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Facility Effluent Monitoring Plan for the Plutonium- Uranium Extraction Facility

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Document Title: Facility Effluent Monitoring Plan for the Plutonium-Uranium
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**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**. 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 is the first annual report. It 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 as a minimum 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, Westinghouse Hanford Company, Richland, Washington, 1991.

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LIST OF TERMS

AFAN	ammonium fluoride and ammonium nitrate
AMU	aqueous makeup unit
ANSI	American National Standards Institute
ASD	ammonia scrubber discharge
ASTM	American Society for Testing and Materials
BAT	best available technology
CERCLA	<i>Comprehensive Environmental Response, Compensation, and Liability Act of 1980</i>
CFR	Code of Federal Regulations
CSL	chemical sewer line
CWL	cooling water line
DCG	derived concentration values
DOE	U.S. Department of Energy
Ecology	Washington State Department of Ecology
EDE	effective dose equivalent
EMP	Environmental Monitoring Plan
EOC	Emergency Operations Center
EPA	U.S. Environmental Protection Agency
FEMP	Facility Effluent Monitoring Plan
GC	gas chromatograph
GC/MS	gas chromatograph/mass spectrometer
HEPA	high-efficiency particulate air (filter)
HVAC	heating, ventilating, and air conditioning
IC	ion chromatography
ICRP	International Commission on Radiological Protection
ISE	ion-specific electron
M/S	monitoring/sampling
MCL	maximum contaminant levels
MEI	maximally exposed individual
MS	mass spectrometer
M/S	monitoring/sampling
NESHAP	National Emission Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
NEC	Operations and Engineering Contractor
P&O	pipe and operating
PAO	Public Affairs Office
PDD	process distillate discharge
PNL	Pacific Northwest Laboratory
PR	product removal
PSD	prevention of significant deterioration
PUREX	Plutonium-Uranium Extraction (Plant)
QA	quality assurance
QAPP	Quality Assurance Program Plan
QC	quality control
RCRA	<i>Resource Conservation and Recovery Act of 1976</i>
RL	U.S. Department of Energy Field Office, Richland
SALDS	State Approved Land Disposal Structure
SCD	steam condensate discharge
SQA	Safety and Quality Assurance
SWP	special work permit
TDS	total dissolved solids

LIST OF TERMS (continued)

TEDF	Treated Effluent Disposal Facility
TLD	thermoluminescent dosimeter
TOC	total organic carbon
TOX	total organic halides
TSD	treatment, storage, or disposal
WAC	Washington (State) Administrative Code
Westinghouse Hanford	Westinghouse Hanford Company

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METRIC CONVERSION CHART		
1 inch	=	2.54 centimeters
1 foot	=	30 centimeters
1 gallon	=	3.8 liters
1 ton	=	0.9 metric tons
$1\text{ }^{\circ}\text{F} = \left(\frac{9}{5}\text{ }^{\circ}\text{C}\right) + 32$		
<p>1 Btu/h = 2.930711 E-01 watts (International Table)</p>		

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**FACILITY EFFLUENT MONITORING PLAN FOR
PLUTONIUM-URANIUM EXTRACTION PLANT****1.0 INTRODUCTION**

The U.S. Department of Energy (DOE) Order 5400.1 (DOE 1988a) requires Facility Effluent Monitoring Plans (FEMP) be prepared for DOE facilities that have 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 being transitioned into a standby mode. No processing activities are occurring and the majority of the tanks have been emptied. Three wastewater discharges and eleven air exhaust stacks are active. One previous air discharge and two previous wastewater discharges have been eliminated, and two additional wastewater discharges are being eliminated.

1.1 POLICY

It is the policy of DOE and Westinghouse Hanford Company (Westinghouse Hanford) 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 radiation standards and requirements. It is also DOE and DOE contractor policy that effluent monitoring programs meet high standards of quality and credibility.

1.2 PURPOSE

The purpose of this FEMP is to (1) identify and evaluate the gaseous and liquid effluents from the PUREX Plant through characterization, (2) determine the discharge criteria, and (3) establish a program to ensure compliance with those discharge criteria. Compliance is determined by a thorough monitoring program which uses the correct sampling locations, laboratory analyses, sample and data handling, quality assurance (QA)/quality control (QC) procedures and notification/reporting requirements.

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1.3 SCOPE

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

<u>Section</u>	<u>Scope</u>
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, federal, and state regulations that establish FEMP requirements, and discharge criteria are summarized.
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 given.
6.0	The design criteria of 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 given.
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 QA plan governing the field activities, laboratory analysis, and record keeping is stated. Audits are also covered.
13.0	Internal and external FEMP review requirements are given.
14.0	Compliance assessment is summarized.
15.0	A summary is provided and conclusions are listed.
16.0	References and acceptance criteria used in the FEMP are listed.

1.4 DISCUSSION

The characterization of the radioactive and nonradioactive constituents in each effluent stream coupled to the regulatory framework provide 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, chemical, and equipment use. An accurate description of the effluent's point of discharge is required for emission modeling and location of end-of-the-pipe M/S stations. Both normal and upset (either projected or actual) conditions are characterized.

As stated in federal regulations [40 Code of Federal Regulations (CFR) 61, Subpart H] (EPA 1989a), when determining the upset condition of 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 at the discharge point during normal operating conditions.

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 1989b). Other regulations, such as 40 CFR 61, Subpart H (EPA 1989a), 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.

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2.0 FACILITY DESCRIPTION

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

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

Further specific information on the gaseous and liquid effluents is given in Chapter 4.0, Identification/Characterization of Effluent Streams.

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-eastern region of Washington State. The main building, 202-A (Figure 2-1), is a heavily shielded, reinforced concrete structure known as a "canyon" building. This building contains the main equipment used in the PUREX Plant process. Figure 2-2 is a plot plan for the PUREX Plant.

Principal buildings 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 are 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 (in cells below grade); (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 2-1. 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.

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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 [special work permit (SWP) lobby], blower room, a switchgear room, compressor room, central control room, and the aqueous makeup unit (AMU). 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 tank farm, and pumps and piping to receive and transfer the solutions in the tank farm. The tank farm stores aqueous uranium nitrate products, recycled nitric acid from the Uranium Trioxide (UO_3) Plant, and contaminated uranium nitrate solution. 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 and ion-exchange columns and ancillary equipment used to produce demineralized water from sanitary water. The 211-A Tank Farm stores bulk liquid chemicals for use in the PUREX process. The chemicals stored include an aqueous mixture of ammonium fluoride and ammonium nitrate (AFAN), 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, and aluminum nitrate. 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 concentrates recovered nitric acid. The heat transfer piping in the vacuum fractionator is a major contributor to the PUREX Plant chemical sewer line (CSL) waste stream during operation. During standby 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 back-up facility, which removes nitrogen oxides from the dissolver off-gas stream then converts them to nitric acid. The nitric acid is then recycled into the PUREX process via the 206-A Building. This process does not operate during standby 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 wastewater 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 condensate, also known as 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 standby. Re-use of this tank is not anticipated.

2.1.8 Railroad Tunnel

The railroad tunnel receives 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 that is too bulky for immediate burial. Storage of the equipment allows the radioactivity to decay to less dangerous levels. During standby conditions PUREX will not receive railcar fuel shipments.

2.1.9 The 291-AE Building

Building 291-AE is an above-grade concrete structure that houses the No. 4 high-efficiency particulate air (HEPA) filter system. The No. 4 HEPA filter consists of 10 parallel banks of two-stage HEPA filters for final filtration of the canyon exhaust system. Instrumentation for 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 usable actinides from fission products in irradiated nuclear fuel. Briefly, the process consists of dissolving the fuel and then separating the actinides using 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 11 principal gaseous effluent streams which resulted from the control of process vapors/gases and potential contamination. One of these

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stacks (296-A-24) was deactivated in early 1990, leaving 10 principal streams. 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 non-contaminated, normally occupied areas. 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 CSL, the steam condensate discharge (SCD), the PDD, the ammonia scrubber discharge (ASD), and the cooling water line (CWL) streams. There are also approximately 50 exhaust points that are exempt from regulation; such as lavatory, office, and lunch room exhausts.

During the current standby condition of the PUREX Plant, the gaseous effluents will continue. Continuous air flow through the process areas will ensure control of trace quantities of contamination. The building ventilation may be changed in the future and affect the six minor gaseous effluents. Of the five liquid effluent streams, the ASD and PDD have been eliminated. Activities are underway to also eliminate the CWL and SCD. 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.

2.3 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 on operating or standby mode. This document has been written to address the current standby 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 major effluents with the potential to release radioactive and non-radioactive constituents in excess of DOE and U.S. Environmental Protection Agency (EPA) monitoring requirements (see Chapter 3.0). It also has six minor gaseous effluents that have little potential for release of hazardous constituents.

The PUREX main exhaust stack (291-A-1) exhausts the off-gas from a number of sources. Specifically, these are:

- Vapor from the dissolvers when they are not 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
- Gases from the vessel vent system

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- Gases from the condenser vent system
- 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.

Hoods in the west half of the sample gallery are exhausted by the west sample gallery hood exhaust (296-A-2).

Hoods in the east half of the sample gallery are exhausted by the east sample gallery hood exhaust (296-A-3). Stack 296-A-3 is being evaluated for deactivation during plant standby. In the event of stack shutdown the hoods are exhausted by hood exhaust 296-A-2.

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

The east sample gallery and u-cell exhaust (296-A-6) exhausts the east half of the sample gallery and the nitric acid recovery cell (u-cell).

The west sample gallery and r-cell exhaust (296-A-7) exhausts the west half of the sample gallery and the second cycle solvent treatment area (r-cell).

Filtered exhaust from the west end of the P&O gallery is provided by the white room exhaust (Stack 296-A-8).

The Storage Tunnel No. 2 exhaust exhausts through stack 296-A-10 which operates as titled. The storage tunnel stores used contaminated equipment as discussed in Section 2.1.8.

Building 293-A contains two nitric acid absorption columns for acid recovery from the uranium dissolver off-gases. These gases are exhausted through the backup facility exhaust (296-A-14).

The ammonia bearing gases formed in e-cell and f-cell during the decladding of fuel elements are isolated from other vent systems to prevent the formation of ammonium nitrate, which can plug ventilation filters. The gases are heated, filtered, and exhausted through the ammonia off-gas exhaust (296-A-24). During standby conditions this exhaust system does not operate.

The six minor gaseous effluents are discharged from five wall exhausters and the AMU roof exhauster. The wall exhausters provide air circulation for the P&O Gallery. Currently three of the wall exhausters are active. These

exhausters are being evaluated for deactivation. The AMU roof exhauster provides air circulation for the basement, second, and third floors of the AMU of the 202-A Building.

2.3.2 Liquid Effluents

The 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. Cold (radiologically) 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, also known as process condensate. Since PUREX is in a standby mode and not processing, the PDD 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 streams.

Ventilation, heating, water services, and room drainage contribute the remainder of the CSL. Room drainage consists of wastewater from shower rooms, water coolers, housekeeping steam, water, and occasional chemical leaks.

The 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 to remove the radionuclides. Before 1987, the resulting ammonia-bearing condensate stream was released as the ASD. In the current standby mode, the ASD does not exist and is mentioned as historical fact only. In the future, with the implementation of the ammonia destruction process, this stream will consist of water with only traces of ammonia. The new ASD might be combined with the PDD, or it might be recycled to the ammonia scrubbers. In the event PUREX is restarted the ASD route will be evaluated for consistency with environmental regulations.

Figure 2-3 shows the PUREX Plant liquid effluent system.

Within the operating history of PUREX, the various wastewater streams have been discharged to several ponds and cribs as follows.

Stream	Discharged to
PDD	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-3 Pond, CWL sometimes to 216-A-25 Gable Mt. Pond

During the existing standby mode, the PDD and ASD waste streams are eliminated completely. The potential for contamination via the SCD, CWL, and CSL waste streams will be eliminated after the recommended best available technology (BAT) to control effluent quality is implemented as per DOE Order 5400.5 (DOE 1990a). The BAT for the CSL includes relining the existing contaminated line and eventual routing to the Treated Effluent Disposal Facility (TEDF). The BAT for the SCD is being revised; however, a recirculating system without discharge is presently favored. The BAT for the CWL includes source control, monitoring and automatic diversion, and possible treatment of contaminated effluent at the TEDF. The BATs will be implemented prior to restart of PUREX. Modifications required to eliminate the SCD and CWL during standby are now being investigated and implemented.

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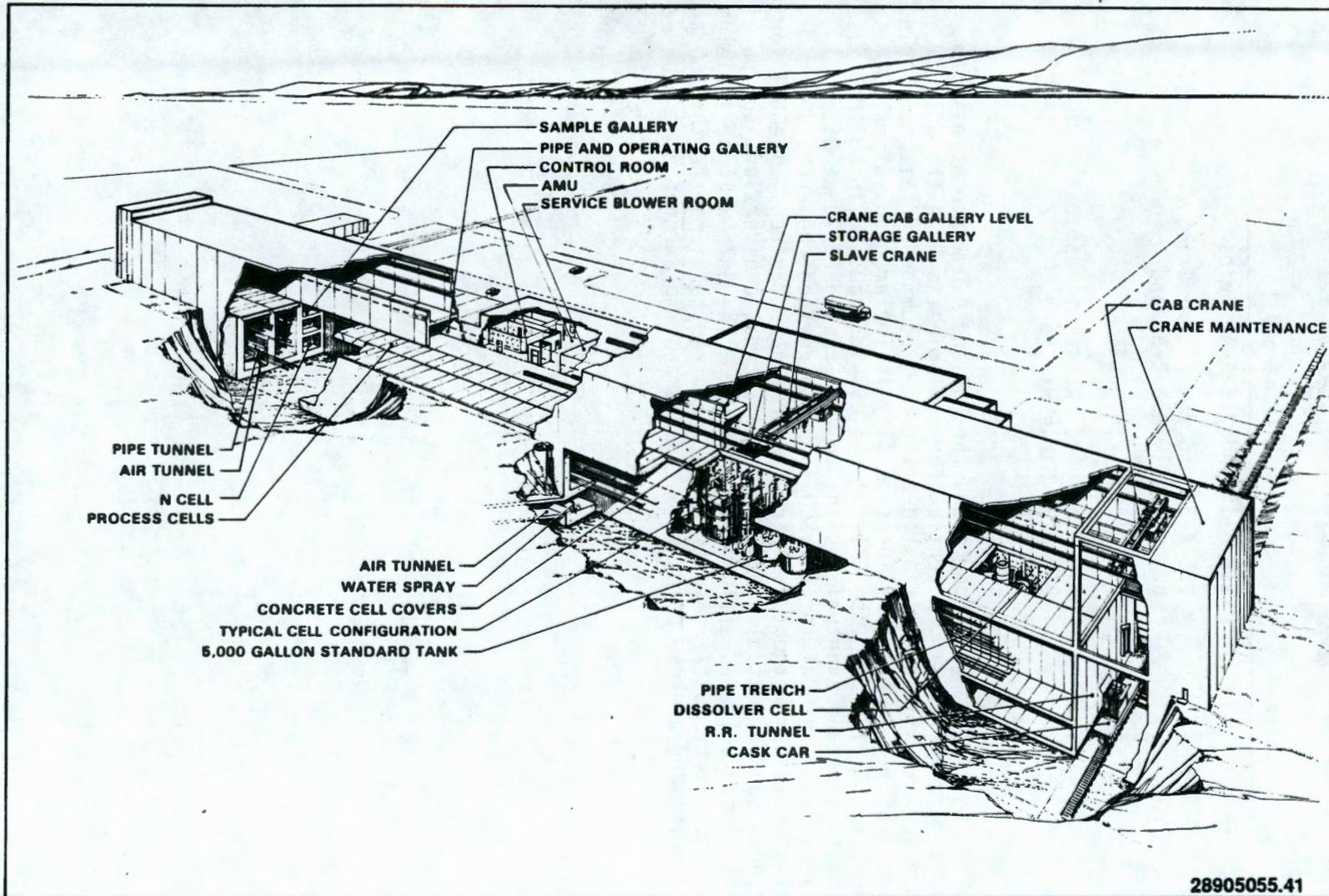
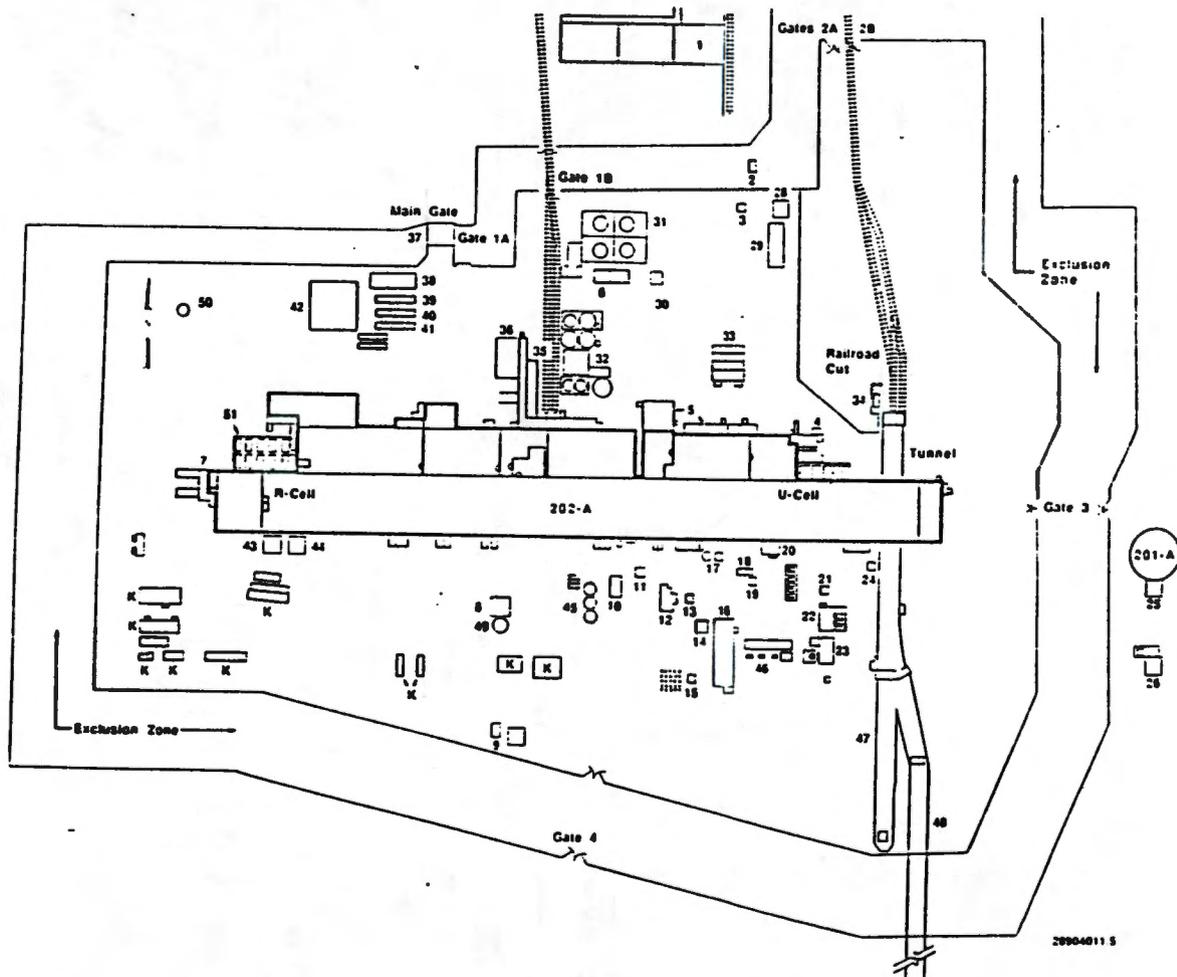


Figure 2-1. The 202-A Building.

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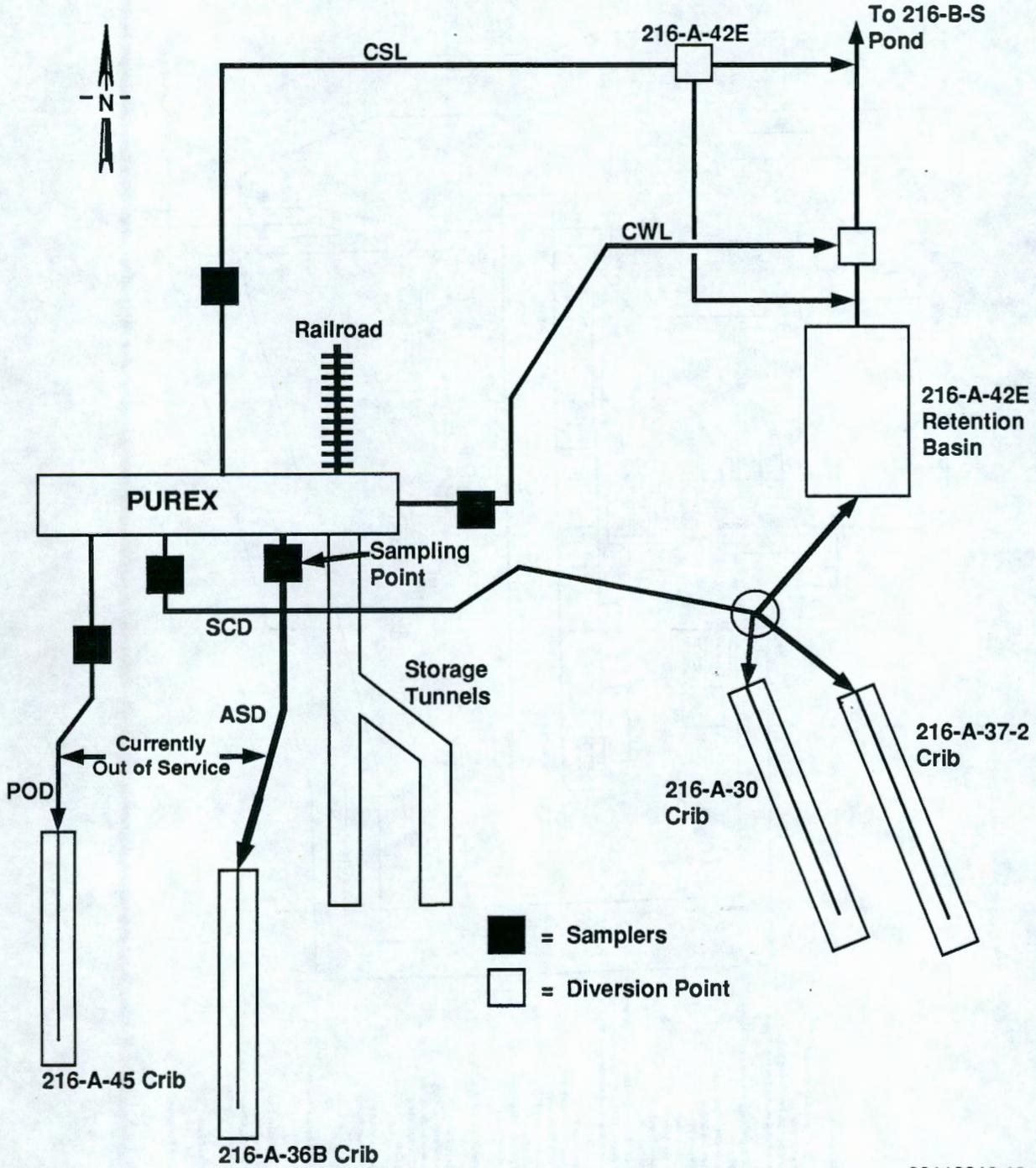
Figure 2-2. The Plutonium-Uranium Extraction Plant Plot Plan.

1. 275-EA Warehouse
 2. CSL PIT
 3. 295-AC CSL (Chem. Sewer Line)
 4. 206-A Fractionator
 5. Laboratory Sample Receiving Dock
 6. 203-A UHM Pump House Control Room
 7. PR-Dock
 8. 295-AB PDD (Process Distillate Discharge)
 9. A-4 PIT PDD PIT
 10. 213-A Reg Maint. Workshop
 11. 291-AB Sample Shack
 12. Shielded Valve PIT
 13. 291-AC Instr. Shack
 14. 291-AG Instr. Shack
 15. 291-AJ Instr. Shack
 16. 291-AE 90 Filter Bldg.
 17. 295-AA SCD (Steam Condensate Discharge)
 18. 291-AH Ammonia OH Gas Filter Bldg.
 19. 291-AH Ammonia OH Gas Sampler Bldg.
 20. 212-A Lead Out
 21. 294-A Instr. Shack
 22. 293-A Dissolver OH Gas Bldg.
 23. 292-AB Main Stack Bldg.
 24. 295-A ASD (Ammonia Scrubber Discharge)
 25. 201-A Pump PIT
 26. 295-AD CWL (Cooling Water Line)
 27. BT2 Exhauster Area
 28. 252-A
 29. 281-A Emergency Generators
 30. MO-322
 31. 203-A Storage Area
 32. 211-A Demineralizer Bldg.
 33. MO-409 Laboratory Trailer
 34. Railroad Storage Shed
 35. 214 A, B, C, D
 36. 2714-A
 37. 2701-A Badge House
 38. MO-035 Training Trailer
 39. MO-707
 40. 64-15323
 41. 202A-T-1
 42. MO-023 Engineering Trailer
 43. 2711-A-1
 44. 2712-A
 45. Hydrogen Peroxide Tanks
 46. 291-A Exhaust Fans
 47. 218-E-14 Storage Tunnel
 48. 218-E-15 Storage Tunnel
 49. 218-A-S
 50. 2901-A Water Tank
 51. 276-A R Cell
- K = Kasser Related Facilities



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Figure 2-3. The Plutonium-Uranium Extraction Plant Liquid Effluents.



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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, federal, state, and local laws and regulations. Table 3-2 gives a brief summary of the regulations and standards applicable to this FEMP. Westinghouse Hanford is currently reviewing this FEMP for compliance to applicable regulations, and comments will be incorporated in future revisions. This review will be completed by January 1, 1992.

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 1988a), 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 describing the extent and frequency of the monitoring analysis. The plan also must contain 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 should also evaluate the effectiveness of treatment, identify potential environmental problems, and 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 that make use of information obtained from the monitoring and surveillance programs.

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 sets out monitoring requirements. The exposure limits for members of the public from radionuclide emissions is an effective dose equivalent not

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to exceed 10 mrem/yr. Compliance with this standard is measured by calculating the highest effective dose equivalent 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 effective dose equivalent in excess of 1% of the standard. If the effective dose equivalent caused by all emissions is less than 1% of the standard (<0.1 mrem/yr) the facility is exempt from source reporting requirements. All radionuclides that could contribute greater than 10% of the potential effective dose equivalent for a release point (1 mrem/yr) 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.

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.

Subpart H also states that 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 so as to provide a representative sample of the emissions.

3.2.2 Reportable Quantities 40 Code of Federal Regulations 302

The regulations in 40 CFR 302 (EPA 1989c) 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 of 1980* (CERCLA) and the *Clean Water Act of 1977*.

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

Although this 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 1987b) protect groundwater to the level of drinking water standards. These standards limit exposures to gross alpha, gross beta, tritium, ⁹⁰Sr, and ^{226,228}Ra (Table 3-1). For radionuclides that are not specifically listed exposures are limited by the federal standard of 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) Administrative Code (WAC) (WAC 1987a)] 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.

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Table 3-1. 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	

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Table 3-1. Groundwater Quality Criteria. (5 sheets)

Contaminant		Criterion	
B. Secondary Contaminants (continued)			
	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
	⁹⁰ Sr	8	pCi/L
	^{226,228} Ra	5	pCi/L
	²²⁶ Ra	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 3-1. Groundwater Quality Criteria. (5 sheets)

Contaminant		Criterion	
II. Carcinogens (continued)			
	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-2methyl 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

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Table 3-1. Groundwater Quality Criteria. (5 sheets)

Contaminant	Criterion	
II. Carcinogens (continued)		
Direct Black 38	0.009	µg/L
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 sulfate	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

Table 3-1. Groundwater Quality Criteria. (5 sheets)

Contaminant		Criterion	
II. Carcinogens (continued)			
	N-Nitrosodiethanolamine	0.03	µg/L
	N-Nitrosodiethylamine	0.0005	µg/L
	N-Nitrosodimethylamine	0.002	µg/L
	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
	PAH	0.01	µg/L
	PBBs	0.01	µg/L
	PCBs	0.01	µg/L
	o-Phenylenediamine	0.005	µg/L
	Propylene oxide	0.01	µg/L
	2,3,7,8-Tetrachlorodibenzo-p-dioxin	0.000000 6	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

mg/L = milligrams/liter.

mL = milliliter.

pCi/L = pico Curie/liter.

µg/L = micrograms/liter.

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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
U.S. Environmental Protection Agency, (EPA) Washington, D.C.	40 CFR 61, 1989 National Emission Standards for Hazardous Air Pollutants	X		X		Sets national emission standards for hazardous air pollutants (NESHAP)
	Subpart A General Provisions	X				Regulates hazardous pollutants
	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 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	Sets maximum contaminant levels in public water systems
	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

Table 3-2. Applicable Regulations and Standards. (2 sheets)

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Agency/Originator	Regulation No.	HA	HL	RA	RL	Summary/Application
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, 1989 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 wastewater discharges to navigable waterways; controls NPDES permit process
	WAC 173-240, 1990 Submission of Plans and Reports for Construction of Wastewater 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
Benton-Franklin Walla-Walla Counties Air Pollution Control Authority, (APCA) Richland, Washington	General Regulation 80-7, 1980	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.

Table 3-2. Applicable Regulations and Standards. (2 sheets)

MHC-EP-0468

4.0 IDENTIFICATION/CHARACTERIZATION OF EFFLUENT STREAMS

This chapter 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 CONTRIBUTING TO EACH AIR EFFLUENT STREAM

PUREX has 16 sources of air effluents with a potential for contamination. There are 10 major effluent streams and 6 of the effluents are minor. Characterization of the effluents is based upon averaged and normalized second, third, and fourth quarter 1990 preliminary concentration and flow data. These are representative of standby conditions.

4.1.1 Descriptions

The characterizations that follow are taken from the *Effluent Monitoring Plan PUREX Gaseous Effluents* (WHC 1988a). Stack locations are shown in Figure 4-1; while their heights and diameters are summarized in Table 4-2.

291-A-1--Main Building Exhaust Stack

The point of discharge is a 61 m (200 ft) tall stack, located south of the PUREX Plant. It typically has a flow rate of between 28 and 61 m³/s (60,000 and 130,000 ft³/min). The average flow rate is 57 m³/s (120,000 ft³/min). For the last three quarters of 1990, the exhaust typically contained 3.3×10^{-10} μ Ci/mL radioactivity. The average value for individual radionuclides are shown in Table 4-1.

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. No NO_x is released during standby.

296-A-1--Product Removal Room Exhaust

The point of discharge for the PR room exhaust is stack 296-A-1, located on the north side of the northwest corner of the PUREX Plant.

The 296-A-1 stack has an average flow of 2.0 m³/s (4,300 ft³/min). The range of flow is 1.9 to 3.6 m³/s (4,000 to 7,600 ft³/min). The exhaust contained 1.4×10^{-14} μ Ci/mL of radioactivity based on data from the last three quarters of 1990.

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 Plant.

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The 296-A-2 stack has an average flow of $1.6 \text{ m}^3/\text{s}$ ($3,400 \text{ ft}^3/\text{min}$). The range of flow is 1.4 to $2.2 \text{ m}^3/\text{s}$ ($3,000$ to $4,600 \text{ ft}^3/\text{min}$). The exhaust contained $9.5 \times 10^{-16} \text{ } \mu\text{Ci/mL}$ of radioactivity based on data from the last three quarters of 1990.

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 PUREX Plant.

Normal flow for this stack is $1.6 \text{ m}^3/\text{s}$ ($3,400 \text{ ft}^3/\text{min}$), while the range is 1.6 to $2.2 \text{ m}^3/\text{s}$ ($3,500$ to $4,600 \text{ ft}^3/\text{min}$). The average activity was not distinguishable from background and, therefore, the dose contribution is indeterminant. Based on a single peak analysis assumed for an entire year resulted in a effective dose equivalent (EDE) of $1 \times 10^{-6} \text{ mrem/yr}$ or unmitigated $1 \times 10^{-3} \text{ mrem/yr}$. Contribution by this stack is negligible during standby.

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 PUREX Plant.

The flow through stacks 296-A-5A and 296-A-5B nominally range from 7.1 to $10.8 \text{ m}^3/\text{s}$ ($15,000$ to $23,000 \text{ ft}^3/\text{min}$), respectively. Their average flow rate is $7.6 \text{ m}^3/\text{s}$ ($16,000 \text{ ft}^3/\text{min}$). The exhaust from stack 296-A-5A had an activity of $9.7 \times 10^{-16} \text{ } \mu\text{Ci/mL}$, and stack 296-A-5B had an activity of $1.0 \times 10^{-15} \text{ } \mu\text{Ci/mL}$ based on the last three quarters of 1990. The combined average is $1.0 \times 10^{-15} \text{ } \mu\text{Ci/mL}$.

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

The 296-A-6 stack is located on the north side of the PUREX Plant (202-A) near the east corner. The stack extends 3.0 m (10 ft) above the top of the building. Its top 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 has an average flow of $6.6 \text{ m}^3/\text{s}$ ($14,000 \text{ ft}^3/\text{min}$). The range of flow is 6.1 to $9.1 \text{ m}^3/\text{s}$ ($13,000$ to $19,200 \text{ ft}^3/\text{min}$). The exhaust contained $1.0 \times 10^{-15} \text{ } \mu\text{Ci/mL}$ of radioactivity based on data from the last three quarters of 1990.

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

The 296-A-7 stack is located on the west wall of the PUREX Plant near the south corner. The top of the stack is 22.6 m (74 ft) above grade [3.0 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).

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The 296-A-7 stack has an average flow of $7.6 \text{ m}^3/\text{s}$ ($16,000 \text{ ft}^3/\text{min}$), with a range of 6.6 to $10.2 \text{ m}^3/\text{s}$ ($14,000$ to $21,600 \text{ ft}^3/\text{min}$). The exhaust contained $2.3 \times 10^{-15} \text{ } \mu\text{Ci/mL}$ of radioactivity based on data from the last three quarters of 1990.

296-A-8--White Room Exhaust

The 296-A-8 stack is located at the northwest corner of the PUREX Building (202-A). 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 has a nominal flow of $6.1 \text{ m}^3/\text{s}$ ($13,000 \text{ ft}^3/\text{min}$). The range of flow is 5.7 to $7.6 \text{ m}^3/\text{s}$ ($12,000$ to $16,200 \text{ ft}^3/\text{min}$). The exhaust contained $1.1 \times 10^{-15} \text{ } \mu\text{Ci/mL}$ of radioactivity based on data from the last three quarters of 1990.

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

The 296-A-10 stack is located about 640 m (2100 ft) south of the PUREX Building (202-A) near the east end. It is 6.1 m (20 ft) high. This stack exhausts the used equipment storage tunnel.

The 296-A-10 stack has an average flow of $1.6 \text{ m}^3/\text{m}$ ($3,500 \text{ ft}^3/\text{min}$). The exhaust contained $1.7 \times 10^{-14} \text{ } \mu\text{Ci/mL}$ of radioactivity based on data from the last three quarters of 1990.

296-A-14--Backup 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 7.5 m ($24 \text{ ft } 6 \text{ in.}$).

The 296-A-14 stack exhausts the 293-A Building, which contains two absorption columns that recovers nitric acid from the dissolver off-gases. The dissolvers are not in operation.

Flow through the 296-A-14 stack is a nominal $1.9 \text{ m}^3/\text{s}$ ($4,000 \text{ ft}^3/\text{min}$). The exhaust contained $5.7 \times 10^{-15} \text{ } \mu\text{Ci/mL}$ of radioactivity based on data from the last three quarters of 1990.

296-A-24--Ammonia Off-Gas Exhaust

This stack is not used during standby and is no longer a gaseous effluent source:

The 296-A-24 stack is located about 61 m (200 ft) south of the PUREX Building. The top is 24.4 m (80 ft) above grade level.

The ammonia bearing gases formed in e-cell and f-cell during the decladding of fuel elements were isolated from other vent systems to prevent the formation of ammonium nitrate which can plug ventilation filters. The gases were heated, filtered, and exhausted through the ammonia stack. Decladding operations and operation of stack 296-A-24 have ceased with the shutdown of the PUREX Plant.

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During operations, the 296-A-24 stack has a nominal flow rate of $0.47 \text{ m}^3/\text{s}$ ($1,000 \text{ ft}^3/\text{min}$). The exhaust contained between $<3.5 \times 10^{-15}$ and $7.8 \times 10^{-14} \text{ } \mu\text{Ci/mL}$ of total alpha and 2×10^{-14} and $1 \times 10^{-9} \text{ } \mu\text{Ci/mL}$ of total beta radioactivity.

EF-3-5 Through EF-3-10--Wall Exhausters, Pipe and Operating Gallery

The five P&O gallery wall exhausts are $1.02 \text{ m} \times 1.02 \text{ m}$ (40 in. x 40 in.) square openings fitted with gravity dampers. A total of six openings are located along the top of the P&O gallery north wall at approximately 6.8 m (22 ft 3 in.) above grade level. Five of the openings are fitted with exhaust fans to remove air from the P&O gallery. Three of the exhausters (EF-3-5, EF-3-6, and EF-3-8) are inactive (including the fanless opening). The remaining three are being evaluated for shutdown during plant standby.

Radioactivity is not normally present in the P&O gallery, however, there are service connections to many of the process vessels in the canyon. In the event that a line in the gallery is broken, or loosened for replacement or repair, and the associated canyon vessel is pressurized, solution could blow-back from the vessel to the gallery.

The initial concept was that the P&O gallery wall exhausters would run continuously. However, the upgrade of the white room exhaust system (296-A-8 stack) provided sufficient capacity to exhaust the entire P&O gallery via that stack. The wall exhausters discharge minor effluents.

The flow from the exhausters EF-3-5 through EF-3-9 ranges from 0 to $3.5 \text{ m}^3/\text{s}$ (0 to $7,500 \text{ ft}^3/\text{min}$). The monthly total alpha radioactivity values for the exhausters ranged from $<3.5 \times 10^{-14}$ to $2.4 \times 10^{-14} \text{ } \mu\text{Ci/mL}$. The monthly total beta radioactivity values ranged from a low of $<1.2 \times 10^{-14}$ to a high of $9.3 \times 10^{-12} \text{ } \mu\text{Ci/mL}$.

Aqueous Makeup Roof Exhauster System Description

The basement, second floor, and third floor AMUs are exhausted into vertical ducts that lead to the roof of the 202-A Building. Motive force is supplied by an exhaust fan which discharges $7.6 \text{ m}^3/\text{s}$ ($16,000 \text{ ft}^3/\text{min}$) of untreated unfiltered air to the atmosphere. In as much as this is a non-radioactive area where aqueous solutions of solid or liquid chemicals are prepared, no regulated materials of a gaseous nature are emitted.

The AMU exhaust is a minor effluent.

4.1.2 Routine Operating Conditions

The ventilation systems will continue to exhaust the same areas of the PUREX Plant as described in Chapter 2.0 and Section 4.1.1. 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 be at or below the low end of the previously given ranges.

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4.1.3 Upset Operating Conditions

The *Effluent Monitoring Plan for PUREX Gaseous Effluents* (WHC 1988a), describes upset conditions for each stack. However, these are based upon the PUREX process being active in the plant and are no longer applicable. In the shutdown mode, upset operating conditions could involve failure of a single engineered barrier, which is taken to be failure of the HEPA filtration. Filtration is provided for all of the gas streams except the five wall exhausters and the AMU roof exhauster. A HEPA filter failure is modeled in Section 4.1.4.4.

4.1.4 Dispersion Modeling

Only radiological emissions are present in the PUREX air effluent during the standby 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 National Emission Standards for Hazardous Air Pollutants (NESHAP) (EPA 1989a) standard for radiological releases. The CAP-88 computes the radiation exposure to the maximally exposed individual (MEI) via the ingestion, inhalation, air-immersion (exposure resulting from being inside the plume of radiation), and groundshine (exposure resulting from deposited radioactive particles) pathways. The magnitude of exposure via any of the aforementioned pathways is strongly related to the distance between the source and receptor.

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 4-2 summarizes the characteristics of the 11 PUREX exhaust stacks.

A 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, only the dry deposition removal process has an appreciable effect on the resulting downwind air concentration. For this analysis, a dry deposition velocity of 0.0018 m/s was used for all radionuclide particulates.

Historically, the MEI was located at the facility boundary where it was hypothetically possible for a person to continuously reside and raise all food consumed. In December 1989, the EPA promulgated new regulations (EPA 1989a) which redefined the MEI to be the maximum exposure to a member of the public at an actual school, business, or residence. In this analysis, boundary locations are used for MEI distances. As such, calculated doses will, in

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general, be greater than those for actual resident/worker locations at greater distances and will represent a conservatively high estimate of the MEI dose.

The MEI was found to occur in the east wind direction sector from the PUREX Plant at a distance of 18.05 km (WHC 1988a). No additional distance beyond the Hanford Site boundary can be credited to the MEI exposure location for PUREX releases as a result of the new EPA regulations. Table 4-3 shows the distance from PUREX to the MEI/boundary locations used in assessing the MEI location.

A CAP-88 incorporates dose conversion factors from the International Commission on Radiological Protection (ICRP) 26/30 methodology (DOE 1988). Resulting doses are a 50-yr committed effective dose equivalent.

4.1.4.1 Meteorological Data. A joint frequency distribution of wind direction, wind speed class, and Pasquill stability class was used to calculate wind data for the CAP-88 code. The wind data was measured at the 10 m level of the Hanford Site meteorological tower located between the 200 East and 200 West Areas. Although all 11 stacks of the 10 sources analyzed are higher than the 10 m measurement, the 10 m data is still applicable because the plume ultimately disperses near ground levels where the MEI is located. In addition, the 10 m wind is "slower" than the prevailing winds at stack height and, therefore, yields a conservatively higher dose.

The data were used to calculate reciprocal and true averaged wind speeds, frequency of occurrence of wind direction, and frequency of occurrence of wind stability class in each of 16 wind direction sectors. Table 4-4 shows some of the most general wind rose data calculated from the joint frequency distribution.

Additional meteorological data used by CAP-88 included the average mixing height which limits the extent of vertical dispersion. An average annual value of 1,120 m was calculated as the average of the winter and summer mixing heights of 240 m and 2,000 m.

4.1.4.2 Radioisotope Screening.

CHI/Q Values. The MEI location was analyzed using 16 MEI exposure distances (Table 4-5) and the meteorological data described in Section 4.1.4.1. The CAP-88 code calculated a ground-level CHI/Q value (air concentration per unit source release) in each of the 16 wind direction sectors. The greatest CHI/Q value at the MEI distance, calculated for each sector, represents the MEI location. Table 4-5 shows the CHI/Q values calculated for the 16 sectors around the PUREX Plant. A maximum CHI/Q value of 3.2×10^{-8} s/m³ was calculated to occur in the east sector at a distance of 18.05 km from the PUREX Plant.

Radionuclide Screening Analysis. Very small quantities of many different radioactive isotopes are released from PUREX during the standby mode. To reduce the number of radioisotopes analyzed, only releases that yielded the greatest radiation doses at the MEI receptor location were entered into the CAP-88 code. The radionuclides were screened for potential dose contribution via multiple exposure pathways. The specific radionuclide doses used in the screening process were calculated as the product of the released amount of the

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radionuclide and the dose conversion factor. The resulting products were compared with and concluded to be proportional to the CAP-88 calculated doses. Radionuclides screened for significant contribution in each pathway were specifically flagged for dose assessment.

Table 4-6 summarizes the radionuclide screening analysis. The "Prod 1" column of the table displays the product of the inhalation dose conversion factors and radionuclide releases. Similarly, the "Prod 2" and "Prod 3" columns display the products of the ingestion and air-immersion pathways with the radionuclide releases, respectively. Table 4-6 shows that ^{90}Sr , ^{239}Pu , and ^{241}Am comprise most of the inhalation dose. All radionuclides within two orders of magnitude of the maximum "Prod 1" column are carried into the final CAP-88 analysis for the inhalation dose. The total inventory of radionuclides are screened for significant contribution to the ingestion and submersion pathways in a similar manner.

The groundshine pathway is omitted from the dose analysis because the gravitational settling velocity of the released particles is zero. Particulate matter emerging from the HEPA filters is too small to be affected by gravitation. Consequently, the radionuclide surface deposition at downwind locations is attributable only to dry deposition velocity and is exceedingly small. The screening for significant radionuclides was done for the main stack only because releases from the other stacks contain similar proportional quantities of radionuclides.

4.1.4.3 Routine Release Dose Assessment. During normal operations in standby mode at PUREX, only small quantities of radionuclides are released from the exhaust stacks (Table 4-7). A maximally exposed individual was found to occur in the east sector at a distance of 18.05 km downwind from the PUREX Plant. This position corresponds to the boundary of the Hanford Site reservation on the east side of the Columbia River. Several private residences are located at this point.

An effective dose equivalent of 1.4×10^{-1} mrem was assessed for the MEI location as a result of releases from all 10 operating PUREX stacks. This total dose is well below the EPA annual dose criterion (EPA 1989a) 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 4-8 summarizes the individual stack contributions to the MEI dose from each PUREX stack. As noted in Table 4-8, any stack with an individual dose greater than the EPA standard of 0.1 mrem/yr (1% 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 1.4×10^{-2} mrem to the MEI. This dose is well below the 1.0×10^{-1} mrem annual dose standard.

The MEI dose resulted primarily from the ingestion and inhalation of ^{129}I that originated from the main exhaust stack (291-A-1) at PUREX. Since all stack doses are below the 1.0×10^{-1} mrem annual dose standard, specific radionuclide analysis is not required.

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4.1.4.4 **Upset Release Dose Assessment.** Applicable EPA regulations (EPA 1989a) 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 4-9. Monitoring of the effluent stream is not made prior to 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 off-gas system, are neither needed nor in service during standby operation; so there is no increase in radioactive iodine emissions due to bypass of pollution control equipment. Its 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. Volatiles are assumed to exist as vapor and are not filterable.

Table 4-9 summarizes the contributions to the unmitigated MEI dose from each PUREX stack during standby. As noted in Table 4-9, 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 stack 296-A-1 both have unmitigated dose consequences that are in excess of this standard.

The unmitigated MEI dose resulted primarily from the ingestion and inhalation of ^{239}Pu originating from the main stack at PUREX. Inhalation of ^{90}Sr also contributes a significant percentage of the dose. The unmitigated MEI dose from stack 296-A-1 resulted primarily from the ingestion and inhalation of ^{241}Am and ^{239}Pu ; in essentially equal contributions. Table 4-10 summarizes the most significant radionuclides and their dose contributions to the MEI. Any radionuclide that contributes 10% of the dose from a release point which could exceed the EPA annual dose standard of 0.1 mrem must be selectively monitored at the exhaust point. Two radionuclides from the main stack and two radionuclides from the 296-A-1 stack have individual radionuclides that exceed this standard and will require selective air monitoring. Air monitoring requirements are discussed in more detail in Section 5.1.

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

The three PUREX liquid effluents active during transition to standby conditions are the CWL, SCD, and CSL, and are described in the following sections.

4.2.1 Descriptions

PUREX water effluents are described in detail in a series of stream-specific reports (WHC 1990a), which were written to reflect PUREX in its operating mode. The points of discharge and compositions for the streams are given in Table 4-11. The composition data given in Table 4-11 are for the upper limits of the 90% confidence interval as given in the stream-specific reports. These compositions are higher than anticipated for standby conditions. Table 4-11 also indicates the average flow rate, point of discharge, and stream-specific report number for each stream.

4.2.2 Routine Operating Conditions

Cooling Water Stream. The CWL is made up of raw water used to cool process vessels, and steam condensate. Sources that contribute water to the CWL are numerous, as shown in Table 4-12. The process vessels that contribute to this stream are not expected to experience coil failure and subsequent release of radionuclides. The collection pipes merge into one common discharge line that exits the plant on the east side of the PUREX Plant. A detailed description of the CWL and a complete list of the contributing sources to the CWL are given in the stream-specific report (WHC 1990a, Addendum 20).

The data compiled in the CWL stream-specific report represent six samples that were collected during routine operations in 1989-1990. The evaluation concluded that the CWL did not contain any dangerous wastes, as defined by the WAC (WAC 1987a). A full discussion of the chemicals detected in the samples, the reported concentrations of these chemicals, analytical detection limits, and the pertinent regulatory limits is contained in the stream-specific report (WHC 1990a, Addendum 20).

The CWL flow rate is fairly consistent and only varies slightly as process activities change. The flow rates reported in the stream-specific report ranged from 3.9×10^8 to 6.3×10^8 L/mo (WHC 1990a, Addendum 20). This rate is now reduced to 1.0×10^7 L/mo during standby. Until the TEDF and BAT systems are complete, the CWL will continue to be discharged to the 216-B-3 Pond, or to the 216-A-42 Retention Basin during diversions.

Current plans are to deactivate the CWL stream entirely during the plant standby.

The PUREX process does not introduce chemicals into the CWL.

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A corrosion inhibitor called Filmeen* is added to the steam makeup water at the powerhouse, where the steam is produced. It is the only product added to the steam condensate portion of the stream. This corrosion inhibitor contains both fatty amines and organic acids. The material safety data sheet for this product does not list chemical ingredients. It does, however, state that the product does not contain EPA hazardous constituents.

The steam supply consists of sanitary water that has been treated in softeners similar to those in ordinary household use. "Sanitary" water is Columbia River water that has been treated with small amounts of aluminum sulfate (alum) and chlorine. Steam condensate is estimated to make up only about 1% of the CWL (WHC 1990a, Addendum 20).

"Raw" water is untreated Columbia River water. It is used in cooling process vessels. Raw water may contribute some corrosion products from the piping used in its transport. During standby conditions no raw water is used for cooling purposes.

Steam Condensate Stream. The SCD consists almost entirely of warm raw water and condensed steam that has been used to control the temperature of certain process vessels. These vessels could experience heat transfer surface failure and radionuclide release. The process consists of routing the water or steam through a coil or tube bundle to heat or cool the process vessels.

The waste stream consists almost entirely of raw water (pumped from the Columbia River) and condensed steam, in varying proportions. Added to this mixture are (1) minute traces of radionuclides and chemical contaminants deposited from the air onto jumpers (a remotely removable pipe) and nozzles (when the jumpers are disconnected), (2) corrosion products from the piping used to conduct water from the Columbia River to the PUREX Plant, and (3) elevated concentration of radionuclides arising from tube failure.

Contributors to the SCD are listed in Table 4-13.

No chemicals are added to the SCD stream in the PUREX Plant. A detailed description of the SCD is given in the stream-specific report for this effluent (WHC 1990a, Addendum 5).

The data compiled in the SCD stream-specific report represent six samples that were collected during routine operations. The evaluation concluded that the SCD did not contain any dangerous wastes, as defined by WAC 173-303-070 (WAC 1987a). A full discussion of the chemicals detected in the samples, the reported concentrations of these chemicals, analytical detection limits, and the pertinent regulatory limits is contained in (WHC 1990a, Addendum 5).

The SCD flow rate is fairly consistent and only varies slightly as process activities change. The flow rates reported in the stream-specific report ranged from 2.9×10^7 to 6.8×10^7 L/mo (WHC 1990a, Addendum 5). This rate is now reduced to 1.0×10^7 L/mo during standby. During standby conditions the SCD discharge will be eliminated.

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

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Chemical Sewer Stream. The CSL collects wastewater from the nonradiologically controlled service areas of the PUREX Plant (the 202-A Building and supporting facilities), as well as steam condensate and cooling water from the vacuum fractionator. 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.

The following contribute to the PUREX Plant CSL waste stream.

- 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. No chemicals containing listed compounds are stored in this room.
- The 618-1 and 618-2 flash tanks contain spray water and steam condensate from heating coils located in the P&O gallery and AMU. These tanks are in the 202-A Building.
- Cooling water and steam condensate from the three fractionator condensers and reboiler in the 206-A Building.
- 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 change rooms in the PUREX Plant laboratory (202-A Building).
- HVAC-related drainage from the laboratory ventilation room 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.
- 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. These drains flow through the B-669 pH neutralization system before entering the CSL. See Section 2.3.1.3 for administrative controls used on the 202-A Site.

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- Sumps from the 203-A Area, via TK-P1, which are used to collect sump waste (mostly rainwater) 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 L/min (30 gal/min)] used to continuously flush the PUREX Plant CSL 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 L/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. In Figure 2-1, TK-2901A is located in the position of the north arrow.
- 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 4-14 for a list of chemicals used in the PUREX Plant.
- Project CK0081 installed an extensive chemical collection and reuse system in the AMU in 1987. 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.)

The collection pipes merge into a common discharge line on the north side of the Plant.

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 wastewater stream did not contain any dangerous wastes, as defined in WAC 173-303-070 (WAC 1987a). A full discussion of the chemicals detected in the samples, the reported concentrations of these chemicals, analytical detection limits, and the pertinent regulatory limits is 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/min (0.05 to 0.8 gal/min), with an average of 0.8 L/min (0.2 gal/min).

There are three water demineralizers in the 211-A Building that contribute water to the CSL intermittently during regeneration. The demineralizers convert 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 uses sulfuric acid and sodium hydroxide, and releases the contaminants that the demineralizer had removed from the sanitary water feed.

Project B-669 (recently installed) provides a three-chamber pH control system for the effluent from the 211-A Building. This effluent is comprised of leakage from pipes and pumps in the building, seal water drainage from certain pumps, and demineralizer regeneration waste. Of these, the regeneration waste has the highest volume. In addition to the cations and anions removed from the sanitary water (the demineralizer feed), the regenerant contains (at different times) sodium hydroxide (NaOH), sulfuric acid (H_2SO_4), sodium hydrogen sulfate ($NaHSO_4$), and sodium sulfate (Na_2SO_4). The anionic and cationic demineralizers are 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.

The PUREX Plant CSL is a highly variable stream. The vacuum fractionator effluent, which accounts for approximately 80% of the stream, normally flows only during the PUREX Plant operation and contributes little, if any, contamination. During periods of the PUREX Plant shutdown, concentrations of many components may increase by a factor of five. The primary contributor of detectable solutes, the ion exchanger regenerant, flows intermittently into the CSL and is a highly variable stream, even during regeneration.

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). This rate is maintained at 5.0×10^7 while PUREX is in standby. Until the TEDF and BAT systems are complete, the CSL will continue to be discharged to the 216-B-3 Pond or to the 216-A-42 Retention Basin during diversions.

4.2.3 Upset Operating Conditions

Cooling Water Line. If the stream is operating, the cooling water stream could become contaminated by vessel coil failure.

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

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A continuously running pump transfers a small sample stream of the CWL to the 295-AD sample and monitor shack, where some of the CWL flows through two process control radiation monitors and past a composite sampler and the grab sampler that were used for the chemical samples of the CWL. One monitor is sensitive to alpha radiation and the other monitor is sensitive to beta gamma radiation. Both monitors alarm in the dispatch office and central control rooms if readings exceed alarm limits. When either monitor triggers an alarm, flow is diverted from the 216-B-3 Pond to the 216-A-42 Retention Basin. Liquid effluents diverted to the retention basin are usually disposed either to the SCD cribs or to the 216-B-3 Pond. The choice of disposal site is dependent on the radionuclide content of the diverted effluent. The basin contents may also be sent back to the PUREX Plant for processing if necessary.

Steam Condensate Discharge. If the stream is operating, vessel coil failure could contaminate the steam condensate stream.

A continuously running pump in the 202-A-417 Caisson transfers a sample stream of the SCD from the caisson to the 295-AA sample and monitor shack, where some of the SCD flows through two process control radiation monitors and past a composite sampler and the grab sampler that were used for the chemical samples of the SCD. One monitor is sensitive to alpha radiation and the other monitor is sensitive to beta-gama radiation. When either monitor triggers an alarm, flow is diverted from the 216-B-3 Pond to the 216-A-42 Retention Basin. Liquid effluents diverted to the retention basin are usually disposed either to the SCD cribs or to the 216-B-3 Pond. Any probable chemical contamination would be from process solutions, which also contain detectable levels of radioactive contamination. Therefore, the chance of significant undetected chemical contamination is small.

Chemical Sewer Line. The CSL could become contaminated during upset conditions.

After the contributors to the CSL have flowed together, the CSL flows through Manhole 4. A flowmeter in Manhole 4 measures the flow rate of the CSL. The flow rate of the CSL determines the activity of a flow totalizer and flow-proportional sampler. 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 passes through a pH monitor and a radiation process control monitor. This side stream also passes by a grab sampler (used for taking the characterization samples) and a flow proportional sampler used for providing a record of the radioactivity in the CSL. The radiation monitor is sensitive to beta-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 11.

4.2.4 Wastewater Discharge Criteria

The PUREX wastewater will be discharged to a State Approved Land Disposal Structure (SALDS) on or before the 1996 regulatory deadline. This is the currently recommended option. The discharge criteria for PUREX wastewater effluents then becomes the acceptance criteria for a SALDS.

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Currently, the CWL and CSL are disposed of to the 216-B-3 Pond; the SCD flows to the 216-A-30 and 216-A-37-2 Cribs. All water effluent flow to ponds or cribs will cease by 1996 when water must be discharged to a SALDS. The acceptance criteria for B-Pond or the cribs are given in WHC-CM-7-5, *Environmental Compliance Manual* (WHC 1991a).

Based on Washington State Department of Ecology (Ecology) guidance WAC 173-303 (WAC 1987a), a SALDS will consider an effluent that is below the most restrictive of the following criteria as acceptable for soil column discharge (Mishko 1990):

- Primary maximum contaminant levels (MCL)
- Secondary MCL
- Proposed MCL
- WAC groundwater quality enforcement limits.

Acceptance criteria for a SALDS are the same as acceptance criteria for the TEDF. The TEDF will have emergency treatment capability, but its main functions will be equalization and holding during laboratory analyses. The TEDF will not be designed nor permitted to accept any effluents which are considered to be a dangerous waste under WAC 173-303 (WAC 1987a).

A listing of the most restrictive criteria was prepared for the purposes of establishing acceptance criteria for the TEDF. This list is reproduced in Section 16.2. The most restrictive single value for each parameter is given in Table 16-1. If a wastewater does not meet these criteria it is not necessarily a hazardous waste, but is rather a stream which may not be acceptable for discharge to a SALDS.

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/yr is equal to 4% of the derived concentration guide (DCG) (DOE 1990a).

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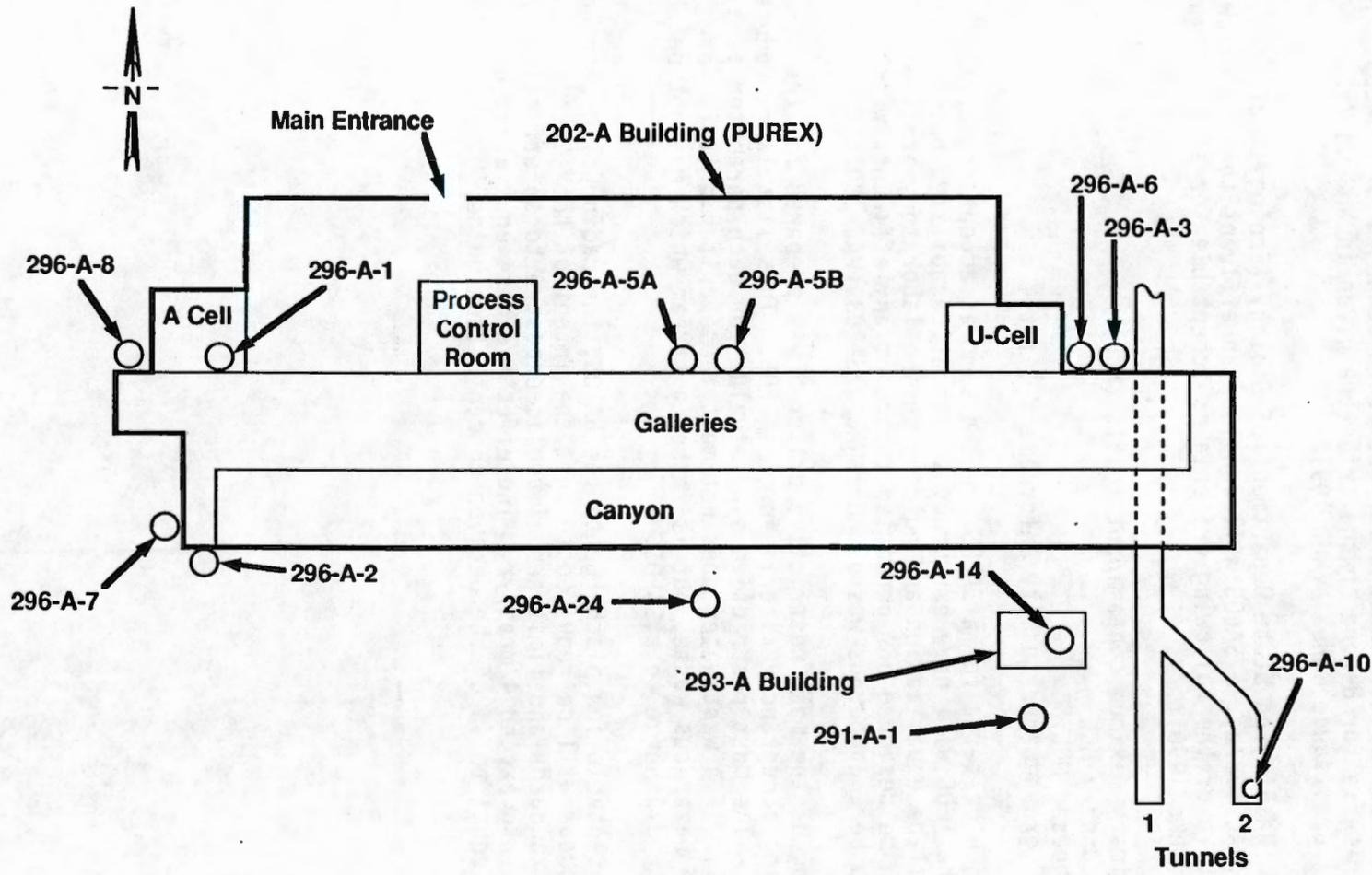


Figure 4-1. Plutonium-Uranium Extraction Plant Exhaust Stacks.

MHC-EP-0468

29108034.1

Table 4-1. Stack 291-A-1 Radionuclide Content for the Last Three Quarters of 1990 ($\mu\text{Ci/mL}$).

Chemical	Low
^3H	2.9 E-10
^{14}C	2.6 E-11
^{90}Sr	2.3 E-13
^{103}Ru	3.2 E-14
^{106}Ru	2.9 E-13
^{113}Sn	3.4 E-14
^{125}Sb	2.2 E-13
^{129}I	1.0 E-11
^{131}I	2.5 E-13
^{137}Cs	2.2 E-15
^{147}Pm	1.6 E-14
^{212}Pb	4.2 E-13
^{238}Pu	2.9 E-16
^{239}Pu	5.1 E-15
^{241}Am	4.3 E-16

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Table 4-2. Plutonium-Uranium Extraction Stack Exhaust Data.

Stack reference	Height		Stack diameter		Outlet diameter		Average flow ²		Temperature	
	(ft)	(m)	(ft)	(m)	(ft)	(m)	(ft ³ /min)	(m ³ /s)	(°C)	(°K)
291-A-1	200	61.0	7.0	2.13	7.0	2.13	1.2 E+05	56.00	35	308
296-A-1	74	22.6	2.0	0.61	1.8	0.53	4,300	2.03	25	298
296-A-2	78	23.8	1.7	0.51	1.3	0.41	3,400	1.60	25	298
296-A-3	74	22.6	1.7	0.51	1.3	0.41	3,400	1.60	25	298
296-A-5A ¹	89	27.1	3.5	1.07	3.0	0.91	16,000	7.55	25	298
296-A-5B ¹	89	27.1	3.5	1.07	3.5	1.07	16,000	7.55	25	298
296-A-6	74	22.6	3.3	1.02	2.8	0.84	14,000	6.61	25	298
296-A-7	78	23.8	3.7	1.12	3.3	1.02	16,000	7.55	25	298
296-A-8	34	10.4	3.3	1.02	3.3	1.02	13,000	6.14	25	298
296-A-10	20	6.1	2.0	0.61	2.0	0.61	3,500	1.65	25	298
296-A-14	42	12.8	2.0	0.61	2.0	0.61	4,000	1.89	25	287

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

²Average flow from 1984 to 1988.

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Table 4-3. Distances from the Plutonium-Uranium Extraction Facility to the Hanford Site Boundary.

Direction	Distance (km)
N	23.67
NNW	21.02
NW	21.30
WNW	20.71
W	20.42
WSW	20.71
SW	19.53
SSW	17.75
S	20.73
SSE	22.19
SE*	27.22
ESE*	23.96
E*	18.05
ENE	18.34
NE	21.30
NNE	26.63

*Distances to actual public residences are the same as to boundary locations.

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Table 4-4. Summary of Wind Data.¹

Sector	Wind direction ² frequency of occurrence	Average wind speed (m/s)
N	0.042	2.74
NNW	0.034	2.25
NW	0.038	1.94
WNW	0.034	1.52
W	0.035	1.54
WSW	0.024	1.86
SW	0.027	1.66
SSW	0.036	2.22
S	0.060	2.02
SSE	0.065	2.41
SE	0.143	4.00
ESE	0.155	4.08
E	0.128	3.44
ENE	0.080	3.86
NE	0.057	4.58
NNE	0.038	4.07

¹Data calculated from Joint Frequency Distribution for the 200 Area Meteorological Station at the 10 m Level.

²Wind direction is "toward" the indicated sector from a central point location.

Table 4-5. CHI/Q Values for the 16 Wind Sectors Surrounding the Plutonium-Uranium Extraction Plant.

Direction	CHI/Q (s/m ³)
E	9.1 E-09
NNW	8.5 E-09
NW	9.5 E-09
WNW	9.0 E-09
W	8.8 E-09
WSW	5.2 E-09
SW	6.5 E-09
SSW	9.2 E-09
S	1.3 E-08
SSE	1.3 E-08
SE	1.8 E-08
ESE	2.6 E-08
E*	3.2 E-08
ENE	1.8 E-08
NE	1.1 E-08
NNE	6.1 E-09

*Represents the maximum CHI/Q and the sector containing the Maximally Exposed Individual for releases from the main stack (291-A-1).

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Table 4-6. Screening Analysis for the Most Significant Radionuclide Releases.

Nuclide	Release ¹ (Ci/yr)	Inhal. ² cnvrsn factor (rem/μCi)	Ingest ² cnvrsn factor (rem/μCi)	Air-sub ² cnvrsn factor ($\frac{\text{mrem-m}^3}{\mu\text{Ci-yr}}$)	Prod-1 inhal ($\frac{\text{rem-Ci}}{\mu\text{Ci-yr}}$)	Prod-2 ingest ($\frac{\text{rem-Ci}}{\mu\text{Ci-yr}}$)	Prod-3 air ($\frac{\text{mrem-m}^3\text{-Ci}}{\mu\text{Ci-yr}^2}$)
⁹⁰ Sr	4.0 E-04	1.3 E+00	1.3 E-01	0.0 E+00	5.2 E-04	5.2 E-05	0.0 E+00
¹⁰⁶ Ru	5.2 E-04	4.4 E-01	2.1 E-02	0.0 E+00	2.3 E-04	1.1 E-05	0.0 E+00
¹¹³ Sn	5.9 E-05	3.4 E-05	1.0 E-04	1.3 E+03	2.0 E-09	5.9 E-09	2.1 E-02
¹²⁵ Sb	3.9 E-04	9.8 E-03	2.6 E-03	2.1 E+03	3.8 E-06	1.0 E-06	8.2 E-01
¹³⁷ Cs	3.8 E-06	3.2 E-02	5.0 E-02	0.0 E+00	1.2 E-07	1.9 E-07	0.0 E+00
¹⁴⁷ Pm	2.8 E-05	3.4 E-02	9.5 E-04	1.8 E-02	9.5 E-07	2.7 E-08	5.0 E-08
²³⁸ Pu	5.1 E-07	4.6 E+02	3.8 E+00	4.4 E-01	2.2 E-04	1.9 E-06	2.2 E-07
²³⁹ Pu	9.0 E-06	5.1 E+02	4.3 E+00	4.1 E-01	4.5 E-03	3.9 E-05	3.7 E-06
²⁴¹ Am	7.5 E-07	5.2 E+02	4.5 E+00	9.5 E+01	4.0 E-04	3.4 E-06	7.1 E-05

¹Based on averaged and normalized second, third, and fourth quarter 1990 preliminary concentration and flow data for stack 291-A-1.

²Dose Conversion Factors are from DOE 1990a which represent the ICRP 26/30 Methodologies.

Table 4-7. Significant Radionuclide Releases from the Plutonium-Uranium Extraction Plant During Standby¹ (In Curies per Year).

Stack reference	Significant radionuclide			
	⁹⁰ Sr	²³⁸ Pu	²³⁹ Pu	²⁴¹ Am
291-A-1	4.0 E-04	5.1 E-07	9.0 E-06	7.5 E-07
296-A-1	NA ²	NA	5.8 E-07	2.9 E-07
296-A-2	NA	NA	1.6 E-08	3.8 E-08
296-A-3 ³	NA	NA	NA	NA
296-A-5A	NA	NA	7.6 E-08	1.6 E-07
296-A-6	NA	NA	7.1 E-08	1.5 E-07
296-A-7	NA	NA	4.0 E-07	1.6 E-07
296-A-8	NA	NA	7.0 E-08	1.3 E-07
296-A-10	NA	NA	8.7 E-09 ⁴	NA
296-A-14	3.6 E-07 ⁵	NA	5.8 E-09 ⁴	NA
Total	4.1 E-04	5.1 E-07	1.0 E-05	1.8 E-06

¹Most significant radionuclides contributing to dose assessment from Table 4-6.

²NA indicates no analysis was required or performed for the radionuclide listed.

³Average radionuclide concentrations were indistinguishable from background.

⁴The ²³⁹Pu concentration inferred from total α data as a worst case scenario.

⁵The ⁹⁰Sr concentration inferred from total β data as a worst case scenario.

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Table 4-8. Doses to the Maximally Exposed Individual from Routine Standby Mode Releases.

Stack reference	Effective dose equivalent (mrem)	Stack contribution to MEI dose (%)	Standard for* required monitoring (mrem)
291-A-1	1.4 E-02	99.3	1.0 E-01
296-A-1	3.5 E-05	0.25	1.0 E-01
296-A-2	2.3 E-06	0.02	1.0 E-01
296-A-3	0.0 E+00	0	1.0 E-01
296-A-5A/5B	1.1 E-05	0.08	1.0 E-01
296-A-6	1.0 E-05	0.07	1.0 E-01
296-A-7	2.2 E-05	0.16	1.0 E-01
296-A-8	9.5 E-06	0.07	1.0 E-01
296-A-10	3.0 E-07	0.00	1.0 E-01
291-A-14	2.6 E-07	0.00	1.0 E-01
Total	1.4 E-02	100.3	

*Dose standard for required radioactivity effluent monitoring (EPA 1989a).

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Table 4-9. Doses to the Maximally Exposed Individual from an Unmitigated Release.

Stack reference	Effective dose equivalent (mrem)	Unmitigated release factor (dimensionless)	Unmitigated effective dose equivalent (mrem)	Dose standard* for required monitoring (mrem)
291-A-1 Volatiles Particulates Total	1.4 E-02 <u>1.4 E-05</u> 1.4 E-02	1.0 E+00 3.0 E+03 -----	1.4 E-05 <u>4.1 E-04</u> 4.3 E-04	1.0 E-01
296-A-1	3.5 E-02	3.0 E+03	1.06 E-01	1.0 E-01
296-A-2	2.3 E-03	3.0 E+03	6.7 E-03	1.0 E-01
296-A-3	0.0 E+00	3.0 E+03	0.0 E+00	1.0 E-01
296-A-5A/5B	1.1 E-05	3.0 E+03	3.2 E-02	1.0 E-01
296-A-6	1.0 E-05	3.0 E+03	3.0 E-02	1.0 E-01
296-A-7	2.2 E-05	3.0 E+03	6.6 E-02	1.0 E-01
296-A-8	9.5 E-06	3.0 E+03	2.8 E-02	1.0 E-01
296-A-10	3.0 E-07	3.0 E+03	9.1 E-04	1.0 E-01
296-A-14	2.6 E-07	3.0 E+03	7.9 E-04	1.0 E-01

*Dose standard for total radioactivity effluent monitoring (EPA 1989a).

Table 4-10. Individual Radionuclide Doses to the Maximally Exposed Individual from an Unmitigated Release.

PUREX Stack	Radionuclide	EDE Contribution (rem/yr)	Contribution to stack total (%)
291-A-1	²³⁹ Pu	2.56 E-01	60
	⁹⁰ Sr	6.15 E-02	14
296-A-1	²⁴¹ Am	4.56 E-02	43
	²³⁹ Pu	6.00 E-02	57

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Table 4-11. Summary of Plutonium-Uranium Extraction Plant Liquid Effluent Qualities.¹ (4 sheets)

Analyte	CWL ⁵	SCD ⁵	CSL ⁵ IX Regen ²	CSL ⁵ Routine
Inorganic Compounds - Metals ³				
Aluminum			499	341
Antimony				
Arsenic				
Barium	32	30	113	34
Beryllium				
Boron	25	24		22
Cadium			11	
Calcium	1.9 E+04	1.8 E+04	5.9 E+04	1.9 E+04
Chromium				
Copper	11		1,310	40
Iron	53	32	675	443
Lead			30	6
Magnesium	4.5 E+03	4.3 E+03	1.2 E+04	4,350
Manganese	7		58	30
Mercury			1.7	0.1
Nickel			15	
Potassium	772	713	3,360	740
Selenium				
Silicon	2.6 E+03	2.3 E+03		2,910
Silver			17	
Sodium	2.2 E+03	2.1 E+03	4.0 E+05	2,160
Strontium	100	88	353	95
Thallium				
Uranium	0.5	0.6	1.3	0.6
Zinc	8	6	416	25

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Table 4-11. Summary of Plutonium-Uranium Extraction Plant Liquid Effluent Qualities.¹ (4 sheets)

Analyte	CWL ⁵	SCD ⁵	CSL ⁵ IX Regen ²	CSL ⁵ Routine
Inorganic compounds - Ionic Species ³				
Ammonium	52		79	63
Chloride	1.2 E+03	1.0 E+03	2.6 E+04	1.8 E+03
Cyanide			12	
Fluoride	146	123		154
Fluoride (IC)			3,390	
Fluoride (ISE)			213	
Nitrate	628	582	7.0 E+04	588
Nitrate				
Sulfate	1.1 E+04	9.8 E+03	1.5 E+06	1.3 E+04
Organic Compounds ³				
Acetone	11	10	148	
1-Butanol		24		
2-Butanone	10			
Butylated				
Hydroxytoluene	10			10
Chloroform			240	
Dibutyl phosphate				
Dichloromethane	6		15	
Tributylphosphate		12		
Other Parameters ⁴				
Alkalinity	6.2 E+04	5.8 E+04		6.6 E+04
Conductivity (μ S)	154	146	3,990	158
pH (dimensionless)	7.9	7.7	6.6	7.8
TDS	7.2 E+04	6.6 E+04		6.5 E+04
Temperature ($^{\circ}$ C)	20	22	29	28
TOC	1.1 E+03	1.1 E+03	1.08 E+04	
Total Carbon	1.6 E+04	1.5 E+04		1.5 E+04
TOX (as Cl)	11	8	266	99

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Table 4-11. Summary of Plutonium-Uranium Extraction Plant Liquid Effluent Qualities.¹ (4 sheets)

Analyte	CWL ⁵	SCD ⁵	CSL ⁵ IX Regen ²	CSL ⁵ Routine
Radionuclides ⁴				
Total Alpha		7	4	1
Total Beta		224	11	2
^{226,228} Ra		<4.4 E+00		<1.9 E-01
Gross uranium-natural				4.9 E+02
³ H				4.9 E+02
¹⁴ C	6.3 E+00			4.28 E+00
⁹⁰ Sr	3.9 E-01	3.3 E+00		
¹²⁹ I	1.5 E-01			
¹³⁷ Cs		1.6 E-01		4.6 E-01
¹⁴⁴ Ce/Pr		3.4 E+02		
¹⁴⁷ Pm				
²³⁴ U	2.6 E-01	2.6 E-01		1.9 E-01
²³⁸ Pu		5.5 E-01		1.6 E-02
²³⁸ U	1.9 E-01	1.8 E-01		1.6 E-01
^{239,240} Pu		7.2 E+00		5.3 E-01
^{239,240} U	3.5 E-03			
²⁴¹ Am	4.8 E-03	8.7 E-01		2.0 E-01
Stream-Specific Report (WHC 1990a) Addendum Number	Addendum 20	Addendum 5	Addendum 2	Addendum 2
Approximate Average Flow Rate (L/mo)	5.2 E+08	4.3 E+07		7.7 E+07
Estimated Flow Rate for PUREX Shutdown Condition (L/mo)	1.0 E+07	1.0 E+07		5.0 E+07

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Table 4-11. Summary of Plutonium-Uranium Extraction Plant Liquid Effluent Qualities.¹ (4 sheets)

Analyte	CWL ⁵	SCD ⁵	CSL ⁵ IX Regen ²	CSL ⁵ Routine
Estimated Flow Rate for PUREX Standby (L/mo)	0	0		5.0 E+07
Discharge Point	216-B-3 Pond	216-A-30 and 216-A-37-2 Cribs		216-B-3 Pond

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

²Effluent quality for CSL waste stream during ion exchange regeneration operations.

³Effluent concentrations expressed as µg/L unless indicated otherwise.

⁴Effluent concentrations for radionuclides expressed as picocuries per liter.

⁵Abbreviations used:

CWL = cooling water line

SCD = steam condensate discharge

CSL = chemical sewer line (ion exchanger regeneration and routine operations)

TDS = total dissolved solids

TOC = total organic carbon

TOX = total organic halides

MS = microsiemen

IC = fluoride analysis using ion chromatography technique

ISE = fluoride analysis using ion-specific electrode technique.

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Table 4-12. Plutonium-Uranium Extraction Plant Cooling Water Line Contributors. (2 sheets)

Location	Process unit	Source description
2711-A, 2712-A		Pump seal water
202-A, L Cell	TK-L3	3A feed tank coil
202-A, L Cell	E-L6	L-6 concentrator condenser cooling water
202-A, L Cell	E-L7-2	L-7 concentrator condenser cooling water
202-A, Q Cell	E-Q9	Ventilation jet condenser cooling water
276-A, R Cell	TK-R8	20W waste tank coil
276-A, R Cell	TK-R7	200 receiver tank coil
276-A, R Cell	TK-R5	200 rework tank coil
276-A, R Cell	TK-R2	20 waste tank coil
276-A, R Cell	TK-R1	20 feed tank coil
202-A, PR Room	E-L12	TK-L11 jet steam condenser cooling water
202-A, K Cell	TK-K6	2UC sampler tank coil
202-A, K Cell	Spare	No connection
202-A, K Cell	TK-K5	2UC receiver tank coil
202-A, K Cell	E-K4-2	K4 concentrator condenser cooling water (four contributors)
202-A, K Cell	E-K4-1	Left tube bundle steam condensate
202-A, K Cell	E-K4-1	Right tube bundle steam condensate
202-A, K Cell	TK-K1	2D feed tank coil
202-A, J Cell	E-J8-1	J8 concentrator condenser cooling water (three contributors)
202-A, J Cell	Spare	No connection
202-A, J Cell	TK-J3	1BX feed tank coil
202-A, J Cell	TK-J1	3WB recycle tank coil
202-A, H Cell	Spare	No connection (two spares)
202-A, H Cell	E-H4-2	H4 concentrator condenser cooling water (three contributors)
202-A, G Cell	TK-G8	10W waste tank coil
202-A, G Cell	TK-G7	100 receiver tank coil
202-A, G Cell	Spare	No connection (two spares)
202-A, G Cell	TK-G5	100 feed tank coil
202-A, G Cell	TK-G2	10 waste tank coil
202-A, G Cell	TK-G1	10 feed tank coil
202-A, F Cell	TK-F18	Sump waste receiver tank coil
202-A, F Cell	Spare	No connection (10 spares)

Table 4-12. Plutonium-Uranium Extraction Plant Cooling Water Line Contributors. (2 sheets)

Location	Process unit	Source description
202-A, F Cell	TK-F13	Utility organic recovery tank coil
202-A, F Cell	TK-F12	Ammonia concentrator feed tank coil
202-A, F Cell	E-F11-12	Ammonia concentrator condenser cooling water (three contributors)
202-A, F Cell	TK-F10	3WF decanter coil
202-A, F Cell	E-F9	TK-F8 ventilation condenser cooling water
202-A, F Cell	TK-F26	1WW receiver tank coil
202-A, F Cell	E-F5	Acid absorber condenser cooling water (three contributors)
202-A, F Cell	TK-F3	Acid receiver tank coil
202-A, E Cell	Spare	No connection
202-A, E Cell	E-F1	Process ventilation condenser cooling water (two contributors)
202-A, E Cell	TK-E5	Decladding waste tank coil
202-A, E Cell	TK-E3-2	Ammonia scrubber catch tank coil
202-A, E Cell	TK-E3	Centrifuge feed tank coil
202-A, D Cell	TK-D5	Metal solution accountability tank coil
202-A, D Cell	TK-D4	Metal solution storage tank coil
202-A, D Cell	Spare	No connection (two spares)
202-A, D Cell	TK-D3	Metal solution storage tank coil
202-A, D Cell	TK-D2	Decladding waste receiver tank coil
202-A, D Cell	TK-D1	Metathesis solution storage tank coil
202-A, C Cell	T-C3-1	Dissolver downdraft condenser cooling water (three contributors)
202-A, C Cell	TK-C3-4	Ammonia scrubber catch tank coil
202-A		CWL/SCD cross tie
202-A, B Cell	T-B3-1	Dissolver downdraft condenser cooling water (three contributors)
202-A, B Cell	TK-B3-4	Ammonia scrubber catch tank coil
202-A, A Cell	T-A3-1	Dissolver downdraft condenser cooling water (three contributors)
202-A, A Cell	TK-A3-4	Ammonia scrubber catch tank coil
293-A	E-XA-1,2	NO _x backup facility intercooler cooling water
293-A	TK-XD	Recovered nitric acid catch tank coil
202-A	RR Tunnel	Drain from railroad tunnel water-fillable door

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Table 4-13. The Plutonium-Uranium Extraction Plant Steam Condensate Contributors.

Contributor location	Process unit	Source description
Concentrator tube bundles (steam condensate)		
202A, J Cell	E-J8	Concentrator steam condensate
202A, H Cell	E-H4-1	Concentrator steam condensate
202A, F Cell	E-F11-1	Concentrator steam condensate
202A, F Cell	E-F6	Concentrator steam condensate
Vessel coils (steam condensate or cooling water)		
202A, J Cell	TK-J5	2A Feed Tank coil
202A, H Cell	TK-H1	HA Feed Tank coil
202A, F Cell	TK-F16	High-level waste tank coil
202A, F Cell	TK-F15	Denigration tank coil
202A, F Cell	TK-F8	Rework tank coil
202A, E Cell	TK-E6	Solvent extraction feed adjustment tank coil
202A, E Cell	TK-E1	Zirflex actinide recovery tank coil
202A, C Cell	TK-C3	Dissolver coil
202A, C Cell	T-C2	Silver-reactor steam condensate
202A, B Cell	TK-B3	Dissolver coil
202A, B Cell	T-B2	Silver-reactor steam condensate
202A, A Cell	TK-A3	Dissolver coil
202A, A Cell	T-A2	Silver-reactor steam condensate
Miscellaneous waste sources (liquid drainage)		
202A, P&O	Mezzanine	Decontamination shower drain by east crane maintenance platform
202A Tunnels		Room drains from the railroad tunnel
202A		SCD alpha monitor flush
202A	Storage Basin	Fuel storage basin overflow and empty out
202A S. Side	Pump Pit 6	Drainage from SCD and CWL contributor piping leaks
202A S. Side	Pump Pit 7	Drainage from SCD and CWL contributor piping leaks

Table 4-14. List of Plutonium-Uranium Extraction Plant Chemicals.

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

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5.0 EFFLUENT POINT OF DISCHARGE DESCRIPTION

This chapter describes the point of discharge for both the air and liquid effluents.

5.1 AIR EFFLUENTS

The 10 major air effluent streams dimensions and heights have been previously summarized in Table 4-2. The location of each stack is shown in Figure 4-1. Additional information on each discharge is given in Section 4.1.1 Descriptions.

5.2 WATER EFFLUENTS

The composition, flow rates and discharge points of the two liquid effluents have been previously summarized in Table 4-11. The location of each discharge point can be seen on Figure 2-3. Additional information on each discharge is given in Section 4.2.2 Routine Operating Conditions.

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6.0 EFFLUENT MONITORING/SAMPLING SYSTEM DESIGN CRITERIA

Design criteria of a system or equipment states the functional requirements that must be met.

6.1 NEW FACILITIES

No new facilities or modifications to the existing equipment are being implemented or are currently planned for the monitoring systems at the PUREX Plant. Therefore, there are no design criteria.

6.2 EXISTING FACILITIES

The equipment used to create both the air and liquid M/S systems for the PUREX Plant is to meet the following common design criteria; accurate, rugged, and low maintenance.

6.2.1 Air Effluent Design Criteria

The following additional specific criteria apply to the air effluents.

- Radioactive effluent releases shall be sampled, monitored as required, analyzed, measured for volume, and reported (total quantities). Compliance will be monitored via laboratory analysis of record samples.
- A program for testing filters shall be established which includes performance limits of minimum acceptable removal of 99.95% for HEPA filters with 0.1 to 3.0 micron particle size range with a mean size of 0.5 micron.
- A program for limiting and monitoring the oxides of nitrogen released from the PUREX Plant shall be established.
- Minimum equipment operability requirements and repair schedules for the gaseous effluent control and monitoring equipment shall be defined to support processing operations.
- Operability testing/calibration schedules for equipment and instruments required to support these specific control features shall be established and executed.

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6.2.2 Water Effluent Design Criteria

The following additional specific criteria apply to the PUREX Plant effluents.

- Radioactive liquid effluent releases shall be sampled and monitored as required, analyzed, measured for volume, and reported (total quantities). Radiation monitors will be set as low as technically feasible. Composite of batch or proportional samples with a composite time period of less than 30 days will be used.
- Capability shall be provided for automatically diverting the chemical sewer, cooling water, and steam condensate streams containing levels of radioactivity or pH exceeding established trip levels to a lined retention basin.
- Limits shall be established for the chemical composition of the streams. The PDD and CSL pH alarm set points will be 5.0 and 11.0.
- Controls to prevent the presence of a separate organic phase in any radioactive liquid effluent stream shall be established. Less than 100 mg/L total organic carbon of organic compounds, which could affect mobility of radionuclides, will be allowed.
- Minimum equipment operability requirements and repair schedules shall be defined to support the liquid effluent disposal program.
- Operability testing/calibration schedules for equipment and instruments required to support these specific control features shall be established and executed.

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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 (EPA 1989a). Currently, liquid effluent M/S are used to verify compliance with discharge criteria for effluents discharged to 216-B-3 Pond (B Pond), 216-A-30 and 216-A-37-2 Crib. After 1996 liquid effluents must meet the more restrictive SALDS criteria. Monitoring and Sampling of the air and liquid effluents will be conducted in accordance with the current operating procedures, WHC-CM-7-5 (WHC 1991a).

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 4.1.4, 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 1989a); 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, rather a system that samples continuously so that variations in effluent concentrations are accurately represented by analysis. A continuous air sampler that draws air through and deposits particulates on a filter is an example. Both alpha and beta emitters are present in all PUREX stack effluents.

Stacks and their monitoring requirements are discussed in the following (Table 7-1 summarizes the results of the dose analysis):

- Two stacks, 291-A-1 and 296-A-1, will require radiation monitoring (EPA definition)
- Both stacks will require continuous total alpha/beta monitoring (EPA 1989a)
- The main stack, 291-A-1, will require radionuclide selective analysis for ^{90}Sr and ^{239}Pu
- The 296-A-1 stack will require selective analysis for ^{239}Pu and ^{241}Am

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- The other nine stacks in Table 7-1 require only periodic monitoring to verify compliance during standby operations at PUREX
- No stack at PUREX requires monitoring for non-radiological hazardous or EPA criteria pollutants during standby mode

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, 1990a).

7.1.2.1 291-A-1 Stack Monitoring/Sampling Description. Multi-point sample probes are located at three elevations on the main stack; 60, 74, and 88 ft. There are two sample probes at each location. Two of the six probes, one each at 60 and 74 ft, are used for record effluent sampling purposes. The remaining probes lead to monitors or samplers used for process control or to samplers which are not required during plant standby conditions. Each of the record samplers consists of a filter through which a near isokinetic ($\pm 10\%$) sample is pulled. Automatic flow controllers maintain the near isokinetic sampling conditions.

The particulate filters from the record sampling unit are removed weekly and transferred to the 222-S Laboratory for radio-chemical analyses. One sample is designated as the primary record while the other is used as a backup. These analyses include total alpha, total beta and the specific radionuclide analyses.

7.1.2.2 296-A-1 Stack Monitoring/Sampling Description. Samples are removed from the gas stream by stack sampling probe SSP-V28A-1 and routed to a record sampler. As with stack 291-A-1, particles are collected on a filter within the sampler. Flow through the system is manually adjusted when needed to maintain a near-isokinetic sampling condition.

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

A sampling probe provides the capability of analysis of all required radionuclides. Table 7-2 summarizes the current required monitoring and sampling.

The current design, location, and number of sample probes on the main stack are in compliance with ANSI N13.1 (ANSI 1969). However, the sampling system does not meet the EPA flow measurement requirements for continuous sampling. 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 1989a).

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7.1.3 Remaining Stacks

Based upon EPA criteria (EPA 1989a), 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 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 ^{90}Sr and ^{239}Pu . Air samples from 296-A-1 shall be analyzed for ^{239}Pu and ^{241}Am . The M/S program for air effluents is included in Table 7-3. Air sampling shall comply with the criteria provided in applicable Westinghouse Hanford manuals and procedures. Stack flow measurements shall comply with the criteria provided by the EPA (EPA 1989a).

Stack 291-A-1. Air sampling equipment is located at the 74 ft and 60 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 systems is monitored and controlled by flow controllers to ensure near isokinetic sampling.

The particulate filters from the record sampling unit will be removed weekly and transferred to a laboratory for radiochemical analyses. These analyses will include ^{90}Sr and ^{239}Pu determinations. One of the two samples will be designated as the primary sample. While the other sample will normally be handled the same as the record sample, it may be designated for special 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 particulate filter from the record sampling unit will be removed weekly and transferred to a laboratory for radiochemical analysis. The analyses will include ^{239}Pu and ^{241}Am determinations.

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 1989a, 1990g) and engineering drawings (WHC 1990e, 1990b, 1990f).

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7.2.1 Monitoring/Sampling Requirements

Currently, discharges of liquid effluents must meet B Pond or crib acceptance criteria. The concentrations of constituents in each PUREX liquid waste stream must be below regulatory limits before the effluents can be discharged. After 1996, more restrictive SALDS criteria must be met. The discharge criteria, based on SALDS acceptance, are compared with the reported effluent quality from the three PUREX waste streams on Table 7-4. The effluent concentrations presented in the table represent the 90% confidence interval limit as reported in the stream-specific reports (WHC 1990a).

7.2.1.1 Routine Conditions. The following are observed after review of the discharge criteria and available stream-specific data.

- Some effluent concentrations exceed the SALDS acceptance criteria.
- The selection of analytes for characterization is not uniform.
- The selection of analytes is not consistent with the discharge criteria parameters.
- The wastestream characterizations must be refined before discharge to the SALDS commences.

These deficiencies in the database are largely a function of project scope. The stream-specific reports were prepared to evaluate whether the waste streams were designated dangerous wastes pursuant to the WAC 173-303 (WAC 1987a). Process knowledge and historic sampling data were used to select the analytical tests. It was not the intention of the stream-specific project to show that the waste stream quality meet all applicable discharge criteria.

7.2.1.2 Monitoring/Diversion Interface. At the present time, 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.

Due to 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 4.2.4. Weekly process control samples will identify releases greater than annual limits. Past upset conditions have typically produced releases an order of magnitude greater than alarm limits.

In addition, the PUREX effluent streams are not monitored continuously for 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 diversion values exceeds the response time of the monitors, so all upset flow is diverted.

7.2.1.3 Monitoring/Sampling Criteria. The effluent concentrations in the CWL, SCD, and CSL waste streams, during routine operations of the PUREX Plant, were below the most restrictive of applicable federal and state standards for water quality. The effluent concentrations are also expected to meet the intent of the state's Groundwater Protection standards while the plant is in a standby operational-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 effluent at the concentrations adopted as 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 analyses.

The sampling strategy must include provisions for correcting the deficiencies noted in this chapter. Uniformity and consistency must be incorporated in the sampling and analysis plan to ensure that the database contains the information necessary for making an informed judgement as to the acceptability of effluent for disposal at the SALDS. The sampling criteria are summarized below and are presented in more detail in Sections 10.2 and 10.3.

7.2.2 Cooling Water Line Effluent Monitoring/Sampling System

7.2.2.1 Cooling Water Line Monitoring/Sampling Description. The CWL M/S equipment is located in the 295-AD Building. The composite samples for process control and environmental records are collected weekly; the environmental samples are recomposited monthly. The sampling system is tested at least once a month and is inspected daily for rotameter operation, sample tank levels, leaks and sample value actuation. Monitoring includes alpha and beta-gamma monitoring as well as flow measurement and flow totalizing. If the concentration of radionuclides exceeds the alarm limit, an alarm is sounded in the dispatcher's office, a verification sample is automatically collected and the stream is automatically diverted to the covered 216-A-42 Retention Basin. The monitoring system is checked for functionality once a month and is calibrated every 6 months. 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 Cooling Water Line Monitoring/Sampling Specifications. Table 7-5 describes the normal operating parameters for the CWL stream.

7.2.2.3 Cooling Water Line Monitoring/Sampling Deficiencies. The minimum detection limit for ^{241}Am , ^{239}Pu , and ^{240}Pu , which should be equal to 4% of the DCG for discharge to SALDS, will not be met. The current detection limits at the 222-S Laboratory are $5.0 \times 10^{-9} \mu\text{Ci/mL}$ for Plutonium and $1.2 \times 10^{-8} \mu\text{Ci/mL}$ for americium (WHC 1990g). Revised detection limits, based upon 4% of the DCG, of $1.2 \times 10^{-9} \mu\text{Ci/mL}$ for both are required. The monitoring system for

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both radioactive and nonradioactive liquid discharges have no source of backup power in the event of a power failure, but should (WHC 1990g).

7.2.3 Steam Condensate Discharge Effluent Monitoring/Sampling System

7.2.3.1 Steam Condensate Discharge Monitoring/Sampling Description. The SCD M/S system is located in the 295-AA Building. The composite samples for process control and environmental records are collected weekly; the environmental samples are recomposited monthly. The sampling system is tested at least once a month and is inspected daily for rotameter operation, sample tank levels, leaks, and sample value actuation. Monitoring includes alpha and beta-gamma monitoring as well as flow measurement and flow totalizing. If the concentration of radionuclides exceeds the alarm limit, an alarm is sounded in the dispatcher's office, a verification sample is automatically collected and the stream is automatically diverted to the covered 216-A-42 Retention Basin. The monitoring system is checked for functionality once a month and is calibrated every 6 months. 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.

7.2.3.2 Steam Condensate Discharge Monitoring/Sampling Specifications. Table 7-6 describes the normal operating parameters for the SCD stream.

7.2.3.3 Steam Condensate Discharge Monitoring/Sampling Deficiencies. The deficiencies previously described for the CWL effluent (Section 5.2.1.3) also apply. These deficiencies are the lack of backup power and the inability of laboratory 222-S to detect certain radionuclides at levels that are meaningful for future environmental compliance issues. (WHC 1990g).

7.2.4 Chemical Sewer Line Effluent Monitoring/Sampling System

7.2.4.1 Chemical Sewer Line Monitoring/Sampling Description. The CSL monitoring equipment is located in the 295-AC Building and includes continuous pH and beta-gamma radiation monitoring and continuous flow monitoring. Excursions above or below pH limits, beta/gamma radiation alarm limits, and flow rates below set limits results in alarms in the central control room. Radiation and pH alarm points trigger 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.

7.2.4.2 Chemical Sewer Line Monitoring/Sampling Specifications. Table 7-7 describes the normal operating parameters for the CSL stream.

7.2.4.3 Chemical Sewer Line Monitoring/Sampling Deficiencies. The deficiencies previously described for the CWL effluent (Section 5.2.1.3) also apply. These deficiencies are the lack of backup power and the inability of

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the 222-S Laboratory to detect certain radionuclides at levels that are meaningful for future environmental compliance issues (WHC 1990g).

7.2.5 Liquid Effluents Monitoring Program

The currently available alpha and beta/gamma monitoring equipment is inadequate for determining compliance with discharge criteria. As a result, 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 the DOE.

7.2.6 Liquid Effluent Sampling Program

The sampling program for liquid effluent 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 7-8.

7.2.6.1 Cooling Water Line Effluent Stream. The CWL composite sampling equipment is located in the 295-AD Building. During stream operation, a 7-day composite sample shall be collected weekly and recomposited monthly for radiochemical and metal analyses. In addition, the pH of the CWL stream shall be determined from each weekly composite sample.

Grab samples shall be collected quarterly from the flow in 295-AD Building. The grab sample shall be analyzed for pH, major cations, major anions, metals, radionuclide, and organic chemical concentrations.

During the first and third quarters, a complete gas chromatograph (GC)/mass spectrometer (MS) analysis of the effluent shall be performed. Using analytical techniques that are comparable to EPA-SW 846 Method 8270 (EPA 1986) for detection capability. During the second and fourth quarters, organic analyses shall only include gas (GC) methods, comparable to EPA-SW 846 Methods 8010 and 8020 (EPA 1986), for determination of volatile organic chemicals. If four consecutive quarterly analyses show that organic chemicals are below detection limits, the sampling and analytical requirements for organic chemicals may be reevaluated for reduction in scope.

7.2.6.2 Chemical Sewer Line 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 metals analyses in accordance with WHC-CM-7-5 (WHC 1991a). In addition, the pH of the CWL stream shall be determined from each weekly composite sample.

Grab samples shall be collected quarterly. The grab sample shall be analyzed for pH, major cations, major anions, metals, radionuclide, and organic chemical concentrations.

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During the first and third quarter, a complete GC/MS analysis of the effluent shall be performed. Using analytical techniques that are comparable to EPA-SW 846 Method 8270 (EPA 1986) for detection capability. During the second and fourth quarters, organic analyses shall only include GC methods, comparable to EPA-SW 846 Methods 8010 and 8020 (EPA 1986), for determination of volatile organic chemicals. If four consecutive quarterly analyses show that organic chemicals are below detection limits, the sampling and analytical requirements for organic chemicals may be reevaluated for reduction in scope.

7.2.6.3 Steam Condensate Discharge Effluent Stream. The SCD composite sampling equipment is located in the 295-A Building. During stream operation, a 7-day composite sample shall be collected weekly and recomposited monthly for radiochemical and metals analyses. In addition, the pH of the CWL stream shall be determined from each weekly composite sample.

Grab samples shall be collected quarterly. The grab sample shall be analyzed for pH, major cations, major anions, metals, radionuclide, and organic chemical concentrations.

During the first and third quarters, a complete GC/MS analysis of the effluent shall be performed. Using analytical techniques that are comparable to EPA-SW 846 Method 8270 (EPA 1986) for detection capability. During the second and fourth quarters, organic analyses shall only include GC methods, comparable to EPA-SW 846 Methods 8010 and 8020 (EPA 1986), for determination of volatile organic chemicals. If four consecutive quarterly analyses show that organic chemicals are below detection limits, the sampling and analytical requirements for organic chemicals may be reevaluated for reduction in scope.

7.2.6.4 Diverted Effluent. Upon receipt of a HIGH RADIATION alarm from the stream radiation monitors, additional samples shall be collected from the affected waste streams. These samples can be collected using the equipment provided for verification sampling.

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 per Westinghouse Hanford plant operating procedure. Assuming the initial sample results meet acceptable criteria, the basin will be pumped to the 216-B-3 Pond. Before pumping the basin, additional samples will be taken for environmental release record keeping.

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Table 7-1. Radioactive Sampling Requirements for the Plutonium-Uranium Extraction Plant During Standby.*

Stack	Sampling/analysis requirements*	
	Total alpha/beta	Selective radionuclide(s)
291-A-1	Yes	⁹⁰ Sr ²³⁹ Pu
296-A-1	Yes	²³⁹ 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 CFR (EPA 1989a).

Table 7-2. Current Monitoring and Sampling.*

Constituent	Time period	Sampling analytical limit (μCi/mL)	Required detection limit (μCi/mL)
Total Alpha	Annual Avg.	5.0 E-15	6.1 E-15
Total Beta	Annual Avg.	4.0 E-14	2.4 E-12
⁹⁰ Sr	Annual Avg.	2.0 E-14	2.4 E-12
²³⁹ Pu	Annual Avg.	1.0 E-14	6.2 E-15
²⁴¹ Am	Annual Avg.	6.0 E-15	6.1 E-15

*Calculated from NESHAP Standards (EPA 1989a) for required monitoring.

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Table 7-3. 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 ¹ (60-ft)	Alpha, beta	Continuous	M	CPRM ²
SPL-V18-1 (74-ft)	⁹⁰ Sr, ²³⁹ Pu	Weekly	S	Record Sampler
SPL-V19-1 (60-ft)	⁹⁰ Sr, ²³⁹ Pu	Weekly	S	Record Sampler
Stack 296-A-1				
RM-V29A-1	Alpha	Continuous	M	Eberline Alpha CAM
SPL-V28A-1	²³⁹ Pu, ²⁴¹ Am	Weekly	S	Record Sampler

¹Moving Filters Radiological Aerosol Monitor; will be deactivated during PUREX standby and replaced with annual average method.

²Continuous Particulate Release Monitor.

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Table 7-4. Comparison of the Plutonium-Uranium Extraction Plant
Liquid Effluent Qualities¹ and State Approved Land Disposal
Structure Acceptance Criteria. (4 sheets)

Analyte	Acceptance criterion	CWL ⁵	SCD ⁵	CSL ⁵ IX Regen ²	CSL ⁵ Routine
Inorganic Compounds - Metals ³					
Aluminum	50			499	341
Antimony	5				
Arsenic	50				
Barium	1,000	32	30	113	34
Beryllium	1				
Boron	NC	25	24		22
Cadium	5			11	
Calcium	NC	1.9 E+04	1.8 E+04	5.9 E+04	1.9 E+04
Chromium	50				
Copper	1,000	11		1,310	40
Iron	300	53	32	675	443
Lead	5			30	6
Magnesium	NC	4.5 E+03	4.3 E+03	1.2 E+04	4,350
Manganese	50	7		58	30
Mercury	2			1.7	0.1
Nickel	100			15	
Potassium	NC	772	713	3,360	740
Selenium	10				
Silicon	NC	2.6 E+03	2.3 E+03		2,910
Silver	50			17	
Sodium	NC	2.2 E+03	2.1 E+03	4.0 E+05	2,160
Strontium	NC	100	88	353	95
Thallium	1				
Uranium	NC	0.5	0.6	1.3	0.6
Zinc	5,000	8	6	416	25

Table 7-4. Comparison of the Plutonium-Uranium Extraction Plant Liquid Effluent Qualities¹ and State Approved Land Disposal Structure Acceptance Criteria. (4 sheets)

Analyte	Acceptance criterion	CWL ⁵	SCD ⁵	CSL ⁵ IX Regen ²	CSL ⁵ Routine
Inorganic compounds - Ionic Species ³					
Ammonium	NC	52		79	63
Chloride	2.5 E+05	1.2 E+03	1.0 E+03	2.6 E+04	1.8 E+03
Cyanide	200			12	
Fluoride	2,000	146	123		154
Fluoride (IC)	NC			3,390	
Fluoride (ISE)	NC			213	
Nitrate	10,000	628	582	7.0 E+04	588
Nitrate	1,000				
Sulfate	2.5 E+05	1.1 E+04	9.8 E+03	1.5 E+06	1.3 E+04
Organic Compounds ³					
Acetone	NC	11	10	148	
1-Butanol	NC		24		
2-Butanone	NC	10			
Butylated					
Hydroxytoluene	NC	10			10
Chloroform	6			240	
Dibutyl phosphate	NC				
Dichloromethane	5	6		15	
Tributylphosphate	NC		12		
Other Parameters ³					
Alkalinity	NC	6.2 E+04	5.8 E+04		6.6 E+04
Conductivity (μS)	NC	154	146	3,990	158
pH (dimensionless)	6.5-8.5	7.9	7.7	6.6	7.8
TDS	5.0 E+05	7.2 E+04	6.6 E+04		6.5 E+04
Temperature (°C)	NC	20	22	29	28
TOC	NC	1.1 E+03	1.1 E+03	1.08 E+04	

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Table 7-4. Comparison of the Plutonium-Uranium Extraction Plant Liquid Effluent Qualities¹ and State Approved Land Disposal Structure Acceptance Criteria. (4 sheets)

Analyte	Acceptance criterion	CWL ⁵	SCD ⁵	CSL ⁵ IX Regen ²	CSL ⁵ Routine
Other Parameters ³ (continued)					
Total Carbon	NC	1.6 E+04	1.5 E+04		1.5 E+04
TOX (as Cl)	NC	11	8	266	99
Radionuclides ^d					
Total Alpha	15		7	4	1
Total Beta	20		224	11	2
^{226,228} Ra	5.0 E+00		<4.4 E+00		<1.9 E-01
Gross uranium-natural	2.4 E+01				4.9 E+02
³ H	2.0 E+01				4.9 E+02
¹⁴ C		6.3 E+00			4.28 E+00
⁹⁰ Sr	8.0 E+00	3.9 E-01	3.3 E+00		
¹²⁹ I	2.0 E+01	1.5 E-01			
¹³⁷ Cs	1.2 E+02		1.6 E-01		4.6 E-01
¹⁴⁴ Ce/Pr	2.8 E+02		3.4 E+02		
¹⁴⁷ Pm	8.0 E+04				
²³⁴ U	2.0 E+01	2.6 E-01	2.6 E-01		1.9 E-01
²³⁸ Pu	1.6 E+00		5.5 E-01		1.6 E-02
²³⁸ U	2.4 E+01	1.9 E-01	1.8 E-01		1.6 E-01
^{239,240} Pu	1.2 E+00		7.2 E+00		5.3 E-01
^{239,240} U	1.2 E+03	3.5 E-03			
²⁴¹ Am	1.2 E+00	4.8 E-03	8.7 E-01		2.0 E-01
Stream-Specific Report (WHC 1990a) Addendum Number		Addendum 20	Addendum 5	Addendum 2	Addendum 2
Approximate Average Flow Rate (L/mo)		5.2 E+08	4.3 E+07		7.7 E+07
Estimated Flow Rate for PUREX Shutdown Condition (L/mo)		1.0 E+07	1.0 E+07		5.0 E+07

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Table 7-4. Comparison of the Plutonium-Uranium Extraction Plant Liquid Effluent Qualities¹ and State Approved Land Disposal Structure Acceptance Criteria. (4 sheets)

Analyte	Acceptance criterion	CWL ⁵	SCD ⁵	CSL ⁵ IX Regen ²	CSL ⁵ Routine
Estimated Flow Rate for PUREX Standby Condition (L/mo)		0	0		5.0 E+07
Discharge Point		216-B-3 Pond	216-A-30 and 216-A-37-2 Cribs		216-B-3 Pond

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

²Effluent quality for CSL waste stream during ion exchange regeneration operations.

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

⁴Effluent concentrations for radionuclides expressed as picocuries per liter.

⁵Abbreviations used:

CWL = cooling water stream

SCD = steam condensate stream

CSL = chemical sewer stream (ion exchanger regeneration and routine operations)

TDS = total dissolved solids

TOC = total organic carbon

TOX = total organic halides

MS = microsiemen

IC = fluoride analysis using ion chromatography technique

ISE = fluoride analysis using ion-specific electrode technique.

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Table 7-5. Cooling Water Normal Operating Parameters.

Parameter	Measurement unit	Parameter range		Monitor identification
		Low value	High value	
Flow	gal/min	0	12,000	FR-W10-1-1
Low flow alarm	--	--	--	FA-W10-1-1
Beta-Gamma Recorder	cpm	normal = <300	1,000	RR-W10-7-1
High B/ γ alarm	%of chart $\mu\text{Ci/mL } ^{137}\text{Cs}$	--	90% 8 E-05	RA-W10-7-1
Gross Alpha	counts	0 normal = <50	100	RR-W-10-1-1
High Alpha alarm	$\mu\text{Ci/mL}$	--	3 E-04	RA-W10-1-1
Flow Totalizer	--	--	--	FQI-W10-1-1
Diversion alarm	--	--	--	FDA-W10-9-1
Sampler/monitor Low flow alarm	gal/min	0.5	--	
pH	dimensionless	6	9	weekly sample
Conductivity	$\mu\text{S/cm}$	1.4 E+01	1.4 E+02	special sample
Temperature	$^{\circ}\text{C}$	10.0	31.4	special sample

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Table 7-6. Steam Condensate Discharge Normal Operating Parameters.

Parameter	Measurement unit	Parameter range		Monitor identification
		Low value	High value	
Flow Recorder	% Gal/Min	0 0 (300)	100 1,000	FR-W30-1-1
Flow Totalizer	Gal			FQI-W30-1-1
Alpha Recorder	Counts/Minute	0	10 E+06	RR-W30-12-1
Beta/Gamma Recorder	Counts/Minute	10	10 E+06	RR-W30-3-1
High Alpha Alarm	Counts/1,000 Seconds	N/A	33	RA-W30-12-1
High Gamma Alarm	Counts/Minute	N/A	70,000 (60% of chart)	RA-W30-3-1
Flow Diversion Alarm	N/A	N/A	N/A	FDA-W30-7-2
Catch Tank Overflow Alarm	in. H ₂ O g	N/A	109	WFA-30-5-1
Uranium	g/L	1 E-06	1 E-02	Weekly Sample
pH	N/A	7 7	11 12	Weekly Sample Grab Sample
Total Alpha	μCi/L	1 E-05 1 E-05	3 E-04 6 E-04	Weekly Sample Grab Sample
Total Beta	μCi/L	1 E-04 1 E-04	1 E-02 2 E-02	Weekly Sample Grab Sample

Numbers in parentheses indicate average value.
N/A = Not Applicable.

Table 7-7. 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	Units	Alarm Set 5.0	Points 11.0	NE-W20-19-1
Total Alpha	$\mu\text{Ci/mL}$	0	2.0 E-05	Laboratory Analyses
Total Beta	$\mu\text{Ci/mL}$	0	1.2 E-06	Laboratory Analyses
^3H	$\mu\text{Ci/mL}$	0	1.2 E-02	Laboratory Analyses
^{90}Sr	$\mu\text{Ci/mL}$	0	1.2 E-02	Laboratory Analyses
^{137}Cs	$\mu\text{Ci/mL}$	0	8.0 E-05	Laboratory Analyses
Flow	gal/min	1	1,400	FR-W20-1-1

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Sample location	Waste stream	Analytes	Sample frequency	Sample type	Analytical technique
295-AD	CWL	pH, Metals, Radionuclides	Monthly	C	Liquid Scintillation, ICP
241-A-201	CWL	pH, Metals, Radionuclides, VOC, EOC, Major Ions	First and Third Quarters	G	Liquid Scintillation, IC, GC/MS, ICP, Wet Chemistry
			Second and Forth Quarters	G	Liquid Scintillation, GC, ICP, Wet Chemistry
295-AC	CSL	pH, Metals, Radionuclides	Monthly	C	Liquid Scintillation, ICP
Manhole 4	CSL	pH, Metals, Radionuclides, VOC, EOC, Major Ions	First and Third Quarters	G	Liquid Scintillation, IC, GC/MS, ICP, Wet Chemistry
			Second and Forth Quarters	G	Liquid Scintillation, GC, ICP, Wet Chemistry
295-AA	SCD	pH, Metals, Radionuclides	Monthly	C	Liquid Scintillation, ICP
SCD Pumps	SCD	pH, Metals, Radionuclides, VOC, EOC, Major Ions	First and Third Quarters	G	Liquid Scintillation, IC, GC/MS, ICP, Wet Chemistry
			Second and Forth Quarters	G	Liquid Scintillation, GC, ICP, Wet Chemistry
295-AD, 295-AC, 295-AA (as appropriate)	Diverted Effluent	Radionuclides	Hourly during alarm and daily composite for 7 d after diversion ceases	G,C	Liquid Scintillation

C = composite
 EOC = base-neutral-acid extractable organic compounds
 G = grab
 IC = ion chromatography
 GC = gas chromatography
 ICP = inductively-coupled plasma atomic emission spectroscopy
 MS = mass spectroscopy
 VOC = volatile organic compounds.

Table 7-8. Sampling and Analysis Program for Liquid Effluents.

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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 six annual reports are listed below, but only 1990 annual report preliminary data presents data collected during standby conditions. PUREX is now in standby condition and will remain so until a projected 1997 restart or the initiation of terminal cleanout operations.

Annual Reports

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

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

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

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8.1.2 Upset Conditions

Upset operating conditions of each stack is described in Section 4.1.3.

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 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 standby condition data.

- 1990, *PUREX Liquid Effluent Monitoring Plan*, WHC-SD-CP-EMP-006, Westinghouse Hanford Company, Richland, Washington.
- 1990, *Stream Specific Reports*, WHC-EP-0342, Addenda 1-33, Westinghouse Hanford Company, Richland, Washington.
- 1990, Addendum 2, *PUREX Plant Chemical Sewer Stream-Specific Report*, WHC-EP-0342, Westinghouse Hanford Company, Richland, Washington.
- 1990, Addendum 5, *PUREX Plant Steam Condensate Stream-Specific Report*, WHC-EP-0342, Westinghouse Hanford Company, Richland, Washington.
- 1990, Addendum 12, *PUREX Plant Process Condensate Stream-Specific Report*, WHC-EP-0342, Westinghouse Hanford Company, Richland, Washington.
- 1990, Addendum 14, *PUREX Plant Ammonia Scrubber Condensate Stream-Specific Report*, WHC-EP-0342, Westinghouse Hanford Company, Richland, Washington.
- 1990, Addendum 20, *PUREX Plant Cooling Water Stream-Specific Report*, WHC-EP-0342, Westinghouse Hanford Company, Richland, Washington.

8.2.2 Upset Conditions

Upset operating conditions of each liquid discharge is given in Section 4.2.3.

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9.0 SAMPLE ANALYSIS

9.1 ANALYTICAL LABORATORY AND PROCEDURES

Requirements for the development, issuance, and control of instructions and procedures within the Analytical Labs are covered by WHC-CM-5-4, *Analytical Chemistry Services Laboratories Operating Instructions* (WHC 1988d). 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.

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 lab operations supporting analytical techniques. This would include such operations as packaging, shipping, etc.
3. **LE Series--Essential Materials Procedures.** These procedures cover the analysis of supplies, chemicals, metals, etc. using industry standard analyses such as 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:

- Title
- Author
- Issued By
- Laboratory Manager
- Release Date
- Review Date
- Document Number
- Revision/Modification
- Page Number.

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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 1990h). 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 1990h)
- SD-CD-QAPP-001, *Analytical Chemistry Services Laboratories Quality Assurance Plan* (WHC 1989b).

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

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 1988d) and individual analytical laboratory procedures.

The PUREX Plant has no formal chain of custody procedure. A formal chain of custody procedure similar to EII-5.1 "Chain of Custody" from WHC-CM-7-7 (WHC 1989c) should be adopted.

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9.3 U.S. DEPARTMENT OF ENERGY ANALYTICAL AND LABORATORY GUIDELINES

The analytical and laboratory procedures for the FEMP activities are identified in the *Quality Assurance Project Plan for the Facility Effluent Monitoring Plan Activities* (WHC 1991b). General requirements for laboratory procedures, data analyses, and statistical treatment are addressed in the *Quality Assurance Project Plan (QAPP)*. Detailed descriptions of these requirements are given in each FEMP.

The following elements are identified in *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE 1991).

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Table 9-1. Laboratory Procedures.

Element	Documentation
Sample identification system	To be provided when complete
Procedures preventing crosscontamination	Contained in 222-S Laboratory Analytical Procedures (identified in QAPP (WHC 1991b) Table 8-1)
Documentation of methods	Contained in 222-S Laboratory Analytical Procedures (identified in QAPP (WHC 1991b) Table 8-1)
Gamma emitting radionuclides	See QAPP Table 8-1
Calibration	See QAPP Table 8-1
Handling of samples	See QAPP Table 8-1
Analysis method and capabilities	See QAPP Table 8-1
Gross alpha, beta, and gamma measurements	See QAPP Table 8-1
Direct gamma-ray spectrometry	See QAPP Table 8-1
Beta counters	See QAPP Table 8-1
Alpha-energy analysis	See QAPP Table 8-1
Radiochemical separation procedures	To be provided when available
Reporting of results	To be provided when available
Counter calibration	See Table 8-1, QAPP
Intercalibration of equipment and procedures	To be provided when available
Counter background	Contained in 222-S Laboratory Analytical Procedures (QAPP, Table 8-1)
Quality assurance	To be provided when available

Table 9-2. Data Analyses and Statistical Treatment.

Element	Documentation
Summary of data and statistical treatment requirements	To be provided when available
Variability of effluent and environmental data	To be provided when available
Summarization of data and testing for outliers	To be provided when available
Treatment of significant figures	To be provided when available
Parent-decay product relationships	To be provided when available
Comparisons to regulatory or administrative control standards and control data	To be provided when available
Quality assurance	To be provided when available

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10.0 NOTIFICATION AND REPORTING REQUIREMENTS

Notification and reporting requirements are imposed by federal and state law as well as by DOE orders. Since DOE and EPA documents are periodically updated, the current requirements should be obtained from the latest CFR, DOE order, etc. 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 FEDERAL REQUIREMENTS

10.1.1 Resource Conservation and Recovery Act of 1976

Resource Conservation and Recovery Act of 1976 (RCRA) requires biennial reports to be submitted to the regional administrator of EPA. The 40 CFR 262, Subpart D (EPA 1988c), sets forth the reporting requirements for generators of hazardous waste that ship waste offsite or who 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 1988a), and 40 CFR 265, Subpart E (EPA 1988b).

10.1.2 Comprehensive Environmental Response, Compensation, and Liability Act of 1980

The 40 CFR 302 (EPA 1989c) contains reportable quantities and notification requirements for releases of hazardous substances as designated by CERCLA and the *Clean Water Act of 1977*.

10.1.3 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 1989a). NESHAP requires that an annual report be submitted to EPA headquarters and the appropriate regional office.

10.2 STATE REQUIREMENTS

10.2.1 Generator Reporting

Generator reporting requirements are found in WAC 173-303-220 (WAC 1987a). The state requires that annual reports covering the preceding year be submitted by March 1 to Ecology.

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10.2.2 Facility Reporting

Owners or operators of TSD facilities are also required to prepare and submit annual reports. These also must be submitted by March 1 and cover facility activities for the previous year. The specific content requirements are in WAC 173-303-390 (WAC 1987a).

Effluents from PUREX in the standby mode do not contain hazardous or dangerous wastes; therefore, PUREX operations are not subject to RCRA or WAC 173 reporting requirements. Westinghouse Hanford would only have to comply with the above federal and state reporting requirements if the facility operations change and discharges (either liquid or gaseous) from the PUREX facility contain a hazardous or dangerous component.

10.3 U.S. DEPARTMENT OF ENERGY REQUIREMENTS

10.3.1 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), 5000.3A (DOE 1990b), 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 1988a).

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.

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

Annual Radiation Exposure Reports are required to be submitted to the System Safety Development Center by March 31 for the preceding calendar year. 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.

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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 U.S. Department of Energy, Field Office, Richland (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 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. For a listing of occurrences requiring a Type A or Type B investigation see Chapter I of DOE Order 5484.1.

Contractors are required to verbally notify responsible SQA environmental protection officials within 24 h 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 that exceed DOE requirements and/or contractor specific radiological release concentration guides.

Following verbal notifications, written reports must be submitted according to procedures in DOE Order 5000.3A (DOE 1990b).

10.3.3 U.S. Department of Energy Order 5000.3A Occurrence Reporting and Processing of Operations Information

This order sets forth notification and follow-up requirements for a variety of reportable occurrences. Categorization of reportable occurrences should be made as soon as possible. Guidance to categorization and definitions can be found in Section 7.0 of this order.

Emergency occurrences must be reported to DOE and offsite authorities within 15 min or less of categorization. Written notification must be made within 24 h.

Unusual occurrences must be reported to DOE within 2 h of categorization. Written notification shall be made within 24 h.

Off-normal occurrences must be reported via written notification within 24 h of categorization.

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In addition, follow-up oral notification shall also be made to DOE if any further degradation in the level of safety of the facility or other worsening conditions occur, when there is any change from one emergency action level to another, or upon termination of an emergency.

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11.0 INTERFACE WITH THE OPERATIONAL ENVIRONMENTAL SURVEILLANCE PROGRAM

11.1 DESCRIPTION

The sitewide Environmental Monitoring Plan (EMP), as described in the FEMP Management Plan (WHC 1991c), consists of two distinct but related components: environmental surveillance conducted by Pacific Northwest Laboratory (PNL) and effluent monitoring conducted by Westinghouse Hanford. The responsibilities for these two portions of the EMP are delineated in a Memorandum of Understanding (PNL 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) environmental monitoring. Projected EDEs, reported in this FEMP, are the products of in-line effluent monitoring. Near-field monitoring is required by Part O, "Environmental Monitoring," *Environmental Compliance Manual* (WHC 1991a), and procedures are described in *Operational Environmental Monitoring* (WHC 1988f).

11.2 PURPOSE

The purpose of near-field monitoring is to determine the effectiveness of environmental controls in preventing unplanned spread of contamination from facilities and sites managed by Westinghouse Hanford under the approval of DOE. Effluent monitoring and reporting, monitoring of surplus and waste management units, and monitoring near-field environmental media are, therefore, conducted by Westinghouse Hanford for the purposes of: controlling operations, determining the effectiveness of facility effluent controls, measuring the adequacy of containment at waste transportation and disposal units, detecting and monitoring upset conditions, and evaluating and upgrading effluent monitoring capabilities.

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 DOE Orders 5400.1, *General Environmental Protection Program* (DOE 1988a); 5400.5, *Radiation Protection of the Public and the Environment* (DOE 1990a); 5484.1, *Protection, Safety, and Health Protection Information Reporting System* (DOE 1983); 5820.2A, *Radioactive Waste Management* (DOE 1988b); and DOE/EH-0173T, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE 1991), are addressed through this activity.

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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 at the capture location.

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, Westinghouse Hanford relies upon 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 (WHC 1988f).

Additionally, surveys to detect surface radiological contamination, scheduled in WHC-CM-7-4, 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 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.

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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 environmental monitoring program are published in the WHC-EP-0145 (WHC 1988g), *Westinghouse Hanford Company Environmental Surveillance Annual Report* (WHC 1988g). 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) 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.

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12.0 QUALITY ASSURANCE

12.1 PURPOSE

The Quality Assurance Program Plan (QAPP) WHC-EP-0446 (WHC 1991b) describes the QA requirements associated with implementing FEMPs. The plan identifies the FEMP activities and assigns the appropriate QA requirements defined by the Westinghouse Hanford *Quality Assurance Manual*, WHC-CM-4-2 (WHC 1988e). This QAPP shall be consistent with the requirements in DOE 5700.6B, "Quality Assurance" (DOE 1986). In addition, QA requirements in 40 CFR 60, Appendix A, "Reference Methodologies" (EPA 1990) shall be considered when performing monitoring calculations and establishing monitoring systems.

12.2 OBJECTIVE

The objective of the plan is to provide a documented QA plan describing QA requirements for facilities implementing the FEMPs.

12.3 REQUIREMENTS

A QAPP has been developed to implement the overall QA program requirements defined by WHC-CM-4-2, (WHC-EP-0446) and 40 CFR 61, Method 114, Appendix B (EPA 1989a). The QAPP applies specifically to the field activities, laboratory analyses, and continuous monitoring performed for all FEMPs conducted by Westinghouse Hanford. Plans and procedures referenced in the QAPP are available for regulatory review upon request by the direction of the Westinghouse Hanford Environmental Assurance Manager. Westinghouse Hanford supporting activities for FEMP activities are described in the QAPP (see Table B-1).

12.4 FACILITY SPECIFIC REQUIREMENTS

The QAPP includes a list of analytes of interest and analytical methods for RCRA groundwater monitoring at the Hanford Site SALDS criteria.

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13.0 INTERNAL AND EXTERNAL PLAN REVIEW

The DOE Order 5400.1, *General Environmental Protection Program* (DOE 1988a), Chapter IV.4 requires the facility effluent monitoring plan be reviewed annually and updated every 3 yr. 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, waste treatment, or 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 yr. Operations management shall maintain records of reports on measurements of stack particulates or other nonradioactive hazardous pollutant emissions for 3 yr.

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 Environmental Protection 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 Environmental Protection and submitted to EPA as well as DOE-HQ.

Facility management is to obtain the environmental protection 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.

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14.0 COMPLIANCE ASSESSMENT

A comparison of M/S system capabilities to regulatory and other requirements was completed to determine which areas were not in compliance. This section summarizes that comparison.

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. For Stacks 291-A-1 and 296-A-1, EPA flow measurement requirements for continuous sampling are not met. Laboratory analysis and chain-of-custody procedures are adequate to maintain sample accuracy and reliability. All QA documentation to ascertain full compliance with 40 CFR 61 (EPA 1989a) is not available.

Current water effluents are periodically sampled and analyzed. This technique meets established standards for discharge to 216-B-3 Pond and 216-A-30 and 216-A-37-2 Cribs. Future discharge to a State Approved Land Disposal System 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 has the capability to accurately characterize the stream's general parameters such as flow rate, loss of flow, temperature, pH, etc. These general parameters are also appropriate to indicate changes in the effluents. Laboratory analysis can be selected to characterize any desired effluent parameter.

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14.1.4 Comparison of Projected Effluent Characteristics with Historical Data

Historical data used to project effluent characteristics throughout this FEMP were edited so that only data representing standby conditions were used. Therefore, the projected characteristics are the same as the selected historical effluent data.

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 Westinghouse Hanford Company 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; however, compliance with the intent of SALDS acceptance criteria will likely require equipment upgrades in the liquid effluent M/S system.

14.4 CLEAN AIR ACT REQUIREMENTS

A point-by-point evaluation of the *Clean Air Act of 1977* (NESHAP) requirements is being conducted by the facility at this time and will be incorporated in this document in the next revision.

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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, ^{239}Pu , and ^{90}Sr .

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}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 wastestreams 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 Section 14.1.1.

15.2.2 Sampling Requirements for Liquid Effluents

Composite and grab samples will be analyzed for radioactive, organic, and non-radioactive inorganic constituents. Composite samples will be collected and analyzed monthly; grab samples will be collected quarterly to verify the data reported in the monthly composite program. In addition, the quarterly analyses will include both GC and GC/MS determinations for organic constituents. The GC and GC/MS methods will be used in alternate quarters to maximize sensitivity in the detection of volatile organic chemicals (GC) and the capability for screening a broad variety of organic chemicals (GC/MS). The sampling and analytical program is detailed in Section 7.2.6.

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**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 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}Pu and ^{241}Am 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

The selection of analytes for characterization is not uniform nor is it consistent with the discharge criteria parameters. Some effluent concentrations exceed the SALDS acceptance criteria. The wastestream characterizations must be refined before discharge to the SALDS commences. (See Table 7-4 for SALDS acceptance criteria.)

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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.
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- Clean Water Act of 1977*, 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.
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- EPA, 1989b, *Identification and Listing of Hazardous Waste*, Title 40, Code of Federal Regulations, Part 261.3, U.S. Environmental Protection Agency, Washington, D.C.
- EPA, 1989c, *Designation, Reportable Quantities and Notification*, Title 40, Code of Federal Regulations, Part 302, U.S. Environmental Protection Agency, Washington, D.C.
- EPA, 1989d, *National Interim Primary Drinking Water Regulations*, Title 40, Code of Federal Regulations, Part 141, as amended, U.S. Environmental Protection Agency, Washington, D.C.
- EPA, 1990, *Quality Assurance Methods*, Title 40, Code of Federal Regulations, Part 60, 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.
- 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.
- WAC, 1986, *Ambient Air Quality Standards and Emission Limits for Radionuclides*, WAC-173-480, Washington Administrative Code, Olympia, Washington.
- WAC, 1987a, *Dangerous Waste Regulations*, Washington Administrative Code 173-303, Washington State Department of Ecology, Olympia, Washington.
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WHC, 1991c, *Management Plan for Facility Effluent Monitoring Plan Activities*, WHC-EP-0491, Westinghouse Hanford Company, Richland, Washington.

16.2 STATE APPROVED LAND DISPOSAL STRUCTURE ACCEPTANCE CRITERIA

Acceptance Criteria for the 200 Area Treated Effluent Disposal Facility are displayed in the following table (Table 16-1).

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Table 16-1. Acceptance Criteria for 200 Area Treated Effluent Disposal Facility.¹ (7 sheets)

Analytical category: Analytes of interest	SDWA					WPCA		Basis
	Drinking Water Standards					Groundwater quality standards (mg/L)	Most restrictive limit (mg/L)	
	Current			Proposed				
	MCL (mg/L)	MCLG (mg/L)	SMCL (mg/L)	MCL (mg/L)	SMCL (mg/L)			
INORGANICS: METALS								
Aluminum					0.06		0.050	S,W
Antimony				0.01/0.005			0.005	W
Arsenic (III)	0.05			0.03		0.00005	0.00005	W
Arsenic (V)	0.05			0.03		0.00005	0.00005	S
Asbestos				7,000 F/mL			7,000 F/mL	S
Barium	1.00			5.0		1.000	1.000	S,W
Boron								
Beryllium				0.001			0.001	S,W
Cadmium	0.01			0.005		0.010	0.005	S
Calcium								
Chromium (VI)	0.05			0.1		0.050	0.050	S,W
Chromium (III)	0.05			0.1		0.050	0.050	S,W
Copper			1.0		1.0	1.000	1.000	S,W
Iron			0.3		0.3	0.300	0.300	S,W
Lead	0.05			0.011/0.005		0.050	0.005	S
Magnesium								
Manganese			0.05		0.05	0.050	0.050	S,W
Mercury	0.002			0.002		0.002	0.002	S,W
Nickel				0.1			0.100	S,W
Phosphorous								
Potassium								
Selenium	0.01			0.05		0.010	0.010	S,W
Silicon								
Silver	0.05				0.09	0.050	0.050	S,W
Sodium								
Thallium				0.002/0.001			0.001	S
Uranium								
Vanadium								
Zinc			5.0		5.0	5.000	5.000	S,W
INORGANICS: IONS								
Ammonium								
Carbonate								
Chloride			250.0		250.0	250.00	250.00	S,W
Cyanide				0.200			0.200	S
Fluoride	4,000	4,000	2,000	4,000	2,000	4,000	2,000	S
Nitrate (as Nitrogen)	10.00			10.0		10.000	10.000	S,W
Nitrite (as Nitrogen)				1.000			1.000	S
Sulfate			250.0	400/600	250.0	250.000	250.000	S,W
Sulfide								

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Table 16-1. Acceptance Criteria for 200 Area Treated Effluent Disposal Facility.¹ (7 sheets)

Analytical category: Analytes of interest	SDWA					WPCA		Basis
	Drinking Water Standards					Groundwater quality standards (mg/L)	Most restrictive limit (mg/L)	
	Current			Proposed				
	MCL (mg/L)	MCLG (mg/L)	SMCL (mg/L)	MCL (mg/L)	SMCL (mg/L)			
MISCELLANEOUS								
Ammonia						20.00**	20.0	W
Corrosivity			Noncorr.		Noncorr.	Noncorr.	Noncorr.	S,W
Color			15 CU		15 CU	15 CU	15 CU	S,W
Foaming Agents			0.5		0.5	500.0	0.5	S,W
Ores			3 TON		3 TON	3 TON	3 TON	S,W
pH			6.5-8.5		6.5-8.5	6.5-8.5	6.5-8.5	S,W
Total Dissolved Solids			500.0		600.0	500.0	500.0	S,W
Direct Black 38						0.000009	0.000009	W
Direct Blue 6						0.000009	0.000009	W
Direct Brown 95						0.000009	0.000009	W
RADIONUCLIDES								
²⁴¹ Am								
¹³⁷ Cs								
¹⁵⁵ Eu								
Gross Alpha	15 pCi/L					15 pCi/L	15 pCi/L	S,W
Gross Beta	4 mrem/yr					20 pCi/L	20 pCi/L	W
¹²⁹ I								
²³⁸ Pu								
²³⁹ Pu								
²⁴⁰ Pu								
²⁴¹ Pu								
¹⁴⁷ Pm								
^{226,228} Ra	5 pCi/L					5 pCi/L	5 pCi/L	S,W
²²⁵ Ra	3 pCi/L					3 pCi/L	3 pCi/L	S,W
¹⁰³ Ru								
¹⁰⁶ Ru								
⁸⁰ Sr						8 pCi/L	8 pCi/L	W
¹⁰⁵ Sn								
Tritium						20,000 pCi/L	20,000 pCi/L	W
ORGANICS: PAHs								
Polynuclear Aromatics						0.00001	0.00001	W
Hydrocarbons (PAHs)								
Benzo(a)pyrene				0.0002		0.000008	0.000008	W
Benzo(a)anthracene				0.0001			0.0001	S
Benzo(b)fluoranthene				0.0002			0.0002	S
Benzo(k)fluoranthene				0.0002			0.0002	S
Chrysane				0.0002			0.0002	S

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Table 16-1. Acceptance Criteria for 200 Area Treated Effluent Disposal Facility.¹ (7 sheets)

Analytical category: Analytes of interest	SDWA					WPCA		Basis
	Drinking Water Standards					Groundwater quality standards (mg/L)	Most restrictive limit (mg/L)	
	Current			Proposed				
	MCL (mg/L)	MCLG (mg/L)	SMCL (mg/L)	MCL (mg/L)	SMCL (mg/L)			
ORGANICS: PAHs (continued)								
Dibenz(a,b)-anthracene				0.0003			0.0003	S
Indenopyrene				0.0004			0.004	S
ORGANICS: BENZENES								
Azobenzene						0.0007	0.0007	W
Benzene	0.005	0.000		0.005		0.001	0.001	W
1,4-Dichlorobenzene						0.004	0.004	W
para-Dichlorobenzene	0.075	0.075		0.076	0.005		0.005	S
ortho-Dichlorobenzene				0.6	0.01		0.01	S
Ethylbenzene				0.7	0.03		0.03	S
Hexachloroene				0.001		0.00005	0.00005	W
Monochlorobenzene				0.1			0.1	S
1,2,4-Trichlorobenzene				0.009			0.009	S
o-Chloronitrobenzene						0.003	0.003	W
p-Chloronitrobenzene						0.005	0.005	W
ORGANICS: OTHER AROMATICS								
Benzotrichloride						0.000007	0.000007	W
Styrene				0.005/0.1	0.01		0.005	S
Toluene				2.0	0.04		0.04	S
2,6-Dinitrotoluene						0.0001	0.0001	W
2,6-Dinitrotoluene						0.0001	0.0001	W
p,a,a,a-Tetrachlorotoluene						0.000004	0.000004	W
Xylene (total)				10.0	0.02		0.02	S
ORGANICS: PHENOLICS								
Pentachloropnenol				0.2	0.03		0.03	S
2,4,5-Trichlorophenol						0.004	0.004	W
ORGANICS: PHTHALATES								
Ble(2-ethylhexyl) phthalate				0.004		0.006	0.004	S
Butylbenzylphthalate				0.1			0.1	S
Methylene chloride (Dichloromethane)						0.006	0.006	W
Trichloromethane (Chloroform)	0.1					0.007	0.007	W
Total Trihalomethanes	0.1						0.1	S
Dibromochloropropane				0.0002			0.0002	S
1,2-Dichloropropane				0.006		0.0006	0.0006	W

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Table 16-1. Acceptance Criteria for 200 Area Treated Effluent Disposal Facility.¹ (7 sheets)

Analytical category: Analytes of interest	SDWA					WPCA		Basis
	Drinking Water Standards					Groundwater quality standards (mg/L)	Most restrictive limit (mg/L)	
	Current			Proposed				
	MCL (mg/L)	MCLG (mg/L)	SMCL (mg/L)	MCL (mg/L)	SMCL (mg/L)			
ORGANICS: ADIPATES								
Di(ethylhexyl)-adipate				0.5			0.5	S
ORGANICS: ALKANES								
1,1-Dichloroethane						0.001	0.001	W
1,2-Dichloroethane	0.005	0.0		0.005		0.0005	0.0005	W
1,1,1-Trichloroethane	0.2	0.2		0.2		0.200	0.2	S,W
1,1,2-Trichloroethane				0.006			0.006	S
Bromodichloromethane						0.003	0.003	W
Bromoform						0.005	0.005	W
Carbon tetrachloride	0.005	0.0		0.005		0.0003	0.0003	W
Chlorodibromomethane						0.00055	0.0005	W
1,2 Dibromoethane						0.000001	0.000001	W
ORGANICS: ALKENES								
1,1-Dichloroethylene	0.007	0.007		0.007			0.007	S
cis-1,2-Dichloroethylene				0.07			0.07	S
trans-1,2-Dichloroethylene				0.1			0.1	S
Tetrachloroethylene				0.005		0.0008	0.0008	W
Trichloroethylene	0.005	0.0		0.005		0.003	0.003	S
Ethylene dibromide				0.00006		0.000001	0.000001	W
1,3-Dichloropropene						0.0002	0.0002	W
Hexachlorocyclopentadiene				0.05	0.005		0.005	S
Vinylchloride (Ethylenechloride)	0.002	0.0		0.002		0.00002	0.00002	S
ORGANICS: NITRILES								
Acrylonitrile						0.00007	0.00007	W
ORGANICS: AZINES/AZIDES								
1,2-Dimethylhydrazine						0.060	0.06	W
1,2-Diphenylhydrazine						0.00008	0.00008	W
Hydrazine/Hydrazine sulfate						0.00003	0.00003	W
ORGANICS: AMINES								
Aniline						0.014	0.014	W
4-Chloro-2-methylaniline						0.0001	0.0001	W
4-Chloro-2-methylaniline hydrochloride						0.0002	0.0002	W

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Table 16-1. Acceptance Criteria for 200 Area Treated Effluent Disposal Facility.¹ (7 sheets)

Analytical category: Analytes of interest	SDWA					WPCA		Basis
	Drinking Water Standards					Groundwater quality standards (mg/L)	Most restrictive limit (mg/L)	
	Current			Proposed				
	MCL (mg/L)	MCLG (mg/L)	SMCL (mg/L)	MCL (mg/L)	SMCL (mg/L)			
ORGANICS: AMINES (continued)								
2-Methoxy-6-nitroaniline						0.002	0.002	W
2-Methylaniline						0.0002	0.0002	W
2-Methylaniline hydrochloride						0.0005	0.0005	W
4,4'-Methylene bis(N,N'-dimethyl)-aniline						0.002	0.002	W
3,3'-Dichlorobenzidine						0.0002	0.0002	W
3,3'-Dimethoxybenzidine						0.006	0.006	W
3,3'-Dimethylbenzidine						0.000007	0.000007	W
Dimethylnitroamine						0.0000007**	0.0000007	W
N-Nitroso-di-n-butylamine						0.00002	0.000002	H
N-Nitrosodi-ethanolamine						0.00003	0.00001	H
N-Nitrosodi-ethylamine						0.00000006	0.0000006	W
N-Nitrosodi-methylamine						0.000002	0.000002	W
N-Nitroso-n-methyl-ethylamine						0.000004	0.000004	W
N-Nitrosodi-phenylamine						0.017	0.017	W
N-Nitroso-di-n-propylamine						0.00001	0.00001	W
N-Nitrosopyrroidine						0.00004	0.00004	W
o-Phenylenediamine						0.000005	0.000005	W
2,4-Toluenediamine						0.000002	0.000002	W
o-Toluidine						0.0002	0.0002	W
ORGANICS: ETHERS								
Bis(chloroethyl)-ether						0.00007	0.00007	W
Bis(chloromethyl)-ether						0.0000004	0.0000004	W
1,4-Dioxane						0.007	0.007	W
ORGANICS: BIPHENYLS								
Polychlorinated biphenyls (PCBs)				0.0005		0.00001	0.00001	W
Polybrominated biphenyls (PBBs)						0.00001	0.00001	W

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Table 16-1. Acceptance Criteria for 200 Area Treated Effluent Disposal Facility.¹ (7 sheets)

Analytical category: Analytes of interest	SDWA					WPCA		Basis
	Drinking Water Standards					Groundwater quality standards (mg/L)	Most restrictive limit (mg/L)	
	Current			Proposed				
	MCL (mg/L)	MCLG (mg/L)	SMCL (mg/L)	MCL (mg/L)	SMCL (mg/L)			
ORGANICS: DIOXINS/FURANS								
2,3,7,8-TCDD (Dioxin)				0.00000006		0.0000000006	0.0000000006	W
Hexachlorodibenzo-p- dioxin						0.00000001	0.00000001	W
ORGANICS: MISCELLANEOUS								
Acrylamide						0.00002	0.00002	W
Benzylchloride						0.0005	0.0005	W
Carbazols						0.006	0.006	W
Chlorthalonil						0.030	0.030	W
Epichlorohydrine						0.006	0.006	W
Ethoxytriethylene- glycol								
Ethyl acrylate						0.002	0.002	W
Ethylene thiourea						0.002	0.002	W
Furum						0.000002	0.000002	W
Furmecyclox						0.003	0.003	W
Mirex						0.00005	0.00005	W
Nitrofurazone						0.00006	0.00006	W
Propylene oxide						0.00001	0.00001	W
Trimethyl phosphate						0.002	0.002	W
ORGANICS: PESTICIDES								
Alachlor				0.002			0.002	S
Aldicarb				0.01			0.010	S
Aldicarb sulfoxide				0.01			0.010	S
Aldicarb sulfone				0.04			0.040	S
Aldrin/Dieldrin						0.000006	0.000006	W
Aramite						0.003	0.003	W
Atrazine				0.003			0.003	S
Carbofuran				0.04			0.040	S
Chlordane				0.002		0.00006	0.00006	W
2,4-D	0.1			0.07		0.100	0.070	S
Daiapon				0.2			0.200	S
DDT						0.0003	0.0003	W
Diallate						0.001	0.001	W
Dichlorvos						0.0003	0.0003	W
Dieldrin						0.000005	0.000005	W
Dinoseb				0.007			0.0070	S
Diquetas				0.02			0.020	S
Endothall				0.1			0.100	S
Endrin	0.0002			0.002		0.0002	0.0002	W,S
Furazolidone						0.00002	0.00002	W

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Table 16-1. Acceptance Criteria for 200 Area Treated Effluent Disposal Facility.¹ (7 sheets)

Analytical category: Analytes of interest	SDWA					WPCA		Basis
	Drinking Water Standards					Groundwater quality standards (mg/L)	Most restrictive limit (mg/L)	
	Current			Proposed				
	MCL (mg/L)	MCLG (mg/L)	SMCL (mg/L)	MCL (mg/L)	SMCL (mg/L)			
ORGANICS: PESTICIDES (continued)								
Folpet						0.020	0.020	W
Glyphosphate				0.7			0.700	S
Heptachlor (and hydroxide)				0.0004		0.00002	0.00002	W
Heptachlor epoxide				0.0002		0.000009	0.000009	W
Hexachlorocyclohexane (alpha)						0.000001	0.000001	W
Hexachlorocyclohexane (technical)						0.00005	0.00005	W
Lindane	0.004			0.0002		0.00006	0.00006	W
Methoxychlor	0.1			0.4		0.100	0.100	W,S
Oxamyl(vydate)				0.2			0.200	S
Phloram				0.6			0.600	S
Simazine				0.001			0.001	S
ORGANICS: PESTICIDES								
Toxaphene	0.006			0.005		0.00006	0.00006	W
2,4,5-TP (Silvex)	0.01			0.05		0.010	0.0100	W,S

This table is compiled from regulatory levels published in the Federal Safe Drinking Water Act and the Washington State Water Pollution control Act. The 200 Area waste streams intended for disposal in the TEDF are expected to contain some constituents that are not identified on this table. The Water Quality Standards for the State of Washington (WAC 173-200) state. "Where a criterion is not established for a contaminant, the enforcement limits in ground water shall equal the practical quantification level except: (a) where there is evidence that a lower concentration would better protect human health and the environment (based on published health advisories, risk assessments and other available information), the department shall establish a more stringent enforcement limit (b) if clear and convincing evidence can be provided to the department's satisfaction that an alternative concentration will provide protection to human health and the environment, the department may establish an enforcement limit higher than the practical quantification level."

- MCL = Maximum contaminant Level
- MCLG = Maximum Contaminant Level Goal
- SDWA = Federal Safe Drinking Water Act
- SMCL = Secondary Maximum Contaminant Level
- TON = Threshold Odor Number
- WPCA = Washington State Water Pollution Control Act
- mg/kg = milligrams per kilogram
- F/mL = fibers per milliliter
- pCi/L = picocuries per liter.

*Based on human health criteria for carcinogens. Value presented is based on 1.0 E-06 risk level.

**Calculated, using MTCA and WPCA formulas, and available reference dose and/or cancer potency factor data.

*Criteria is hardness dependent. Assumed harness equal to 30 mg/L as CaCO₃.

**Criteria is pH dependent. Assumed pH equal to 7.0.

***Criteria is pH and temperature dependent. Assumes pH equal to 7.0 and temperature equal to 20 °C.

Column marked "Basis" indicates source of "Most restrictive limit:"

- H = Health Based Limits
- L = Land Disposal Restrictions
- P = PQL
- S = SDWA
- W = WPCA.

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