from the solvent layer. For colorimetry, dibenzoylmethane is added, and the uranium is measured by the absorbance in a colorimeter. For fluorometry, a portion of the solution is fused with a sodium fluoride-lithium fluoride flux and the uranium is determined by the ultraviolet activated fluorescence of the fused disk in a fluorometer. Applicability: This method is applicable to the measurements of emission rates of uranium when the isotopic ratio of the uranium radionuclides is well known. ASTM-E-318(15), ASTM-D-2907(14).	LA-925-107	Exceeds performance of EPA method	Total uranium is determined by procedure LA-925-107 (WHC 1992g). The laser-induced kinetic phosphorescence analyzer is an improvement over the old fluorometric method for uranium determination. It is highly sensitive (lower detection level of 50 ppt is quite possible) because the laser frequency is used specifically for excitation of uranium atoms. It is faster and produces quality numbers. Quality can also be monitored during analysis. It exceeds the requirements mentioned in the EPA method.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.1.6 Method A-6, Radon-222-Continuous Gas Monitor. Principle: Radon-222 is measured directly in a continuously extracted sample stream by passing the air stream through a calibrated scintillation cell. Prior to the scintillation cell, the air stream is treated to remove particulates and excess moisture. The alpha particles from radon-222 and its decay products strike a zinc sulfide coating on the inside of the scintillation cell producing light pulses. The light pulses are detected by a photomultiplier tube which generates electrical pulses. These pulses are processed by the system electronics and the read out is in pCi/l of radon-222. Applicability: This method is applicable to the measurement of radon-222 in effluent streams which do not contain significant quantities of radon-220. Users of this method should calibrate the monitor in a radon calibration chamber at least twice per year. The background of the monitor should also be checked periodically by operating the instrument in a low radon environment. EPA 520/1-89-009(24).		Not applicable	

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.1.7 Method A-7, Radon-222-Alpha Track Detectors Principle: Radon-222 is measured directly in the effluent stream using alpha track detectors (ATD). The alpha particles emitted by radon-222 and its decay products strike a small plastic strip and produce submicron damage tracks. The plastic strip is placed in a caustic solution that accentuates the damage tracks which are counted using a microscope or automatic counting system. The number of tracks per unit area is corrected to the radon concentration in air using a conversion factor derived from data generated in a radon calibration facility. Applicability: Prior approval from EPA is required for use of this method. This method is only applicable to effluent streams which do not contain significant quantities of radon-220, unless special detectors are used to discriminate against radon-220. This method may be used only when ATDs have been demonstrated to produce data comparable to data obtained with Method A-6. Such data should be submitted to EPA when requesting approval for the use of this method. EPA 520/1-89-009(24).		Not applicable	

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.2 Methods for Gaseous Beta Emitting Radionuclides. 3.2.1 Method B-1, Direct Counting in Flow-Through Ionization Chambers. Principle: An ionization chamber containing a specific volume of gas which flows at a given flow rate through the chamber is used. The sample (effluent stream sample) acts as the counting gas for the chamber. The activity of the radionuclide is determined from the current measured in the ionization chamber. Applicability: This method is applicable for measuring the activity of a gaseous beta emitting radionuclide in an effluent stream that is suitable as a counting gas, when no other beta-emitting nuclides are present. DOE/EP-009(1 7), NCRP-58(23).		Not applicable	Noble gases are not monitored. Rather, the total available inventory is assumed to be released during fuel dissolution. (The PUREX plant ventilation system has no barriers to the escape of noble gases.)

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.2.2 Method B-2, Direct Counting With In-line or Off-line Beta Detectors. Principle: The beta detector is placed directly in the effluent stream (in-line) or an extracted sample of the effluent stream is passed through a chamber containing a beta detector (off-line). The activities of the radionuclides present in the effluent stream are determined from the beta count rate, and a knowledge of the radionuclides present and the relationship of the gross beta count rate and the specific radionuclide concentration. Applicability: This method is applicable only to radionuclides with maximum beta particle energies greater than 0.2 MeV. This method may be used to measure emissions of specific radionuclides only when it is known that the sample contains only a single radionuclide or the identity and isotopic ratio of the radionuclides in the effluent stream are well known. Specific radionuclide analysis of periodic grab samples may be used to identify the types and quantities of radionuclides present and to establish the relationship between specific radionuclide analyses and gross beta count rates. This method is applicable to unidentified mixtures of gaseous radionuclides only for the purposes and under the conditions described in section 3.7.		Not applicable	

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.3 Methods for Non-Gaseous Beta Emitting Radionuclides. 3.3.1 Method B-3, Radiochemistry-Beta Counting. Principle: The element of interest is separated from other elements, and from the sample matrix by radiochemistry. This may involve precipitation, distillation, ion exchange, or solvent extraction. Carriers (elements chemically similar to the element of interest) may be used. The element is deposited on a planchet, and counted with a beta counter. Corrections for chemical yield and decay (if necessary) are made. The beta count rate determines the total activity of all radionuclides of the separated element. This method may also involve the radiochemical separation and counting of a daughter element, after a suitable period of ingrowth, in which case it is specific for the parent nuclide. Applicability: This method is applicable for measuring the activity of any beta-emitting radionuclide, with a maximum energy greater than 0.2 MeV, provided no other radionuclide is present in the separated sample. APIA-608(5).	LA-549-112 LA-220-103 LA-508-111	Yes	Our method for determining ^{89}Sr in air filter samples is carried out using procedures LA-549-112 (dissolution) and LA-220-103 (for chemical separation), followed by procedure LA-508-111 (total beta counting) (WHC 1992g). The laboratory method certainly meets the requirements stated above.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.3.2 Method B-4, Direct Beta Counting (Gross beta determination). Principle: The sample, collected on a suitable filter, is counted with a beta counter. The sample must be thin enough so that self-absorption corrections can be made. Applicability: Gross beta measurements are applicable only to radionuclides with maximum beta particle energies greater than 0.2 MeV. Gross beta measurements may be used to measure emissions of specific radionuclides only (1) when it is known that the sample contains only a single radionuclide, and (2) measurements made using Method B-3 show reasonable agreement with the gross beta measurement. Gross beta measurements are applicable to mixtures of radionuclides only for the purposes and under the conditions described in section 3.7. APHA-602(4), ASTM-D-1890(11).	LA-508-110 LA-508-114	Yes	For gross beta determination, procedure LA-508-110 or LA-508-114 is followed (WHC 1992g). It satisfies the method requirements.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.3.3 Method B-5, Liquid Scintillation Spectrometry. Principle: An aliquot of a collected sample or the result of some other chemical separation or processing technique is added to a liquid scintillation "cocktail" which is viewed by photomultiplier tubes in a liquid scintillation spectrometer. The spectrometer is adjusted to establish a channel or "window" for the pulse energy appropriate to the nuclide of interest. The activity of the nuclide of interest is measured by the counting rate in the appropriate energy channel. Corrections are made for chemical yield where separations are made. Applicability: This method is applicable to any beta-emitting nuclide when no other radionuclide is present in the sample or the separated sample provided that it can be incorporated in the scintillation cocktail. This method is also applicable for samples which contain more than one radionuclide but only when the energies of the beta particles are sufficiently separated so that they can be resolved by the spectrometer. This method is most applicable to the measurement of low-energy beta emitters such as tritium and carbon-14. APCA.609(6), EMLLV-539-17(19).	LA-348-101 LA-218-112 LA-508-121 LA-548-111 LA-549-112 LA-613-111	Yes	It is used for determining ^{147}Pm in air filter samples (LA-549-112 for dissolution, LA-613-111 for chemical separation, LA-548-111 for incorporating into scintillation cocktail, and LA-508-121 for liquid scintillation counting). This is also used for determination of ^{14}C (LA-348-101, LA-548-111, and ^3H LA-508-121, sequentially) and (LA-218-112, LA-548-111, and LA-508-121, sequentially) in gas samples (WHC 1992g). This method satisfies all of the requirements.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.4 Gamma Emitting Radionuclides 3.4.1 Method G-1. High Resolution Gamma Spectrometry. Principle: The sample is counted with a high resolution gamma detector, usually either a Ge(Li) or a high purity Ge detector, connected to a multichannel analyzer or computer. The gamma emitting radionuclides in the sample are measured from the gamma count rates in the energy regions characteristic of the individual radionuclide. Corrections are made for counts contributed by other radionuclides to the spectral regions of the radionuclides of interest. Radiochemical separations may be made prior to counting but are usually not necessary. Applicability: This method is applicable to the measurement of any gamma emitting radionuclide with gamma energies greater than 20 keV. It can be applied to complex mixtures of radionuclides. The samples counted may be in the form of particulate filters, absorbers, liquids or gases. The method may also be applied to the analysis of gaseous gamma emitting radionuclides directly in an effluent stream by passing the stream through a chamber or cell containing the detector. ASTM-3649(9), IDO-12096(18).	LA-508-052	Yes	Our method uses gamma ray spectroscopy with high-resolution germanium detectors and follows procedure LA-508-052 (WHC 1992g). It meets all the requirements explained in the EPA method.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.4.2 Method G-2, Low Resolution Gamma Spectrometry. Principle: The sample is counted with a low resolution gamma detector, a thallium activated sodium iodide crystal. The detector is coupled to a photomultiplier tube and connected to a multichannel analyzer. The gamma emitting radionuclides in the sample are measured from the gamma count rates in the energy regions characteristic of the individual radionuclides. Corrections are made for counts contributed by other radionuclides to the spectral regions of the radionuclides of interest. Radiochemical separation may be used prior to counting to obtain less complex gamma spectra if needed. Applicability: This method is applicable to the measurement of gamma emitting radionuclides with energies greater than 100 keV. It can be applied only to relatively simple mixtures of gamma emitting radionuclides. The samples counted may be in the form of particulate filters, absorbers, liquids or gas. The method can be applied to the analysis of gaseous radionuclides directly in an effluent stream by passing the gas stream through a chamber or cell containing the detector. ASTM-D-2459(12), EMSL-LV-0539-17(19).		Not applicable	

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.4.3 Method G-3, Single Channel Gamma Spectrometry. Principle: The sample is counted with a thallium activated sodium iodide crystal. The detector is coupled to a photomultiplier tube connected to a single channel analyzer. The activity of a gamma emitting radionuclide is determined from the gamma counts in the energy range for which the counter is set. Applicability: This method is applicable to the measurement of a single gamma emitting radionuclide. It is not applicable to mixtures of radionuclides. The samples counted may be in the form of particulate filters, absorbers, liquids or gas. The method can be applied to the analysis of gaseous radionuclides directly in an effluent stream by passing the gas stream through a chamber or cell containing the detector.		Not applicable	

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.4.4 Method G-4, Gross Gamma Counting. Principle: The sample is counted with a gamma detector usually a thallium activated sodium iodine crystal. The detector is coupled to a photomultiplier tube and gamma rays above a specific threshold energy level are counted. Applicability: Gross gamma measurements may be used to measure emissions of specific radionuclides only when it is known that the sample contains a single radionuclide or the identity and isotopic ratio of the radionuclides in the effluent stream are well known. When gross gamma measurements are used to determine emissions of specific radionuclides periodic measurements using Methods G-1 or G-2 should be made to demonstrate that the gross gamma measurements provide reliable emission data. This method may be applied to analysis of gaseous radionuclides directly in an effluent stream by placing the detector directly in or adjacent to the effluent stream or passing an extracted sample of the effluent stream through a chamber or cell containing the detector.		Not applicable	

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.5 Counting Methods. All of the methods with the exception of Method A-5 involve counting the radiation emitted by the radionuclide. Counting methods applicable to the measurement of alpha, beta and gamma radiations are listed below. The equipment needed and the counting principles involved are described in detail in ASTM-3648(8). 3.5.1 Alpha Counting: ■Gas Flow Proportional Counters. The alpha particles cause ionization in the counting gas and the resulting electrical pulses are counted. These counters may be windowless or have very thin windows. ■Scintillation Counters. The alpha particles transfer energy to a scintillator resulting in a production of light photons which strike a photomultiplier tube converting the light photons to electrical pulses which are counted. The counters may involve the use of solid scintillation materials such as zinc sulfide or liquid scintillation solutions. ■Solid-State Counters. Semiconductor materials, such as silicon surface-barrier p-n junctions, act as solid ionization chambers. The alpha particles interact with the detector producing electron hole pairs. The charged pair is collected by an applied electrical field and the resulting electrical pulses are counted. ■Alpha Spectrometers. Semiconductor detectors used in conjunction with multichannel analyzers for energy discrimination.		Yes	Alpha proportional counters (home-built chambers with EG&G ORTEC electronics), window-type gas flow proportional counters (some having automatic sample changer), surface-barrier solid-state detectors connected to a multichannel analyzer (MCA) (Series 85, Jupiter system manufactured by Canberra Industries, Inc.) are used for air filter analysis in 222-S Laboratory. Laboratory equipment meets the EPA specifications.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.5.2 Beta Counting: ■ Ionization Chambers. These chambers contain the beta-emitting nuclide in gaseous form. The ionization current produced is measured. ■ Geiger-Muller (GM) Counters or Gas Flow Proportional Counters. The beta particles cause ionization in the counting gas and the resulting electrical pulses are counted. ■ Proportional gas flow counters which are heavily shielded by lead or other metal, and provided with an anti-coincidence shield to reject cosmic rays, are called low background beta counters. ■ Scintillation Counters. The beta particles transfer energy to a scintillator resulting in a production of light photons, which strike a photomultiplier tube converting the light photon to electrical pulses which are counted. This may involve the use of anthracene crystals, plastic scintillator, or liquid scintillation solutions with organic phosphors. ■ Liquid Scintillation Spectrometers. Liquid scintillation counters which use two photomultiplier tubes in coincidence to reduce background counts. This counter may also electronically discriminate among pulses of a given range of energy.		Yes	Window-type gas flow proportional counter (some having an automatic sample changer) liquid scintillation spectrometers manufactured by Beckman Instruments, Inc., are used for analysis. Our counting equipment meets the requirements.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.5.3 Gamma Counting: ■Low-Resolution Gamma Spectrometers. The gamma rays interact with thallium-activated sodium iodide or cesium iodide crystal resulting in the release of light photons which strike a photomultiplier tube converting the light pulses to electrical pulses proportional to the energy of the gamma ray. Multi-channel analyzers are used to separate and store the pulses according to the energy absorbed in the crystal. ■High-Resolution gamma Spectrometers. Gamma rays interact with a lithium-drifted (Ge(Li)) or high-purity germanium (HPGe) semiconductor detectors resulting in a production of electron-hole pairs. The charged pair is collected by an applied electrical field. A very stable low noise preamplifier amplifies the pulses of electrical charge resulting from the gamma photon interactions. Multichannel analyzers or computers are used to separate and store the pulses according to the energy absorbed in the crystal. ■Single Channel Analyzers. Thallium activated sodium iodide crystals used with a single window analyzer. Pulses from the photomultiplier tubes are separated in a single predetermined energy range.		Yes	High-resolution gamma detectors (high-purity Ge detectors for both low and high energies) from EG&G ORTEC and Princeton Gamma Tech, well-type pure Ge detectors connected to MCA (Canberra's Jupiter system) are available and used for air filter analysis. Our equipment exceeds the EPA requirements.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.5.4 Calibration of Counters. Counters are calibrated for specific radionuclide measurements using a standard of the radionuclide under either identical or very similar conditions as the sample to be counted. For gamma spectrometers a series of standards covering the energy range of interest may be used to construct a calibration curve relating gamma energy to counting efficiency. In those cases where a standard is not available for a radionuclide, counters may be calibrated using a standard with energy characteristics as similar as possible to the radionuclide to be measured. For gross alpha and beta measurements of the unidentified mixtures of radionuclides, alpha counters are calibrated with a natural uranium standard and beta counters with a cesium-137 standard. The standard must contain the same weight and distribution of solids as the samples, and be mounted in an identical manner. If the samples contain variable amounts of solids, calibration curves relating weight of solids present to counting efficiency are prepared. Standards other than those prescribed may be used provided it can be shown that such standards are more applicable to the radionuclide mixture measured. (Continued below)		Yes	A mixed gamma standard (NIST traceable) emitting various gamma-rays ranging from 59 to 1850 keV is used, using vendor-supplied calibration software, for constructing efficiency versus energy calibration curves for different geometrical configurations used in gamma analysis. The calibration procedure for gamma ray spectrometer is documented in LQ-508-003 (WHC 1992g). Our calibration procedure meets the EPA criteria for gamma ray spectroscopic analysis. $^{90}\text{Sr}/^{90}\text{Y}$ analysis, procedure LQ-508-002 is used in conjunction with LQ-508-005. It meets the requirements of the EPA-suggested method. A method standard also is used to check the performance and calibration of the detector. For calibration of alpha/beta proportional counters, the procedure LQ-508-002 is carried out. It partially deviates from the EPA requirements. For gross alpha and gross beta measurements, our ^{241}Am instruments are calibrated with ^{241}Am and ^{60}Co standards, respectively. The reasons for choosing the ^{241}Am standard for alpha calibration are as follows: • It is commonly found in the main stack air samples. • Alpha counting efficiency usually is the same for other alpha emitters that also are found in the air stack samples • The ^{241}Am standard also can be checked independently by gamma analysis.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.5.4. (Continued)		Yes	The reason for using the ^{60}Co standard for beta calibration is the lower counting efficiency with ^{60}Co (beta max = 317 keV) compared to those with ^{137}Cs (beta max = 511 keV) and ^{90}Sr (beta max = 546 keV). Consequently, it will generate conservative numbers in our analysis. The calibration curves relating weight of solids present to counting efficiencies are not done in alpha/beta analysis, but currently are being evaluated.
3.6 Radiochemical Methods for Selected Radionuclides. Methods for a selected list of radionuclides are listed in Table 1. The radionuclides listed are those which are most commonly used and which have the greatest potential for causing doses to members of the public. For radionuclides not listed in Table 1, methods based on any of the applicable "principles of measurement" described in section 3.1 through 3.4 may be used.		Yes	The air samples from the main stacks are well characterized. Some of the radionuclides identified, ^{241}Am, ^{137}Cs, ^{144}Ce, ^{147}Pm, ^{14}C, ^3H, and ^{131}I are listed in Table 1 of Method 114 (EPA 1991) and are analyzed according to the approved methods given in the table. Other radionuclides, ^{106}Rh, ^{106}Ru, ^{113}Sn, ^{125}Sb, and ^{103}Ru not listed in the table are analyzed by the methods outlined in Method 114, depending on the type of emitted radiation. It is important to note here that the radionuclides ^{95}Zr, ^{95}Nb, and ^{103}Ru have nearly decayed to nondetectable levels because no product is being produced.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.7 Applicability of Gross Alpha and Beta Measurements to Unidentified Mixtures of Radionuclides. Gross alpha and beta measurements may be used as a screening measurement as a part of an emission measurement program to identify the need to do specific radionuclide analyses or to confirm or verify that unexpected radionuclides are not being released in significant quantities. Gross alpha (Method A-4) or gross beta (Methods B-2 or B-4) measurements may also be used for the purpose of comparing the measured concentrations in the effluent stream with the limiting "concentration Levels for Environmental Compliance" in Table 2 of Appendix E. For unidentified mixtures, the measured concentration value shall be compared with the lowest environmental concentration limit for any radionuclide which is not known to be absent from the effluent stream.		Not applicable	This is not applicable because the air effluents from the Hanford Site main stacks are well characterized. However, gross alpha and beta analyses for weekly and daily air samples are routinely performed in the 222-S Laboratory before starting specific radionuclide analyses. Following this practice, the facility can verify a significant release of a radionuclide into the air so corrective actions to minimize radionuclide emission into the environment can be taken promptly by facility personnel. The gross alpha and beta results from analysis are compared to those listed in the appendix of DOE Order 5400.5 (DOE 1990) for compliance.
4.0 Quality Assurance Methods Each facility required to measure their radionuclide emissions shall conduct a quality assurance program in conjunction with the radionuclide emission measurements. This program shall assure that the emission measurements are representative, and are of known precision and accuracy and shall include administrative controls to assure prompt response when emission measurements indicate unexpectedly large emissions. The program shall consist of a system of policies, organizational responsibilities, written procedures, data quality specifications, audits, corrective actions and reports. This quality assurance program shall include the following program elements: 4.1 The organizational structure functional responsibilities, levels of authority and lines of communications for all activities related to the emissions measurement program shall be identified and documented.	WHC-EP-0536-1	Yes	See Section 7.0 of WHC-EP-0536-1 for the organizational structure

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations.	WHC-CM-4-12, Section 1.14, REV 0, ALARM RESPONSE AND MANAGEMENT	Yes	WHC-CM-4-12 (WHC 1992e), Section 1.14, REV 0, ALARM RESPONSE AND MANAGEMENT. Provides guidance and sets requirements for managing the responses to alarms which are the responsibility of Occupational Health and Safety (OHS). This practice is applicable to all members of the Occupational Health and Safety organization. Area Health and Safety managers shall ensure that all members of their organizations are aware of and adhere to this practice.
4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations. (Continued)	WHC-CM-4-12, Section 2.1, REV 0, RADIOLOGICAL PROBLEM REPORTING PROGRAM	Yes	WHC-CM-4-12, Section 2.1, REV 0, RADIOLOGICAL PROBLEM REPORTING PROGRAM. The purpose of the Radiological Problem Report (RPR) program is to provide a documented record of observed radiological problems, a mechanism for reporting these problems to management for action, a capability to track and monitor the progress of the planned corrective actions, and a database for assessing trends in radiological program performance and needed actions.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations. (Continued)	WHC-CH-4-12, Section 12.1, REV 1 EMERGENCY RESPONSE	Yes	WHC-CH-4-12, Section 12.1, REV 1 EMERGENCY RESPONSE. An EMERGENCY is a sudden, unexpected event requiring immediate response to mitigate impacts to people, property, or the environment. When radioactive material is involved, Health Physics (HP) plays a major role in evaluating, controlling, and recovering from the event. To be able to perform this function HP personnel receive training to respond to a variety of emergency situations. The HP procedures are written to provide guidelines to respond to emergencies. Together, the training and written procedure detail the HP Emergency Response Program. Emergency Response. The HP personnel are, in many situations, the first to respond to a radiological emergency. The ability to assess and evaluate the situation and take immediate steps to minimize the effects of the event is crucial for controlling the emergency. The HP personnel must use their training and experience to make good decisions during the initial response to an emergency.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations. (Continued)	WHC-CM-4-12, Section 12.1, REV 1 EMERGENCY RESPONSE	Yes	An emergency response may be initiated by personnel observing the event, alarms, the Patrol Operation Center, or the Emergency Control Center(s) once they are staffed. For a planned response, HP personnel shall be in teams of at least two. Out of necessity (e.g., backshift response), one member could be an operations person or other emergency service person such as fire or patrol. A rapid response is required; however, no undue risks should be taken nor should employee personnel safety be compromised. The type of emergency determines the level of planning for HP response. For example, a continuous air monitor (CAM) alarm or a small radioactive spill requires little planning for the initial response. However, when an emergency causes a facility evacuation, preplanning (e.g., stay time, entry route) and approval of the Building/Facility Emergency Director is necessary for a re-entry. Although HP personnel respond to an emergency using basic guidelines, an area/facility may have specific procedures that have priority over these guidelines.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations. (Continued)	WHC-IP-0718 (1993h), Section ER-04, Rev. 0, CAM Alarms	Yes	WHC-IP-0718 (1993h), Section ER-04, Rev. 0, CAM Alarms. This procedure establishes the standard method of handling samples from, and response to alarms at, Effluent Exhaust CAM systems. It establishes the method of responding to high-activity levels detected on the Effluent Release Record sample. This procedure establishes guidelines for responding to a potential or actual release of radioactive material through exhaust stacks.
4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations. (Continued)	WHC-IP-0718, Section ER-02, Rev. 0, General Emergency Response Guidelines and Checklists	Yes	WHC-IP-0718, Section ER-02, Rev. 0, General Emergency Response Guidelines and Checklists. This procedure provides the organizational structure of, the instructions for, and the responsibilities of the IP Emergency Response Team and the Health Physics Technician Field Survey Teams. Further instruction and guidelines for sampling in an emergency situation will be appended into the 0718 document.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations. (Continued)	WHC-IP-0718, Section ER-02, Rev. 0, General Emergency Response Guidelines and Checklists WHC-IP-0263-202A, Westinghouse Hanford Company Emergency Plan for PUREX Facility	Yes	WHC-IP-0718, Section er-02, Rev. 0, General Emergency Response Guidelines and Checklists. This procedure establishes the instructions to track a plume created from a radioactive material release to the environment, and other general guidelines to handle emergency situations. WHC-IP-0263-202A (WHC 1991g), Westinghouse Hanford Company Emergency Plan for PUREX Facility. This document provides instructions for many types of emergencies, including excessive releases of radioactivity via the stacks.
4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations. (Continued)	WHC-CM-5-9, Section 2.3, REV 1, PUREX/UO ₃ Plant Occurrence Categorization, Notification, and Reporting	Yes	WHC-CM-5-9 (WHC 1992f), REV 1, Section 2.3, "PUREX/UO ₃ Plant Occurrence Categorization, Notification, and Reporting." This procedure provides instructions for notification and reporting of specific events including environmental releases and related events.
4.3 The sample collection and analysis procedures used in measuring the emissions shall be described including where applicable:			

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.1 Identification of sampling sites and number of sampling points, including the rationale for site selections.		Yes	The 291-A-1 stack is 2.1 m (7 ft) in diameter. The record sampling site is a vertical section of the stack, at a height of 18 m (60 ft) above grade. There are a total of three sampling sites and six sampling probes. The elevations of the sample ports are 18, 23, and 27 m (60, 74, and 88 ft) above grade, which is the location of the last major flow disturbance in the stack. The sample ports are, therefore, approximately 8.6, 10.6, and 12.6 diameters downstream of the last major disturbance. The stack is 61 m (200 ft), or 28.6 diameters, tall. The sample ports are, therefore, approximately 20, 18, and 16 diameters upstream of the next major flow disturbance. The sites were chosen to provide representative sampling of the effluent and to comply with ANSI M13.1-1969 (ANSI 1969). The lowest sample port was chosen as the location of the record sample probe to minimize the length of sample line in accordance with ANSI M13.1-1969. These sample points also meet the criteria of 40 CFR 60, Appendix A, Method 1 (EPA 1991).

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.2 A description of sampling probes... (Continued below).		Yes	The sampling probes are "rakes," that is, multiport probes. The rakes are paired (i.e., there are two rakes at each sample location). With the exception of the particulate record sample, each rake has six inlet ports consisting of 3/8 in. outer diameter by 0.035 in. wall 316 stainless steel tubing. At the inlet, each port is tapered to a knife edge with a 15-degree angle. At the 74-ft level, the inlet ports have a 2-in. vertical section followed by a 2-in. radius bend leading into the rake. (The backup record sample is collected from a rake at the 74-ft level.) At the 60-ft and 88-ft levels, the inlet ports have a 1-7/8-in. vertical section followed by a 1-7/8-in. radius bend.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS																								
4.3.2 A description of sampling probes... (Continued)			The six-point sample rakes collect samples from the approximate centers of equal-area annuli in the stack, alternating between the near and far sides of the annuli. (For an annulus, the "center" is halfway between the inner and outer radii of an annulus.) The table below compares the actual and ideal locations of the inlet ports, and also lists the difference in inches. The positions are measured from the center of the stack in the direction away from the liner penetration. The tolerance on the actual dimensions is 0.3 cm. The limits for the locations of the new probes should therefore be: <table><tr><th>SI (cm)</th><th>SI (cm)</th><th>SI (cm)</th></tr><tr><th>Actual</th><th>Ideal</th><th>Difference</th></tr><tr><td>-101.60</td><td>-102.032</td><td>-0.43</td></tr><tr><td>-81.28</td><td>-81.269</td><td>0.01</td></tr><tr><td>-50.80</td><td>-52.572</td><td>-1.77</td></tr><tr><td>0.00</td><td>0.000</td><td>0.00</td></tr><tr><td>68.58</td><td>68.513</td><td>-0.07</td></tr><tr><td>91.44</td><td>92.244</td><td>0.80</td></tr></table>	SI (cm)	SI (cm)	SI (cm)	Actual	Ideal	Difference	-101.60	-102.032	-0.43	-81.28	-81.269	0.01	-50.80	-52.572	-1.77	0.00	0.000	0.00	68.58	68.513	-0.07	91.44	92.244	0.80
SI (cm)	SI (cm)	SI (cm)																									
Actual	Ideal	Difference																									
-101.60	-102.032	-0.43																									
-81.28	-81.269	0.01																									
-50.80	-52.572	-1.77																									
0.00	0.000	0.00																									
68.58	68.513	-0.07																									
91.44	92.244	0.80																									

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS																														
4.3.2 A description of sampling probes... (Continued)			The rake that currently collects the particulate record sample has 16 inlets, consisting of 304 stainless steel tubing. At the inlet, each port is tapered to a knife edge with a 15-degree angle. The inlet ports have a 2-in. vertical section followed by a 2-in. radius bend leading into the rake at a 45-degree angle. The outer two ports are made of 3/8 in. outer diameter, 0.065-in. wall tube. The next six ports are made of 1/4 in. outer diameter, 0.028-in. wall tube. The inner eight ports are made of 1/4 in. outer diameter, 0.035-in. wall tube. The inlet ports are arranged symmetrically and approximately centered over equal-area semi-annuli. The table compares the actual and ideal locations of the inlet ports, and also lists the difference. The positions are measured from the center of the stack. The tolerance on the actual dimensions is 0.3 cm. Old 16-point rake (still used for record sample) <table><thead><tr><th colspan="2">Metric (cm)</th><th>Metric (cm)</th></tr><tr><th>Actual</th><th>Ideal</th><th>Difference</th></tr></thead><tbody><tr><td>18.80</td><td>18.859</td><td>0.06</td></tr><tr><td>45.72</td><td>45.529</td><td>0.19</td></tr><tr><td>59.44</td><td>59.334</td><td>0.10</td></tr><tr><td>70.36</td><td>70.381</td><td>0.02</td></tr><tr><td>80.01</td><td>79.886</td><td>0.12</td></tr><tr><td>88.39</td><td>88.363</td><td>0.03</td></tr><tr><td>96.01</td><td>96.089</td><td>0.08</td></tr><tr><td>103.12</td><td>103.235</td><td>0.11</td></tr></tbody></table>	Metric (cm)		Metric (cm)	Actual	Ideal	Difference	18.80	18.859	0.06	45.72	45.529	0.19	59.44	59.334	0.10	70.36	70.381	0.02	80.01	79.886	0.12	88.39	88.363	0.03	96.01	96.089	0.08	103.12	103.235	0.11
Metric (cm)		Metric (cm)																															
Actual	Ideal	Difference																															
18.80	18.859	0.06																															
45.72	45.529	0.19																															
59.44	59.334	0.10																															
70.36	70.381	0.02																															
80.01	79.886	0.12																															
88.39	88.363	0.03																															
96.01	96.089	0.08																															
103.12	103.235	0.11																															
4.3.2 (Continued) A description of representativeness of the samples.		Yes	The use of an isokinetic 16-point probe located more than eight duct diameters downstream of the last major flow disturbance ensures representative sampling.																														

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.3 A description of any continuous monitoring system used to measure emissions, including the sensitivity of the system, calibration procedures and frequency of calibration.		Yes	Not applicable--emissions are not monitored continuously for compliance demonstration.
4.3.4 A description of the sample collection systems for each radionuclide measured, including frequency of collection, calibration procedures and frequency of calibration. (Continued Below)		Yes	The sample is continuously removed from the effluent stream via the rake described in Section 4.3.2. The sample then flows through the sample line and the particulates are collected on a sample filter. The sample filters are replaced weekly, and sometimes more often. The filtered gas then flows through two silver zeolite cartridges to capture iodine and other volatile elements. Section 4.3.6 describes the calibration of the sample flow rate measurement equipment.
4.3.4 A description of the sample collection systems for each radionuclide measured, including frequency of collection, calibration procedures and frequency of calibration. (Continued)		Yes	No irradiated fuel has been introduced into the PUREX Plant for several years. No dissolutions have been performed since late 1989. Gaseous sampling systems had shown that the levels of ^3H and ^{14}C had fallen to levels at or below the analytical detection limit, which were well below environmental release and monitoring limits. Consequently, sampling for these radionuclides is no longer required or performed. The release of other radioactive gases decreased more rapidly than for these radionuclides. Consequently, there is no need for gaseous radionuclide sampling.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration. (Continued Below)	LA-508-110 LA-508-114 LO-150-115 LQ-508-002	Yes	Total alpha/total beta activity is determined by procedure LA-508-110 or LA-508-114 on weekly samples, and occasionally on daily air-samples, per collection point. The calibration procedure is documented in LQ-508-002. It is done only when deemed necessary by a responsible scientist. The counting system is recalibrated only in case of (1) major repairs or adjustments to the power supply or detector or (2) calibration shift as indicated by the instrument control standards. The performance of the counting systems is checked by running the instrument control standards (147Pm for low-energy beta, 60Co for mid-energy beta, 137Cs for high-energy beta, and 241Am for alpha activity) separately. When a batch of air filter samples is run, all the performance standards and the background (for counting frequency refer to LO-150-115) also are run with it. To verify that the counting system is working properly, the standard values from analysis should fall within the administrative limits set according to appropriate quality assurance program plans (QAPP).

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration. (Continued)	LA-508-051 LA-542-101 LA-943-123 LO-150-115	Yes	Our laboratory method for analysis of alpha emitters (^{241}Am, ^{238}Pu, and ^{239}Pu) involves various steps (LA-549-112 for dissolution, LA-943-123 for chemical separation, LA-542-101 for electrodeposition, and LA-508-051 for final alpha spectrometry). The analysis of alpha emitters is done on a quarterly composite of weekly/daily air filter samples. The energy resolution and calibration of the AEA system over the energy range of 4 to 6 MeV are checked once a month by the preventive maintenance (PM) procedure 2S18006. Efficiency calibration of the AEA is not needed in our analysis method because direct comparison of the sample with recoveries of the tracers (^{241}Am and ^{238}Pu) is made to determine the activities of the radionuclides present in the sample. To carry out the sample analysis, AEA system performance is checked once every 24 hours for alpha energy shift with a certified mixed alpha source standard. Each alpha energy peak identified in the standard must fall within administratively assigned certain channels (+10) on the MCA. For counting frequency of performance check standards, procedure LO-150-115 is referred to. The recovery of the radionuclides and the calibration of the system are checked on a batch basis by running a method standard under the identical conditions as the sample.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration. (Continued)	LA-220-103 LA-508-111 LA-549-112 LQ-508-002 LQ-508-005	Yes	The lab method for determining beta activity (^{89}Sr, ^{90}Sr, ^{90}Y) consists of a dissolution step (LA-549-112), chemical separation (LA-220-103), and total beta counting (LA-508-111). Analysis is done on a quarterly composite of weekly/daily air filter samples per collection point. The calibration procedure LQ-508-002 (for window-type gas flow proportional counter) is used in conjunction with LQ-508-005 (^{90}Sr in mother/daughter case, i.e., $^{90}\text{Sr}/^{90}\text{Y}$ in growth calibration). It is performed only when the responsible scientist finds it necessary. The reasons are the same as stated for total alpha/total beta. The performance of the counting system is checked once per shift by running instrument control standards (^{60}Co, ^{137}Cs, and ^{147}Pm for beta activity). The complete procedure for the $^{90}\text{Sr}/^{90}\text{Y}$ analysis in the sample is carried out with a method standard (several filter samples spiked with ^{90}Sr, ^{147}Pm, ^{60}Co, ^{137}Cs, ^{241}Am, ^{239}Pu, and U provided by the 222-SA Standard Laboratory) on a batch basis. This checks the overall performance of our method. The chemical yield is determined by using appropriate carrier.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration. (continued)	LA-218-112 LA-348-101 LA-508-111 LA-508-121 LA-549-112 LA-613-111 LO-150-115	Yes	Determination of beta activity (^{147}Pm, ^{14}C, and ^3H) involves processing (LA-549-112 and LA-613-111 for ^{147}Pm, LA-348-101 for ^{14}C, and LA-218-112 for ^3H), mounting in scintillation cocktail (LA-508-111), and finally, liquid scintillation counting (LA-508-121). The ^{147}Pm analysis is done on quarterly composites of weekly/daily air filter samples. The ^{14}C and ^3H analyses are done on biweekly gas samples. For calibration, the quality assurance (QA) section of procedure LA-508-121 is referenced. The calibration of the instrument is checked by the manufacturer's supplied sources (^{14}C and ^3H) and its software. For ^{147}Pm analysis, the method standard is run once per quarter. The method standard is always run with a batch of samples for ^3H and ^{14}C analysis. The results of the method standard checks the overall performance, including the calibration of the counting system. The instrument calibration check is done a minimum of once a week (refer to LO-150-115).

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration. (Continued)	LA-288-101 LA-508-052 LQ-508-003	Yes	For analysis of gamma emitters ⁹⁵Nb, ⁹⁵Zr, ¹³⁷Cs, and ¹⁴⁴Ce the procedure LA-508-052 is followed. Analysis is done on quarterly composites of weekly/ daily air filter samples. For analysis of volatile radionuclides (¹²⁵I, ¹³¹I, ¹⁰⁶Rh/¹⁰⁶Ru, ¹²⁵Sb, and ¹⁰³Ru) collected weekly on silver zeolite cartridge, the procedure LA-288-101 is used in conjunction with procedure LA-508-052. Calibration of the gamma ray spectrometer is done with the procedure documented in LQ-508-003 using a (NIST traceable) certified mixed gamma ray standard. It is carried out only when it is deemed necessary by a responsible scientist. To check efficiency and energy calibration daily, the performance of each detector of the GEA system over the whole energy range is done once every shift by running a mixed gamma standard consisting of ²⁴Am for low energy, ¹³⁷Cs for mid energy, and ⁶⁰Co for high energy. The results of each of these radionuclides should fall within the administrative limits set according to the appropriate QAPP to continue analysis of samples. The daily performance results are documented. Minor adjustments of the electronics (e.g., fine gain, pole zero of the amplifiers, lower level discriminator of analog-to-digital converter) are done from time to time when necessary for proper energy calibration. Whenever a minor electronic adjustment is done on a detector, it is followed by analysis of a performance standard. For a major shift in the calibration, the system is then thoroughly calibrated using LQ-508-003.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration. (Continued)	WHC-CH-5-4, Section 5.4, "Analytical Laboratory Procedures"	Yes	The content of the 222-S Laboratory's procedures, test plans, supporting documents, and drawings provide a sufficient level of detail to allow trained personnel to produce quality results safely. Laboratory procedures are controlled as required by WHC-CH-5-4, Section 5.4, "Analytical Laboratory Procedures." The specific content of laboratory procedures is defined by its author, based on accepted methods such as 40 CFR 61, Appendix B, Method 114 (EPA 1991). The content must be agreed to by the peer and technical reviewers. While authors are responsible for the specific content of their procedures, they address the topics below.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration. (Continued)		Yes	<u>Summary</u>--MANDATORY--A short description or abstract of the procedure containing enough information to distinguish it from other procedures. <u>Applications</u>--MANDATORY--Defines the scope and purpose of the specific procedure. This section may be combined with the following element under the title "Applications and Limitations." <u>Limitations</u>--MANDATORY--Briefly describes those areas in which the procedure is not applicable. A statement of accuracy and precision will be given where appropriate. <u>Quality Control Protocol</u>--Procedures used to support environmental projects that have specific quality control requirements. For these procedures, the source of the quality control requirements will be identified. The samples or project that this element applies to will be identified. The following information is typical of quality control requirements: frequency and type of calibration, reagent blank analysis, spike sample analysis, and duplicate sample analysis.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration. (Continued)		Yes	Impact Level Identifier--MANDATORY--An impact level will be identified for each procedure following WHC-CN-1-3, MRP 5.43, with a brief basis of determination statement. This MRP lists several descriptive paragraphs delineating what constitutes an Impact Level 1, 2, 3, or 4 activity. The following parts of MRP 5.43 cover most analytical laboratory procedures. 1. Section 5, Paragraph 6, Part c.; Impact Level 3--work authorization documentation associated with work involving occupational hazards not covered by approved procedure, such as Operational Safety Assessments, Radiation Work Permits, or Industrial Safety Standards. 2. Section 5, Paragraph 6, Part c.; Impact Level 4--Documentation for any activity not classed as Impact Level 1, 2, or 3. The laboratories' procedures are usually specific to one activity. These activities are well defined using common scientific instrumentation and equipment operated in an acceptable manner. The chemicals and materials used are normally small quantities with limited potential for environmental or personnel safety impact. In general, the equipment used in the laboratory is not classified as Safety Class 3 or higher.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration. (Continued)		Yes	Safety--MANDATORY--The procedure must identify applicable safety hazards. The following documents identify Hanford Site safety requirements: • WHC-CM-4-3, Volume 1-3, <u>Industrial Safety</u> • WHC-CM-4-10, Radiation Protection • WHC-CM-4-15, Radiation Work Requirements and Work Permits Manual • WHC-CM-4-29, <u>Nuclear Criticality Safety</u>. Supporting document WHC-SD-CP-LB-003, Safety in the Analytical Laboratory (WHC 1992g), is the laboratory general safety document. The authors must review safety requirements and include safety warnings appropriate to the actions directed by the procedure.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration. (Continued)		Yes	Reagents--If the procedure requires analytical reagents, a list of reagents will be provided. The MSDS number will be placed in brackets by each chemical name. Reagent makeup, storage container requirements, unique storage needs, shelf-life requirements, special labeling, and special preparation steps will be included. Special notations for any known or suspected carcinogen as listed on WHC-CN-4-3, Volume 2, Table 1, "IARC Master Carcinogen List," will be made on the reagent list. Reagent preparation described fully in other current Hanford Site documentation may be included by reference. Equipment--Special equipment needs will be listed. Standard hood or glovebox equipment is assumed to be available at the work station and does not need to be listed. The fabrication of off-standard equipment will be referenced or described in this section.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration. (Continued)		Yes	<u>Procedure Steps</u>--MANDATORY--A step-by-step description of operations necessary to perform the task will be presented in a logical and sequentially numbered order or an assignment of responsibilities. CAUTION and WARNING notations will be included for the applicable safety hazard before the action is described. Steps with potential for criticality specification violation will be identified. Explanatory "Notes" may be included for clarification of process. <u>Calculations</u>--Calculations required to complete the work will be described in this section. Examples with sample values may be included. All combined factors will be fully described and units noted. <u>Calibrations</u>--When calibrations are required, a description of how to carry out required calibrations will be given. <u>Discussion</u>--A discussion of the theoretical aspects of the procedure. Brief identification of unique characteristics and interfaces to aid in troubleshooting may be included. <u>References</u>--A reference list of published information to provide technical basis for the procedure may be included.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration. (Continued)		Yes	The mandatory topics are addressed in both procedures. However, the laboratories have technical, analytical, and administrative procedures. Nonmandatory topics are included if appropriate to the activity covered by the procedure. The calibrations of all laboratory instruments are controlled by the Laboratory Instrument Calibration Control System (LICCS) (WHC-CH-5-4, the Section 8.2). The LICCS documents the requirements for and the performance of calibration activities for each analytical instrument or measurement device.
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration. (Continued)		Yes	The Facility Effluent Monitoring Plan Determination for the 200 Area Facilities (WHC 1991h) lists the analytes of interest for the 201A-1 Stack. These are: ^{238}Pu, ^{239}Pu, ^{241}Am, ^{89}Sr, ^{90}Sr, ^{137}Cs, ^{135}I, ^{137}Cs, ^{103}Ru, and ^{106}Ru. See Section 3.0 for details on laboratory procedures.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.6 A description of the sample flow rate measurement systems or procedures, including calibration procedures and frequency of calibration.	PSCP-1-045 PSCP-4-16 PSCP-4-197	Yes	After exiting the record sample filter, the air flows through a flow measurement and control system. Currently a Kurz ¹ Model 505 system measures the sample flow rate, a Kurz model 101-RM totalizes the sample flow, and a Kurz 710RMD(4200) adjusts a control valve to maintain a constant flow. At least once a day an employee adjusts the 710RMD to ensure isokinetic. The instruments are calibrated at least once per year (normally every 6 months). Currently the calibration procedures are PSCP-1-045, PSCP-4-167, and PSCP-4-197.
4.3.7 A description of the effluent flow rate measurement procedures, including frequency of measurements, calibration procedures, and frequency of calibration.	PSCP-7-001	Yes	After exiting the flow control valve, the air flows through a rotameter which provides backup indication. Approximately yearly calibration is accomplished by comparison with a standard rotameter, using procedure PSCP-7-001.
4.3.7 A description of the effluent flow rate measurement procedures, including frequency of measurements, calibration procedures, and frequency of calibration.	PSCP-1-044 PSCP-4-001 PSCP-4-167	Yes	A six-point Kurz probe continuously measures the flow through the stack at the 74-ft level. A Kurz Model 1958 transmitter sends the signal to a Kurz Model 142-RMD and a Kurz Model 132, which then drives a recorder, which continuously records the flow rate. The total flow is then summed from the recorder trace. The six flow elements on the six-point probe are pre-calibrated by the manufacturer. The remaining instruments are calibrated at least once per year (normally every 6 months). Currently the calibration procedures are PSCP-1-044, PSCP-4-001, and PSCP-4-167.

¹Kurz is a trademark of Kurz Instruments, Inc.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.4 The objectives of the quality assurance program shall be documented and shall state the required precision, accuracy and completeness of the emission measurement data including a description of the procedures used to assess these parameters. Accuracy is the degree of agreement of a measurement with a true or known value. Precision is a measure of the agreement among individual measurements of the same parameters under similar conditions. Completeness is a measure of the amount of data obtained compared to the amount expected under normal conditions.	<u>Environmental Protection Quality Assurance Project Plan, WHC-EP-0528</u>	Yes	The objectives are documented in the Environmental Protection Quality Assurance Project Plan (QAPJP) (WHC 1992b)
4.5 A quality control program shall be established to evaluate and track the quality of the emissions measurement data against preset criteria. The program should include where applicable a system of replicates, spiked samples, split samples, blanks and control charts. The number and frequency of such quality control checks shall be identified.	<u>Environmental Protection Quality Assurance Project Plan, WHC-EP-0528</u>		The quality control program is documented in the Environmental Protection Quality Assurance Project Plan (QAPJP) (WHC 1992b)
4.6 A sample tracking system shall be established to provide for positive identification of samples and data through all phases of the sample collection, analysis and reporting system. Sample handling and preservation procedures shall be established to maintain the integrity of samples during collection, storage and analysis.	<u>Program Plan for Radionuclide Airborne Emissions Monitoring Program, WHC-EP-0536-1</u>	Yes	Refer to Section 6.2.2 of WHC-EP-0536-1.
4.7 Periodic internal and external audits shall be performed to monitor compliance with the quality assurance program. These audits shall be performed in accordance with written procedures and conducted by personnel who do not have responsibility for performing any of the operations being audited.	<u>Program Plan for Radionuclide Airborne Emissions Monitoring Program, WHC-EP-0536-1</u>	Yes	Refer to Section 8.0 of WHC-EP-0536-1.

Table 14-1. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.8 A corrective action program shall be established including criteria for when corrective action is needed, what corrective action will be taken and who is responsible for taking the corrective action.	Program Plan for Radionuclide Airborne Emissions Monitoring Program, WHC-EP-0536-1	Yes	Refer to Sections 4.0 and 9.0 of WHC-EP-0536-1.
4.9 Periodic reports to responsible management shall be prepared on the performance of the emissions measurements program. These reports should include assessment of the quality of the data, results of audits and description of corrective actions.	Program Plan for Radionuclide Airborne Emissions Monitoring Program, WHC-EP-0536-1	Yes	Refer to Section 10.0 of WHC-EP-0536-1.
4.10 Provide qualifications and training needed for Facility Cognizant Engineer.	WHC-QM-5-9, REV 0, Section 2.19, "Selection of PUREX/UO ₂ Cognizant Engineers and Managers"	Yes	This procedure establishes the requirements, qualifications, and process for the selection of PUREX/UO ₂ Cognizant Engineers and Cognizant Engineer Managers.

Trademarks:

Air Neutronics MP Series 4 Autozero Digital Micromanometer is a trademark of Air Neutronics Limited.
 Gelman Veraspor 3000 is a trademark of Gelman Sciences.
 Jupiter System, Series 85 is a trademark of Canberra Industries, Inc.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
40 CFR 61. Subpart H. National Emission Standards for Emissions of Radionuclides Other Than Radon From U.S. Department of Energy Facilities			

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
61.92 Standard Emissions of radionuclides to the ambient air from Department of Energy facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/yr.		Yes	Dose calculations for atmospheric radionuclide releases from the Hanford Site for calendar year (CY) 1992 were performed by Pacific Northwest Laboratory (PNL) using the approved U.S. Environmental Protection Agency (EPA) CAP-88 computer model. Emissions from discharge points in the Hanford Site 100, 200, 300, 400, and 600 areas were calculated based on results of analyses of continuous and periodic sampling conducted at the discharge points. These calculated emissions were provided for inclusion in the CAP-88 model by area and by individual facility for those facilities having the potential to contribute more than 10% of the Hanford Site total or to result in an impact of greater than 0.1 mrem per year to the maximally exposed individual (MEI). Also included in the assessment of offsite dose modeling are the measured radioactive emissions from all Hanford Site stacks that have routine monitoring performed. Record sampling systems have been installed on all stacks and vents that use exhaust fans to discharge air that may potentially carry airborne radioactivity. Estimation of activity from ingrowth of long-lived radioactive progeny is not included in the CAP-88 model; therefore, the Hanford Site GENII code (Napier et al. 1988) was used to supplement the CAP-88 dose calculations. When the dose to the MEI located in the Ringold area was calculated, the effective dose equivalent (EDE) from combined Hanford Site radioactive airborne emissions was shown to be 3.7E-03 mrem. This value was reported in the annual air emissions report prepared for the Hanford Site (RL 1993).

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
61.93 <u>Emission monitoring and test procedures</u> (a) To determine compliance with the standard, radionuclide emissions shall be determined and effective dose equivalent values to members of the public calculated using EPA approved sampling procedures, computer models CAP-88 or AIRDOS-PC, or other procedures for which EPA has granted prior approval.		Yes	Dose calculations for atmospheric radionuclide releases from the Hanford Site for CY 1992 were performed by PNL using the approved EPA CAP-88 computer model. Emissions from discharge points in the Hanford Site 100, 200, 300, 400, and 600 areas were calculated based on results of analyses of continuous and periodic sampling conducted at the discharge points. These calculated emissions were provided for inclusion in the CAP-88 model by area and by individual facility for those facilities having the potential to contribute more than 10% of the Hanford Site total or to result in an impact of greater than 0.1 mrem per year to the maximally exposed individual. Estimation of activity from ingrowth of long-lived radioactive progeny is not included in the CAP-88 model; therefore, the Hanford Site GENII code (Napier et al. 1988) was used to supplement the CAP-88 dose calculations. When the dose to the maximally exposed individual located in the Ringold area was calculated, the effective dose equivalent (EDE) from combined Hanford Site radioactive airborne emissions was shown to be 3.7E-03 mrem. This value was reported in the annual air emissions report prepared for the Hanford Site (RL 1993).

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
(b) Radionuclide emission rates from point sources (stacks or vents) shall be measured in accordance with the following requirements or other procedures for which EPA has granted prior approval: (1) Effluent flow rate measurements shall be made using the following methods: (i) Reference Method 2 of Appendix A to part 60 shall be used to determine velocity and volumetric flow rates for stacks and large vents.	Drawing H-2-75570 (WHC 1991)	Yes	Based on the drawing referenced above, the velocity measuring location used by Hanford Site Vent and Balance personnel has a cross-sectional area sufficient to be considered a large stack; therefore, Reference Method 2 applies.
(ii) Reference Method 2A of Appendix A to part 60 shall be used to measure flow rates through pipes and small vents. (iii) The frequency of the flow rate measurements shall depend upon the variability of the effluent flow rate. For variable flow rates, continuous or frequent flow rate measurements shall be made. For relatively constant flow rates only periodic measurements are necessary.		Equivalent	Although the stack flow rate is relatively constant, Reference Method 2 is not used. Instead, the flow is measured continuously, as described in Section 4.3.7 of Method 114.
(2) Radionuclides shall be directly monitored or extracted, collected and measured using the following methods: (i) Reference Method 1 of Appendix A part 60 shall be used to select monitoring or sampling sites.	See point-by-point comparison with Method 1, Section 2.1.		
(ii) The effluent stream shall be directly monitored continuously with an inline detector or representative samples of the effluent stream shall be withdrawn continuously from the sampling site following the guidance of ANSI N13.1-1969 (including Appendix A of ANSI N13.1).	See point-by-point comparison with American National Standards Institute (ANSI) N13.1-1969 (ANSI 1969).		

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
(111) Radionuclides shall be collected and measured using procedures based on the principles of measurement described in Appendix B, Method 114 [of part 61]. Use of methods based on principles of measurement different from those described in Appendix B, Method 114 must have prior approval from the Administrator. EPA reserves right to approve measurement procedures.	See point-by-point comparison with Method 114.		
(iv) A quality assurance program shall be conducted that meets the performance requirements described in Appendix B, Method 114.	See point-by-point comparison with Method 114.		
(3) When it is impractical to measure the effluent flow rate as in (b)(1) or to monitor or sample an effluent stream as in (b)(2), see this section for further requirements.		Yes	WHC-SD-CP-TI-188 indicates that this stack should be measured (WHC 1994a).
(4)(1) Radionuclide emission measurements in conformance with the requirements of paragraph (b) of this section shall be made at all release points which have a potential to discharge radionuclides into the air in quantities which could cause an effective dose equivalent (EDE) in excess of 1% of the standard. All radionuclides which could contribute >10% of the EDE for a release point shall be measured. For other release points with potential to release radionuclides into the air, periodic confirmatory measurements shall be made to verify the low emissions.			

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
(11) In evaluating the potential of a release point to discharge radionuclides into the air, for the purpose of this section, the estimated rad release rates shall be based on the discharge of the effluent stream that would result if all pollution control equipment did not exist, but the facility operations were otherwise normal.	FEMP		Offsite dose calculations were performed on all stacks (registered with the Washington Department of Health under Permit FF-01) without pollution control equipment and using the PNL unit dose conversions. A total of 15 Hanford Site stacks exceeded the 0.1-mrem criterion and will require continuous monitoring in accordance with provisions of 40 CFR 61.93(b).

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
(5) Environmental measurements of radionuclide air concentrations at critical receptor locations may be used as an alternative to air dispersion calculations in demonstrating compliance with the standard if the owner or operator meets the following criteria: (i) The air at point of measurement shall be continuously sampled for collection of radionuclides. (ii) Major contributing radionuclides to the EDE must be collected and measured. (iii) Rad concentrations causing an EDE of 10% of the standard shall be readily detectable and distinguishable from background. (iv) Net measured radionuclide concentrations shall be compared to the concentration levels in Table 2 of App. E (part 61) to determine compliance with the standard. In the case of multiple radionuclides, compliance is demonstrated if the value for all rad is less than the concentration levels in Table 2, and the sum of the fractions that result when each measured concentration value is divided by the value in Table 2 for each rad is <1. (v) A program for quality assurance shall be conducted meeting the requirements of App. B, Method 114 (part 61). (vi) Use of environmental measurements to demonstrate compliance with the standard is subject to prior approval of EPA.		Not Applicable	Air dispersion calculations are performed.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
<u>61.94 Compliance and reporting.</u> (a) Compliance with this standard shall be determined by calculating the highest EDE to any member of the public at any offsite point where there is a residence, school, business, or office. Each facility shall submit an annual report to both EPA HQ and Regional by June 30, which includes monitoring results and dose calculations required by 61.43 (a) for the previous calendar year.		Yes	The Ringold location was chosen several years ago as the area where the offsite dose from all air pathways would be the highest for the MEI for the Hanford Site. The selection of Ringold was made because nearly all of the dose from air releases in recent years has been contributed by radionuclides from the Plutonium-Uranium Extraction (PUREX) Plant stack. The Ringold area is the closest farming area to the PUREX Plant, and it realistically matches the assumption that the MEI diet consists of 100% home-grown food. The Ringold area historically has been capable of producing all of the items in the MEI diet with the possible exception of cereal grain. The Ringold area lies in the path of the prevailing winds from the 200 East area. The atmospheric dispersion factor (X/Q) at Ringold is historically within 10% to 20% of the maximum offsite X/Q value associated with 200 Areas' releases. The maximum value usually occurs in an adjacent sector where there is no farming. The U.S. Department of Energy Field Office, Richland (RL), provided the annual report for CY 1992 (RL 1993) to U.S. Department of Energy, Headquarters; the EPA, Region X, personnel; and the Washington Department of Health personnel in compliance with the regulatory deadline.
(b) In addition to the requirements of paragraph (a) of this section, an annual report shall include the following information:			(Future annual reports will also address the following requirements.)

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
(1) Name and location of facility.	RL-93-36, Pages 1-5 through 1-29. The Hanford Site summary is discussed on pages 1-1 through 1-5.	Yes	
(2) List of radioactive materials used at the facility.	RL-93-36, Table 2-1 on pages 2-2 through 2-11.	Yes	Please also refer to explanatory remarks for 40 CFR 61.93(b)(4)(1) above.
(3) Description of handling and processing of rad materials at the facility.	RL-93-36, Pages 1-5 through 1-29.	Yes	
(4) List of the stacks and vents (or other points where radioactive materials are released to the atmosphere).	RL-93-36, Pages 1-5 through 1-29.	Yes	
(5) A description of the effluent controls that are used on each stack vent of release point, and an estimate of the efficiency of each control device.	RL-93-36, Table 2-1 on pages 2-2 through 2-11.	Yes	
(6) Distances from the points of release to the nearest residence, school, business or office and the nearest farms producing vegetables, milk, and meat.	RL-93-36, Tables 3-2, 3-3, in Section 3.	Yes	These tables show the CAP-88 dose estimates for the offsite individual at Ringold exposed to radionuclide emissions from Hanford Site during 1992. Please also refer to explanatory remarks for 40 CFR 61.94 above.
(7) The values used for all other input parameters for the computer models (meteorological data) and the source of these data.	RL-93-36, Input parameters are shown in Table 2-1, pages 2-2 through 2-11. Annual average dispersion factors around the 100, 200, 300, and 400 Areas during 1992 are given in Tables 3-5 through 3-9.	Yes	These tables use site-specific measurements of the occurrence frequencies for wind speed, wind direction, and atmospheric stability. The products of the dispersion models are annual average dispersion factors (X/g' , in units of ci/m^3 per ci/s or s/m') that, when combined with annual average release rates, will predict average radionuclide air concentrations for the year.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
(8) A brief description of all construction and modifications which were completed in the calendar year for which the report is prepared, but for which the requirement to apply for approval to construct or modify was waived under 61.96.	RL-93-36, Section 3.6.1.	Yes	No projects were completed that needed approval for construction or waiver for modifications.
(9) Each report shall be signed and dated by a corporate officer or public official in charge of the facility and containing a declaration of belief of accuracy and truth of the report.	RL-93-36, page 3-13, signed by John D. Wagoner, Manager, RL.	Yes	
(c) If the facility is not in compliance with the emission limits of 61.96 in the calendar year, reporting the information in (b) [above] must be done on a monthly basis starting immediately following the noncompliance annual report. Monthly reports shall also include:	RL-93-36	Yes	The annual emissions report indicate that the Hanford site is <10 mrem/yr for 1993.
(1) Controls or other changes installed to bring the facility into compliance.		Not applicable	This information is not classified; hence this section is not applicable.
(2) If the facility is under a judicial or administrative enforcement decree, the report will describe the facility performance under the terms of the decree.			
(d) If this information is classified, it will be made available to EPA separately and handled in accordance with regulations.			
61.95 Recordkeeping requirements. All facilities must maintain records documenting the source of input parameters including the results of all measurements, calculations, analytical methods, and procedure for determining EDE. Sufficient information to allow an independent auditor to verify the accuracy should be kept. The records must be kept at the site for at least five years and must be made available upon request to an authorized representative.		Yes	All records and data used in the generation and verification of regulatory reports are controlled in accordance with WHC-QM-4-2, QR 4.0, "Document Control," and QR 17.0, "Quality Assurance Records." (WHC 1992b)

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
61.96 Applications to construct or modify. In addition to construction as defined under 40 CFR 61 subpart A, any fabrication, erection or installation of a new building or structure within a facility that emits radionuclides is also defined as new construction for purposes of 40 CFR 61 subpart A. (b) Application for approval [61.07] or notification of startup [61.09] does not need to be filed for any new construction or modification if the EDE caused by all emissions from the new construction or modification is less than 1% of the standard of 61.92. EDE shall be calculated using the source term derived from Appendix D as input to dispersion described in 61.93. A facility is eligible for this exemption only if it is in compliance based on its last annual report. (c) Conditions to approvals granted under 61.08 will not contain requirements for post approval reporting on operating conditions beyond those specified in 61.94.		Not applicable	
61.97 Exemption from the reporting and testing requirements of 40 CFR 61.10. All facilities designated under subpart H are exempt from the reporting requirements of 40 CFR 61.10.			

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
40 CFR 60, APPENDIX A, REFERENCE METHOD 2, DETERMINATION OF STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE (TYPE S PITOT TUBE)			Although the stack flow rate is relatively constant, Reference Method 2 is not used for demonstrating compliance. Instead, the flow is measured continuously, as described in Section 4.3.7 of Method 114. Pitot traverses are performed as a check on the accuracy of the continuous flow instrumentation.
1.0 Principle and Applicability 1.1 Principle. The average gas velocity in a stack is determined from the gas density and from measurement of the average velocity head with a Type S (Stausscheibe or reverse type) pitot tube.	7-GN-56 (WHC 1993a).		Average gas velocity is determined by averaging the results of exhaust duct traverses which have been conducted using a standard pitot tube and typically an Air Neotronics Limited MP Series 4 Autozero Digital Micromanometer (see description of this latter instrument in Section 2.2 below). Procedure 7-GN-56 indicates that traverse locations are determined in accordance with Section 9 of the American Industrial Hygiene Association Industrial Ventilation manual rather than EPA Method 1.
1.2 Applicability. This method is applicable for measurement of the average velocity of a gas stream and for quantifying gas flow. This procedure is not applicable at measurement sites which fail to meet the criteria of Method 1, Section 2.1. Also, the method cannot be used for direct measurement in cyclonic or swirling gas streams; Section 2.4 of Method 1 shows how to determine cyclonic or swirling flow conditions. When unacceptable conditions exist, alternative procedures, subject to the approval of the Administrator, U.S. Environmental Protection Agency, must be employed to make accurate flow rate determinations; examples of such alternative procedures are: (1) to install straightening vanes; (2) to calculate the total volumetric flow rate stoichiometrically; or (3) to move to another measurement site at which the flow is acceptable.			At the traverse location used by Vent and Balance the stack diameter is .61m (2 ft). The distance between the nearest downstream and upstream disturbances are 16.2 m and 2.7 m (53 and 9 ft), respectively. The eight-and-two-diameter criterion of Method 1, Section 2.1, is therefore met.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.0 Apparatus Specifications for the apparatus are given below. Any other apparatus that has been demonstrated (subject to approval of the Administrator) to be capable of meeting the specifications will be considered acceptable. 2.1 Type S Pitot Tube. The Type S pitot tube (Figure 2-1) shall be made of metal tubing (e.g., stainless steel). It is recommended that the external tubing diameter (dimension D_t Figure 2-2b) be between 0.48 and 0.95 centimeter (3/16 and 3/8 inch). There shall be an equal distance from the base of each leg of the pitot tube to its face-opening plane (dimensions PA and PB Figure 2-2b); it is recommended that this distance be between 1.05 and 1.50 times the external tubing diameter. The face openings of the pitot tube shall, preferably, be aligned as shown in Figure 2-2; however, slight misalignments of the openings are permissible (see Figure 2-3). The Type S pitot tube shall have a known coefficient, determined as outlined in Section 4. An identification number shall be assigned to the pitot tube; this number shall be permanently marked or engraved on the body of the tube.			

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
(2.1 continued) A standard pitot tube may be used instead of a Type S, provided that it meets the specifications of Sections 2.7 and 4.2: note, however, that the static and impact pressure holes of standard pitot tubes are susceptible to plugging in particulate-laden gas streams. Therefore, whenever a standard pitot tube is used to perform a traverse adequate proof must be furnished that the openings of the pitot tube have not plugged up during the traverse period; this can be done by taking a velocity head ΔP reading at the final traverse point, cleaning out the impact and static holes of the standard pitot tube by "back-purging" with pressurized air, and then taking another ΔP reading. If the ΔP readings made before and after the air purge are the same (± 5 percent), the traverse is acceptable. Otherwise, reject the run. Note that if ΔP at the final traverse point is unsuitably low, another point may be selected. If "back-purging" at regular intervals is part of the procedure, then comparative ΔP readings shall be taken, as above, for the last two back purges at which suitably high ΔP readings are observed.	7-GN-56		The standard pitot tube is used in conjunction with a digital micromanometer to determine stack velocities. Document 7-GN-56 does not reference procedures used to prove that pitot tube openings have plugged during velocity measurements, however, because the measurement locations are positioned downstream from high-efficiency particulate air (HEPA) filter banks, it is unlikely that plugging of tube openings occurs. (Note: As of April 1994, a new procedure is being used (PROC. NO. 1202) to include a pressure differential measurement after the last traverse (WHC 1994b).

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.2 Differential Pressure Gauge. An inclined manometer or equivalent device is used. Most sampling trains are equipped with a 10-in. (water-column) inclined-vertical manometer, having 0.01-in. H₂O divisions on the 0- to 1-in. inclined scale, and 0.1-in. H₂O divisions on the 1- to 10-in. vertical scale. This type of manometer (or other gauge of equivalent sensitivity) is satisfactory for the measurement of ΔP values as low as 1.3 mm (0.05 in.) H₂O. However, a differential pressure gauge of greater sensitivity shall be used (subject to the approval of the Administrator), if any of the following is found to be true: (1) the arithmetic average of all ΔP readings at the traverse points in the stack is less than 1.3 mm (0.05 in.) H₂O; (2) for traverses of 12 or more points, more than 10 percent of the individual ΔP readings are below 1.3 mm (0.05 in.) H₂O; (3) for traverses of fewer than 12 points, more than one ΔP reading is below 1.3 mm (0.05 in.) H₂O. Citation 18 in Section 6 describes commercially available instrumentation for the measurement of low-range gas velocities. As an alternative to criteria (1) through (3) above, the following calculation may be performed to determine the necessity of using a more sensitive differential pressure gauge: (see equation 40 CFR Pt. 60 App. A, Meth. 2, page 695) If T is greater than 1.05, the velocity head data are unacceptable and a more sensitive differential pressure gauge must be used.			

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
(2.2 continued) NOTE: If differential pressure gauges other than inclined manometers are used (e.g., magnetic gauges) their calibration must be checked after each test series. To check the calibration of a differential pressure gauge, compare ΔP readings of the gauge with those of a gauge-oil manometer at a minimum of three points, approximately representing the range of ΔP values in the stack. If, at each point, the values of ΔP as read by the differential pressure gauge and gauge-oil manometer agree to within 5 percent, the differential pressure gauge shall be considered to be in proper calibration. Otherwise, the test series shall either be voided, or procedures to adjust the measured ΔP values and final results shall be used subject to the approval of the Administrator.	7-GN-56 and manufacturer's product literature.		An Air Heatonics MP Series 4 Autozero Digital Micromanometer (Air Heatonics Limited) typically is used to determine differential pressure and flow velocity. This instrument consists of a differential capacitance transducer and internal electronics that allow the instrument to calculate and display corrected velocity readings directly from pitot tube probes. Dynamic pressure signals from pitot static and total head tubes are corrected automatically within the instrument and displayed in feet per minute. The instrument is capable of resolving pressure to .025 mm (0.001 in.) H_2O (according to manufacturer's literature). Procedure 7-GN-56 requires that the instrument carry a current calibration sticker, traceable to National Institute of Standards and Technology (NIST).
2.3 Temperature Gauge. A thermocouple, liquid-filled bulb thermometer, bimetallic thermometer, mercury-in-glass thermometer, or other gauge, capable of measuring temperature to within 1.5 percent of the minimum absolute stack temperature shall be used. The temperature gauge shall be attached to the pitot tube such that the sensor tip does not touch any metal; the gauge shall be in an interference-free arrangement with respect to the pitot tube face openings (see Figure 2-1 and also Figure 2-7 in Section 4). Alternate positions may be used if the pitot tube-temperature gauge system is calibrated according to the procedure of Section 4. Provided that a difference of not more than 1 percent in the average velocity measurement is introduced, the temperature gauge need not be attached to the pitot tube; this alternative is subject to the Approval of the Administrator.	7-GN-56		Temperatures are not measured. The density program internal to the micromanometer described above is used to compensate for temperature. Depending on process conditions, the correction to reported velocity values derived from the actual measurement of stack gas temperatures may be minimal.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.4 Pressure Probe and Gauge. A piezometer tube and mercury- or water-filled U-tube manometer capable of measuring stack pressure to within 2.5 mm (0.1 in.) Hg is used. The static tap of a standard type pitot tube or one leg of a Type S pitot tube with the face opening planes positioned parallel to the gas flow may also be used as the pressure probe.	7-GN-56		The static tap of a standard pitot tube is used to measure stack pressure.
2.5 Barometer. A mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg) may be used. In many cases, the barometric reading may be obtained from a nearby National Weather Service station, in which case the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and the sampling point shall be applied at a rate of minus 2.5 mm (0.1 in.) Hg per 30-meter (100 foot) elevation increase or vice-versa for elevation decrease.	7-GN-56		Barometric pressures are not measured. The density program internal to the micromanometer is set for standard conditions [21 °C (70 °F) and 76.00 cm (29.92 in.) mercury]. This introduces minimal error provided the temperature of the air stream varies no more than 1.1 °C (30 °F) from standard air, the altitude of the site does not exceed 300 m (1,000 ft) above sea level, or the moisture content of the air is .009 kg/kg (0.02 lb/lb) of dry air or less.
2.6 Gas Density Determination Equipment. Method 3 equipment, if needed (see Section 3.6), to determine the stack gas dry molecular weight, and Reference Method 4 or Method 5 equipment for moisture content determination; other methods may be used subject to approval of the Administrator.	7-GN-56		Stack gas moisture content is not determined. Considering the dry climate and conditioning of supply air, however, the correction to reported velocity values derived from the actual measurement of both stack dry molecular weight and moisture content may be minimal. The PUREX Plant is presently in the process of transition to shutdown and few activities are expected to add moisture to air exhausted via this stack.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.7 Calibration Pitot Tube. When calibration of the Type S pitot tube is necessary (see Section 4), a standard pitot tube is used as a reference. The standard pitot tube shall, preferably, have a known coefficient, obtained either (1) directly from the National Bureau of Standards, Route 270, Quince Orchard Road, Gaithersburg, Maryland, or (2) by calibration against another standard pitot tube with an NBS-traceable coefficient. Alternatively, a standard pitot tube designed according to the criteria given in 2.7.1 through 2.7.5 below and illustrated in Figure 2-4 (see also Citations 7, 8, and 17 in Section 6) may be used. Pitot tubes designed according to these specifications will have baseline coefficients of about 0.99 ± 0.01 .	7-GN-56	Not applicable	This requirement is not applicable, because the Type S pitot tube is not used to measure velocity.
2.7.1 Hemispherical (shown in Figure 2- 4), ellipsoidal, or conical tip.	Manufacturer's print 72-000031-00 (F. W. Dwyer Manufacturing Company).		The standard pitot tubes used are procured commercially from sources such as F. W. Dwyer Manufacturing Company. They are constructed to standards outlined in Section 2.7 and contain hemispherical tips.
2.7.2 A minimum of six diameters straight run (based upon D, the external diameter of the tube) between the tip and the static pressure holes.	Manufacturer's print 72-000031-00 (F. W. Dwyer Manufacturing Company).		A minimum of six diameters straight run between tip and static pressure holes is provided.
2.7.3 A minimum of eight diameters straight run between the static pressure holes and the centerline of the external tube, following the 90 degree bend.	Manufacturer's print 72-000031-00 (F. W. Dwyer Manufacturing Company).		A minimum of eight diameters straight run between the static pressure holes and the centerline of the external tube is provided.
2.7.4 Static pressure holes of equal size (approximately 0.1 D), equally spaced in a piezometer ring configuration.	Manufacturer's print 72-000031-00 (F. W. Dwyer Manufacturing Company).		The above criteria are met by the manufacturer.
2.7.5 Ninety degree bend, with curved or mitered junction.	Manufacturer's print 72-000031-00 (F. W. Dwyer Manufacturing Company).		The above criteria are met by the manufacturer.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.8 Differential Pressure Gauge for Type S Pitot Tube Calibration. An inclined manometer or equivalent is used. If the single-velocity calibration technique is employed (see Section 4.1.2.3), the calibration differential pressure gauge shall be readable to the nearest 0.13 mm H₂O (0.005 in. H₂O). For multiveLOCITY calibration, the gauge shall be readable to the nearest 0.13 mm H₂O (0.005 in. H₂O) for ΔP values between 1.3 and 25 mm H₂O (0.05 and 1.0 in. H₂O), and to the nearest 1.3 mm H₂O (0.05 in. H₂O) for ΔP values above 25 mm H₂O (1.0 in. H₂O). A special, more sensitive gauge will be required to read ΔP values below 1.3 mm H₂O (0.05 in. H₂O) (see Citation 18 in Section 6).	7-GN-56		Not applicable. The Type S pitot tube is not used.
3.0 Procedure Procedures described in these sections shall be used to determine the stack velocity when the Type S pitot tube is used.	7-GN-56		Not applicable. The Type S pitot tube is not used.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.1 Set up the apparatus as shown in Figure 2-1. Capillary tubing or surge tanks installed between the manometer and pitot tube may be used to dampen ΔP fluctuations. It is recommended, but not required, that a pretest leak-check be conducted, as follows: (1) blow through the pitot impact opening until at least 7.6 cm (3 in.) H_2O velocity pressure registers on the manometer; then, close off the impact opening. The pressure shall remain stable for at least 15 seconds; (2) do the same for the static pressure side, except using suction to obtain the minimum of 7.6 cm (3 in.) H_2O. Other leak check procedures, subject to the approval of the Administrator, may be used.			
3.2 Level and zero the manometer. Because the manometer level and zero may drift due to vibrations and temperature changes, make periodic checks during the traverse. Record all necessary data as shown in the example data sheet (Figure 2-5).			
3.3 Measure the velocity head and temperature at the traverse points specified by Method 1. Ensure that the proper differential pressure gauge is being used for the range of ΔP values encountered (see Section 2.2). If it is necessary to change to a more sensitive gauge, do so, and remeasure the ΔP and temperature readings at each traverse point. Conduct a post-test leak-check (mandatory), as described in Section 3.1 above, to validate the traverse run.			
3.4 Measure the static pressure in the stack. One reading is usually adequate.			
3.5 Determine the atmospheric pressure.			

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.6 Determine the stack gas dry molecular weight. For combustion processes or processes that emit essentially CO₂, O₂, CO and N₂, use Method 3. For processes emitting essentially air, an analysis need not be conducted; use a dry molecular weight of 29.0. For other processes, other methods, subject to the approval of the Administrator, must be used.			
3.7 Obtain the moisture content from Reference Method 4 (or equivalent) or from Method 5.			
3.8 Determine the cross-sectional area of the stack or duct at the sampling location. Whenever possible, physically measure the stack dimensions rather than using blueprints.			

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.0 <u>Calibration</u> 4.1 Type S Pitot Tube. Before its initial use, carefully examine the Type S pitot tube in top, side, and end views to verify that the face openings of the tube are aligned within the specifications illustrated in Figure 2-2 or 2-3. The pitot tube shall not be used if it fails to meet these alignment specifications. After verifying the face opening alignment, measure and record the following dimensions of the pitot tube: (a) the external tubing diameter (dimension D, Figure 2-2b); and (b) the base-to-opening plane distances (dimensions P_A and P_B, Figure 2-2b). If Dt is between 0.48 and 0.95 cm (3/16 and 3/8 in.) and if P_A and P_B are equal and between 1.05 and 1.50 D, there are two possible options: (1) the pitot tube may be calibrated according to the procedure outlined in Sections 4.1.2 through 4.1.5 below, or (2) a baseline (isolated tube) coefficient value of 0.84 may be assigned to the pitot tube. Note, however, that if the pitot tube is part of an assembly, calibration may still be required, despite knowledge of the baseline coefficient value (see Section 4.1.1). If D, P_A, and P_B are outside the specified limits, the pitot tube must be calibrated as outlined in 4.1.2 through 4.1.5 below.	7-GN-56		Not applicable.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.1.1 Type S Pitot Tube Assemblies. During sample and velocity traverses, the isolated Type S pitot tube is not always used; in many instances, the pitot tube is used in combination with other source-sampling components (thermocouple, sampling probe, nozzle) as part of an "assembly." The presence of other sampling components can sometimes affect the baseline value of the Type S pitot tube coefficient (Citation 9 in Section 6); therefore an assigned (or otherwise known) baseline coefficient value may or may not be valid for a given assembly. The baseline and assembly coefficient values will be identical only when the relative placement of the components in the assembly is such that aerodynamic interference effects are eliminated. Figures 2-6 through 2-8 illustrate interference-free component arrangements for Type S pitot tubes having external tubing diameters between 0.48 and 0.95 cm (3/16 and 3/8 in.). Type S pitot tube assemblies that fail to meet any or all of the specifications of Figures 2-6 through 2-8 shall be calibrated according to the procedure outlined in Sections 4.1.2 through 4.1.5 below, and prior to calibration, the values of the intercomponent spacings (pitot-nozzle, pitot-thermocouple, pitot-probe sheath) shall be measured and recorded. NOTE: Do not use any Type S pitot tube assembly which is constructed such that the impact pressure opening plane of the pitot tube is below the entry plane of the nozzle (see Figure 2-6b).			

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.1.1.2 Calibration Setup. If the Type S Pitot tube is to be calibrated, one leg of the tube shall be permanently marked A, and the other, B. Calibration shall be done in a flow system having the following essential design features: 4.1.1.2.1 The flowing gas stream must be confined to a duct of definite cross-sectional area, either circular or rectangular. For circular cross-sections, the minimum duct diameter shall be 30.5 cm (12 in.); for rectangular cross-sections, the width (shorter side) shall be at least 25.4 cm (10 in.).			

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.1.2.2 The cross-sectional area of the calibration duct must be constant over a distance of 10 or more duct diameters. For a rectangular cross-section, use an equivalent diameter, calculated from the following equation, to determine the number of duct diameters: $D_e = \frac{2LW}{(L+W)}$ 2-1 where: D_e = Equivalent diameter L = Length W = Width To ensure the presence of stable, fully developed flow patterns at the calibration site, or "test section," the site must be located at least eight diameters downstream and two diameters upstream from the nearest disturbances. NOTE: The eight- and two-diameter criteria are not absolute; other test section locations may be used (subject to approval of the Administrator), provided that the flow at the test site is stable and demonstrably parallel to the duct axis.			

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.1.2.3 The flow system shall have the capacity to generate a test-section velocity around 915 m/min (3,000 ft/min). This velocity must be constant with time to guarantee steady flow during calibration. Note that Type S pitot tube coefficients obtained by single-velocity calibration at 915 m/min (3,000 ft/min) will generally be valid to within ± 3 percent for the measurement of velocities above 305 m/min (1,000 ft/min) and to within ± 5 to 6 percent for the measurement of velocities between 180 and 305 m/min (600 and 1000 ft/min). If a more precise correlation between C_p and velocity is desired, the flow system shall have the capacity to generate at least four distinct time-invariant test-section velocities covering the velocity range from 180 and 1,525 m/min (600 to 5,000 ft/min), and calibration data shall be taken at regular velocity intervals over this range (see Citations 9 and 14 in Section 6 for details).			
4.1.2.4 Two entry ports, one each for the standard and Type S pitot tubes, shall be cut in the test section; the standard pitot entry port shall be located slightly downstream of the Type S port, so that the standard and Type S impact openings will lie in the same cross-sectional plane during calibration. To facilitate alignment of the pitot tubes during calibration, it is advisable that the test section be constructed of plexiglass or some other transparent material.			

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.1.3 Calibration Procedure. Note that this procedure is a general one and must not be used without first referring to the special considerations presented in Section 4.1.5. Note also that this procedure applies only to single-velocity calibration. To obtain calibration data for the A and B sides of the Type S pitot tube, proceed as follows: 4.1.3.1 Make sure that the manometer is properly filled and that the oil is free from contamination and is of the proper density. Inspect and leak-check all pitot lines; repair or replace if necessary. 4.1.3.2 Level and zero the manometer. Turn on the fan and allow the flow to stabilize. Seal the Type S entry port.			

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.1.3.3 Ensure that the manometer is level and zeroed. Position the standard pitot tube at the calibration point (determined as outlined in Section 4.1.5.1), and align the tube so that its tip is pointed directly into the flow. Particular care should be taken in aligning the tube to avoid yaw and pitch angles. Make sure that the entry port surrounding the tube is properly sealed.			
4.1.3.4 Read ΔP and record its value in a data table similar to the one shown in Figure 2-9. Remove the standard pitot tube from the duct and disconnect it from the manometer. Seal the standard entry port.			
4.1.3.5 Connect the Type S pitot tube to the manometer. Open the Type S entry port. Check the manometer level and zero. Insert and align the Type S pitot tube so that its A side impact opening is at the same point as was the standard pitot tube and is pointed directly into the flow. Make sure that the entry port surrounding the tube is properly sealed.			
4.1.3.6 Read ΔP, and enter its value in the data table. Remove the Type S pitot tube from the duct and disconnect it from the manometer.			
4.1.3.7 Repeat steps 4.1.3.3 through 4.1.3.6 above until three pairs of ΔP readings have been obtained.			
4.1.3.8 Repeat steps 4.1.3.3 through 4.1.3.7 above for the B side of the Type S pitot tube.			
4.1.3.9 Perform calculations, as described in Section 4.1.4 below.			

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.1.4 Calculations 4.1.4.1 For each of the six pairs of ΔP readings (i.e., three from side A and three from side B) obtained in Section 4.1.3 above, calculate the value of the Type S pitot tube coefficient as follows: $C_{p(s)} = C_{p(std)} \sqrt{\frac{\Delta P_{std}}{\Delta P_s}} \quad 2-2$ Where: $C_{p(s)}$ = Type S Pitot tube coefficient $C_{p(std)}$ = Standard Pitot tube coefficient: use 0.99 if the coefficient is unknown and the tube is designed according to the criteria of Sections 2.7.1 to 2.7.5 of this method. ΔP_{std} = Velocity head measured by the standard pitot tube, cm H_2O (in. H_2O) ΔP_s = Velocity head measured by the Type S pitot tube, cm H_2O (in. H_2O) 4.1.4.2 Calculate C_p (side A), the mean A side coefficient, and C_p (side B), the mean B side coefficient; Calculate the difference between these two average values.			

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.1.4.3 Calculate the deviation of each of the three A-side values of $C_p(s)$ from C_p (side A), and the deviation of each B-side value of $C_p(s)$ from C_p (side B). Use the following equation: $\text{Deviation} = C_{p(s)} - \overline{C_p} \text{ (A OR B)} \quad 2-3$ 4.1.4.4 Calculate α, the average deviation from the mean, for both the A and B sides of the pitot tube. Use the following equation: $\alpha \text{ (side A OR B)} = \frac{\sum_{i=1}^3 C_{p(s)} - \overline{C_p} \text{ (A OR B)} }{3} \quad 2-4$ 4.1.4.5 Use the Type S pitot tube only if the values of α (side A) and α (side B) are less than or equal to 0.01 and if the absolute value of the difference between C_p (A) and C_p (B) is 0.01 or less.			

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.1.5 Special considerations. 4.1.5.1 Selection of calibration point. 4.1.5.1.1 When an isolated Type S pitot tube is calibrated, select a calibration point at or near the center of the duct, and follow the procedures outlined in Section 4.1.3 and 4.1.4 above. The Type S pitot coefficients so obtained, i.e., C_p (side A) and C_p (side B), will be valid, so long as either: (1) the isolated pitot tube is used; or (2) the pitot tube is used with other components (nozzle, thermocouple, sample probe) in an arrangement that is free from aerodynamic interference effects (see Figures 2-6 through 2-8). 4.1.5.1.2 For Type S pitot tube-thermocouple combinations (without sample probe), select a calibration point at or near the center of the duct, and follow the procedures outlined in Sections 4.1.3 and 4.1.4 above. The coefficients so obtained will be valid so long as the pitot tube-thermocouple combination is used by itself or with other components in an interference-free arrangement (Figures 2-6 and 2-8). 4.1.5.1.3 For assemblies with sample probes, the calibration point should be located at or near the center of the duct; however, insertion of a probe sheath into a small duct may cause significant cross-sectional area blockage and yield incorrect coefficient values (Citation 9 in Section 6). Therefore, to minimize the blockage effect, the calibration point may be a few inches off-center if necessary. The actual blockage effect will be negligible when the theoretical blockage, as determined by a projected-area model of the probe sheath, is 2 percent or less of the duct cross-sectional area for assemblies without external sheaths (Figure 2-10a), and 3 percent or less for assemblies with external sheaths (Figure 2-10b).			

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.1.5.2 For those probe assemblies in which pitot tube-nozzle interference is a factor (i.e., those in which the pitot-nozzle separation distance fails to meet the specification illustrated in Figure 2-6a), the value of $C_p(s)$ depends upon the amount of free-space between the tube and nozzle, and therefore is a function of nozzle size. In these instances, separate calibrations shall be performed with each of the commonly used nozzle sizes in place. Note that the single-velocity calibration technique is acceptable for this purpose, even though the larger nozzle sizes (>0.635 cm or $1/4$ in.) are not ordinarily used for isokinetic sampling at velocities around 915 m/min ($3,000$ ft/min), which is the calibration velocity; note also that it is not necessary to draw an isokinetic sample during calibration (see Citation 19 in Section 6).			
4.1.5.3 For a probe assembly constructed such that its pitot tube is always used in the same orientation, only one side of the pitot tube need be calibrated (the side which will face the flow). The pitot tube must still meet the alignment specifications of Figures 2-2 or 2-3, however, and must have an average deviation (σ) value of 0.01 or less (see Section 4.1.4.4).			

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.1.6 Field Use and Recalibration. 4.1.6.1 Field Use. 4.1.6.1.1 When a Type S pitot tube (isolated tube or assembly) is used in the field, the appropriate coefficient value (whether assigned or obtained by calibration) shall be used to perform velocity calculations. For calibrated Type S pitot tubes, the A side coefficient shall be used when the A side of the tube faces the flow, and the B side coefficient shall be used when the B side faces the flow; alternatively, the arithmetic average of the A and B side coefficient values may be used, irrespective of which side faces the flow.			
4.1.6.1.2 When a probe assembly is used to sample a small duct (12 to 36 in. in diameter), the probe sheath sometimes blocks a significant part of the duct cross-section, causing a reduction in the effective value of $C_p(s)$. Consult Citation 9 in Section 6 for details. Conventional pitot-sampling probe assemblies are not recommended for use in ducts having inside diameters smaller than 12 inches (Citation 16 in Section 6).			
4.1.6.2 Recalibration. 4.1.6.2.1 Isolated Pitot tubes. After each field use, the pitot tube shall be carefully reexamined in top, side, and end views. If the pitot face openings are still aligned within the specifications illustrated in Figures 2-2 or 2-3, it can be assumed that the baseline coefficient of the pitot tube has not changed. If, however, the tube has been damaged to the extent that it no longer meets the specifications of Figures 2-2 or 2-3, the damage shall either be repaired to restore proper alignment of the face openings or the tube shall be discarded.			

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.1.6.2.2 Pitot tube Assemblies. After each field use, check the face opening alignment of the pitot tube, as in Section 4.1.6.2.1; also, remeasure the intercomponent spacings of the assembly. If the intercomponent spacings have not changed and the face opening alignment is acceptable, it can be assumed that the coefficient of the assembly has not changed. If the face opening alignment is no longer within the specifications of Figures 2-2 or 2-3, either repair the damage or replace the pitot tube (calibrating the new assembly, if necessary). If the intercomponent spacings have changed, restore the original spacings or recalibrate the assembly.			
4.2 Standard pitot tube (if applicable). If a standard pitot tube is used for the velocity traverse, the tube shall be constructed according to the criteria of Section 2.7 and shall be assigned a baseline coefficient value of 0.99. If the standard pitot tube is used as part of the assembly, the tube shall be in an interference-free arrangement (subject to the approval of the Administrator).	7-GN-56 and manufacturer's product literature.		The standard pitot tube used for velocity traverses meets the criteria of Section 2.7. It is used in conjunction with a digital micromanometer. The tube coefficient (undetermined) is an integral part of the internal program used by the micromanometer to determine the pressure differential and flow velocity.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3 Temperature Gauges. After each field use, calibrate dial thermometers, liquid-filled bulb thermometers, thermocouple-potentiometer systems, and other gauges at a temperature within 10 percent of the average absolute stack temperature. For temperatures up to 405° C (761° F) use an ASTM mercury-in-glass reference thermometer, or equivalent, as a reference; alternatively, either a reference thermocouple and potentiometer (calibrated by NBS) or thermometric fixed points, e.g., ice bath and boiling water (corrected for barometric pressure) may be used. For temperatures above 405° C (761° F), use an NBS-calibrated reference thermocouple-potentiometer system or an alternate reference, subject to the approval of the Administrator. If, during calibration, the absolute temperatures measured with the gauge being calibrated and the reference gauge agree within 1.5 percent, the temperature data taken in the field shall be considered valid. Otherwise, the pollutant emission test shall either be considered invalid or adjustments (if appropriate) of the test results shall be made, subject to the approval of the Administrator.	7-GN-56		No temperature-measuring devices are used.
4.4 Barometer. Calibrate the barometer used against a mercury barometer.	7-GN-56		No barometric-pressure-measuring devices are used.
5.0 Calculations Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation. 5.1 Nomenclature. See 40 CFR Pt. 60 App. A, Meth. 2, page 707 and 708 for details).	7-GN-56 and manufacturer's product literature.		The density program internal to the digital micromanometer is used to determine stack gas velocities, which are recorded on datasheets and averaged. The volumetric flow rate is determined from the average flow velocity and cross-sectional area.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
40 CFR 60. Appendix A. Method 1. <u>Sample and Velocity Traverses for Stationary Sources</u> 1.0 Principle and Applicability 1.1 Principle. To aid in the representative measurement of pollutant emissions and/or total volumetric flow rate from a stationary source, a measurement site where the effluent stream is flowing in a known direction is selected, and the cross-section of the stack is divided into a number of equal areas. A traverse point is then located within each of these equal areas. 1.2 Applicability. This method is applicable to flowing gas streams in ducts, stacks, and flues. The method cannot be used when: (1) flow is cyclonic or swirling (see Section 2.4); (2) a stack is smaller than about 0.30 meter (12 in.) in diameter, or 0.071 m² (113 in.²) cross-sectional area; or (3) the measurement site is less than two stack or duct diameters downstream or less than a half diameter upstream from a flow disturbance. The requirements of this method must be considered before construction of a new facility from which emissions will be measured; failure to do so may require subsequent alterations to the stack or deviation from the standard procedure. Cases involving variants are subject to approval by the Administrator, U.S. Environmental Protection Agency.		Yes.	This method applies. See Section 2.1 below. The 296-A-1 stack is .61 m (2 ft) in diameter and tapers to .53 m (1.8 ft) at the top. The elevations of the sample ports are 10.4, 11.6, and 12.8 m (34, 38, and 42 ft) above the base, the location of the last major flow disturbance. The top of the stack is 22.6 m (74 ft) above the grade and 18.9 m (62 ft) above the base. The sample ports are approximately 17, 19, and 21 diameters downstream of the last major disturbance. The sample ports are approximately 14, 12, and 10 diameters upstream of the next major disturbance.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.0 Procedure 2.1 Selection of Measurement Site. Sampling or velocity measurement is performed at a site located at least eight stack or duct diameters downstream and two diameters upstream from any flow disturbance such as a bend, expansion, or contraction in the stack, or from a visible flame. If necessary, an alternative location may be selected, at a position at least two stack or duct diameters downstream and a half diameter upstream from any flow disturbance. For a rectangular cross section, an equivalent diameter (D_e) shall be calculated from the following equation to determine the upstream and downstream distances: $D_e = \frac{2LW}{L+W}$ L+W where L = length W = width. An alternative procedure is available for determining the acceptability of a measurement location not meeting the criteria above. This procedure, determination of gas flow angles at the sampling points and comparing the results with acceptability criteria, is described in Section 2.5.		Yes	The elevations of the sample ports are 10.4, 11.6, and 12.8 m (34, 28, and 42 ft) above the base of the stack. The top of the stack is 18.9 m (62 ft) above the base. The stack is .61 m (2 ft) in diameter and tapers to .53 m (1.8 ft) at the top. The sample ports are approximately 17, 19, and 21 diameters downstream of the last major disturbance. The sample ports are approximately 14, 12, and 10 diameters upstream of the next major disturbance.
2.2 Determining the Number of Traverse Points.		Not applicable	Method 1 is used for determining the sample site. The number of points is described in Section A3.4, Comparison to ANSI M13.1-1969 (ANSI 1969).
2.2.1 Particulate traverses. When the eight- and two-diameter criterion can be met, the minimum number of traverse points shall be: (1) twelve, for circular or rectangular stacks with diameters (or equivalent diameters) greater than 0.61 meter (24 in.); (2) eight, for circular stacks with diameters between 0.30 and 0.61 meter (12-24 in.); (3) nine, for rectangular stacks with equivalent diameters between 0.30 and 0.61 meter (12-24 in.).			Eight- and two-diameter criteria met. Samples are collected by a 4-port probe, not traverse. Sample port is described in comparison to ANSI M13.1-1969, section A3.2 (ANSI 1969).

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
When the eight- and two-diameter criterion cannot be met, the minimum number of traverse points is determined from Figure 1-1. Before referring to the figure, however, determine the distances from the chosen measurement site to the nearest upstream and downstream disturbances, and divide each distance by the stack diameter or equivalent diameter, to determine the distance in terms of the number of duct diameters. Then, determine from Figure 1-1 the minimum number of traverse points that corresponds: (1) to the number of duct diameters upstream; and (2) to the number of diameters downstream. Select the higher of the two minimum numbers of traverse points, or a greater value, so that for circular stacks the number is a multiple of 4, and for rectangular stacks, the number is one of those shown in Table 1-1.		Not applicable	Eight and two criterion met.
2.2.2 Velocity (Non-Particulate) Traverses. When velocity or volumetric flow rate is to be determined (but not particulate matter), the same procedure as that for particulate traverses (Section 2.2.1) is followed, except that Figure 1-2 may be used instead of Figure 1-1.		Not applicable	Velocity is measured by multipoint probe, not by traverse. NOTE: Velocity probe is discussed in Method 114 Comparison, Section 4.3.7.
2.3 Cross-sectional Layout and Location of Traverse Points.		Not applicable	Method 1 is used for determining the sample site, not the number of points in a velocity traverse. Velocity is measured by multipoint probe, not by traverse.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.3.1 Circular Stacks. Locate the traverse points on two perpendicular diameters according to Table 1-2 and the example shown on Figure 1-3. Any equation (for examples, see Citations 2 and 3 in the Bibliography) that gives the same values as those in Table 1-2 may be used in lieu of Table 1-2. For particulate traverses, one of the diameters must be in a plane containing the greatest expected concentration variation, e.g., after bends, one diameter shall be in the plane of the bend. This requirement becomes less critical as the distance from the disturbance increases; therefore, other diameter locations may be used, subject to approval of the Administrator. In addition for stacks having diameters greater than 0.61 m (24 in.) no traverse points shall be located within 2.5 cm (1.00 in.) of the stack walls; and for stack diameters equal to or less than 0.61 m (24 in.), no traverse points shall be located within 1.3 cm (0.50 in.) of the stack walls. To meet these criteria, observe the procedures given below.		Not applicable	Method 1 is used for determining the sample site. The number of points is described in section A3.4, Comparison to ANSI M13.1-1969 (ANSI 1969).

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.3.1.1 Stacks With Diameters Greater Than 0.61 m (24 in.). When any of the traverse points as located in Section 2.3.1 fall within 2.5 cm (1.00 in.) of the stack walls, relocate them away from the stack walls to: (1) a distance of 2.5 cm (1.00 in.); or (2) a distance equal to the nozzle inside diameter, whichever is larger. These relocated traverse points (on each end of a diameter) shall be the "adjusted" traverse points. Whenever two successive traverse points are combined to form a single adjusted traverse point, treat the adjusted point as two separate traverse points, both in the sampling (or velocity measurement) procedure, and in recording the data. 2.3.1.2 Stacks With Diameters Equal to or Less Than 0.61 m (24 in.). Follow the procedure in Section 2.3.1.1, noting only that any "adjusted" points should be relocated away from the stack walls to: (1) a distance of 1.3 cm (0.50 in.); or (2) a distance equal to the nozzle inside diameter, whichever is larger.		Not applicable	Method 1 is used for determining the sample site. The number of points is described in section A3.4, Comparison to ANSI M13.1-1969 (ANSI 1969).

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.3.2 Rectangular Stacks. Determine the number of traverse points as explained in Sections 2.1 and 2.2 of this method. From Table 1-1, determine the grid configuration. Divide the stack cross-section into as many equal rectangular elemental areas as traverse points, and then locate a traverse point at the centroid of each equal area according to the example in Figure 1-4. If the tester desires to use more than the minimum number of traverse points, expand the "minimum number of traverse points" matrix (see Table 1-1) by adding the extra traverse points along one or the other or both legs of the matrix; the final matrix need not be balanced. For example, if a 4x3 "minimum number of points" matrix were expanded to 36 points, the final matrix could be 9x4 or 12x3, and would not necessarily have to be 6x6. After constructing the final matrix, divide the stack cross-section into as many equal rectangular, elemental areas as traverse points, and locate a traverse point at the centroid of each equal area. The situation of traverse points being too close to the stack walls is not expected to arise with rectangular stacks. If this problem should ever arise, the Administrator must be contacted for resolution of the matter.		Not applicable	The stack is circular, not rectangular.
2.4 Verification of Absence of Cyclonic Flow. In most stationary sources, the direction of stack gas flow is essentially parallel to the stack walls. However, cyclonic flow may exist (1) after such devices as cyclones and inertial demisters following venturi scrubbers.		Yes	There are no cyclones or inertial demisters following venturi scrubbers on this system.
(2) in stacks having tangential inlets or other duct configurations which tend to induce swirling; in these instances, the presence or absence of cyclonic flow at the sampling location must be determined. The following techniques are acceptable for this determination.		Yes	This stack does not have a tangential inlet or other duct configuration that tends to induce swirling.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
Level and zero the manometer. Connect a Type S pitot tube to the manometer. Position the Type S pitot tube at each traverse point, in succession, so that the planes of the face openings of the pitot tube are perpendicular to the stack cross-sectional plane; when the Type S pitot tube is in this position, it is at "0° reference." Note the differential pressure (ΔP) reading at each traverse point. If a null (zero) pitot reading is obtained at 0° reference at a given traverse point, an acceptable flow condition exists at that point. If the pitot reading is not zero at 0° reference, rotate the pitot tube (up to $\pm 90^\circ$ yaw angle), until a null reading is obtained. Carefully determine and record the value of the rotation angle (α) to the nearest degree. After the null technique has been applied at each traverse point, calculate the average of the absolute values of α; assign α values of 0° to those points for which no rotation was required, and include these in the overall average. If the average value of α is greater than 20°, the overall flow condition in the stack is unacceptable and alternative methodology, subject to the approval of the Administrator, must be used to perform accurate sample and velocity traverses. The alternative procedure described in Section 2.5 may be used to determine the rotation angles in lieu of the procedure described above.		Not applicable	Because there are no cyclones, inertial demisters following venturi scrubbers, tangential inlets, or other duct configuration that tend to induce swirling, there is no need to determine the presence or absence of cyclonic flow.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.5 Alternative Measurement Site Selection Procedure. This alternative applies to sources where measurement locations are less than 2 equivalent stack or duct diameters downstream or less than 1/2 duct diameter upstream from a flow disturbance. The alternative should be limited to ducts larger than 24 in. in diameter where blockage and wall effects are minimal. A directional flow sensing probe is used to measure pitch and yaw angles of the gas flow at 40 or more traverse points; the resultant angle is calculated and compared with acceptable criteria for mean and standard deviation. NOTE: Both the pitch and yaw angles are measured from a line passing through the traverse point and parallel to the stack axis. The pitch angle is the angle of the gas flow component in the plane that INCLUDES the traverse line and is parallel to the stack axis. The yaw angle is the angle of the gas flow component in the plane PERPENDICULAR to the traverse line at the traverse point and is measured from the line passing through the traverse point and parallel to the stack axis.		Not applicable	The selected site is greater than 2 diameters downstream and 1/2 diameter upstream from a flow disturbance.
2.5.1 Apparatus. 2.5.1.1 Directional Probe. Any directional probe, such as United Sensor Type DA Three-Dimensional Directional Probe, capable of measuring both the pitch and yaw angles of gas flows is acceptable. (NOTE: Mention of trade name or specific products does not constitute endorsement by the U.S. Environmental Protection Agency.) Assign an identification number to the directional probe, and permanently mark or engrave the number on the body of the probe. The pressure holes or directional probes are susceptible to plugging when used in particulate-laden gas streams. Therefore, a system for cleaning the pressure holes by "backpurging" with pressurized air is required.		Not applicable	See 2.5, above.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.5.1.2 Differential Pressure Gauges. Inclined manometers, U-tube manometers, or other differential pressure gauges (e.g., manometric gauges) that meet the specifications described in Method 2, section 2.2. NOTE: If the differential pressure gauge produces both negative and positive readings, then both negative and positive pressure readings shall be calibrated at a minimum of three points as specified in Method 2, section 2.2.		Not applicable	See 2.5, above.
2.5.2 Traverse Points. Use a minimum of 40 traverse points for circular ducts and 42 points for rectangular ducts for the gas flow angle determinations. Follow section 2.3 and Table 1-1 or 1-2 for the location and layout of the traverse points. If the measurement location is determined to be acceptable according to the criteria in this alternative procedure, use the same traverse point number and locations for sampling and velocity measurements.		Not applicable	See 2.5, above.
2.5.3 Measurement Procedure. 2.5.3.1 Prepare the directional probe and differential pressure gauges as recommended by the manufacturer. Capillary tubing or surge tanks may be used to dampen pressure fluctuations. It is recommended, but not required, that a pretest leak check be conducted. To perform a leak check, pressurize or use suction on the impact opening until a reading of at least 7.6 cm (3 in.) H₂O registers on the differential pressure gauge, then plug the impact opening. The pressure of a leak-free system will remain stable for at least 15 seconds.		Not applicable	See 2.5, above.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.5.3.2 Level and zero the manometers. Since the manometer level and zero may drift because of vibrations and temperature changes, periodically check the level and zero during the traverse.		Not applicable	See 2.5, above.
2.5.3.3 Position the probe at the appropriate locations in the gas stream, and rotate until zero deflection is indicated for the yaw angle pressure gauge. Determine and record the yaw angle. Record the pressure gauge readings for the pitch angle, and determine the pitch angle from the calibration curve. Repeat this procedure for each traverse point. Complete a "back-purge" of the pressure lines and the impact openings prior to measurements of each traverse point. A post-test check as described in section 2.5.3.1 is required. If the criteria for a leak-free system are not met, repair the equipment, and repeat the flow angle measurements.		Not applicable	See 2.5, above.
2.5.4 Calculate the resultant angle at each traverse point, the average resultant angle, and the standard deviation using the following equations. Complete the calculation retaining at least one extra significant figure beyond that of the acquired data. Round the values after the final calculations.		Not applicable	See 2.5, above.
2.5.4.1 Calculate the resultant angle at each traverse point:		Not applicable	See 2.5, above.
2.5.5 The measurement location is acceptable if $R \leq 20^\circ$ and $S_d \leq 10^\circ$.		Not applicable	See 2.5, above.
2.5.6 Calibration. Use a flow system as described in Sections 4.1.2.1 and 4.1.2.2 of Method 2. In addition, the flow system shall have the capacity to generate two test-section velocities: one between 365 and 730 m/min (1200 and 2400 ft/min) and one between 730 and 1100 m/min (2400 and 3610 ft/min).		Not applicable	See 2.5, above.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.5.6.1 Cut two entry ports in the test section. The axes through the entry ports shall be perpendicular to each other and intersect in the centroid of the test section. The ports should be elongated slots parallel to the axis of the test section and of sufficient length to allow measurement of pitch angles while maintaining the pitot head position at the test-section centroid. To facilitate alignment of the directional probe during calibration, the test section should be constructed of plexiglass or some other transparent material. All calibration measurement should be made at the same point in the test section, preferably at the centroid of the test-section.		Not applicable	See 2.5, above.
2.5.6.2 To ensure that the gas flow is parallel to the central axis of the test section, follow the procedure in Section 2.4 for cyclonic flow determination to measure the gas flow angles at the centroid of the test section from two test ports located 90° apart. The gas flow angle measured in each port must be $\pm 2^\circ$ of 0°. Straightening vanes should be installed, if necessary, to meet this criterion.		Not applicable	See 2.5, above.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.5.6.3 Pitch Angle Calibration. Performs a calibration traverse according to the manufacturer's recommended protocol in 5° increments for angles from -60° to +60° at one velocity in each of the two ranges specified above. Average the pressure ratio values obtained for each angle in the two flow ranges, and plot a calibration curve with the average values of the pressure ratio (or other suitable measurement factor as recommended by the manufacturer) versus the pitch angle. Draw a smooth line through the data points. Plot also the data values for each traverse point. Determine the differences between the measured data values and the angle from the calibration curve at the same pressure ratio. The difference at each comparison must be within 2° for angles between 0° and 40° and within 3° for angles between 40° and 60°.		Not applicable	See 2.5, above.
2.5.6.4 Yaw Angle Calibration. Mark the three-dimensional probe to allow the determination of the yaw position of the probe. This is usually a line extending the length of the probe and aligned with the impact opening. To determine the accuracy of measurements of the yaw angle, only the zero or null position need be calibrated as follows. Place the directional probe in the test section, and rotate the probe until the zero position is found. With a protractor or other angle measuring device, measure the angle indicated by the yaw angle indicator on the three-dimensional probe. This should be within 2° of 0°. Repeat this measurement for any other points along the length of the pitot where yaw angle measurements could be read in order to account for variations in the pitot markings used to indicate pitot head positions.		Not applicable	See 2.5, above.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
ANSI N13.1-1969, Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities 4.2.1.2			
4.2.1.2 Sampling point should be a minimum of five diameters (or 5 times the major dimension for rectangular ducts) downstream from abrupt changes in flow direction or prominent transitions.		Yes	The elevations of the sample ports are 10.4, 11.6, and 12.8 m (34, 38, and 42 ft) above the base, which corresponds to the last major flow disturbance in the stack. The stack is .61 m (2 ft) in diameter and tapers to .53 m (1.8 ft) at the top. The sample ports are therefore approximately 17, 19, and 21 diameters above the last major disturbance and they are in compliance.
4.2.2 Samples should be representative with respect to physical and chemical composition of airstream.		Yes	The sampling points for the record sampler are a minimum of 17 stack diameters downstream from the last contributor and are designed to be isokinetic within the compliance criteria (stack and sample flow rates are checked daily to ensure near isokinetic $\pm 10\%$).
4.3.1 Sensitivity and accuracy of the analytical or counting method will determine the minimum volume of air which must be sampled to obtain the requisite accuracy and precision of results.		Yes	A vacuum pump for the record sampler withdraws an air sample at an average flow rate of $8.2 \text{ E } 04 \pm 1.1 \text{ E } 04 \text{ cm}^3$ ($2.9 \pm 0.4 \text{ ft}^3/\text{min}$).
4.3.2 If possible, the sample should be large enough to permit 1/10 the permissible level to be determined with reliability.	WHC-EP-0141-2 shows that the PUREX Plant releases are below 1/10 of the permissible level (WHC 1990).	Yes	The frequency of the record air samples have been for a full 168-hour (7 day) week, to ensure adequate sample. As of June 1994, sample times were increased to two weeks to obtain more sample for a better laboratory analysis.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
5.2.2 Airborne particulate matter should be evaluated and characterized at regular intervals and before any anticipated process change.			Particulate matter is sampled continuously with sample filters removed at the frequency discussed above. The particulate size distribution was measured for this stack and results was reported in activities for the environmental monitor's line-loss study for fiscal year 1992 (WHC 1993b).
5.2.2.1 Appropriate filtration should be chosen for sampling.		Yes	Particulates are collected on a sample filter made of Gelman Versapor 3000*. According to the manufacturer, this filter medium has an efficiency of 95.8% for 0.3 μm particles.
5.2.2.1.7 Filter holders and support should be chosen for proper chemical compatibility, mechanical strength, sealing, and ease of operation in changing filters. Sample air movers should have the capability of delivering the necessary air flow against the resistance of the sampling system. Proper location and choice of flow measurement device and flow rate control is important.		Yes	Aluminum sample holders have been used for sampling system. The sample holders are easily screwed apart and have a sealing ring to ensure that all the gas flows through the filter. The sample flow measurement and control systems ensure that the air mover provides adequate air flow through the sampler. These systems are located downstream of the sample collection media to prevent degradation of the sample.
5.3 Airborne radioactive gases or volatile materials should be sampled by an appropriate method if present		Not applicable	The 296-A-1 stack does not exhaust measurable radioactive gases; therefore, this section is not applicable to this stack.
A1. Minimization of the length and bends of sample delivery lines will contribute to representative sampling.			The sample lines are constructed to minimize bends.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
A2. Selection of sampling position along a stack. The distance from the last upstream disturbance to the point of sample extraction should be a minimum of five and preferably ten or more duct diameters downstream. Sampling from a vertical run avoids stratification due to gravity settling. Sampling as far downstream as possible avoids most transient variation in airstream quality.		Yes	The elevations of the sample ports are 10.4, 11.6, and 12.8 m (34, 38, and 42 ft) above the base of the stack, which is the location of the last major disturbance. The stack is .61 m (2 ft) in diameter and tapers to .53 m (1.8 ft) at the top. The sample ports are therefore approximately 17, 19, and 21 diameters above the last major disturbance and they are in compliance.
A3.1 Velocity and flow distribution should be known for the sampling point, and particle and gaseous composition should be representative.		Yes	The Reynold's number of the stack is approximately 250,000, which is solidly in the turbulent regime. Since there are no sources of cyclonic flow, the flow pattern can be described as well developed turbulent and it is in compliance.
A3.2 A multiple number of withdrawal points each representing approximately equal areas based on the duct or stack dimensions is desirable.		Yes	The sampling probes that have been used for the record sampler and the Alpha continuous air monitor (CAM) are designed identically, and each has four inlet ports that span the diameter of the stack with different cross sectional areas. The ports are arranged to collect air from the approximate centers of equal annular areas. (For an annulus, the "center" is half way between the inner and outer radii of an annulus.)

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
A3.3 The velocity distribution across the duct or stack should be known in order to establish isokinetic flow and representative sample points.		Yes	The Reynold's number of the stack is approximately 250,000 which is solidly in the turbulent regime. Since there are no sources of cyclonic flow, the flow pattern can be described as well developed turbulent. Sample flow rate is adjusted to maintain isokinetics in sampling system, see Method 114 Comparison, Sections 4.3.6 and 4.3.7. It is in compliance.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
A3.4 Sampling probe configuration is recommended by figures in this standard, with minimum radius bends and precisely tapered probe end edges.		Yes	The 296-A-1 samplers use multipoint probes, as described in Figure A5 of ANSI M13.1-1969. The sampling probes for the record sampler and the Alpha CAM are identically designed, and each has four inlet ports that are arranged over equal annular areas (drawing H-2-75571, WHC 1991). Note: For information purposes related to this study only, the sampling ports have been numbered 1, 2, 3, and 4. Figure A5 specifies a length as approximately five times the diameter and the radius of the bend as more than five times the diameter. At the inlet, each port is tapered to a knife edge with a 15-degree angle. The diameter of the first port located at the center of the stack, is 0.61 cm (0.242 in.), and its length and radius are both 4.76 cm (1.875 in.), for a ratio of approximately 7.7. The diameter of the second port located 18.4 cm (7.25 in.) inches from the center of the stack, is .68 cm (0.269 in.), and its length and radius are both 6.4 cm (2.5 in.), for a ratio of approximately 9.3. The diameter of the third port located 23.97 cm (9.438 in.) from the center of the stack, is .7 cm (0.277 in.), and its length and radius are both 5.7 cm (2.25 in.), for a ratio of approximately 8.1. The diameter of the fourth port located 28.42 cm (11.188 in.) from the center of the stack, is .76 cm (0.302 in.), and its length and radius are both 8.3 cm (3.25 in.), for a ratio of approximately 10.8. The corresponding ratios are in compliance.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
B1. Sampling line length should be kept to a minimum length. An estimate of the fraction of particles deposited in sampling lines under various conditions should be made using the experimental data presented in this appendix.		Yes	Using the lowest sample probe location for the record sample minimizes sample line length. The methodology of Appendix 8 does not include the estimation of resuspension. It is believed that resuspension occurs because there are no indications that the lines are plugging. Furthermore, the results from sampling line loss study of this stack indicates that more large particles exit long sample lines than enter them. This observation is consistent with the view that deposited particles resuspend after agglomerating on the wall of the sample line with overall estimates of particle line loss in the 25 to 35 percent range in specific size intervals (WHC 1993b).
B3 Velocities must be kept high enough to avoid appreciable losses by Brownian diffusion.		Yes	The sample flow has a Reynold's number of approximately 8,000 and it is in compliance.
B5 Elbows in sampling lines should be avoided if at all possible. When required, the bend radius of the elbow should be as long as practical, and design flow rates through any line containing an elbow should be kept low. When possible, the sampler installation should allow for probe removal in order to evaluate the losses in the probe entry elbow and to permit cleaning.		Yes	There are no unnecessary bends. The bend (in the sample probe) meets the criteria of Appendix A. The bends in sample line consist of two large radius 45° angles. The only difficulty in removal of the probe is its height above the ground.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
40 CFR 61, Appendix B, Method 114, Test Methods for Measuring Radionuclide Emissions from Stationary Sources 1. Purpose and Background This method provides the requirements for: (1) Stack monitoring and sample collection methods appropriate for radionuclides; (2) radiochemical methods which are used in determining the amounts of radionuclides collected by the stack sampling and; (3) quality assurance methods which are conducted in conjunction with these measurements. These methods are appropriate for emissions for stationary sources. A list of references is provided. Many different types of facilities release radionuclides into air. These radionuclides differ in the chemical and physical forms, half-lives and type of radiation emitted. The appropriate combination of sample extraction, collection and analysis for an individual radionuclide is dependent upon many interrelated factors including the mixture of other radionuclides present. Because of this wide range of conditions, no single method for monitoring or sample collection and analysis of a radionuclide is applicable to all types of facilities. Therefore, a series of methods based on "principles of measurement" are described for monitoring and sample collection and analysis which are applicable to the measurement of radionuclides found in effluent streams at stationary sources. This approach provides the user with the flexibility to choose the most appropriate combination of monitoring and sample collection and analysis methods which are applicable to the effluent stream to be measured. 2.0 Stack Monitoring and Sample Collection Methods Monitoring and sample collection methods are described based on "principles of monitoring and sample collection" which are applicable to the measurement of radionuclides from effluent streams at stationary sources. Radionuclides of most elements will be in the particulate form in these			

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
2.0 Cont. effluent streams and can only be readily collected using a suitable filter media. Radionuclides of hydrogen, oxygen, carbon, nitrogen, the noble gases and in some circumstances iodine will be in gaseous form. Radionuclides of these elements will require either the use of an in-line or off-line monitor to directly measure the radionuclides, or suitable sorbers, condensers or bubblers to collect the radionuclides.			
2.1 Radionuclides as Particulates The extracted effluent stream is passed through a filter media to remove the particulates. The filter must have a high efficiency for removal of sub-micron particles. The guidance of ANSI N13.1-1969 shall be followed in using filter media to collect particulates (incorporated by reference - see Sect. 61.18).			Particulates are collected on a sample filter made of Gelman Versapor 3000. According to the manufacturer, this filter medium has an efficiency of 95.8 percent for 0.3 μ m particles.
2.2 Radionuclides as Gases.		Not applicable	Based on process knowledge, the 296-A-1 stack does not exhaust radionuclide gases; therefore, this section is not applicable to this stack.
2.3 Definition of Terms.			No answer is required.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.0 Radionuclide Analysis Methods A series of methods based on "principles of measurement" are described which are applicable to the analysis of radionuclides collected from airborne effluent streams at stationary sources. These methods are applicable only under the conditions stated and within the limitations described. Some methods specify that only a single radionuclide be present in the sample or the chemically separated sample. This condition should be interpreted to mean that no other radionuclides are present in quantities which would interfere with the measurement. Also identified (Table 1) are methods for a selected list of radionuclides. The listed radionuclides are those which are most commonly used and which have the greatest potential for causing dose to members of the public. Use of methods based on principles of measurement other than those described in this section must be approved in advance of use by the Administrator. For radionuclides not listed in Table 1, any of the described methods may be used provided the user can demonstrate that the applicability conditions of the method have been met. The type of method applicable to the analysis of a radionuclide is dependent upon the type of radiation emitted, i.e., alpha, beta or gamma. Therefore, the methods described below are grouped according to principles of measurements for the analysis of alpha, beta and gamma emitting radionuclides.			

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.1 Methods for Alpha Emitting Radionuclides 3.1.1 Method A-1, Radiochemistry-Alpha Spectrometry. Principle: The element of interest is separated from other elements, and from the sample matrix using radiochemical techniques. The procedure may involve precipitation, ion exchange, or solvent extraction. Carriers (elements chemically similar to the element of interest) may be used. The element is deposited on a planchet in a very thin film by electrodeposition or by coprecipitation on a very small amount of carrier, such as lanthanum fluoride. The deposited element is then counted with an alpha spectrometer. The activity of the nuclide of interest is measured by the number of alpha counts in the appropriate energy region. A correction for chemical yield and counting efficiency is made using a standardized radioactive nuclide (tracer) of the same element. If a radioactive tracer is not available for the element of interest, a predetermined chemical yield factor may be used. Applicability: This method is applicable for determining the activity of any alpha-emitting radionuclide, regardless of what other radionuclides are present in the sample provided the chemical separation step produces a very thin sample and removes all other radionuclides which could interfere in the spectral region of interest. APHA-605(2), ASTM-D-3972(13).		Yes	The 222-S Laboratory method involves dissolution (LA-549-112), chemical separation (LA-943-123) (UHC 1992a); electrodeposition (LA-542-101), (LA-508-161) (UHC 1994c). It meets all the requirements of the EPA-suggested method. This is used for analyzing ^{241}Am, ^{238}Pu, and $^{239,240}\text{Pu}$ in the air filter samples. The activities of these nuclides are determined by direct comparison with the 5% recoveries of NIST traceable ^{243}Am and ^{238}Pu tracers.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.1.2 Method A-2, Radiochemistry-Alpha Counting. Principle: The element of interest is separated from other elements, and from the sample matrix using radiochemistry. The procedure may involve precipitation, ion exchange, or solvent extraction. Carriers (elements chemically similar to the element of interest) may be used. The element is deposited on a planchet in a thin film and counted with a alpha counter. A correction for chemical yield (if necessary) is made. The alpha count rate measures the total activity of all emitting radionuclides of the separated element. Applicability: This method is applicable for the measurement of any alpha-emitting radionuclide, provided no other alpha emitting radionuclide is present in the separated sample. It may also be applicable for determining compliance, when other radionuclides of the separated element are present, provided that the calculated emission rate is assigned to the radionuclide which could be present in the sample that has the highest dose conversion factor. 100-12096(18).		Not applicable	Because the tracer technique is used in the separation process, this method is not used for air filter analysis.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.1.3 Method A-3, Direct Alpha Spectrometry. Principle: The sample, collected on a suitable filter, is counted directly on an alpha spectrometer. The sample must be thin enough and collected on the surface of the filter so that any absorption of alpha particle energy in the sample or the filter, which would degrade the spectrum, is minimal. Applicability: This method is applicable to simple mixtures of alpha emitting radionuclides and only when the amount of particulates collected on the filter paper are relatively small and the alpha spectra is adequately resolved. Resolutions should be 50 keV (FWHM) or better, ASTM-D-3084(16).		Not applicable	The 222-S Laboratory method follows the procedure LO-150-133, then LA-508-110 for total alpha counts (WHC 1992a), and finally LA-508-161 for alpha spectrometry (WHC 1994c). It partially meets the requirements of the EPA method. This method is usually used for emergency air samples. The sample is counted on the alpha counter of known efficiency to obtain the total alpha counts. In the alpha energy analysis (AEA), the relative peak fractions of different alpha emitters identified in the sample are determined. The peak fractions are then used to correct the total alpha counts and thus determine the activities of individual alpha nuclides present in the sample.
3.1.4 Method A-4, Direct Alpha Counting (Gross alpha determination). Principle: The sample, collected on a suitable filter, is counted with an alpha counter. The sample must be thin enough so that self-absorption is not significant and the filter must be of such a nature that the particles are retained on the surface. Applicability: Gross alpha determination may be used to measure emissions of specific radionuclides only (1) when it is known that the sample contains only a single radionuclide, or the identity and isotopic ratio of the radionuclides in the sample are well known, and (2) measurements using either Method A-1, A-2 or A-5 have shown that this method provides a reasonably accurate measurement of the emission rate. Gross alpha measurements are applicable to unidentified mixtures of radionuclides only for the purposes and under the conditions described in section 3.7. APHA-601(3), ASTM-D-1943(10).		Yes	The 222-S Laboratory method follows the procedure LA-508-110 or LA-508-114 (WHC 1992a). It meets all of the requirements stated in Method A-4.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.1.5 Method A-5, Chemical Determination of Uranium. Uranium: Uranium may be measured chemically by either colorimetry or fluorometry. In both procedures, the sample is dissolved, the uranium is oxidized to the hexavalent form and extracted into a suitable solvent. Impurities are removed from the solvent layer. For colorimetry, dibenzoylmethane is added, and the uranium is measured by the absorbance in a colorimeter. For fluorometry, a portion of the solution is fused with a sodium fluoride-lithium fluoride flux and the uranium is determined by the ultraviolet activated fluorescence of the fused disk in a fluorometer. Applicability: This method is applicable to the measurements of emission rates of uranium when the isotopic ratio of the uranium radionuclides is well known. ASTM-E-318(15), ASTM-D-2907(14).		Exceeds performance of EPA method	Total uranium is determined by procedure LA-925-107 (WHC 1992a). The laser-induced kinetic phosphorescence analyzer is an improvement over the old fluorometric method for uranium determination. It is highly sensitive (lower detection level of 50 parts per trillion is quite possible) because the laser frequency is used specifically for excitation of uranium atoms. It is faster and produces quality numbers. Quality can also be monitored during analysis. It exceeds the requirements in Method A-5.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.1.6 Method A-6, Radon-222-Continuous Gas Monitor. Principle: Radon-222 is measured directly in a continuously extracted sample stream by passing the air stream through a calibrated scintillation cell. Prior to the scintillation cell, the air stream is treated to remove particulates and excess moisture. The alpha particles from radon-222 and its decay products strike a zinc sulfide coating on the inside of the scintillation cell producing light pulses. The light pulses are detected by a photomultiplier tube which generates electrical pulses. These pulses are processed by the system electronics and the read out is in pCi/l of radon-222. Applicability: This method is applicable to the measurement of radon-222 in effluent streams which do not contain significant quantities of radon-220. Users of this method should calibrate the monitor in a radon calibration chamber at least twice per year. The background of the monitor should also be checked periodically by operating the instrument in a low radon environment. EPA 520/1-89-009(24).		Not applicable	Not applicable at the 222-s Laboratory; direct monitoring of ^{222}Rn is not performed at the 222-s Laboratory.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.1.7 Method A-7, Radon-222-Alpha Track Detectors Principle: Radon-222 is measured directly in the effluent stream using alpha track detectors (ATD). The alpha particles emitted by radon-222 and its decay products strike a small plastic strip and produce submicron damage tracks. The plastic strip is placed in a caustic solution that accentuates the damage tracks which are counted using a microscope or automatic counting system. The number of tracks per unit area is corrected to the radon concentration in air using a conversion factor derived from data generated in a radon calibration facility. Applicability: Prior approval from EPA is required for use of this method. This method is only applicable to effluent streams which do not contain significant quantities of radon-220, unless special detectors are used to discriminate against radon-220. This method may be used only when ATDs have been demonstrated to produce data comparable to data obtained with Method A-6. Such data should be submitted to EPA when requesting approval for the use of this method. EPA 520/1-89-009(24).		Not applicable	Not applicable; direct monitoring of ^{222}Rn is not performed at the 222-S Laboratory.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.2 Methods for Gaseous Beta Emitting Radionuclides. 3.2.1 Method B-1, Direct Counting in Flow-Through Ionization Chambers. Principle: An ionization chamber containing a specific volume of gas which flows at a given flow rate through the chamber is used. The sample (effluent stream sample) acts as the counting gas for the chamber. The activity of the radionuclide is determined from the current measured in the ionization chamber. Applicability: This method is applicable for measuring the activity of a gaseous beta emitting radionuclide in an effluent stream that is suitable as a counting gas, when no other beta-emitting nuclides are present. DOE/EP-0096(17), NCRP-58(23).		Not applicable	Not performed.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.2.2 Method B-2, Direct Counting With In-line or Off-line Beta Detectors. Principle: The beta detector is placed directly in the effluent stream (in-line) or an extracted sample of the effluent stream is passed through a chamber containing a beta detector (off-line). The activities of the radionuclides present in the effluent stream are determined from the beta count rate, and a knowledge of the radionuclides present and the relationship of the gross beta count rate and the specific radionuclide concentration. Applicability: This method is applicable only to radionuclides with maximum beta particle energies greater than 0.2 MeV. This method may be used to measure emissions of specific radionuclides only when it is known that the sample contains only a single radionuclide or the identity and isotopic ratio of the radionuclides in the effluent stream are well known. Specific radionuclide analysis of periodic grab samples may be used to identify the types and quantities of radionuclides present and to establish the relationship between specific radionuclide analyses and gross beta count rates. This method is applicable to unidentified mixtures of gaseous radionuclides only for the purposes and under the conditions described in section 3.7.		Not applicable	Not performed.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.3 Methods for Non-Gaseous Beta Emitting Radionuclides. 3.3.1 Method B-3, Radiochemistry-Beta Counting. Principle: The element of interest is separated from other elements, and from the sample matrix by radiochemistry. This may involve precipitation, distillation, ion exchange, or solvent extraction. Carriers (elements chemically similar to the element of interest) may be used. The element is deposited on a planchet, and counted with a beta counter. Corrections for chemical yield and decay (if necessary) are made. The beta count rate determines the total activity of all radionuclides of the separated element. This method may also involve the radiochemical separation and counting of a daughter element, after a suitable period of ingrowth, in which case it is specific for the parent nuclide. Applicability: This method is applicable for measuring the activity of any beta-emitting radionuclide, with a maximum energy greater than 0.2 Mev, provided no other radionuclide is present in the separated sample. APHA-608(5).		Yes	The method for determining ^{89}Sr, ^{90}Sr in air filter samples is carried out using procedures LA-549-112 (dissolution) and LA-220-103 (for chemical separation), followed by procedure LA-508-111 (total beta counting) (WHC 1992a). The laboratory method meets the requirements stated above.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.3.2 Method B-4, Direct Beta Counting (Gross beta determination). Principle: The sample, collected on a suitable filter, is counted with a beta counter. The sample must be thin enough so that self-absorption corrections can be made. Applicability: Gross beta measurements are applicable only to radionuclides with maximum beta particle energies greater than 0.2 MeV. Gross beta measurements may be used to measure emissions of specific radionuclides only (1) when it is known that the sample contains only a single radionuclide, and (2) measurements made using Method B-3 show reasonable agreement with the gross beta measurement. Gross beta measurements are applicable to mixtures of radionuclides only for the purposes and under the conditions described in section 3.7. APHA-602(4), ASTM-D-1890(11).		Yes	For gross beta determination, procedure LA-508-110 or LA-508-114 is followed (WHC 1992a). It satisfies the Method B-4 requirements.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.3.3 Method B-5, Liquid Scintillation Spectrometry. Principle: An aliquot of a collected sample or the result of some other chemical separation or processing technique is added to a liquid scintillation "cocktail" which is viewed by photomultiplier tubes in a liquid scintillation spectrometer. The spectrometer is adjusted to establish a channel or "window" for the pulse energy appropriate to the nuclide of interest. The activity of the nuclide of interest is measured by the counting rate in the appropriate energy channel. Corrections are made for chemical yield where separations are made. Applicability: This method is applicable to any beta-emitting nuclide when no other radionuclide is present in the sample or the separated sample provided that it can be incorporated in the scintillation cocktail. This method is also applicable for samples which contain more than one radionuclide but only when the energies of the beta particles are sufficiently separated so that they can be resolved by the spectrometer. This method is most applicable to the measurement of low-energy beta emitters such as tritium and carbon-14. APHA.609(6), EMLLV-539-17(19).		Yes	This method is used for determining ^{14}Pm in air filter samples (LA-549-112 for dissolution, LA-613-111 for chemical separation, LA-548-111 for incorporating into scintillation cocktail, and LA-508-121 for liquid scintillation counting). This is also used for determination of ^{14}C (LA-348-101, LA-548-111, and LA-508-121, sequentially) and ^3H (LA-218-112, LA-548-111, and LA-508-121, sequentially) in gas samples (WHC 1992a). This method satisfies all of the requirements.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.4 Gamma Emitting Radionuclides 3.4.1 Method G-1. High Resolution Gamma Spectrometry. Principle: The sample is counted with a high resolution gamma detector, usually either a Ge(Li) or a high purity Ge detector, connected to a multichannel analyzer or computer. The gamma emitting radionuclides in the sample are measured from the gamma count rates in the energy regions characteristic of the individual radionuclide. Corrections are made for counts contributed by other radionuclides to the spectral regions of the radionuclides of interest. Radiochemical separations may be made prior to counting but are usually not necessary. Applicability: This method is applicable to the measurement of any gamma emitting radionuclide with gamma energies greater than 20 keV. It can be applied to complex mixtures of radionuclides. The samples counted may be in the form of particulate filters, absorbers, liquids or gases. The method may also be applied to the analysis of gaseous gamma emitting radionuclides directly in an effluent stream by passing the stream through a chamber or cell containing the detector. ASTM-3649(9), IDO-12096(18).		Yes	The 222-S Laboratory method uses gamma ray spectroscopy with high resolution germanium detectors and follows procedure LA-508-162 (WHC-1994c). It meets all the requirements explained in Method G-1.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.4.2 Method G-2, Low Resolution Gamma Spectrometry. Principle: The sample is counted with a low resolution gamma detector, a thallium activated sodium iodide crystal. The detector is coupled to a photomultiplier tube and connected to a multichannel analyzer. The gamma emitting radionuclides in the sample are measured from the gamma count rates in the energy regions characteristic of the individual radionuclides. Corrections are made for counts contributed by other radionuclides to the spectral regions of the radionuclides of interest. Radiochemical separation may be used prior to counting to obtain less complex gamma spectra if needed. Applicability: This method is applicable to the measurement of gamma emitting radionuclides with energies greater than 100 keV. It can be applied only to relatively simple mixtures of gamma emitting radionuclides. The samples counted may be in the form of particulate filters, absorbers, liquids or gas. The method can be applied to the analysis of gaseous radionuclides directly in an effluent stream by passing the gas stream through a chamber or cell containing the detector. ASTM-D-2459(12), EHSL-LV-0539-17(19).		Not applicable	This method is not used in air filter analysis.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.4.3 Method G-3, Single Channel Gamma Spectrometry. Principle: The sample is counted with a thallium activated sodium iodide crystal. The detector is coupled to a photomultiplier tube connected to a single channel analyzer. The activity of a gamma emitting radionuclide is determined from the gamma counts in the energy range for which the counter is set. Applicability: This method is applicable to the measurement of a single gamma emitting radionuclide. It is not applicable to mixtures of radionuclides. The samples counted may be in the form of particulate filters, absorbers, liquids or gas. The method can be applied to the analysis of gaseous radionuclides directly in an effluent stream by passing the gas stream through a chamber or cell containing the detector.		Not applicable	This technique is not used in air filter analysis.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.4.4 Method G-4, Gross Gamma Counting. Principle: The sample is counted with a gamma detector usually a thallium activated sodium iodine crystal. The detector is coupled to a photomultiplier tube and gamma rays above a specific threshold energy level are counted. Applicability: Gross gamma measurements may be used to measure emissions of specific radionuclides only when it is known that the sample contains a single radionuclide or the identity and isotopic ratio of the radionuclides in the effluent stream are well known. When gross gamma measurements are used to determine emissions of specific radionuclides periodic measurements using Methods G-1 or G-2 should be made to demonstrate that the gross gamma measurements provide reliable emission data. This method may be applied to analysis of gaseous radionuclides directly in an effluent stream by placing the detector directly in or adjacent to the effluent stream or passing an extracted sample of the effluent stream through a chamber or cell containing the detector.		Not applicable	

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.5 Counting Methods. All of the methods with the exception of Method A-5 involve counting the radiation emitted by the radionuclide. Counting methods applicable to the measurement of alpha, beta and gamma radiations are listed below. The equipment needed and the counting principles involved are described in detail in ASTM-3648(8). 3.5.1 Alpha Counting: •Gas Flow Proportional Counters. The alpha particles cause ionization in the counting gas and the resulting electrical pulses are counted. These counters may be windowless or have very thin windows. •Scintillation Counters. The alpha particles transfer energy to a scintillator resulting in a production of light photons which strike a photomultiplier tube converting the light photons to electrical pulses which are counted. The counters may involve the use of solid scintillation materials such as zinc sulfide or liquid scintillation solutions. •Solid-State Counters. Semiconductor materials, such as silicon surface-barrier p-n junctions, act as solid ionization chambers. The alpha particles interact which the detector producing electron hole pairs. The charged pair is collected by an applied electrical field and the resulting electrical pulses are counted. •Alpha Spectrometers. Semiconductor detectors used in conjunction with multichannel analyzers for energy discrimination.		Yes	Alpha proportional counters (home-built chambers with EG&G ORTEC electronics), window-type gas flow proportional counters (some having automatic sample changer), surface-barrier solid-state detectors, connected to a multichannel analyzer (MCA) (GENIE system manufactured by Canberra Industries, Inc.) are used for air filter analysis in 222-S laboratory. Laboratory equipment meets the specifications for alpha counting.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.5.2 Beta Counting: ■ Ionization Chambers. These chambers contain the beta-emitting nuclide in gaseous form. The ionization current produced is measured. ■ Geiger-Muller (GM) Counters or Gas Flow Proportional Counters. The beta particles cause ionization in the counting gas and the resulting electrical pulses are counted. Proportional gas flow counters which are heavily shielded by lead or other metal, and provided with an anti-coincidence shield to reject cosmic rays, are called low background beta counters. ■ Scintillation Counters. The beta particles transfer energy to a scintillator resulting in a production of light photons, which strike a photomultiplier tube converting the light photon to electrical pulses which are counted. This may involve the use of anthracene crystals, plastic scintillator, or liquid scintillation solutions with organic phosphors. ■ Liquid Scintillation Spectrometers. Liquid scintillation counters which use two photomultiplier tubes in coincidence to reduce background counts. This counter may also electronically discriminate among pulses of a given range of energy.		Yes	Window-type gas flow proportional counter (some having an automatic sample changer) liquid scintillation spectrometers manufactured by Beckman Instruments, Inc., are used for analysis. The 222-S Laboratory counting equipment meets the requirements specified above for beta counting.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.5.3 Gamma Counting: ■Low-Resolution Gamma Spectrometers. The gamma rays interact with thallium-activated sodium iodide or cesium iodide crystal resulting in the release of light photons which strike a photomultiplier tube converting the light pulses to electrical pulses proportional to the energy of the gamma ray. Multi-channel analyzers are used to separate and store the pulses according to the energy absorbed in the crystal. ■High-Resolution gamma Spectrometers. Gamma rays interact with a lithium-drifted (Ge(Li)) or high-purity germanium (HPGe) semiconductor detectors resulting in a production of electron-hole pairs. The charged pair is collected by an applied electrical field. A very stable low noise preamplifier amplifies the pulses of electrical charge resulting from the gamma photon interactions. Multichannel analyzers or computers are used to separate and store the pulses according to the energy absorbed in the crystal. ■Single Channel Analyzers. Thallium activated sodium iodide crystals used with a single window analyzer. Pulses from the photomultiplier tubes are separated in a single predetermined energy range.		Yes	High-resolution gamma detectors (high purity Ge detectors for both low and high energies) from EG&G ORTEC and Princeton Gamma Tech, well-type pure Ge detectors connected to MCA (Canberra's system) are available and used for air filter analysis. The 222-S Laboratory equipment exceeds the requirements for gamma counting specified above.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.5.4 Calibration of Counters. Counters are calibrated for specific radionuclide measurements using a standard of the radionuclide under either identical or very similar conditions as the sample to be counted. For gamma spectrometers a series of standards covering the energy range of interest may be used to construct a calibration curve relating gamma energy to counting efficiency. In those cases where a standard is not available for a radionuclide, counters may be calibrated using a standard with energy characteristics as similar as possible to the radionuclide to be measured. For gross alpha and beta measurements of the unidentified mixtures of radionuclides, alpha counters are calibrated with a natural uranium standard and beta counters with a cesium-137 standard. The standard must contain the same weight and distribution of solids as the samples, and be mounted in an identical manner. If the samples contain variable amounts of solids, calibration curves relating weight of solids present to counting efficiency are prepared. Standards other than those prescribed may be used provided it can be shown that such standards are more applicable to the radionuclide mixture measured.		Yes	A mixed gamma standard (NIST traceable) emitting various gamma-rays ranging from 59 to 1850 keV is used with vendor-supplied calibration software for constructing efficiency versus energy calibration curves for different geometrical configurations used in gamma analysis. The calibration procedure for gamma ray spectrometer is documented in LQ-508-003 (WHC 1994c). Our calibration procedure meets the EPA criteria for gamma ray spectroscopic analysis. For calibration of beta detectors for $^{90}\text{Sr}/^{90}\text{Y}$ analysis, procedure LQ-508-002 is used in conjunction with LQ-508-005 (WHC 1992a). It meets the requirements of the EPA-suggested method. A method standard also is used to check the performance and calibration of the detector. For calibration of alpha/beta proportional counters, the procedure LQ-508-002 is carried out. It partially deviates from the EPA requirements. For gross alpha and gross beta measurements, our instruments are calibrated with ^{241}Am and ^{60}Co standards, respectively. The reasons for choosing the ^{241}Am standard for alpha calibration are as follows: • It is commonly found in the PUREX stack air samples. • Alpha counting efficiency usually is the same for other alpha emitters that also are found in the air stack samples • The ^{241}Am standard also can be checked independently by gamma analysis.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
3.5.4 Continued			The reason for using the ^{60}Co beta calibration is the lower counting efficiency with ^{60}Co (beta max = 317 keV). Consequently, it will generate conservative numbers in our analysis. The calibration curves relating weight of solids present to counting efficiencies are not done in alpha/beta analysis, but currently are being evaluated.
3.6 Radiochemical Methods for Selected Radionuclides. Methods for a selected list of radionuclides are listed in Table 1. The radionuclides listed are those which are most commonly used and which have the greatest potential for causing doses to members of the public. For radionuclides not listed in Table 1, methods based on any of the applicable "principles of measurement" described in section 3.1 through 3.4 may be used.		Yes	The air samples from the 296-A-1 stack are well characterized. ^{135}I , ^{137}I , ^{239}Pu , ^{240}Pu are listed in Table 1 of Method 114 (EPA 1991) and are analyzed according to the approved methods given in the table.
3.7 Applicability of Gross Alpha and Beta Measurements to Unidentified Mixtures of Radionuclides. Gross alpha and beta measurements may be used as a screening measurement as a part of an emission measurement program to identify the need to do specific radionuclide analyses or to confirm or verify that unexpected radionuclides are not being released in significant quantities. Gross alpha (Method A-4) or gross beta (Methods B-2 or B-4) measurements may also be used for the purpose of comparing the measured concentrations in the effluent stream with the limiting "Concentration Levels for Environmental Compliance" in Table 2 of Appendix E. For unidentified mixtures, the measured concentration value shall be compared with the lowest environmental concentration limit for any radionuclide which is not known to be absent from the effluent stream.		Not applicable	This is not applicable because the air effluents from the 296-A-1 stack are well characterized. However, gross alpha and beta analyses for bi-weekly air samples are routinely performed in the 222-S Laboratory before starting specific radionuclide analyses. Following this practice, the facility can verify a significant release of a radionuclide into the air so corrective actions to minimize its emission can be taken promptly by facility personnel. The gross alpha and beta results from analysis are compared to those listed in the appendix of U.S. Department of Energy (DOE) Order 5400.5 (DOE 1990) for compliance.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.0 Quality Assurance Methods Each facility required to measure their radionuclide emissions shall conduct a quality assurance program in conjunction with the radionuclide emission measurements. This program shall assure that the emission measurements are representative, and are of known precision and accuracy and shall include administrative controls to assure prompt response when emission measurements indicate unexpectedly large emissions. The program shall consist of a system of policies, organizational responsibilities, written procedures, data quality specifications, audits, corrective actions and reports. This quality assurance program shall include the following program elements: 4.1 The organizational structure functional responsibilities, levels of authority and lines of communications for all activities related to the emissions measurement program shall be identified and documented. 4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations.	WHC-EP-0536-1	Yes	See Section 6.2 of WHC-EP-0536-1 for the organizational structure (WHC cd).
	WHC-CN-4-12 (WHC 1992b), Section 1.14, REV 1, ALARM RESPONSE AND MANAGEMENT	Yes	WHC-CN-4-12 (WHC 1992b), Section 1.14, REV 1, ALARM RESPONSE AND MANAGEMENT. This practice establishes requirements and provides guidance for responding to alarms that are the responsibility of Health Physics (HP). This practice does not apply to alarms intentionally activated according to approved procedures, (e.g., functional test, source test). Facility specific procedures or desk instructions based on those procedures may be provided by the Area HP Managers to address alarm systems specific to each facility.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations. (Continued)	WHC-CH-4-12, Section 2.1, REV 0, RADIOLOGICAL PROBLEM REPORTING PROGRAM	Yes	WHC-CH-4-12, Section 2.1, REV 0, RADIOLOGICAL PROBLEM REPORTING PROGRAM. The purpose of the Radiological Problem Report (RPR) program is to provide a documented record of observed radiological problems, a mechanism for reporting these problems to management for action, a capability to track and monitor the progress of the planned corrective actions, and a database for assessing trends in radiological program performance and needed actions.
	WHC-CH-4-12, Section 12.1, REV 1 EMERGENCY RESPONSE	Yes	WHC-CH-4-12, Section 12.1, REV 1 EMERGENCY RESPONSE. An EMERGENCY is a sudden unexpected event requiring immediate response to mitigate impacts to people, property, or the environment. When radioactive material is involved, Health Physics (HP) plays a major role in evaluating, controlling, and recovering from the event. To be able to perform this function HP personnel receive training to respond to a variety of emergency situations. The HP procedures are written to provide guidelines to respond to emergencies. Together, the training and written procedure detail the HP Emergency Response Program. Emergency Response. The HP personnel are, in many situations, the first to respond to a radiological emergency. The ability to assess and evaluate the situation and take immediate steps to minimize the effects of the event is crucial for controlling the emergency. The HP personnel must use their training and experience to make good decisions during the initial response to an emergency.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations. (Continued)	WHC-CH-4-12, Section 12.1, REV 1 EMERGENCY RESPONSE (Continued)	Yes	An emergency response may be initiated by personnel observing the event, alarms, the Patrol Operation Center, or the Emergency Control Center(s) once they are manned. For a planned response, HP personnel shall be in teams of at least two. Out of necessity (e.g., backshift response), one member could be an Operations person or other emergency service person such as fire or patrol. A rapid response is required; however, no undue risks should be taken nor should employee personnel safety be compromised. The type of emergency determines the level of planning for HP response. For example, a continuous air monitor (CAM) alarm or a small radioactive spill requires little planning for the initial response. However, when an emergency causes a facility evacuation, preplanning (e.g., stay time, entry route, etc.) and approval of the Building/Facility Emergency Director is necessary for a re-entry. Although HP personnel respond to an emergency using basic guidelines, an area/facility may have specific procedures that have priority over these guidelines.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations. (Continued)	WHC-IP-0718 (1993d), Section ER-02, Rev. 1, AIR SAMPLING CHECKLIST.	Yes	WHC-IP-0718 (WHC 1993d), Section ER-02, REV 1, AIR SAMPLING CHECKLIST. This checklist establishes the instruction and guidelines for air sampling in an emergency situation.
	WHC-IP-0718, Section ER-02, Rev. 1, PLUME TRACKING CHECKLIST	Yes	WHC-IP-0718, Section ER-02, REV 1, PLUME TRACKING CHECKLIST. This checklist establishes the instruction to track a plume created from a radioactive material release to the environment.
	WHC-IP-0718, Section ER-02, REV 1, GENERAL EMERGENCY RESPONSE GUIDELINES AND CHECKLISTS.	Yes	WHC-IP-0718, Section ER-02, REV 1, GENERAL EMERGENCY RESPONSE GUIDELINES AND CHECKLISTS. This procedure provides the HPT with checklists and instruction for response to various radiological emergencies.
	WHC-IP-0263-202A (WHC 1992c), Westinghouse Hanford Company Emergency Plan for PUREX Facility.	Yes	WHC-IP-0263-202A (WHC 1992c), Westinghouse Hanford Company Emergency Plan for PUREX Facility. This document provides instructions for many types of emergencies, including excessive releases of radioactivity via the stacks.
	WHC-CM-5-9 (WHC 1992b), Section 2.3, REV 3, PUREX/UC ₃ Plant Occurrence Categorization, Notification, and Reporting.	Yes	WHC-CM-5-9 (WHC 1992b), Section 2.3, REV 3, PUREX/UC ₃ Plant Occurrence Categorization, Notification, and Reporting. This procedure provides instructions for notification and reporting of specific events including environmental releases and related events.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3 The sample collection and analysis procedures used in measuring the emissions shall be described including where applicable: 4.3.1 Identification of sampling sites and number of sampling points, including the rationale for site selection.		Yes	The 296-A-1 stack is .61 m (2 ft) in diameter and tapers to .53 m (1.8 ft) at the top. The record sampling site is located at a height of 10.4 m (46 ft) above-grade. There are a total of three sampling sites and three sampling probes. The elevations of the sample ports are 10.4, 11.6, and 12.8 m (34, 38, and 42 ft) above base, which is the location of the last major flow disturbance in the stack. The sample ports are, therefore, approximately 17, 19, and 21 diameters downstream of the last major disturbance. The stack is 18.9 m (62 ft) from the base, or 31 diameters. The sample ports are, therefore, approximately 14, 12, and 10 diameters upstream of the next major flow disturbance. The sites were chosen to provide representative sampling of the effluent and to comply with ANSI N13.1-1969 (ANSI 1969). The lowest sample port was chosen as the location of the record sample probe to minimize the length of sample line in accordance with ANSI N13.1-1969. These sample points also meet the criteria of 40 CFR 60, Appendix A, Method 1 (EPA 1992).

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.2 A description of sampling probes and representativeness of the samples.		Yes	The sampling probes for the record sampler and the Alpha CAM are identically designed, and are mounted in the horizontal plane at the 14.0- and 16.5-m (46- and 54-ft) level respectively. Note: For information purposes related to this study, the sampling ports have been numbered 1, 2, 3, and 4. The sampling probe consists of four nozzles branching from a single delivery line and is made entirely of 304 stainless steel tubing (drawing H-2-75571, WHC 1991). At the inlet, each port is tapered to a knife edge with a 15-degree angle. The first port, located at the center of the stack, is made of .79-cm (5/16 in.) OD, .089-cm (0.035-in.) wall tube. The inlet has a vertical section of 4.67 cm (1.875 in.), followed by a radius bend of 1.875 leading into the sample delivery line. The second port, located 18.4 cm (7.25 in.) from the center of the stack, is made of 1/8 Schedule 40s pipe 1.68-cm (0.269 in.) ID. The inlet has a vertical section of 6.4 cm (2.5 in.) followed by a radius bend of 2.5 leading into the sample delivery line. The third port, located 23.97 cm (9.438 in.) from the center of the stack, is made of .95-cm (3/8-in.) OD, .124-cm (0.049-in.) wall tube. The inlet, has a vertical section of 5.7 cm (2.25 in.) followed by a radius bend of 2.25, leading into the sample delivery line.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.2 A description of sampling probes and representativeness of the samples (continued).		Yes	The fourth port, located 28.42 cm (11.188 in.) from the center of the stack, is made of 1/4 Schedule 80s pipe [1.76 cm (0.302 in.)]. The inlet, has a vertical section of 8.3 cm (3.25 in.), followed by a radius bend of 3.25, leading into the sample delivery line. The outer sampling line is made of 1.9-cm (3/4 in.) OD, .27-cm (0.109-in.) wall tube. The inlet ports with different cross sectional areas are centered approximately in four equal annular areas. The use of an isokinetic 4-point probe located more than 15 duct diameters downstream of the last major flow disturbance is believed to be representative sampling (stack and sample flow rates are checked daily to ensure near isokinetic of $\pm 10\%$).
4.3.3 A description of any continuous monitoring system used to measure emissions, including the sensitivity of the system, calibration procedures and frequency of calibration.		Yes	Not applicable--emissions are not monitored continuously for compliance demonstration.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.4 A description of the sample collection systems for each radionuclide measured, including frequency of collection, calibration procedures and frequency of calibration.		Yes	The sample is continuously removed from the effluent stream via the probe described in Section 4.3.2. The sample then flows through the sample line and the particulates are collected on a sample filter. The sample filters are replaced bi-weekly, and evaluated for gross alpha and gross beta activities by laboratory analysis. The filter media is then composited for quarterly analysis of specific radionuclide concentrations. The CAM loop collects particulate matter in a similar fashion to that of the record sampler, but the CAM monitors for elevated radioactivity on the filter. This instrument provides process control and backup capability for the record sampler. The CAM is calibrated every six months.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration. (Continued Below)		Yes	Total alpha/total beta activity is determined by procedure LA-508-110 or LA-508-114 on bi-weekly samples, and occasionally on daily air samples, per collection point. The calibration procedure is documented in LO-508-002. It is done only when deemed necessary by a responsible scientist. The counting system is recalibrated only in case of (1) major repairs or adjustments to the power supply or detector or (2) calibration shift as indicated by the instrument control standards. The performance of the counting systems is checked by running the instrument control standards (^{147}Pm for low-energy beta, ^{60}Co for mid-energy beta, and ^{241}Am for alpha activity) separately. When a batch of air filter samples are run, all the performance standards and the background (for counting frequency refer to LO-150-115) are also run with it. To verify that the counting system is working properly, the standard values from analysis should fall within the administrative limits set according to appropriate quality assurance program plans (QAPP).

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration. (Continued)		Yes	The 222-S laboratory method for analysis of ^{241}Am, ^{238}Pu, and ^{239}Pu involves various steps (LA-549-112 for dissolution, LA-943-123 for chemical separation, LA-542-101 for electrodeposition, and LA-508-161 for final alpha spectrometry). The analysis of alpha emitters is done quarterly on bi-weekly air filter samples. The energy resolution and calibration of the AEA system over the energy range of 4 to 6 MeV are checked once a month by the preventive maintenance (PM) procedure 2S18006. Efficiency calibration of the AEA is not needed in our analysis method because direct comparison of the sample with recoveries of the tracers (^{243}Am and ^{235}Pu) is made to determine the activities of the radionuclides present in the sample. To carry out the sample analysis, AEA system performance is checked once every 24 hours for alpha energy shift with a certified mixed alpha source standard. Each alpha energy peak identified in the standard must fall within administratively assigned channels (± 10) on the MCA. For counting frequency of performance check standards, procedure LO-150-115 is referred to. The recovery of the radionuclides and the calibration of the system are checked on a batch basis by running a method standard under the identical conditions as the sample.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration. (Continued)		Yes	The content of the 222-S Laboratory's procedures, test plans, supporting documents, and drawings provide a sufficient level of detail to allow trained personnel to produce quality results safely. Laboratory procedures are controlled as required by WHC-CH-5-4, Section 5.4, "Analytical Laboratory Procedures." The specific content of laboratory procedures is defined by its author, based on accepted methods such as 40 CFR 61, Appendix B, Method 114 (EPA 1991). The content must be agreed to by the peer and technical reviewers. While authors are responsible for the specific content of their procedures, they address the topics below. <u>Summary</u> - MANDATORY - A short description or abstract of the procedure containing enough information to distinguish it from other procedures. <u>Applications</u> - MANDATORY - Defines the scope and purpose of the specific procedure. This section may be combined with the following element under the title "Applications and Limitations."

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration. (Continued)		Yes	<u>Limitations</u> - MANDATORY - Briefly describes those areas in which the procedure is not applicable. A statement of accuracy and precision will be given where appropriate. <u>Quality Control Protocol</u> - Procedures used to support environmental projects that have specific quality control requirements. For these procedures, the source of the quality control requirements will be identified. The samples or project that this element applies to will be identified. The following information is typical of quality control requirements: frequency and type of calibration, reagent blank analysis, spike sample analysis, and duplicate sample analysis. <u>Impact Level Identifier</u> - MANDATORY - An impact level will be identified for each procedure following WHC-CH-1-3, MRP 5.43, with a brief basis of determination statement. This MRP lists several descriptive paragraphs delineating what constitutes an Impact Level 1, 2, 3, or 4 activity. The following parts of MRP 5.43 cover most analytical laboratory procedures. 1. Section 5, paragraph 6, part c., Impact Level 3 - work authorized documentation associated with work involving occupational hazards not covered by approved procedure, such as Operational Safety Assessments, Radiation Work Permits, or Industrial Safety Standards.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration. (Continued)		Yes	2. Section 5, paragraph 6, part c., Impact Level 4 - Documentation for any activity not classified as Impact Level 1, 2, or 3. The laboratories' procedures are usually specific to one activity. These activities are well defined using common scientific instrumentation and equipment operated in an acceptable manner. The chemicals and materials used are normally small quantities with limited potential for environmental or personnel safety impact. In general, the equipment used in the laboratory is not classified as Safety class 3 or higher. Safety - MANDATORY - The procedure must identify applicable safety hazards. The following documents identify Westinghouse Hanford Company (Westinghouse Hanford) safety requirements: • WHC-CM-4-3, Volume 1-3, Industrial Safety • WHC-CM-4-10, Radiation Protection • WHC-CM-4-15, Radiation Work Requirements and Work Permits Manual • WHC-CM-4-29, Nuclear Criticality Safety. Supporting document WHC-SD-CP-LB-003, Safety in the Analytical Laboratory, is the laboratory general safety document. The authors must review safety requirements and include safety warnings appropriate to the actions directed by the procedure.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration. (continued)		Yes	Reagents - If the procedure requires analytical reagents, a list of reagents will be provided. The MSDS number will be placed in brackets by each chemical name. Reagent makeup, storage container requirements, unique storage needs, shelf-life requirements, special labeling, and special preparation steps will be included. Special notations for any known or suspected carcinogen as listed on WHC-CN-4-3, Volume 2, Table 1, "WHC Master Carcinogen List," will be made on the reagent list. Reagent preparation described fully in other current Westinghouse Hanford documentation may be included by reference. Equipment - Special equipment needs will be listed. Standard hood or glovebox equipment is assumed to be available at the work station and does not need to be listed. The fabrication of off-standard equipment will be referenced or described in this section. Procedure Steps - MANDATORY - A step-by-step description of operations necessary to perform the task will be presented in a logical and sequentially numbered order or an assignment of responsibilities. CAUTIONS and WARNINGS notations will be included for the applicable safety hazard before the action is described. Steps with potential for criticality specification violation will be identified. Explanatory "Notes" may be included for clarification of process.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration. (Continued)		Yes	<u>Calculations</u> - Calculations required to complete the work will be described in this section. Examples with sample values may be included. All combined factors will be fully described and units noted. <u>Calibrations</u> - When calibrations are required, a description of how to carry out required calibrations will be given. <u>Discussion</u> - A discussion of the theoretical aspects of the procedure. Brief identification of unique characteristics and interfaces to aid in troubleshooting may be included. <u>References</u> - A reference list of published information to provide technical basis for the procedure may be included. The mandatory topics are addressed in both procedures. However, the laboratories have technical, analytical, and administrative procedures. Non-mandatory topics are included if appropriate to the activity covered by the procedure. The calibrations of all laboratory instruments are controlled by the Laboratory Instrument Calibration Control System (LICCS) (WHC-OK-5-4, Section 8.2). The LICCS documents the requirements for and the performance of calibration activities for each analytical instrument or measurement device.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.6 A description of the sample flow rate measurement systems or procedures, including calibration procedures and frequency of calibration.		Yes	The sample collection and monitoring system consists of a record sampler and one Alpha Continuous Air Monitor (CAM). The record sample is considered the regulatory portion of the system for reporting the amount and concentration of radionuclides released to the environment. The generated reports are forwarded to all appropriate organizations and agencies. The CAM is considered the operational safety device and is set to alarm (located in dispatcher's office) if emissions are detected above present levels. The sampling system is designed with two identical sampling probes mounted in the horizontal plane at the 14.0- and 16.5-m (46- and 54-ft) level for the record sampler and Alpha CAM respectively. The sample flow rate is measured and regulated by instruments located downstream of the sample collection filter and CAM. The record sample loop passes through a flow transmitter, a flow regulator (flow control valve), a flow switch (flow alarm switch), a vacuum gauge, and a vacuum pump. The flow transmitter will send an electrical signal to the flow indicator control and the totalizer. The flow rate regulator is provided to maintain a constant flow rate through the collection filter assembly to compensate for filter-loading effects. At least once a day an employee adjusts the FIC-V28A-2-1 to ensure near isokinesis ($\pm 10\%$). The audible and visible alarm signals which indicate low flow rates for Record Sampler are provided remotely in the dispatcher's office (drawing H-2-75568, WHC 1991). The calibration procedures and frequencies for the record sampler are summarized in Table 1. (Page 209)

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.6 A description of the sample flow rate measurement systems or procedures, including calibration procedures and frequency of calibration. (continued)			The CAM loop differs only in that the sight flow indicator is an integral part of the CAM itself and that there is no flow totalizer. All other flow measurements, regulations, and monitoring are identical to that of the record sampler loop. The audible and visible alarm signals that indicate low flow rates for the CAM are provided remotely in the dispatcher's office. The Alpha count recorder is located in the central control room. The calibration procedures and frequencies for Alpha CAM are summarized in Table 2. (Refer to page 209) Alternative vacuum pumps are provided for the system. Failure annunciation (low flow rates) is provided and checked periodically in the dispatcher's office to demonstrate operability.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.3.7 A description of the effluent flow rate measurement procedures, including frequency of measurements, calibration procedures, and frequency of calibration.		Yes	An Annubar probe (multipoint probe) continuously measures the flow through the stack at the 15.2-m (50-ft) level. The annubar probe senses a total pressure through the velocity ports and a low pressure through the downstream ports. From their differential pressure, the flow transmitter sends the signal to the flow integrator and the totalizer. The total flow is recorded on a digital integrator in the central control room. Flow measurements are accomplished quarterly via Procedure 7-GN-56 per traverse pitot tube. There are 2 ports spaced 90° apart located 4.6 m (15 ft) above the sampling probe location on the stack. These locations are at 26.5 duct diameters downstream and 4.5 duct diameters upstream of any flow disturbances. These measurements are taken in each port at 10 equal annular traverse points (20 in all). The calibration procedures and frequencies for stack flow measurement devices are summarized in Table 3. (Refer to page 210)

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.4 The objectives of the quality assurance program shall be documented and shall state the required precision, accuracy, and completeness of the emission measurement data including a description of the procedures used to assess these parameters.		Yes	The accuracy of all analyses is checked using percent recovery. The evaluation of blind or known check standards provides the percent recovery. For both blind and known check standards, percent recovery is calculated by the following equation: $P = 100 \cdot \frac{R}{S_t}$ Where: P = Percent recovery R = Measured or recovered analyte concentration in the check standard S_t = Concentration of analyte in the check standard. The Laboratories do not use manual W. A. Shenhart control charts (Shenhart 1931). The Laboratory Measurement Control System (LMCS) is a software package designed for support of management quality control decisions. Each analytical measurement system has different control parameter requirements based on the use of specific standards. The LMCS program provides a performance versus limits control chart for each standard. The average percent recovery ($\bar{P}$) or 100 percent, depending on the method, marks the center of the limit. The upper and lower boundaries of the limits are multiples of the standard deviation(s) of the average percent recovery.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.4 The objectives of the quality assurance program shall be documented and shall state the required precision, accuracy, and completeness of the emission measurement data including a description of the procedures used to assess these parameters. (continued)		Yes	The laboratory manager approves the LMCS limits, defined as $\bar{p} \pm ns$, where n is a positive number. The values for $\bar{p}$ and s are either performance based. In general, management sets the warning limits at $2s$ and the control limits at $3s$ or their equivalent. When the LMCS identifies an out-of-control method, it automatically initiates corrective action. The system issues an Off Standard Condition Report (OSCR). The scientist in charge of the method must discover and resolve the problem to close out the OSCR. Until the OSCR has been clear, personnel can not perform any analyses by this method. After the scientist has resolved the problem, personnel evaluate all analyses performed since the last in-control point. The laboratories assess precision by examining the results from split samples or laboratory duplicates. Percent relative difference measures the precision of analyses. Percent relative difference is computed by the following equation: $RD = 100 \cdot \frac{S_d}{\bar{X}}$ Where: RD = Percent relative difference S_d = The standard deviation estimate of the duplicate data set $\bar{X}$ = The arithmetic mean

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.4 The objectives of the quality assurance program shall be documented and shall state the required precision, accuracy, and completeness of the emission measurement data including a description of the procedures used to assess these parameters. (continued)		Yes	The initial QA objective for completeness of analyses in the laboratories is 90 percent. This means that the goal is to produce usable analytical data for a minimum of 90 percent of the analyses requested on all samples submitted to the laboratory. The laboratory evaluates actual performance against the 90 percent objective. If the laboratory performance drops below this limit, management initiates corrective action. This action shall identify and correct those activities within the laboratory that have caused the drop in performance. The objectives are documented in the Environmental Protection Quality Assurance Project Plan (QAPJP) (WHC 1992d).

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.4 The objectives of the quality assurance program shall be documented and shall state the required precision, accuracy, and completeness of the emission measurement data including a description of the procedures used to assess these parameters. (Continued)		Yes	The laboratories assess precision by examining the results from split samples or laboratory duplicates. Percent relative difference measures the precision of analyses. Percent relative difference is computed by the following equation: $RD = 100 \cdot \frac{S_d}{X}$ Where: RD = Percent relative difference S_d = The standard deviation estimate of the duplicate data set X = The arithmetic mean (average) of the duplicate data set. The initial QA objective for completeness of analyses in the laboratories is 90%. This means that the goal is to produce usable analytical data for a minimum of 90% of the analyses requested on all samples submitted to the laboratory. The laboratory evaluates actual performance against the 90% objective. If the laboratory performance drops below this limit, management initiates corrective action. This action shall identify and correct those activities within the laboratory that have caused the drop in performance. The objectives are documented in the Environmental Protection Quality Assurance Project Plan (QAPJP) (WHC 1992d).

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.5 The quality control program shall be established to evaluate and track the quality of the emission measurement data against preset criteria. The program should include, where applicable, a system of replicates; spiked samples; split samples; blanks; and control charts. The number and frequency of such quality control checks shall be identified.		Yes	The samples analyzed under this program consist of mounts made from preparation of stack filters. Each sample collection point produces only one sample which is sent to the laboratory for analysis. No replicate samples are available. Repeat measurement of individual samples are made at the discretion of the scientist in charge. As a type of process control samples, stack filters are not subject to matrix effects and radionuclide spikes are not used. However, tracer elements ^{243}Am and ^{236}Pu are used in the analysis of ^{241}Am, ^{238}Pu, and $^{239,240}\text{Pu}$ in the quarterly composite of bi-weekly filter samples. The laboratory does not split samples. There is no guarantee that the distribution of material on the filter will be homogenous. Because of this, no subsampling procedure, such as splitting, can be assured of producing two representative portions. Also, splitting the sample in effect dilutes the sample, which would adversely effect the method detection limits. Formal blanks are not available for these analysis. However, prior to the analysis of a batch of samples, the background of the counting instrument is checked. This background check is made on each planchet and planchet holder. Control charts and standards used in support of these analysis are described in Section 4.4 above.

Table 14-2. National Emission Standards for Hazardous Air Pollutants Requirements.

APPLICABLE REGULATION, STANDARD, OR REQUIREMENT	PLANT DOCUMENTATION	DOES SYSTEM MEET REQUIREMENTS?	EXPLANATORY REMARKS
4.6 A sample tracking system shall be established to provide for positive identification of samples and data through all phases of the sample collection, analysis and reporting system. Sample handling and preservation procedures shall be established to maintain the integrity of samples during collection, storage and analysis.	WHC-EP-0536-1	Yes	Refer to Section 6.2.1 of WHC-EP-0536-1.
4.7 Periodic internal and external audits shall be performed to monitor compliance with the quality assurance program. These audits shall be performed in accordance with written procedures and conducted by personnel who do not have responsibility for performing any of the operations being audited.	WHC-EP-0536-1	Yes	Refer to Section 8.0 of WHC-EP-0536-1.
4.8 A corrective action program shall be established including criteria for when corrective action is needed, what corrective action will be taken and who is responsible for taking the corrective action.	WHC-EP-0536-1	Yes	Refer to Section 9.0 of WHC-EP-0536-1.
4.9 Periodic reports to responsible management shall be prepared on the performance of the emissions measurements program. These reports should include assessment of the quality of the data, results of audits and description of corrective actions.	WHC-EP-0536-1	Yes	Refer to Section 10.0 of WHC-EP-0536-1.
4.10 The quality assurance program should be documented in a quality assurance project plan which should address each of the above requirements.		Yes	The quality assurance program addressing stack 296-A-1 will be documented in a future quality assurance project plan.

**Table 1. Calibration Procedures and Frequencies for Record Sampler
(Sample Flow Measurement Devices).**

Component	Procedures	CBRS*	Frequency
Flow transmitter (FT-V28A-2-1)	PSCP-6-153	V28A2-2	6 month
Flow alarm switch (FAS-V28A-3-1)	PSCP-6-029	V28A3-1	6 month
Flow indicator control (FIC-V28A-2-1)	PSCP-4-059	V28A2-5	12 month
Flow integrator (FQ-V28A-2-1)	PSCP-1-008	V28A2-3	6 month

* Computer Based Recall System

**Table 2. Calibration Procedures and Frequencies for Alpha Continuous
Air Monitor Sampler (Sample Flow Measurement Devices).**

Component	Procedures	CBRS*	Frequency
Flow alarm switch (FAS-V29A-3-1)	PSCP-6-029	V29A3-1	12 month
Continuous air monitor/rotameter (RAN-V29A-1-1)	PSCP-3-083	YA242-A	6 month

* Computer Based Recall System

Table 3. Calibration Procedures and Frequencies for Stack Flow Measurement Devices.

Component	Procedures	CBRS*	Frequency
Flow transmitter (FT-V21-10-1)	PSCP-6-032	V2110-2	6 month
Flow integrator (FQ-V21-10-1)	PSCP-1-008	V2110-8	6 month
Flow alarm switch (FAS-V21-10-1)	PSCP-4-001	V2110-5	6 month

* Computer Based Recall System

15.0 SUMMARY AND CONCLUSIONS

15.1 MONITORING REQUIREMENTS FOR AIR AND LIQUID EFFLUENTS

15.1.1 Monitoring Requirements for Radioactive Constituents in Air Effluents

Continuous sampling and periodic laboratory analysis are required for Stacks 291-A-1 and 296-A-1. Specific requirements are described below.

15.1.1.1 Stack 291-A-1. Stack 291-A-1 will require continuous sampling for particulates, with analysis for total alpha, total beta, ^{241}Am .

15.1.1.2 Stack 296-A-1. Stack 296-A-1 will require continuous sampling for particulates, with analysis for total alpha, total beta, $^{239,240}\text{Pu}$ and ^{241}Am .

15.1.1.3 Remaining Stacks. The remaining stacks at the PUREX Plant will not require continuous sampling. However, it is advisable to maintain the existing air monitoring equipment in good working order.

15.1.2 Monitoring Requirements for Radioactive Constituents in Liquid Effluent

All operating liquid effluent waste streams will be continuously sampled and periodically analyzed for total alpha and total beta radiation.

15.2 SAMPLING REQUIREMENTS FOR AIR AND LIQUID EFFLUENTS

15.2.1 Sampling Requirements for Radioactive Constituents in Air Effluents

Sampling requirements have been given in 15.1.1.

15.2.2 Sampling Requirements for Liquid Effluents

Composite and grab samples will be analyzed for radioactive, organic, and nonradioactive inorganic constituents. Composite samples will be collected and analyzed monthly. The sampling and analytical program is detailed in Section 7.2.

15.3 SYSTEMS UPGRADES FOR AIR MONITORING AND LIQUID SAMPLING

15.3.1 Systems Upgrades for Air Monitoring/Sampling

15.3.1.1 Stack 291-A-1. The existing equipment at Stack 291-A-1 will not require a system upgrade to meet the sampling needs. Either one of the existing isokinetic sampling systems installed at the 18 m and 22.5 m (60 ft or 74 ft) elevations appear to be adequate for ensuring a representative sample is collected.

15.3.1.2 Stack 296-A-1. The sampling system at Stack 296-A-1 will not require an upgrade to meet the sampling needs. The existing near-isokinetic system appears to be adequate for collecting a representative sample for ^{239,240}Pu and ²⁴¹Am analyses.

15.3.1.3 Remaining Stacks. No system upgrades are required for the remaining stacks at the PUREX Plant.

15.3.2 Systems Upgrades for Liquid Sampling

No system upgrades are required at this time. PUREX liquid effluent discharges to the SALDS will be based upon the criteria set forth in the State Waste Discharge Permit; acceptance criteria for the SALDS are currently under negotiations. A new CSL sampling and analysis plan (SAP) will be written to reflect any changes or modifications to the existing sampling program based upon the final permit discharge criteria.

16.0 ATTACHMENTS

16.1 REFERENCES

- ANSI, 1969, *Guide to Sampling Airborne Radioactive Materials in a Nuclear Facility*, ANSI N13.1, American National Standards Institute, Washington, D.C.
- ANSI, 1974, *Specification and Performances of On-Site Instrumentation for Continuously Monitoring Radioactivity in Effluents*, American National Standards Institute, Washington, D.C.
- Clean Air Act*, as amended, Public Law 95-95, 91 Stat. 685, 45 USC 7401.
- Clean Air Act*, as amended, Public Law 95-217, 92 Stat. 1566, 33 USC 1251.
- Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, as amended, Public Law 96-510, 94 Stat. 2767, 42 USC 9601 et seq.
- DOE, 1983a, *Environmental Protection, Safety, and Health Protection Information Reporting Requirements*, DOE Order 5484.1, U.S. Department of Energy, Washington, D.C.
- DOE, 1983b, *Quality Assurance*, DOE Order 5700.1A, U.S. Department of Energy, Washington D.C.
- DOE, 1988, *Radioactive Waste Management*, DOE Order 5820.2A, U.S. Department of Energy, Washington D.C.
- DOE, 1989, *Environmental Protection, Safety, and Health Protection Standards*, DOE Order 5480.4, U.S. Department of Energy, Washington D.C.
- DOE, 1990a, *Radiation Protection of the Public and the Environment*, DOE Order 5400.5, U.S. Department of Energy, Washington D.C.
- DOE, 1991a, *General Environmental Protection Program*, DOE Order 5400.1, U.S. Department of Energy, Washington, D.C.
- DOE, 1991b, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*, DOE/EH-0173T, U.S. Department of Energy, Washington D.C.
- DOE, 1991d, *Quality Assurance*, DOE Order 5700.6C, U.S. Department of Energy, Washington D.C.
- DOE, 1993, *Occurrence Reporting and Processing of Operations Information*, DOE Order 5000.3B, U.S. Department of Energy, Washington D.C.
- DOE-RL, 1990, *216-B-3 Pond System Closure/Post Closure Plan*, DOE/RL-89-28, U.S. Department of Energy, Richland Field Office, Richland, Washington.

- DOE-RL, 1991, *Calendar Year 1990 Air Emissions Report for the Hanford Site*, DOE/RL-91-10, U.S. Department of Energy, Richland Field Office, Richland, Washington.
- DOE-RL, 1993, *Calendar Year 1993 Air Emissions Report for the Hanford Site*, DOE/RL-93-36, U.S. Department of Energy, Richland Field Office, Richland, Washington.
- Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, U.S. Department of Energy, Olympia, Washington.
- EPA, 1983, *The National Pollutant Discharge Elimination System*, Title 40, Code of Federal Regulations, Part 122, U.S. Environmental Protection Agency, Washington, D.C.
- EPA, 1985, *Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Waste*, Title 40, Code of Federal Regulations, Part 191, U.S. Environmental Protection Agency, Washington, D.C.
- EPA, 1986, *Test Methods for Evaluating Solid Waste*, SW-846, 3rd Ed., U.S. Environmental Protection Agency, Washington, D.C.
- EPA, 1987, *Superfund Amendments and Reauthorizations Act of 1986 (SARA): Emergency Planning and Notification*, Title 40, Code of Federal Regulations, Part 355, U.S. Environmental Protection Agency, Washington, D.C.
- EPA, 1988a, *Standards Applicable to Generators or Hazardous Waste*, Title 40, Code of Federal Regulations, Part 262, U.S. Environmental Protection Agency, Washington, D.C.
- EPA, 1988b, *Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities*, Title 40, Code of Federal Regulations, Part 264, as amended, U.S. Environmental Protection Agency, Washington, D.C.
- EPA, 1988c, *Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities*, Title 40, Code of Federal Regulations, Part 265, as amended, U.S. Environmental Protection Agency, Washington, D.C.
- EPA, 1989a, *Identification and Listing of Hazardous Waste*, Title 40, Code of Federal Regulations, Part 261.3, U.S. Environmental Protection Agency, Washington, D.C.
- EPA, 1990a, *Quality Assurance Methods*, Title 40, Code of Federal Regulations, Part 60, U.S. Environmental Protection Agency, Washington, D.C.
- EPA, 1990b, *Effluent Guidelines Standards*, Title 40, Code of Federal Regulations, Part 403-471, U.S. Environmental Protection Agency, Washington, D.C.

- EPA, 1991a, *National Emission Standards for Hazardous Air Pollutants Requirements*, Title 40, Code of Federal Regulations, Part 61, U.S. Environmental Protection Agency, Washington, D.C.
- EPA, 1991b, *Designation, Reportable Quantities, and Notification*, Title 40, Code of Federal Regulations, Part 302, U.S. Environmental Protection Agency, Washington, D.C.
- EPA, 1991c, *Approval and Promulgation of Implementation Plans*, Title 40, Code of Federal Regulations, Part 52, U.S. Environmental Protection Agency, Washington, D.C.
- EPA, 1991d, *National Interim Primary Drinking Water Regulations*, Title 40, Code of Federal Regulations, Part 141, U.S. Environmental Protection Agency, Washington, D.C.
- EPA, 1991e, *Subchapter N--Effluent Guidelines and Standards*, Title 40, Code of Federal Regulations, 401-471, U.S. Environmental Protection Agency, Washington, D.C.
- EPA, 1991f, *Designation, Reportable Quantities, and Notification*, Title 40, Code of Federal Regulations, Part 261, U.S. Environmental Protection Agency, Washington, D.C.
- Mishko, G. J., 1990, *200 Area Treated Effluent Disposal Facility (TEDF) Effluent Acceptance Criteria (Projects W-049H and C-018H)*, Internal Memo 86132-90-DLF-007, Westinghouse Hanford Company, Richland, Washington.
- Napier, B. A., R. A. Peloquin, D. L. Streng, and J. V. Ramdsell, 1988, *GENII - The Hanford Environmental Radiation Dosimetry Software System*, PNL 6584, Vol. 1-3, Pacific Northwest Laboratory, Richland, Washington.
- PNL and WHC, 1989, *Memorandum of Understanding*, Pacific Northwest Laboratory and Westinghouse Hanford Company, Richland, Washington.
- Resource Conservation and Recovery Act of 1976*, as amended, Public Law 94-580, 90 Stat. 2795, 42 USC 6901 et seq.
- Safe Drinking Water Act*, as amended, 42 USC 300f et seq.
- WAC, 1976, *General Regulations for Air Pollution Sources*, Washington Administrative Code 173-400, Washington State Department of Ecology, Olympia, Washington.
- WAC, 1986, *Ambient Air Quality Standards and Emission Limits for Radionuclides*, WAC-173-480, Washington Administrative Code, Olympia, Washington.
- WAC 1987a, *Water Quality Standards for Ground Water of the State of Washington*, WAC-173-200, Washington Administrative Code, Olympia, Washington.

- WAC, 1988, *National Pollutants Discharge Elimination System Permit*, Washington Administrative Code 173-220, Washington State Department of Ecology, Olympia, Washington.
- WAC, 1990, *Submission of Plans and Reports for Construction of Wastewater Facilities*, Washington Administrative Code 173-240, Washington State Department of Ecology, Olympia, Washington.
- WAC, 1991a, *Dangerous Waste Regulations*, Code 173-303, Washington State Department of Ecology, Olympia, Washington.
- WAC, 1991b, *Radiation Protection Air Emissions*, Washington Administrative Code Chapters 246-247, as amended, Washington State Department of Health, Olympia, Washington.
- WAC, 1991c, *Ambient Radionuclide*, Washington Administrative Code 173-480, Washington State Department of Ecology, Olympia, Washington.
- WAC, 1991d, *State Waste Discharge Permit*, Washington Administrative Code 173-216, Washington State Department of Ecology, Olympia, Washington.
- WAC, 1991e, *Dangerous Waste Regulations*, Washington Administrative Code 173-303, Washington State Department of Ecology, Olympia, Washington.
- WAC, 1991f, *General Regulations of Air Pollution*, Washington Administrative Code 173-400, Washington State Department of Ecology, Olympia, Washington.
- WHC, 1988a, *Effluent Monitoring Plan PUREX Gaseous Effluents*, as amended, SD-CP-EMP-004, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1988b, *Analytical Lab Hood Exhaust Monitor Flow Diagram*, as amended, H-2-92440, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1988c, *DWG List/Engineering Flow Diagram PR Room Stack Monitor*, as amended, H-2-75568, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1988d, *Westinghouse Hanford Company Environmental Surveillance Annual Report 200/600 Areas Calendar Year 1987*, as amended, WHC-EP-0145, R. E. Elder, G. W. Egert, A. R. Johnson, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1989a, *Analytical Chemistry Services Laboratories Quality Assurance Plan*, SD-CP-QAPP-001, G. B. Svancara and S. S. Moss, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1989b, *Quality Assurance Project Plan for the Chemical Analysis of Highly Radioactive Mixed Waste Samples in Support of Environmental Activities on the Hanford Site*, WHC-SD-QAPP-002, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1989c, *PUREX Sample Schedule*, FSS-P-080-00002, Westinghouse Hanford Company, Richland, Washington.

- WHC, 1989d, *Identifying and Resolving Unreviewed Safety Question*, WHC-CM-1-3, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1989e, *Emergency Plan*, WHC-CM-4-1, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1990a, *Stream-Specific Reports*, WHC-EP-0342, Addendum 2, -5, 12, 14, and 20, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1990b, *DWG List/Engineering Flow Diagram, SCS Monitoring & Diversion*, as amended, H-2-75589, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1990c, *East-West Sample Gallery Hood Exhaust Monitor Flow Diagram*, as amended, H-2-92511, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1990d, *EGE/EGW Monitor Flow Diagram*, as amended, H-2-93293, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1990e, *CWL IEFD Aqueous Discharge Cooling Water System*, as amended, H-2-74309, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1990f, *IEFD SCD Steam Condensate Sample System*, as amended, H-2-94372, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1990g, *PUREX Liquid Effluent Monitoring Plan*, as amended, WHC-SD-CP-EMP-006, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1991a, *Quality Assurance Program Plan for the Chemical Analysis of Environmental Samples*, as amended, WHC-SD-CP-QAPP-003, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1991b, *Radiological Design*, as amended, WHC-CM-4-9, Rev. 3, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1991c, *Airflow Capacity and Distribution Tests*, as amended, Maintenance Engineering Services Maintenance Procedure 7-GN-56, Rev 3, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1991d, *Management Plan for Facility Effluent Monitoring Plan Activities*, as amended, WHC-EP-0491, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1992a, *Quality Assurance Project Plan for Radioactive Airborne Emissions Data Compilation and Reporting*, as amended, WHC-EP-0528, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1992b, *Liquid Effluent Sampling Quality Assurance Project Plan*, as amended, WHC-SD-WM-QAPP-011, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1992c, *Quality Assurance Project Plan for Facility Effluent Monitoring Plan Activities*, as amended, WHC-EP-0446, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

WHC, 1992d, *Operational Environmental Monitoring*, as amended, WHC-CM-7-4, Westinghouse Hanford Company, Richland, Washington.

WHC, 1992e, *PUREX CSL Sampling and Analysis Plan*, as amended, WHC-SD-CP-PLN-013, Westinghouse Hanford Company, Richland, Washington.

WHC, 1992f, *Environmental Releases for Calendar Year 1991*, as amended, WHC-EP-0527-1, Westinghouse Hanford Company, Richland, Washington.

WHC, 1992g, *Laboratory Procedures*, as amended, Westinghouse Hanford Company, Richland, Washington.

- LA-220-103, *Strontium-89, 90 and/or Strontium-89 and 90 from Leachates of Soil, Vegetation, Air Filters, and Other Solid Samples*
- LA-508-051, *Alpha Energy Analysis using the Canberra Jupiter Systems*
- LA-508-052, *Gamma Energy Analysis on the Canberra Jupiter System*
- LA-508-110, *Operation of the Tennelec LB-5500 Alpha/Beta Counting System*
- LA-508-111, *Operation of the Tennelec LB-1000 Alpha/Beta Detectors (9, 10, 11, and 12)*
- LA-508-114, *Operation of the gamma products alpha beta counting system using PC control*
- LA-508-121, *Operation of the Beckman Liquid Scintillation Counters*
- LA-542-101, *Electrodeposition of Actinides*
- LA-548-111, *Preparation of Mounts for Liquid Scintillation Counting*
- LA-549-112, *Dissolution of Versapor Type Filers*
- LA-613-111, *Determination of Promethium-147 in Effluent Wastes Samples by Solvent Extraction and Liquid Scintillation Counting*
- LA-925-107, *Uranium by Laser Induced Kinetic Phosphorescence Analyzer*
- LA-943-123, *Separation of Pu and Am by Ion Exchange*
- LO-150-115, *Instrument Standards Counting Frequency--222-S Counting Room*
- LQ-508-002, *Calibration Guidelines for Window Type Gas Flow Alpha/Beta Proportional Counters*
- LQ-508-003, *Calibration of the Jupiter Gamma Energy Analysis Systems*
- LQ-508-005, *Calibration of Beta Detector for Sr-90 and Y-90*

- PM 2S18006, *Inspect and Test the Alpha Energy Analyzer System at 222-S Room BIA (Jupiter Subsystem)*
- WHC-SD-CP-LB-003, *Safety in the Analytical Laboratory*

WHC, 1993a, *Environmental Compliance Manual*, WHC-CM-7-5, Rev 50, Westinghouse Hanford Company, Richland, Washington.

WHC, 1993b, *PUREX/UO₂ Plant Administration*, as amended, WHC-CM-5-9, Westinghouse Hanford Company, Richland, Washington.

WHC, 1993c, *Analytical Chemistry Services Laboratories Operating Instructions*, WHC-CM-5-4, Westinghouse Hanford Company, Richland, Washington.

WHC, 1993d, *Environmental Releases for Calendar Year 1992*, WHC-EP-0527-2, Westinghouse Hanford Company, Richland, Washington.

WHC, 1993e, *Quality Assurance Manual*, WHC-CM-4-2, Westinghouse Hanford Company, Richland, Washington.

WHC, 1993f, *Quality Assurance Plan for Radionuclide Airborne Emissions Monitoring*, WHC-EP-0536, Rev, 1, Westinghouse Hanford Company, Richland, Washington.

WHC, 1993g, *Environmental Investigations and Site Characterization Manual*, as amended, WHC-CM-7-7, Westinghouse Hanford Company, Richland, Washington.

WHC, 1993h, *Health Physics Procedures*, WHC-IP-0718, Westinghouse Hanford Company, Richland, Washington.

REFERENCES to TABLE 14-2

- ANSI, 1969, *Guide to Sampling Airborne Radioactive Materials in a Nuclear Facility*, ANSI N13.1, American National Standards Institute, Washington, D.C.
- DOE, 1990, *Radiation Protection of the Public and the Environment*, DOE Order 5400.5, U.S. Department of Energy, Washington D.C.
- EPA, 1991, *National Emission Standards for Hazardous Air Pollutants Requirements*, Title 40, Code of Federal Regulations, Part 61, U.S. Environmental Protection Agency, Washington, D.C.
- EPA, 1992, "Standards of Performance for New Stationary Sources," Title 40, *Code of Federal Regulations*, Part 60, U.S. Environmental Protection Agency, Washington, D.C.
- Napier, B. A., R. A. Peloquin, D. L. Streng, and J. V. Ramsell, 1988, *GENII- The Hanford Environmental Radiation Dosimetry Software System*, PNL 6584, Vol. 1-3, Pacific Northwest Laboratory, Richland, Washington.
- RL, 1993, *Calendar Year 1992 Radionuclide Air Emissions Report for the Hanford Site*, DOE/RL-93-36, U.S. Department of Energy, Richland Field Office, Richland, Washington.
- WHC, 1990, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas*, WHC-EP-0141-2, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1991, *Drawings*, Westinghouse Hanford Company, Richland, Washington.
- H-2-75568, *DWG List/Engineering Flow Diagram PR Room Stack MON*
 - H-2-75570, *ELEC/INSTM Plan Elevations & DET PR Stack Monitoring*
 - H-2-75571, *ELEC/INSTM Installation Details PR Room Stack Monitor*
- WHC, 1992a, *Laboratory Procedures*, Westinghouse Hanford Company, Richland, Washington.
- LA-218-112, *Tritium analysis on Silica gel by Liquid Scintillation Counting*
 - LA-220-103, *Strontium-89, 90 and/or Strontium-89 and 90 from Leachates of Soil, Vegetation, Air Filters, and Other Solid Samples*
 - LA-348-101, *Carbon-14 by Distilling and Liquid Scintillation Counting*
 - LA-508-110, *Operation of the Tennelec LB-5500 Alpha/Beta Counting System*
 - LA-508-111, *Operation of the Tennelec LB-1000 Alpha/Beta Detectors (9, 10, 11, and 12)*
 - LA-508-114, *Operation of the gamma products alpha beta counting system using PC control*
 - LA-508-121, *Operation of the Beckman Liquid Scintillation Counters*
 - LA-548-111, *Preparation of Mounts for Liquid Scintillation Counting*
 - LA-549-112, *Dissolution of Versapor Type Filers*

- LA-613-111, *Determination of Promethium-147 in Effluent Wastes Samples by Solvent Extraction and Liquid Scintillation Counting*
- LA-925-107, *Uranium by Laser Induced Kinetic Phosphorescence Analyzer*
- LA-943-123, *Separation of Pu and Am by Ion Exchange,*
- LO-150-115, *Instrument Standards Counting Frequency--222-S Counting Room*
- LO-150-133, *Processing Record Stack and Red Bordered Emergency Air Samples*
- LQ-508-002, *Calibration Guidelines for Window Type Gas Flow Alpha/Beta Proportional Counters*
- LQ-508-005, *Calibration of Beta Detector for Sr-90 and Y-90*
- WHC-SD-CP-LB-003, *Safety in the Analytical Laboratory*

WHC, 1992b, *Manuals*, Westinghouse Hanford Company, Richland, Washington.

- WHC-CM-1-3, *Management Requirements and Procedures*
- WHC-CM-4-2, *Quality Assurance Manual*
- WHC-CM-4-3, *Industrial Safety*
- WHC-CM-4-10, *Radiation Protection*
- WHC-CM-4-12, *Health Physics Practices Manual*
- WHC-CM-4-15, *Radiation Work Requirements and Work Permits Manual*
- WHC-CM-4-29, *Nuclear Criticality Safety*
- WHC-CM-5-4, *Analytical Chemistry Services Laboratories - Operating Instructions*
- WHC-CM-5-9, *PUREX/UO₃ Plant Occurrence Categorization, Notification, and Reporting*

WHC, 1992c, *Westinghouse Hanford Company Emergency Plan for PUREX Facility*, WHC-IP-0263-202A, Westinghouse Hanford Company, Richland, Washington.

WHC, 1992d, *Quality Assurance Project Plan for Radioactive Airborne Emissions Data Compilation and Reporting*, WHC-EP-0528, Westinghouse Hanford Company, Richland, Washington.

WHC, 1993a, *Airflow Capacity and Distribution Tests*, Facilities Maintenance support Services Maintenance Procedure 7-GN-56, Rev 2 Change A, Westinghouse Hanford Company, Richland, Washington.

WHC, 1993b, *Final Report on Fiscal Year 1992 Activities for the Environmental Monitors Line-Loss Study*, WHC-EP-0680, Westinghouse Hanford Company, Richland, Washington.

WHC, 1993c, *Quality Assurance Program Plan for Radionuclide Airborne Emissions Monitoring*, WHC-EP-0536-1, Westinghouse Hanford Company, Richland, Washington.

WHC, 1993d, *Health Physics Procedures Manual*, WHC-IP-0718, Westinghouse Hanford Company, Richland, Washington.

WHC, 1994a, *Plutonium-Uranium Extraction Plant Product Removal (296-A-1) Stack Potential Dose Determination*, WHC-SD-CP-TI-188, Westinghouse Hanford Company, Richland, Washington.

WHC, 1994b, *Determination of Effluent Flow for Large Stacks*, Maintenance Engineering Services Maintenance Procedure, PROC. NO. 1202, Westinghouse Hanford Company, Richland, Washington.

WHC, 1994c, *Laboratory Procedures*, Westinghouse Hanford Company, Richland, Washington.

- LA-508-161, *Alpha Energy Analysis using the Canberra Jupiter Systems*
- LA-508-162, *Gamma Energy Analysis on the Canberra Jupiter System*
- LA-542-101, *Electrodeposition of Actinides*
- LQ-508-003, *Calibration of the Jupiter Gamma Energy Analysis Systems*

DISTRIBUTIONNumber of CopiesONSITE

7	<u>U.S. Department of Energy, Richland Operations Office</u>	
	J. D. Bauer	A5-15
	J. B. Hall	A5-55
	G. M. Bell	A5-52
	E. B. Dagan	A5-19
	R. G. Holt	A5-15
	S. D. Stites	A5-19
	Public Reading Room	A1-65
6	<u>Pacific Northwest Laboratory</u>	
	T. D. Chikalla	P7-75
	G. R. Hoenes	P7-78
	R. E. Jaquish	K1-30
	D. L. Klages	P7-68
	R. K. Woodruff	K6-13
	Technical Files	K1-11
29	<u>Westinghouse Hanford Company</u>	
	D. J. Carrell	H6-22
	L. P. Diediker (2)	T1-30
	J. J. Dorian	H6-30
	B. G. Erlandson	H6-20
	T. P. Frazier (5)	T1-30
	J. L. Geiger	R3-01
	E. M. Greager	A6-30
	K. A. Hadley	R3-56
	D. G. Hamrick	S6-15
	D. L. Johnson	S6-19
	R. E. Johnson	T1-30
	J. Lohrasbi	S6-19
	D. G. Ranade	B2-16

DISTRIBUTION (continued)

Number of Copies

ONSITE

Westinghouse Hanford Company (continued)

L. W. Vance	H4-16
D. D. Volkman	H4-25
D. L. Wiegand	S6-19
C. D. Wollam (2)	S6-19
Central Files	L8-04
Document Processing and Distribution (2)	L8-15
Information Release Administration (3)	R1-05