0010805

WHC-EP-0342
Addendum 2

PUREX Plant Chemical Sewer Stream-Specific Report

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

Westinghouse
Hanford Company Richland, Washington

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

Approved for Public Release

This report has been reproduced from the best available copy.
Available in paper copy and microfiche.
The U.S. Department of Energy and its contractors can obtain copies of this report from:
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831
(615) 576-8401
This report is publicly available from:
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
(703) 487-4650

Printed in the United States of America

DISCLM-1.CHP (7-90)

START

0010805 134

WHC-EP-0342
Addendum 2

PUREX Plant Chemical Sewer Stream-Specific Report

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

Westinghouse
Hanford Company Richland, Washington

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

Approved for Public Release

THIS PAGE INTENTIONALLY
LEFT BLANK

START

WHC-EP-0342
Addendum 2

UC-630

PUREX Plant Chemical Sewer Stream-Specific Report

PUREX/UO_3 Operations

Date Published
August 1990

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

Westinghouse
Hanford Company
P.O. Box 1970
Richland, Washington 99352

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

Approved for Public Release

THIS PAGE INTENTIONALLY
LEFT BLANK

PUREX PLANT CSL
STREAM-SPECIFIC REPORT

PUREX/UO_3 Operations

ABSTRACT

The proposed wastestream designation for the PUREX Plan CSL wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations.* *A combination of process knowledge and sampling data was used to make this determination.*

*Ecology, 1989, *Dangerous Waste Regulations*, Washington (State) Administrative Code (WAC) 173-303, Washington State Department of Ecology, Olympia, Washington.

This page intentionally left blank.

EXECUTIVE SUMMARY

The proposed wastestream designation for the Plutonium-Uranium Extraction (PUREX) Plant CSL (sometimes called the Chemical Sewer wastestream), located in the 200 East Area of the Hanford Site, is that this stream is not a dangerous waste, pursuant to the Washington (State) Administrative Code (WAC) 173-303, *Dangerous Waste Regulations*.* This proposed designation is based on applying both process and sample data to the WAC 173-303 requirements for the three types of dangerous waste: (1) listed, (2) criteria, and (3) characteristic dangerous waste. Process data were based on process knowledge of the operation of the PUREX process and operations. Sample data are based on samples downstream of all process contributors. Five random samples were obtained during ion exchanger regeneration between August 1986 and March 1988 and six random samples were obtained between October 1989 and February 1990 during routine operation. The "listed" dangerous waste determination was made with process data supplemented with sampling data; the "criteria" and "characteristic" dangerous waste determinations were made with sampling data.

---

*Ecology, 1989, *Dangerous Waste Regulations*, Washington (State) Administrative Code (WAC) 173-303, Washington State Department of Ecology, Olympia, Washington.

This page intentionally left blank.

LIST OF TERMS

AFAN	ammonium fluoride and ammonium nitrate
AMU	aqueous makeup
DOE	U.S. Department of Energy
EC%	percent equivalent concentration
Ecology	Washington State Department of Ecology
EDTA	ethylenediaminetetraacetic
EP	extraction procedure
EPA	U.S. Environmental Protection Agency
HH	halogenated hydrocarbons
HVAC	heating, ventilation, and air conditioning
ISE	ion-specific electrode
P&O	Pipe & Operations (Gallery)
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyl
PUREX	Plutonium-Uranium Extraction
RCW	Revised Code of Washington
WAC	Washington (State) Administrative Code
90%CI	90% confidence interval

This page intentionally left blank.

CONTENTS

CONTENTS (continued)

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES (continued)

PUREX PLANT CSL STREAM-SPECIFIC REPORT

1.0 INTRODUCTION

1.1 BACKGROUND

In response to the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1989), comments were received from the public about reducing the discharge of liquid effluents into the soil column. As a result, the U.S. Department of Energy (DOE), with the concurrence of the Washington State Department of Ecology (Ecology) and the U.S. Environmental Protection Agency (EPA), committed to assess the contaminant migration potential of liquid discharges at the Hanford Site (Lawrence 1989).

This assessment is described in the *Liquid Effluent Study Project Plan* (WHC 1990a), a portion of which characterizes 33 liquid effluent streams. This characterization consists of integrating the following elements, pursuant to the Washington (State) Administrative Code (WAC) 173-303 (Ecology 1989): process data, sampling data, and dangerous waste regulations.

The results of the characterization study are documented in 33 separate reports, one report per wastestream. The complete list of stream-specific reports appears in Table 1-1. This document is one of the 33 reports.

1.2 APPROACH

This report characterizes the Plutonium-Uranium Extraction (PUREX) Plant CSL (sometimes called the Chemical Sewer wastestream), located in the 200 East Area of the Hanford Site, in sufficient detail so a wastestream designation, in accordance with WAC 173-303, can be proposed.

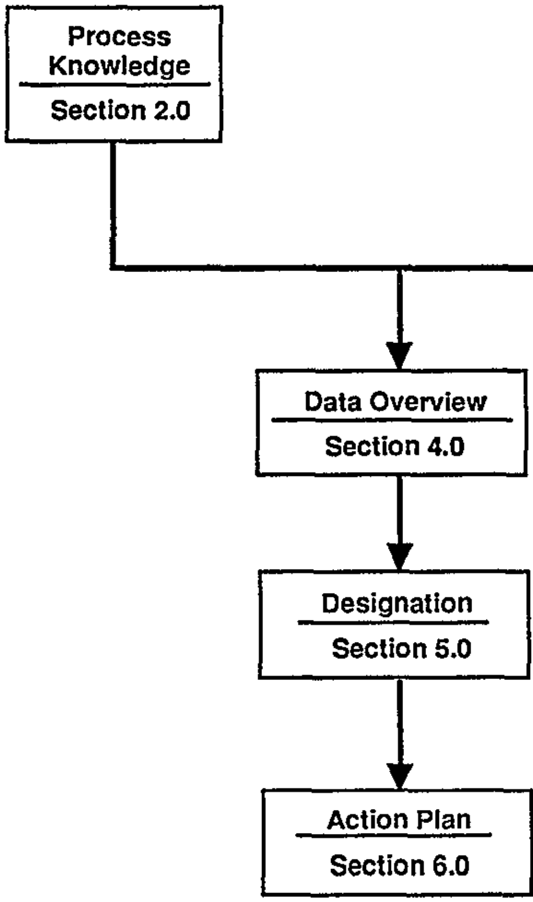
This characterization strategy (shown in Figure 1-1) is implemented by means of the following steps.

1. Describe both process and sampling data (Sections 2.0 and 3.0, respectively).
2. Integrate the data (Section 4.0).
3. Propose a designation (Section 5.0).
4. Design an action plan, if needed, to obtain additional characterization data (Section 6.0).

Table 1-1. Stream-Specific Characterization Reports.

WHC-EP-0342	Addendum 1	300 Area Process Wastewater
WHC-EP-0342	Addendum 2	PUREX Plant Chemical Sewer
WHC-EP-0342	Addendum 3	N Reactor Effluent
WHC-EP-0342	Addendum 4	163-N Demineralization Plant Wastewater
WHC-EP-0342	Addendum 5	PUREX Plant Steam Condensate
WHC-EP-0342	Addendum 6	B Plant Chemical Sewer
WHC-EP-0342	Addendum 7	UO_3/U Plant Wastewater
WHC-EP-0342	Addendum 8	Plutonium Finishing Plant Wastewater
WHC-EP-0342	Addendum 9	S Plant Wastewater
WHC-EP-0342	Addendum 10	T Plant Wastewater
WHC-EP-0342	Addendum 11	2724-W Laundry Wastewater
WHC-EP-0342	Addendum 12	PUREX Plant Process Condensate
WHC-EP-0342	Addendum 13	222-S Laboratory Wastewater
WHC-EP-0342	Addendum 14	PUREX Plant Ammonia Scrubber Condensate
WHC-EP-0342	Addendum 15	242-A Evaporator Process Condensate
WHC-EP-0342	Addendum 16	B Plant Steam Condensate
WHC-EP-0342	Addendum 17	B Plant Process Condensate
WHC-EP-0342	Addendum 18	2101-M Laboratory Wastewater
WHC-EP-0342	Addendum 19	UO_3 Plant Process Condensate
WHC-EP-0342	Addendum 20	PUREX Plant Cooling Water
WHC-EP-0342	Addendum 21	242-A Evaporator Cooling Water
WHC-EP-0342	Addendum 22	B Plant Cooling Water
WHC-EP-0342	Addendum 23	241-A Tank Farm Cooling Water
WHC-EP-0342	Addendum 24	284-E Powerplant Cooling Water
WHC-EP-0342	Addendum 25	244-AR Vault Cooling Water
WHC-EP-0342	Addendum 26	242-A Evaporator Steam Condensate
WHC-EP-0342	Addendum 27	284-W Powerplant Wastewater
WHC-EP-0342	Addendum 28	400 Area Secondary Cooling Water
WHC-EP-0342	Addendum 29	242-S Evaporator Steam Condensate
WHC-EP-0342	Addendum 30	241-AY/AZ Tank Farms Steam Condensate
WHC-EP-0342	Addendum 31	209-E Laboratory Reflector Water
WHC-EP-0342	Addendum 32	T Plant Laboratory Wastewater
WHC-EP-0342	Addendum 33	183-D Filter Backwash Wastewater

Figure 1-1. Characterization Strategy.



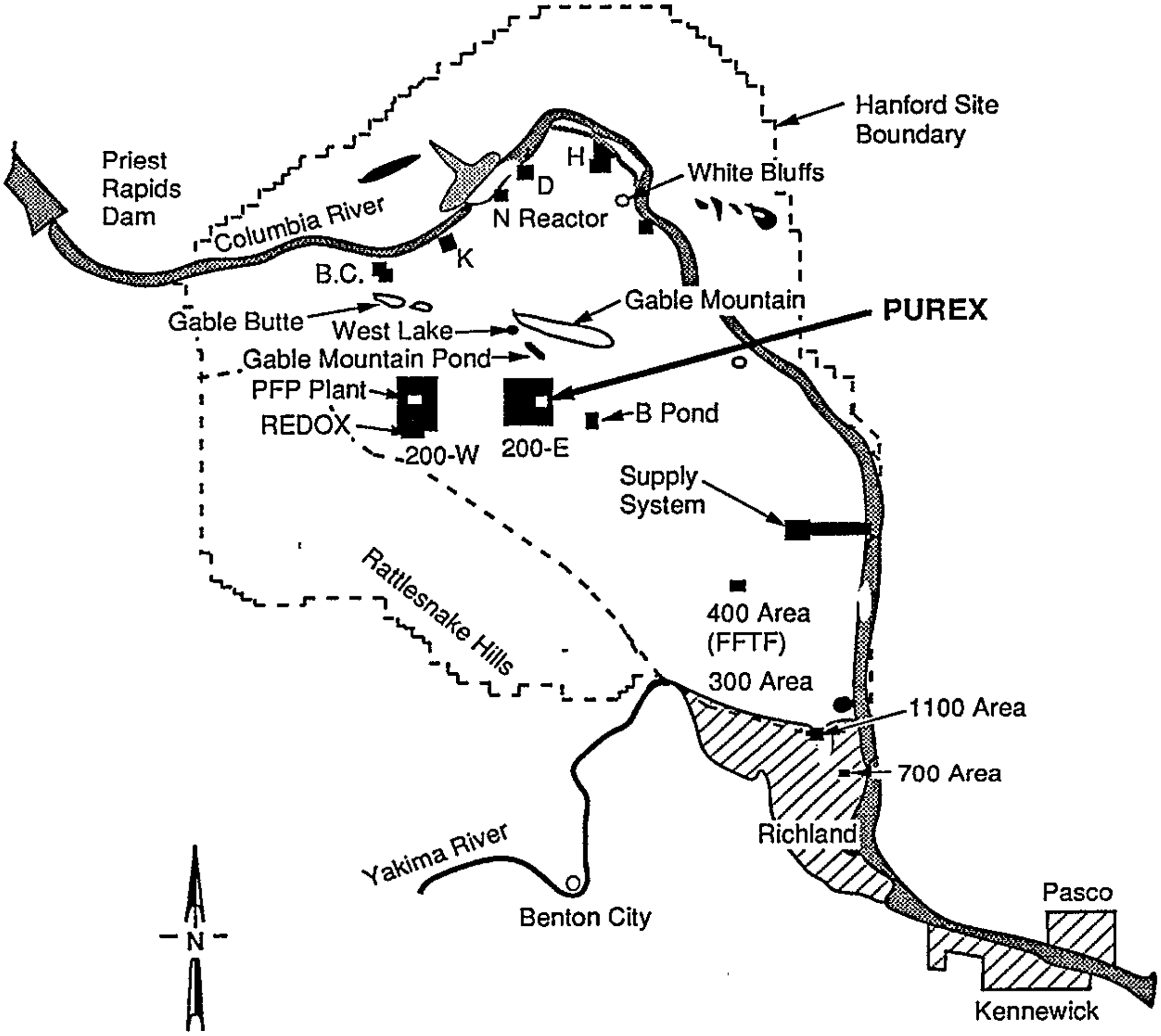
29002020.8

1.3 SCOPE

The scope of this document is the chemical and radiological characterization of the PUREX Plant CSL. The PUREX Plant CSL originates in the PUREX Plant, which is located at the Hanford Site (Figure 1-2). This document does not address any other wastestream leaving the PUREX Plant (e.g., solid, gaseous, or sanitary waste).

Historical changes, process campaign changes, and sampling data are considered only if relevant to the characterization of the wastestream as it presently exists. Future configurational/process modifications are addressed only if they will significantly alter the present effluent.

Figure 1-2. Location of the PUREX Plant at the Hanford Site.



28905055.72M

This page intentionally left blank.

2.0 PROCESS KNOWLEDGE

This section presents a qualitative and quantitative process knowledge-based characterization of the chemical and radiological constituents of the PUREX Plant CSL wastestream, which is located in the 200 East Area of the Hanford Site. These process data are discussed in terms of the following factors:

1. Location and physical layout of the process facility
2. A general description of the present, past, and future activities of the process
3. The identity of the wastestream contributors
4. The identity, flowrate, and concentration of the constituents of each contributor.

2.1 PHYSICAL LAYOUT

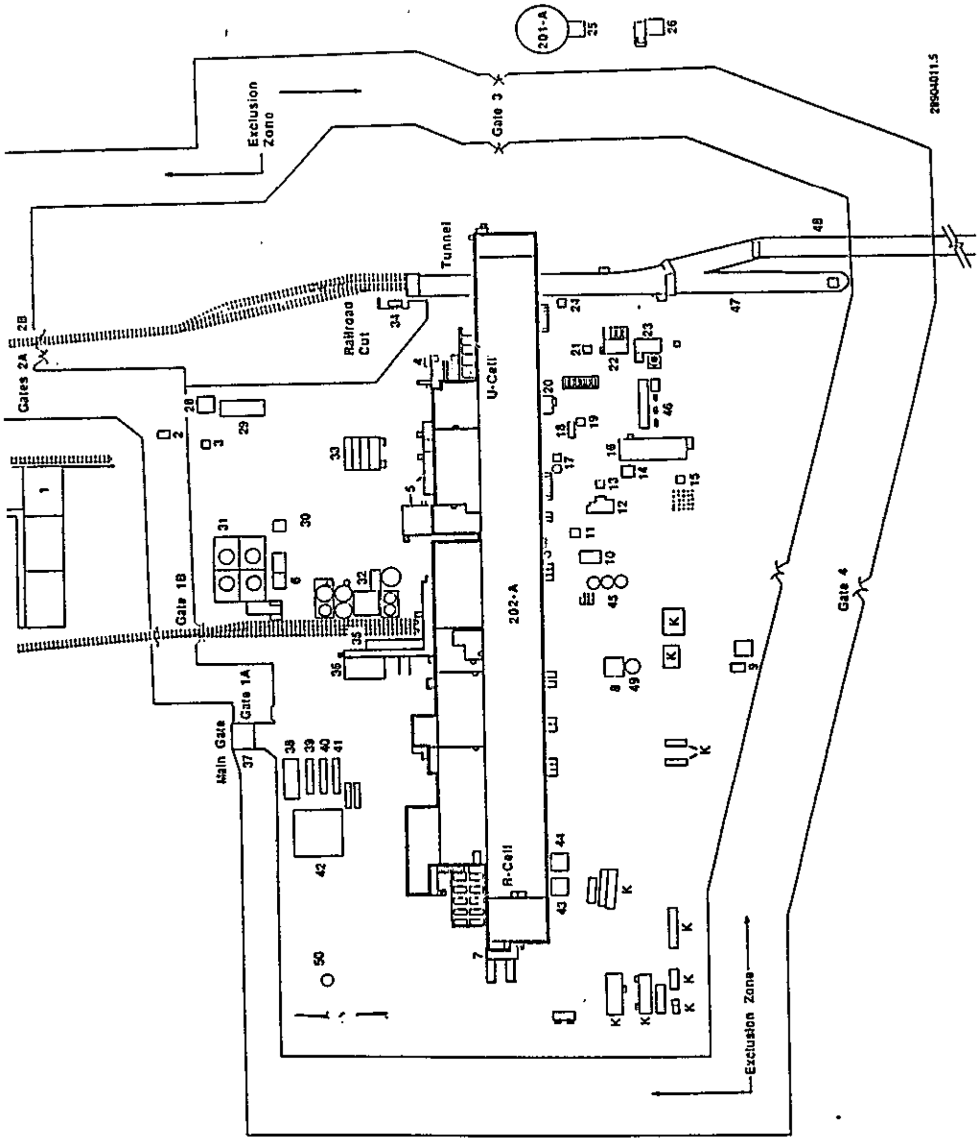
The PUREX Plant CSL is a system of pipes that transport nonradioactive liquid effluents (excluding sanitary waste) from the PUREX process into a common discharge line along the north side of the PUREX Plant. These sources include regenerant from the demineralizer; noncontaminated floor drains; vessel heating and cooling coil effluent; building heating, ventilation, and air conditioning (HVAC) wash water; pipe shaft sump waste; vacuum pump seal water; nonprocess steam condensate, etc.

The PUREX Plant is a collection of buildings and facilities located in the 200 East Area of the Hanford Site. The main building, 202-A, is a heavily shielded, reinforced-concrete structure of the sort known as a canyon building. This building contains the main equipment used in the PUREX process. The main PUREX Plant building, the 206-A Acid Fractionator Building, the 211-A Chemical-Handling Facility, the 203-A Pumphouse and Uranium Storage Area, and the 2901-A High-Water Tank are the contributors to the PUREX Plant CSL. (See Figure 2-1.)

2.1.1 The 202-A Building

Building 202-A is a reinforced-concrete structure 1,005 ft long, 119 ft wide at its widest point, and 100 ft high, with 40 ft of this height below grade (Figure 2-2). The canyon, which extends nearly the length of the 202-A Building, contains and shields the process equipment used for processing irradiated nuclear fuel. The canyon consists of the canyon proper, crane cab gallery, process cells, hot pipe trench, and ventilation air tunnel.

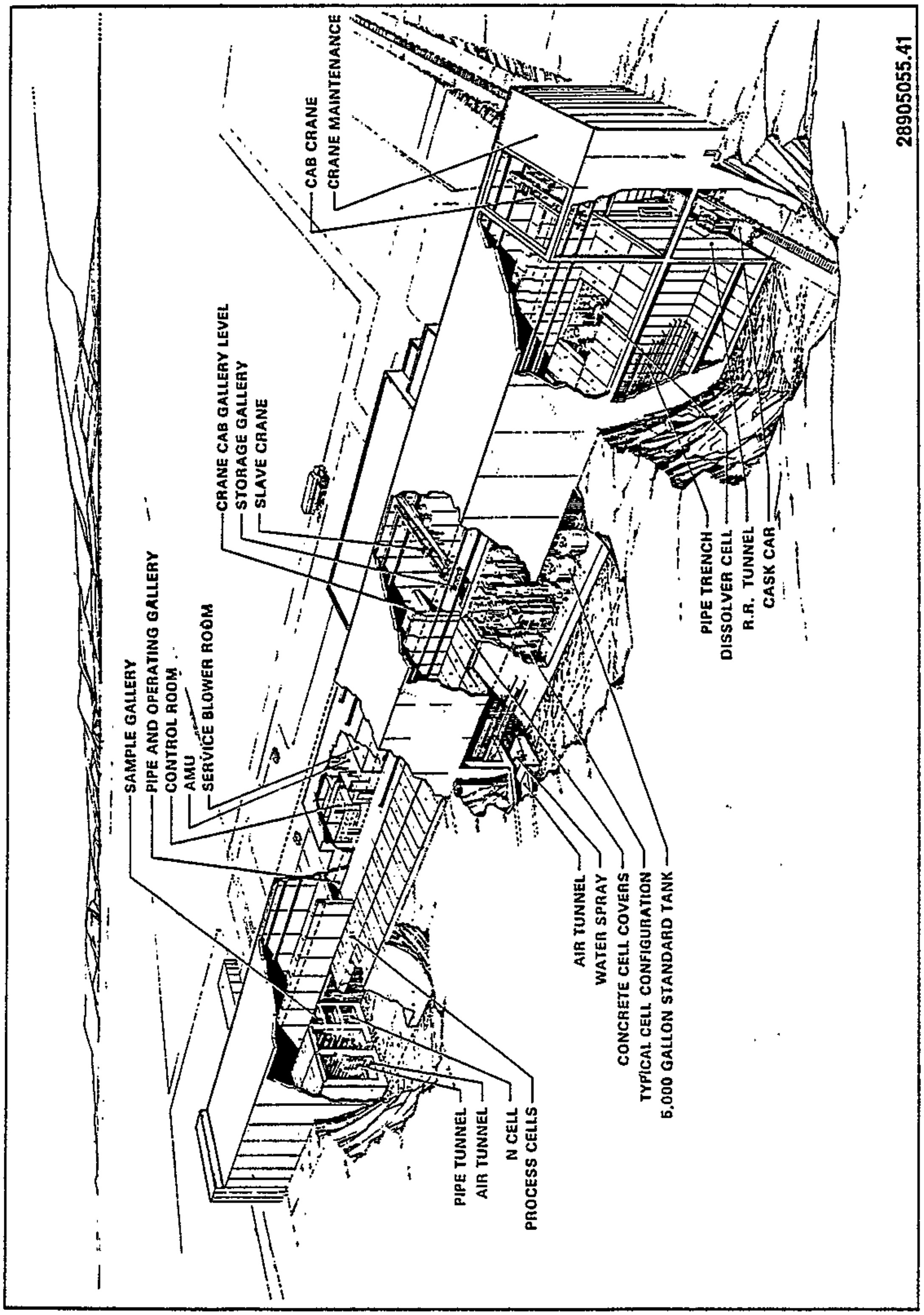
Figure 2-1. The PUREX Plant Plot Plan.



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 UNH 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 #4 Filter Bldg.
17. 295-AA SCD (Steam Condensate Discharge)
18. 291-AH Ammonia Off Gas Filter Bldg.
19. 291-AH Ammonia Off Gas Sampler Bldg.
20. 212-A Load Out
21. 294-A Instr. Shack
22. 293-A Dissolver Off 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-332
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. 216-A-5
50. 2901-A Water Tank

K = Kaiser Related Facilities

Figure 2-2. The 202-A Building.



The process cells are rooms, shielded with massive concrete, which contain most of the process equipment. The floor of the canyon cells is a layer of reinforced concrete nearly 6 ft thick. The process cells are covered by cover blocks, which are removable blocks of reinforced concrete designed to provide radiation shielding.

The Pipe and Operations (P&O) gallery contains "cold side" (nonradioactive) piping to the process.

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 Oxide (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 2-1 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 (1) pumps used to transfer the chemicals stored in the tank farm and (2) 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 2-1 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 is used for concentrating recovered nitric acid. The heat transfer piping in the vacuum fractionator is a major contributor to the PUREX Plant CSL wastestream. This building is called out in Figure 2-1 as the 206-A Fractionator.

2.1.5 Effluent Monitoring Buildings

The 295-AC Building houses equipment for monitoring and sampling the PUREX Plant CSL wastestream.

2.2 CONTRIBUTORS

Contributors to the PUREX Plant CSL wastestream are as follows:

- Floor drains in the 202-A Pipe and Operations (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 containing spray water and steam condensate from heating coils located in the P&O Gallery and aqueous makeup (AMU) area. 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 changerooms in the PUREX Plant lab (202-A Building).
- HVAC-related drainage from the lab ventilation room in the 202-A Building.
- Lab 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.
- 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. 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 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 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 area in the 202-A Building to escape from established spill barriers and enter the PUREX Plant CSL. See Table 2-1 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 valved 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 and use the chemicals. (The overflow lines from the catch tanks do, however, feed into the CSL header. To date, there has not been an overflow into the catch tanks, much less an overflow from the catch tanks into the CSL.)

Table 2-1. List of PUREX 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	

2.3 PROCESS DESCRIPTIONS

The process descriptions comprise three parts: a discussion of current activities, a discussion of relevant past activities, and a discussion of relevant planned future activities. As used in this context, current activities are defined as those activities which occurred during the period from October 1989 through March 1990. Past activities occurred before the current period, and future activities follow it.

2.3.1 Current Activities

The discussion of current activities proceeds in three parts. The first is an overview of processing at the PUREX Plant. The second is a description of those activities which produce the CSL. The third is a discussion of administrative controls.

2.3.1.1 PUREX Process Overview. The PUREX nuclear fuel processing plant, located in the 200 East Area of the DOE's Hanford Site in southeast Washington, 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-liquid solvent extraction. The driving forces for the separations consist of concentration changes, temperature changes, and chemical additions. PUREX is the source of five liquid effluent streams, which are mostly by-products of the various driving forces. These liquid effluent streams are the PDD, CWL, SCD, CSL, and ASD.

The concentration changes are provided by dilution with water and by removal of water (and sometimes nitric acid) by boiling. Cold chemical additions to the process add water that must be removed in the concentration stages. Although most of the water boiled out of solutions is re-used in dilution stages, there is some excess which requires disposal. This water is the source of the PDD, sometimes called Process Condensate. Addendum 12 addresses the PDD.

Boiling process solutions and condensing the resulting vapors requires the use of steam and cooling water, and produces 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 constitutes most of the liquid effluents from PUREX, namely, the CWL (sometimes called Cooling Water), SCD (sometimes called Steam Condensate), and most of the CSL (sometimes called Chemical Sewer). Addenda 20, 5, and 2 address the CWL, SCD, and CSL, respectively.

Ventilation, heating, and water services, together with room drainage (mostly shower rooms, water coolers, housekeeping water, and steam and water leaks, together with occasional chemical leaks), contribute the remainder of the CSL.

Removing the protective cladding from the fuel, the first step in fuel dissolution, produces large quantities of gaseous ammonia. This ammonia is scrubbed from the offgas with water to prevent releasing the ammonia to the air, and to alleviate the explosion hazard which the ammonia would otherwise cause. 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, sometimes called Ammonia Scrubber Condensate. 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. Addendum 14 addresses the ASD.

Figure 2-3 provides an overview of the four liquid effluent streams traditionally released by the PUREX Plant.

2.3.1.2 The PUREX Plant CSL Process. The PUREX Plant CSL collects wastewater from the non-radiologically 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. Figure 2-4 is a simplified schematic flow diagram of the CSL. Figure 2-5, a more detailed flow diagram, includes the contributors discussed below.

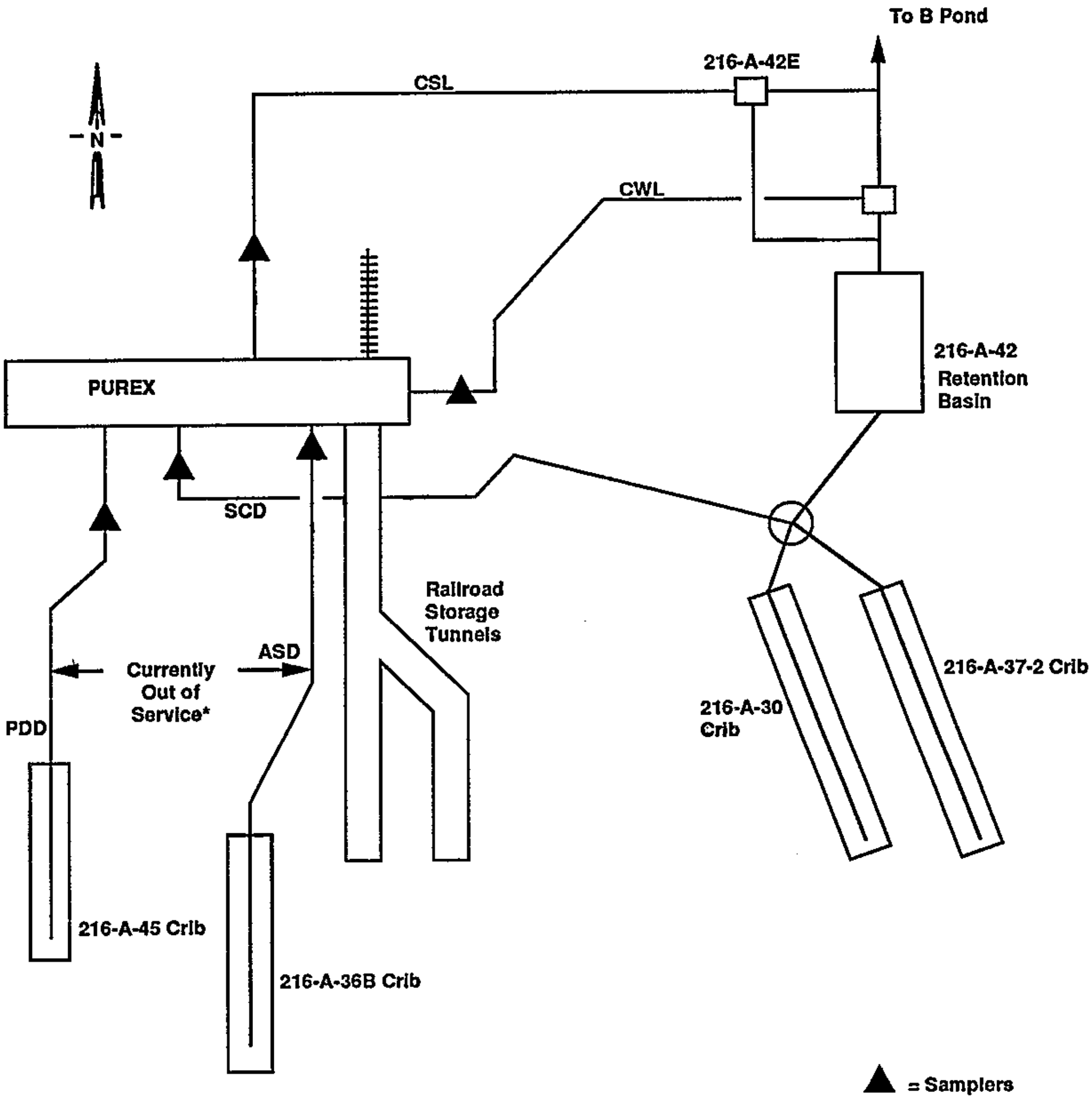
Input lines to the PUREX Plant CSL leave the 202-A Building and 211-A Area and connect to two vitrified clay headers that roughly parallel the north side of the 202-A Building. (These input lines are described in Section 2.2) The two PUREX Plant CSL vitrified clay headers drain via a 12-in.-diameter vitrified clay pipe that feeds into a 15-in.-diameter vitrified clay pipe. The 15-in.-diameter line continues to the 216-A-42E Diversion Box, which diverts the flow to the 216-A-42 Retention Basin for treatment and subsequent disposal if the stream displays high radiation levels, extreme pH, or contains hazardous chemicals. Note that on-line instruments monitor radionuclides and pH only; detection of hazardous chemical releases would be via process knowledge and identification by personnel. The PUREX Plant CSL effluents normally flow from the 216-A-42E Diversion Box through vitrified clay piping to the 216-A-29 Ditch, and thence to the 216-B-3 Pond. The effluents are disposed by evaporation and absorption into the soil.

The condensate entering the PUREX Plant CSL originates as steam in the 200 East Area and 200 West Area Powerhouses. The powerhouse process consists of purifying sanitary water (deaerating and removing the residual chlorine), mixing with three additives (ethylenediaminetetraacetic acid [EDTA], sodium sulfite, and Filmeen*), and boiling the mixture. The EDTA forms complexes with certain ions (particularly calcium and magnesium) to keep them in solution in the boiler water. Sodium sulfite scavenges oxygen in the boiler water. Filmeen, an amine with a molecular weight of approximately 270, protects steam piping from corrosion. Appendix A contains an MSDS for Filmeen.

---

*Filmeen is a registered trademark of Grace Dearborn, Hackettstown, New Jersey.

Figure 2-3. Routing of Liquid Effluents From the PUREX Plant.



*The PDD and ASD are not Currently Discharged to Cribs.

28905055.290

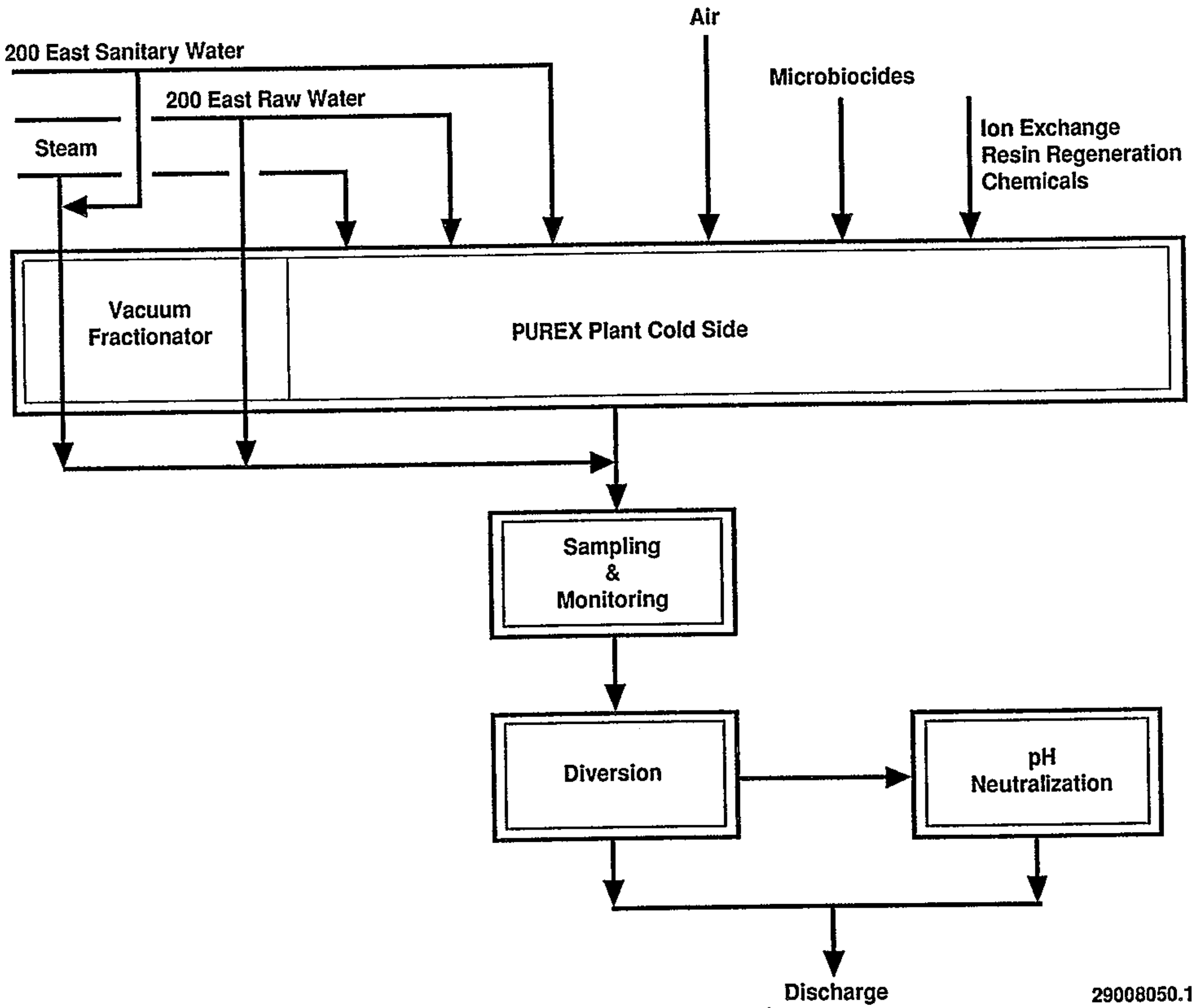
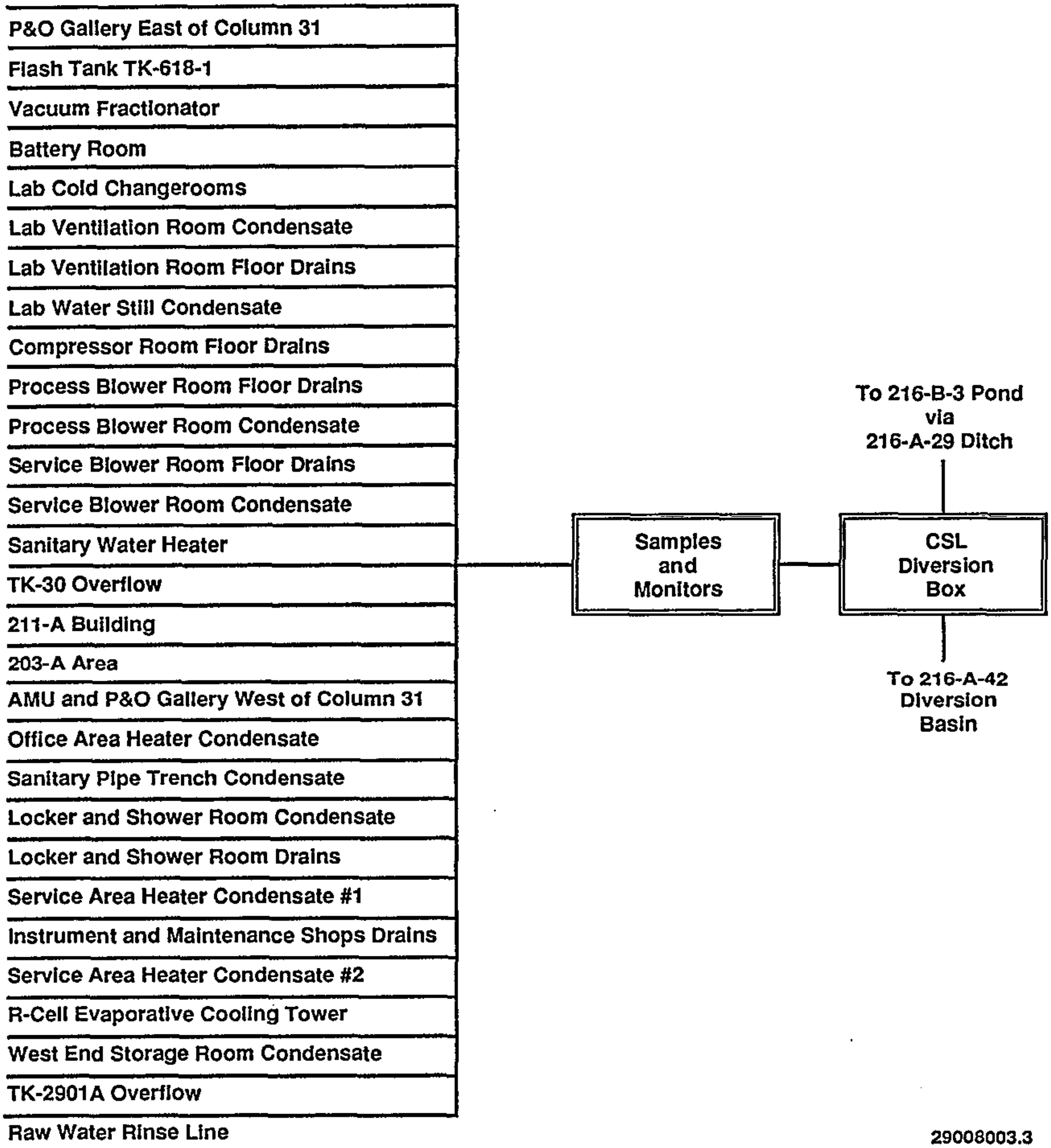


Figure 2-4. Simplified Schematic Flow Diagram of the CSL.

Figure 2-5. CSL Flow Diagram.



Because there is no significant carryover of liquid boiler water into the steam, only the volatile Filmeen becomes a part of the steam at a concentration of about 13,000 ppb.

Steam is used for heating and condenses in various pipes and heat exchangers. The resulting condensate can then pick up corrosion products, primarily iron and copper. Filmeen can facilitate the removal of corrosion products from the piping by forming iron and copper complexes.

The vacuum fractionator sources to the PUREX Plant CSL consist of saturated steam condensate from the re-boiler and cooling water from the three condensers. This stream is, therefore, composed of steam condensate, demineralized water (added to the steam de-superheater for the reboiler), and raw water. Raw water, also called 200 East Area raw water, is water which has been pumped to the 200 East Area from the Columbia River. During normal operation, the combined condensate and demineralized water flow is estimated at 30 gal/min and the raw water flow is 750 gal/min, yielding an average total flow of 780 gal/min. Maximum combined flow was estimated at 900 gal/min. Figure 2-6 is a schematic of a typical condenser, such as the ones in the vacuum fractionator.

A leak in the steam or raw water systems of the vacuum fractionator could result in contamination of this stream with nitric acid and uranium, as well as traces of fission products. However, the process side of the heat exchangers is under negative pressure and leaks should be from the clean side to the process side. Such a leak would introduce significant quantities of water into the PUREX Plant process and would consequently necessitate a prompt shutdown of the plant to repair the leak.

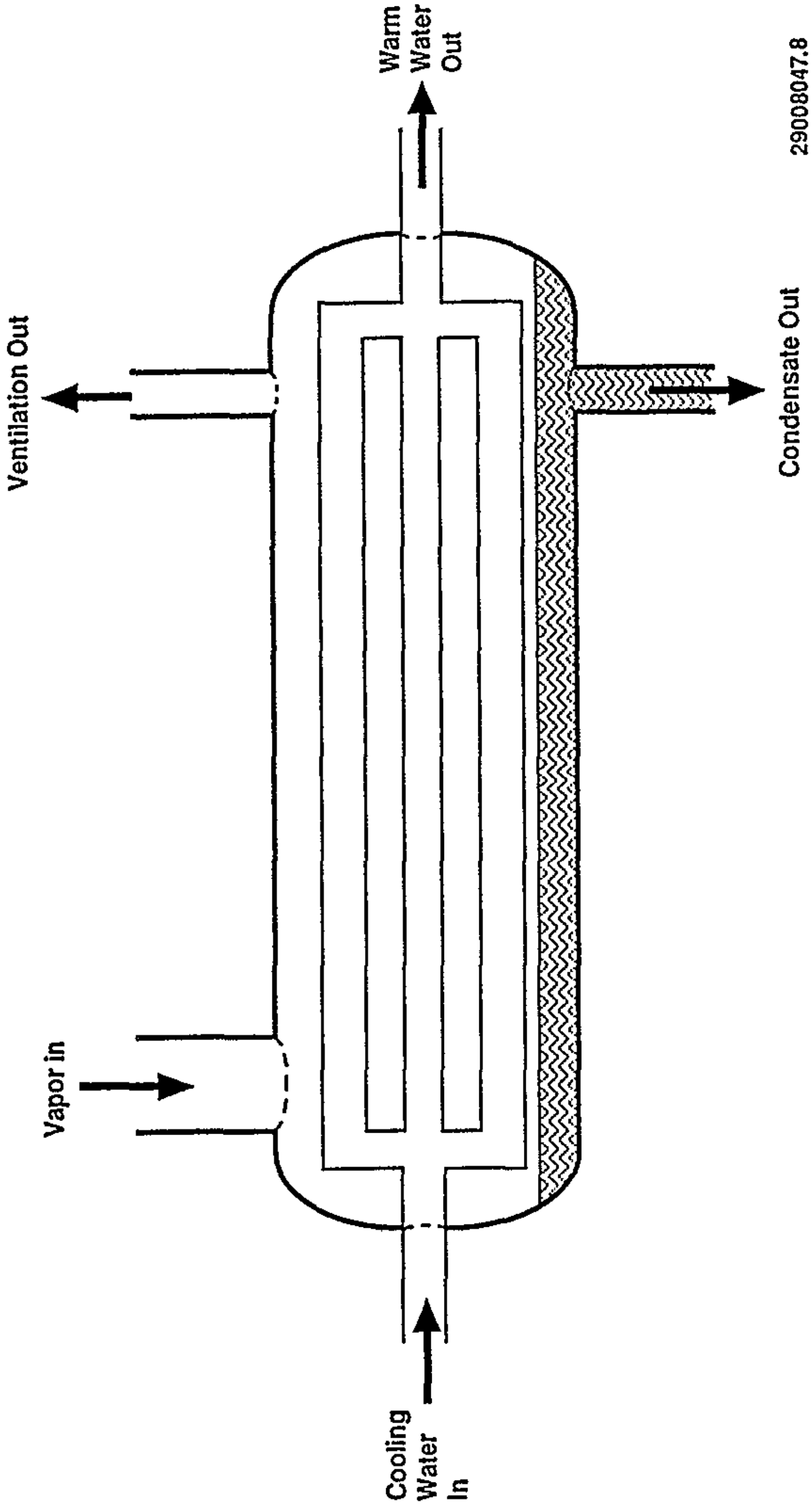
Low-risk floor drains comprise the drainage systems from the lab cold changerooms and the locker and shower room. These two streams are fed by shower drains, locker room floor drains, and water cooler drains. The streams are primarily sanitary water, with an admixture of surfactants used in showering. These streams have an estimated flow range of 0 to 130 gal/min, and an estimated average flowrate of 40 gal/min.

Moderate-risk floor drains comprise the drainage systems from the battery room, laboratory ventilation room, compressor room, process blower room, service blower room, maintenance shops, and effluent from the R-Cell evaporative cooler. Each contributor is composed of one or more of four substreams: floor drainage, ventilation scrub water, water distillation effluent, and compressor cooling water. Effluent from floor drainage rarely exists and can be considered zero from a volume-of-flow standpoint.

Effluent from ventilation scrub water is produced by the wet scrubbing process for ventilation air. Air from outside the 202-A Building is contacted 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 (7 avoirdupois oz/mo/scrubber), Dearcide* 722 (10 fluid oz/mo/scrubber), and

*Dearcide is a registered trademark of W.R. Grace & Company, New York, New York.

Figure 2-6. Typical Condenser Schematic.



Dearcide 717 (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 0.05 to 0.8 gal/min, with an average of 0.2 gal/min. Effluent from water distillation consists of steam condensate. The flow of water distillation effluent is estimated to range from 0 to 20 gal/min, with an average of 3 gal/min. Effluent from compressor cooling water consists of sanitary water that has been used to cool the air compressors and the compressed air they produce and to cool liquids removed from the compressed air. The compressor cooling water flow is estimated to range from 0 to 100 gal/min, with an average of 65 gal/min. Total flowrate for the moderate-risk floor drains is expected to range from 0 to 120.8 gal/min, with an average of 68.2 gal/min.

Drainage from the 211-A Building includes seal water from caustic pumps in the building, leaks and spills from the pumps and chemical piping, and the demineralizer regenerant effluent. Minor leaks are handled by administrative controls and are cleaned up with absorbent materials. Larger leaks would be caught in sumps which drain to the new B-669 project neutralization tank.

There are three water demineralizers in the 211-A Building. 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. Regeneration uses sulfuric acid and sodium hydroxide, and releases the contaminants that the demineralizer had removed from the sanitary water feed. Figure 2-7 is a schematic of an ion exchange column.

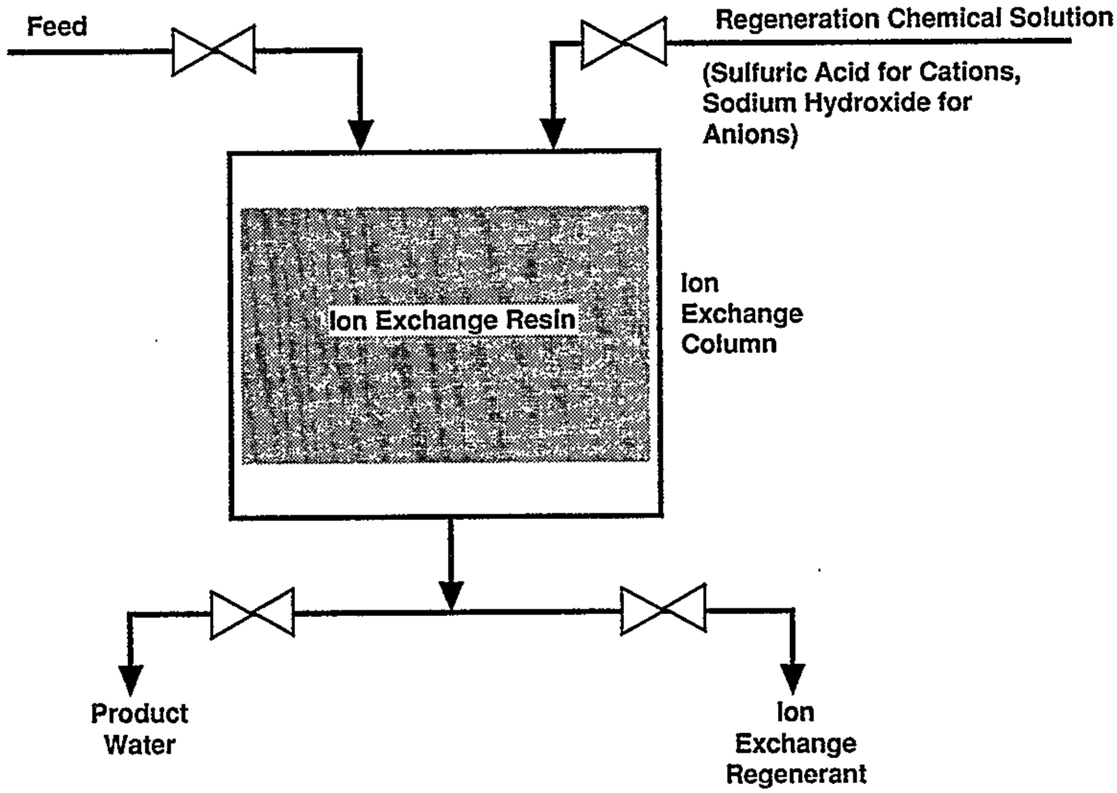
Project B-669 (recently installed) provides a three-chamber pH control system for the effluent from the 211-A Building. This effluent comprises leakage from pipes and pumps in the building, seal water drainage from certain pumps, and demineralizer regeneration waste. Of these, the regeneration waste has the highest volume. In addition to cations and anions removed from the sanitary water (the demineralizer feed), the regenerant contains (at different times) NaOH, H_2SO_4, $NaHSO_4$, and 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.

2.3.1.3 Administrative Controls

Administrative controls have been enacted to implement the overall policy of conducting operations to meet the requirements, intent, and spirit of all applicable federal, state, and local environmental laws, regulations, and standards. A program of regulatory compliance based on the requirements of applicable environmental laws and input from appropriate regulatory agencies has been developed.

Since current technology does not exist for on-line (real-time) monitoring for all regulated materials, PUREX has incorporated administrative controls as an aid to prevent the release of hazardous material to the liquid effluent streams.

Figure 2-7. Ion Exchanger Schematic.



Note: A demineralizer consists of two ion exchangers in series: an anion exchanger and a cation exchanger.

29008050.4

The administrative controls have general requirements that apply to all activities associated with regulated materials.

Training is a very important function of the administrative controls. General training courses are given to all employees, and specific training is given to employees working with regulated materials or in areas where they may come into contact with them. This training program includes annual refresher training.

A general requirement that acts as an important control is the system of frequent surveillances and inspections with the associated action findings and follow-up inspections. These are conducted on a regular basis and are supplemented with random surveillances.

Administrative controls for materials regulated by Ecology, the EPA, and the DOE have the clear goal of assuring that no regulated dangerous (hazardous) material is released into PUREX liquid effluent systems.

Specific activity control is maintained by the use of detailed, written procedures. These outline proper handling of materials as an aid to assure regulatory compliance. They are updated as needed when new regulatory requirements are mandated.

In terms of the management of sinks and drains, there are several stipulations. The most important one is that no dangerous (hazardous) waste shall be disposed of in drains.

There are also several requirements for the acquisition, storage, use and disposal of materials. They are to be physically controlled so that the risks of them entering the PUREX liquid effluent systems are minimized. This is achieved by placing them, wherever possible, at distances removed from entry points to the systems. Also, physical barriers such as closed doors and dams are utilized wherever possible.

2.3.2 Past Activities

Before 1987, the PUREX Plant routinely discharged out-of-specification chemical makeups through the PUREX Plant CSL to B Pond. The practice of such routine disposal through the PUREX Plant CSL to B Pond has since been discontinued. Additional steps have been taken to prevent the accidental discharge of regulated materials through the CSL.

In July 1969, the barometric condenser in the vacuum fractionator was replaced with a shell-and-tube condenser. Prior to this replacement, the process condensate from the vacuum fractionator discharged through the CSL, providing an avenue for radionuclides to enter the CSL. Some of these radionuclides adsorbed onto the vitrified clay pipe, and can desorb, continuing to provide low levels of radioactive contamination in the current CSL.

2.3.3 Future Activities

Project W-019 will tie in the CSL to the PUREX Plant CWL and eliminate the 216-A-29 Ditch as the route to the 216-B-3 Pond. The tie-in point will be downstream of sampling points and diversion valves of both streams. This re-routing will allow the decommissioning of the 216-A-29 Ditch.

The 200 Area Treated Effluent Disposal System will eventually dispose of the CSL. The Tri-Party Agreement milestone for this system is June 1995.

2.4 PROCESS DATA

The discussion of process data proceeds in two parts. The first summarizes the expected concentrations by discussing the entire PUREX Plant CSL. The second discusses the classes of contributors. For the entire CSL, the point of estimation is downstream of all contributors. For the classes of contributors, the points of estimation are just before the contributors enter the CSL. (Please note that the estimated TOX or total organic halide, is an upper limit that is not expected to be exceeded. The actual concentration of TOX is probably lower.)

2.4.1 The Entire PUREX Plant CSL

Table 2-2 presents the estimated average concentrations of the chemical constituents of the PUREX Plant CSL. These concentrations are derived from the estimated concentrations during ion exchanger regeneration and during routine operation (i.e., the rest of the time). The flow of the CSL is estimated to range from 55 to 1,470 gal/min (9,000,000 to 243,000,000 L/mo). When the PUREX Plant if fully operational, the flow is typically about 1000 gal/min (165,000,000 L/mo). When the cooling water to the Vacuum Fractionator is turned off, the flow is typically about 300 gal/min (50,000,000 L/mo). Table 2-3 lists the total flows for the present period, by month.

2.4.1.1 Operation During Ion Exchanger Regeneration. The PUREX Plant CSL flowrate is estimated to range from 255 to 1,470 gal/min (42,000,000 to 243,000,000 L/mo)during regeneration, with an average of 1,070 gal/min (180,000,000 L/mo). Table 2-4 contains the estimated average composition of the PUREX Plant CSL during ion exchanger regeneration.

Table 2-2. Estimated Concentration of the PUREX Plant CSL.
(Units are ppb)

Analyte	Average concentration	Analyte	Average concentration
1,1,1-Trichloromethane	1.3 E-01	Barium	2.8 E+01
Benzene	1.1 E-01	Bromodichloromethane	4.7 E-01
Cadmium	1.8 E+00	Calcium	1.8 E+04
Chloroform	1.4 E+01	Copper	1.1 E+02
Iron	3.3 E+02	Magnesium	4.1 E+03
Manganese	1.1 E+01	Nickel	9.5 E+00
Potassium	7.7 E+02	Sodium	3.3 E+03
Tin*	1.1 E-01	Toluene	1.3 E-01
Uranium	6.9 E-01	Vinyl chloride	9.1 E-01
Zinc	2.2 E+01	Chloride	2.4 E+03
Nitrate	8.2 E+02	Sulfate	1.5 E+04
TOC	2.4 E+06	TOX	<7.78 E+02

*The reported tin concentration is based solely on the quantity of tin added in the PUREX process. There are no data available on the actual tin content of either the raw water supplied from the river or the PUREX Plant CSL.

Table 2-3. Current CSL Flow.

Month/ Year	Flow (L)
Oct 89	1.02 E+08
Nov 89	5.40 E+07
Dec 89	4.70 E+07
Jan 90	6.44 E+07
Feb 90	1.23 E+08
Mar 90	6.99 E+07

Table 2-4. Estimated Concentration of the PUREX Plant CSL During Regeneration. (Units are ppb)

Analyte	Average concentration	Analyte	Average concentration
1,1,1-Trichloromethane	1.8 E-01	Barium	7.2 E+01
Benzene	1.4 E-01	Bromodichloromethane	6.3 E-01
Cadmium	1.5 E+00	Calcium	4.7 E+04
Chloroform	1.5 E+01	Copper	1.2 E+02
Iron	4.3 E+02	Magnesium	1.1 E+04
Manganese	2.7 E+01	Nickel	2.6 E+01
Potassium	2.0 E+03	Sodium	1.5 E+05
Tin*	9.8 E-02	Toluene	1.6 E-01
Uranium	1.8 E+00	Vinyl chloride	9.2 E-01
Zinc	5.3 E+01	Chloride	1.7 E+04
Nitrate	1.4 E+03	Sulfate	5.4 E+05
TOC	8.7 E+02	TOX	<5.8 E+03

*The reported tin concentration is based solely on the quantity of tin added in the PUREX process. There are no data available on the actual tin content of either the raw water supplied from the river or the PUREX Plant CSL.

2.4.1.2 Routine Operation. The PUREX Plant CSL flowrate is estimated to range from 55 to 1,400 gal/min (9,000,000 to 230,000,000 L/mo) during routine operation, with an average of 1,000 gal/min (165,000,000 L/mo). When the cooling water is turned off to the vacuum fractionator, the flow is typically 300 gal/min (50,000,000 L/mo). Table 2-5 presents the estimated composition of the PUREX Plant CSL during routine operation.

2.4.2 Major PUREX Plant CSL Influents

The estimates that follow are based on a combination of process knowledge (that is, how each particular process operates) and sample results for the water supply streams to the respective processes. In each case, a discussion describes the process. Based on this description, analyses of input water are combined, and chemical species are added or removed as appropriate to determine an estimated composition. As a result, the estimates are no better than the sample data for the supply water streams, namely, the 200 East Area raw water, the 200 East Area sanitary water, and the laundry steam condensate. (In particular, the validity of the laundry steam condensate as a model for steam condensate in the PUREX Plant has been questioned. To the extent that the laundry steam condensate data reflect extraneous contamination not derived from by-products, this contamination is included in the estimated concentrations. The estimates should not be construed to suggest that there is process knowledge of contamination from sources other than by-products.)

Table 2-5. Estimated Concentration of the PUREX Plant CSL During Routine Operation. (Units are ppb)

Analyte	Average concentration	Analyte	Average concentration
1,1,1-Trichloromethane	1.3 E-01	Barium	2.8 E+01
Benzene	1.1 E-01	Bromodichloromethane	4.6 E-01
Cadmium	1.8 E+00	Calcium	1.8 E+04
Chloroform	1.4 E+01	Copper	1.1 E+02
Iron	3.3 E+02	Magnesium	4.0 E+03
Manganese	1.1 E+01	Nickel	9.4 E+00
Potassium	7.6 E+02	Sodium	2.2 E+03
Tin*	1.1 E-01	Toluene	1.3 E-01
Uranium	6.8 E-01	Vinyl chloride	9.1 E-01
Zinc	2.1 E+01	Chloride	2.3 E+03
Nitrate	8.2 E+02	Sulfate	1.1 E+04
TOC	1.0 E+03	TOX	<4.75 E+02

*The reported tin concentration is based solely on the quantity of tin added in the PUREX process. There are no data available on the actual tin content of either the raw water supplied from the river or the PUREX Plant CSL.

2.4.2.1 Demineralized Water. The demineralized water is very pure water that can be contaminated with organic halides. Organic halide concentrations in the demineralized water are expected to be similar to those in the sanitary water. Based on the quantity of chlorine added to the sanitary water at the 200 East Area Powerhouse, the organic halide concentration in the demineralized water is not expected to exceed 7,700 ppb. Demineralized water can enter the CSL via the overflow of the demineralized water tanks. This does not normally occur, and the estimated flowrate is 0 gal/min (0 L/mo).

2.4.2.2 Condensate. In addition to water, the condensate contains rust, organic chlorides, amine, and amine breakdown products. Condensate can also contain copper. The estimated concentration of Filmeen and its breakdown products in the condensate is 13,000 ppb. In addition to dissolved rust, the condensate can contain up to 43 ppb iron complexed with Filmeen or up to 28 ppb iron and 32 ppb copper, both complexed with the amine. Analyses of the laundry steam condensate, supplemented with analyses of the 200 East Area sanitary water, have been used for estimating the composition of the CSL. Table 2-6 summarizes the concentrations of contaminants found in condensate.

The total flow of condensate is estimated to range from 0 to 130 gal/min (0 to 21,000,000 L/mo), with an average flow of 63 gal/min (10,000,000 L/mo).

Table 2-6. Estimated Contaminant Concentrations in Condensate.
(Units are ppb)

Analyte	Average concentration	Analyte	Average concentration
Barium	1.8 E+01	Calcium	7.7 E+03
Chloroform	1.2 E+01	Chloride	1.4 E+03
Copper	8.1 E+02	Iron	2.1 E+03
Magnesium	1.8 E+03	Manganese	1.6 E+01
Potassium	3.3 E+02	Sodium	8.9 E+02
Sulfate	5.5 E+03	TOC	1.0 E+04
Toluene	4.0 E-01	Uranium	3.5 E-01
Vinyl chloride	1.0 E+01	Zinc	3.0 E+01

In case of process upset, sanitary water could leak into the condensate lines. Table 2-7 lists the measured contaminant concentrations in sanitary water. The organic chloride value is merely an upper limit based on the quantity of chlorine used in producing sanitary water.

2.4.2.3 Vacuum Fractionator. This stream consists of steam condensate, demineralized water (added to the steam de-superheater for the reboiler), and raw water. Contaminant levels should be slightly lower than those for raw water. Table 2-8 lists estimated contaminant concentrations in the vacuum fractionator effluent.

During normal operation, the combined condensate and demineralized water flow is estimated at 30 gal/min (5,000,000 L/mo), and the raw water flow is 750 gal/min (124,000,000 L/mo), yielding an average total vacuum fractionator flow of 780 gal/min (129,000,000 L/mo).

2.4.2.4 Low-Risk Floor Drains. The streams consist of sanitary water, with an admixture of surfactants used in showering. Better characterization of these streams will require sampling and analysis of sanitary water to establish the component matrix, and sampling and analysis of composite PUREX Plant CSL effluent for surfactants. Table 2-9 lists the estimated contaminant concentrations in the low-risk floor drain effluent.

The estimated flowrate of low-risk floor drains is 0 to 130 gal/min (0 to 21,000,000 L/mo), with an estimated average flowrate of 40 gal/min (7,000,000 L/mo).

2.4.2.5 Moderate-Risk Floor Drains. Each contributor in this classification is composed of one or more of four substreams: floor drainage, ventilation scrub water, water distillation effluent, and compressor cooling water. The collective flow of these streams is estimated to vary between 0 and 120 gal/min (0 and 20,000,000 L/mo), with an average of 68 gal/min (11,000,000 L/mo).

Floor drainage effluent rarely exists and can be ignored for purposes of estimation.

Table 2-7. Analyte Concentrations in Sanitary Water.
(Units are ppb)

Analyte	Average concentration	Analyte	Average concentration
1,1,1-Trichloromethane	5.0 E-01	Barium	2.8 E+01
Benzene	4.0 E-01	Bromodichloromethane	1.8 E+00
Calcium	1.8 E+04	Chloroform	2.7 E+01
Copper	1.1 E+01	Iron	8.3 E+01
Magnesium	4.2 E+03	Manganese	1.0 E+01
Nickel	1.0 E+01	Potassium	8.0 E+02
Sodium	2.3 E+03	Toluene	4.0 E-01
Uranium	7.3 E-01	Vinyl chloride	1.0 E+00
Zinc	2.0 E+01	Chloride	8.6 E+03
Nitrate	3.7 E+02	Sulfate	1.7 E+04
Organic chloride	<7.7 E+03		

Table 2-8. Estimated Concentrations from the Vacuum Fractionator.
(Units are ppb)

Analyte	Average Concentration	Analyte	Average Concentration
1,1,1-Trichloromethane	5.0 E-02	Barium	2.7 E+01
Benzene	4.0 E-02	Bromodichloromethane	1.8 E-01
Cadmium	2.2 E+00	Calcium	1.7 E+04
Chloroform	1.2 E+01	Copper	9.1 E+01
Iron	2.6 E+02	Magnesium	4.0 E+03
Manganese	1.0 E+01	Nickel	9.4 E+00
Potassium	7.5 E+02	Sodium	2.1 E+03
Toluene	4.0 E-02	Uranium	6.9 E-01
Vinyl Chloride	1.0 E-01	Zinc	2.1 E+01
Chloride	9.2 E+02	Nitrate	9.0 E+02
Sulfate	1.0 E+04	TOC	1.2 E+06

Table 2-9. Estimated Concentrations in the Low-Risk Floor Drain Effluent. (Units are ppb)

Analyte	Average concentration	Analyte	Average concentration
1,1,1-Trichloromethane	5.0 E-01	Barium	2.8 E+01
Benzene	4.0 E-01	Bromodichloromethane	1.8 E+00
Calcium	1.8 E+04	Chloroform	2.7 E+01
Copper	1.0 E+01	Iron	8.3 E+01
Magnesium	4.2 E+03	Manganese	1.0 E+01
Nickel	1.0 E+01	Potassium	8.0 E+02
Sodium	2.3 E+03	Toluene	4.0 E-01
Uranium	7.3 E-01	Vinyl chloride	1.0 E+00
Zinc	2.0 E+01	Chloride	8.6 E+03
Nitrate	3.7 E+02	Sulfate	1.7 E+04
Total organic chloride	<3.9 E+03	Surfactants	

Ventilation scrub water effluent is concentrated sanitary water contaminated with microbiocides, some airborne dust, and atmospheric gas. (Several microbiocides are added to the water in the air scrubbers: Dearcide 730 (7 avoirdupois oz/mo/scrubber), Dearcide 722 (10 fluid oz/mo/scrubber), and Dearcide 717 (10 fluid oz/mo/scrubber). These microbiocides are added to the air scrubber to prevent the growth of harmful microorganisms in the scrub water.) Table 2-7 lists the contaminants in sanitary water. In the wet scrubbing process, organic chlorides such as chloroform should evaporate slightly faster than the water. The water should become saturated with carbon dioxide, and should convert ambient nitrogen oxides to nitric acid, which could then react with steel in the scrubber to produce ferric nitrate, as well as other nitrates. Ambient sulfur oxides would also produce sulfuric acid, sulfurous acid, and iron sulfates and sulfites, all at extremely low concentrations. Table 2-10 lists the expected contaminant concentrations in the ventilation scrub water effluent. The flow of ventilation scrub water is estimated to range from 0.05 to 0.8 gal/min (8,000 to 130,000 L/mo), with an average of 0.2 gal/min (33,000 L/mo).

The water distillation effluent consists of steam condensate. Table 2-6 lists expected contaminants for this stream. The flow is estimated to range from 0 to 20 gal/min (0 to 3,000,000 L/mo), with an average of 3 gal/min (500,000 L/mo).

The compressor cooling water effluent consists of sanitary water that has been used to cool the air compressors and the compressed air they produce, and liquids removed from the compressed air. Table 2-11 lists the expected contaminants in the compressor cooling water effluent. The flow of compressor cooling water is estimated to range from 0 to 100 gal/min (0 to 17,000,000 L/mo) with an average of 65 gal/min (11,000,000 L/mo).

Table 2-12 lists the expected contaminants in the moderate-risk floor drain effluent.

Table 2-10. Estimated Concentrations in the Ventilation Scrub Water Effluent. (Units are ppb)

Analyte	Average concentration	Analyte	Average concentration
Barium	3.8 E+03	Calcium	2.5 E+06
Copper	1.4 E+03	Iron	1.1 E+04
Magnesium	5.7 E+05	Manganese	1.4 E+03
Nickel	1.4 E+03	Potassium	1.1 E+05
Sodium	3.1 E+05	Tin	4.7 E+02
Uranium	9.8 E+01	Zinc	2.9 E+03
Chloride	1.2 E+06	Sulfate	2.4 E+06
Nitrate	1.5 E+05		

Table 2-11. Estimated Concentrations in the Compressor Cooling Water. (Units are ppb)

Analyte	Average concentration	Analyte	Average concentration
1,1,1-Trichloromethane	5.0 E-01	Barium	2.8 E+01
Benzene	4.0 E-01	Bromodichloromethane	1.8 E+00
Calcium	1.8 E+04	Chloroform	2.6 E+01
Copper	1.1 E+01	Iron	8.2 E+01
Magnesium	4.2 E+03	Manganese	1.0 E+01
Nickel	1.0 E+01	Potassium	7.9 E+02
Sodium	2.3 E+03	Toluene	4.0 E-01
Uranium	7.3 E-01	Vinyl Chloride	1.0 E+00
Zinc	2.0 E+01	Chloride	8.6 E+03
Nitrate	3.7 E+02	Sulfate	1.7 E+04
Total organic carbon	2.7 E+04		

Table 2-12. Estimated Concentrations in the Moderate-Risk Floor Drain Effluent. (Units are ppb)

Analyte	Average concentration	Analyte	Average concentration
1,1,1-Trichloromethane	5.0 E-01	Barium	4.2 E+01
Benzene	4.0 E-01	Bromodichloromethane	1.8 E+00
Calcium	2.8 E+04	Chloroform	2.6 R+01
Copper	1.6 E+01	Iron	1.2 E+02
Magnesium	6.3 E+03	Manganese	1.5 E+01
Nickel	1.6 E+01	Potassium	1.2 E+03
Sodium	3.4 E+03	Tin*	1.8 E+00
Toluene	8.0 E-01	Uranium	7.2 E-01
Vinyl Chloride	1.1 E+01	Zinc	2.0 E+01
Chloride	1.3 E+04	Nitrate	9.2 E+02
Sulfate	2.6 E+04	Compressor oil	1.1 E+04

*The value for tin represents the concentration added by the air scrubbers, because no information is available on the concentration of tin in raw water.

2.4.2.6 P&O Gallery and AMU. This stream normally consists of an irregular mixture of steam condensate, sanitary water, and raw water. The flow is estimated to vary from 0 to 40 gal/min (0 to 7,000,000 L/mo), with an average of 6 gal/min (1,000,000 L/mo). Expected contaminant concentrations are close to those of sanitary water. Table 2-7 contains estimated contaminant concentrations for sanitary water. (The P&O Gallery portion of this stream normally flows into tanks in U-Cell and into the F-Cell sump. U-Cell tank waste and F-Cell sump waste are sent to underground storage.)

2.4.2.7 211-A. The major portion of this stream consists of discontinuous demineralizer regenerant. Regeneration uses sulfuric acid and sodium hydroxide and releases the contaminants that the demineralizer had removed. Table 2-13 lists the estimated contaminant concentrations during ion exchanger regeneration. The regenerant volume averages 16,000 gal (61,000 L), with an estimated range of from 15,000 to 17,000 gal (57,000 to 64,000 L).

2.4.2.8 Raw Water. The 200 East Area raw water has been sampled and analyzed (Jungfleisch 1988). Table 2-14 lists the estimated contaminant concentrations in raw water. The 200 East Area raw water consists of water which has been pumped from the Columbia River. The estimated flow of raw water into the CSL is 30 gal/min (5,000,000 L/mo). Although fluoride has not been detected in the 200 East Area raw water, the detection limit was 500 ppb, which is much higher than the concentrations found in the CSL during routine operation.

2.4.2.9 Sanitary Water. The overflow from the water tower (Tk-2901A) consists of 200 East Area sanitary water. The flow is estimated at 25 gal/min (4,000,000 L/mo). Table 2-7 lists the composition of 200 East Area sanitary water.

Table 2-13. Estimated Concentrations in the Ion Exchanger Regeneration Effluent. (Units are ppb)

Analyte	Average concentration	Analyte	Average concentration
1,1,1-Trichloromethane	5.0 E-01	Barium	3.7 E+02
Benzene	4.0 E-01	Bromodichloromethane	1.8 E+00
Calcium	2.4 E+05	Chloroform	2.7 E+01
Copper	1.4 E+02	Iron	1.1 E+03
Magnesium	5.5 E+04	Manganese	1.3 E+02
Nickel	1.4 E+02	Potassium	1.1 E+04
Sodium	1.1 E+06	Toluene	4.0 E-01
Uranium	9.5 E+00	Vinyl chloride	1.0 E+00
Zinc	2.6 E+02	Chloride	1.1 E+05
Nitrate	4.9 E+03	Sulfate	4.1 E+06

Table 2-14. Composition of Raw Water (from Columbia River) (Units are ppb)

Analyte	Average concentration	Analyte	Average concentration
Barium	2.8 E+01	Cadmium	2.4 E+00
Calcium	1.8 E+04	Chloroform	1.2 E+01
Copper	1.1 E+01	Iron	6.4 E+01
Magnesium	4.2 E+03	Manganese	9.8 E+00
Nickel	1.0 E+01	Potassium	8.0 E+02
Sodium	2.3 E+03	Uranium	7.3 E-01
Zinc	2.0 E+01	Chloride	8.7 E+02
Nitrate	1.0 E+03	Sulfate	1.1 E+04
Total organic carbon	1.4 E+03		

2.4.3 Variability

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 contamination beyond that found in the Columbia River. During periods of the PUREX Plant shutdown, concentrations of many components may increase by a factor of five. The primary contributor of detectable solutes, ion exchanger regenerant, rarely flows into the PUREX Plant CSL and is a highly variable stream, even during regeneration.

2.4.4 Process Monitoring

After the contributors to the CSL have flowed together, the CSL flows through manhole 4. (Figure 2-1 calls out manhole 4 as the CSL Pit.) A flowmeter in manhole 4 measures the flowrate of the CSL, driving a flow totalizer and flow-proportional sampler. Table 2-3 contains the total flow, in liters, measured by this system during the current period. 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 reported in this addendum) and a flow proportional sampler used for providing a record of the radioactivity in the CSL. The radiation monitor is sensitive to gamma radiation and automatically diverts the CSL to the 216-A-42 Diversion Basin if the count rate exceeds the alarm limit (currently set at 4,580 counts per minute). 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.

This page intentionally left blank.

3.0 SAMPLE DATA

This chapter provides an account of the sampling data relative to the characterization and designation of the CSL. The chapter comprises two parts: a discussion of the source of the data, and the presentation of the data.

3.1 DATA SOURCE

This analysis uses two sources of sampling data: wastestream data and background data. The wastestream data comprise the data collected from samples of the CSL. The background data comprise the data collected from water supply streams which feed the CSL, and from similar streams.

3.1.1 Wastestream Data

The chemical and radiological data for this report come from samples taken at the 295-AC Building, which houses equipment used to monitor and sample the CSL. Five samples (taken on August 5, 1986; December 5, 1986; March 12, 1987; June 12, 1987; and March 11, 1988) provided data for the CSL during ion exchanger regeneration. Six samples (taken on October 16, 1989; October 19, 1989; November 27, 1989; January 17, 1990; February 13, 1990; and February 20, 1990) provided data for the CSL during routine operation (that is, when the demineralizers, or ion exchangers, are not being regenerated). The sample analyses were performed at the contract laboratory.

Sampling and analytical protocols followed are discussed in Section 3.0 of the "parent" document.

Table 3-1 details the analyses which were performed on the CSL during regeneration; Table 3-2 details the analyses which were performed during routine operation.

3.1.2 Background Data

Background data came from three sources: samples of raw water, samples of 200 East Area sanitary water, and samples of condensed steam (2724-W laundry steam condensate). The raw water data are an update of the data presented in *Preliminary Evaluation of Hanford Liquid Discharges to Ground* (Jungfleisch 1988). The 200 East Area sanitary water data derive from *Hanford Sanitary Water Quality Surveillance, CY 1985*, and the corresponding reports for 1986, 1987, and 1988 (Somers 1986, 1987, 1988, 1989). The 2724-W laundry steam condensate data derive from a sampling campaign conducted October 1, 1989, to March 30, 1990, in support of this document. (The 2724-W laundry steam condensate is not a feed stream to the CSL, but should be similar to the steam condensate which feeds the CSL.)

Table 3-1. Analytical Procedures for the CSL During Regeneration.

Date	08/05/86	12/05/86	03/12/87	06/12/87	03/11/88
Alpha	X	X	X	X	X
Beta	X	X	X	X	X
COND-Fld	X	X	X	X	X
CVA	X	X	X		X
GEA	X	X	X	X	X
GFAA	X		X	X	X
IC	X	X	X	X	X
ICP	X	X	X	X	X
ISE	X	X	X	X	X
PH-Fld	X	X	X	X	X
SPEC	X	X	X		X
TEMP-Fld	X	X	X	X	X
TOC	X	X	X	X	X
TOX	X	X	X	X	X
VOA	X	X	X	X	X
VOA(A)	X	X	X		
VOA(B)	X	X	X	X	X

Notes: VOA(B) refers to accompanying VOA blank analyses.

VOA(A) refers to the VOA analysis for acetone. There were no blank analyses for acetone.

The only ion-specific electron (ISE) result for fluoride was on March 11, 1988.

Table 3-2. Analytical Procedures for the CSL During Routine Operation.
(sheet 1 of 3)

LEAD#	50689	50709	50796	50891
C of C#	50689	50709	50796	50891
Alkalinity	X	X	X	X
Alpha counting	X	X	X	X
^{241}Am	X	X	X	X
Ammonia	X	X	X	X
Arsenic	X	X	X	X
Atomic emission spectroscopy	X	X	X	X
Beta counting	X	X	X	X
^{14}C	X		X	X
Conductivity-field	X	X	X	X
Curium isotopes		X	X	
Cyanide	X	X	X	X
Direct aqueous injection (GC)	X	X	X	X
Fluoride (LDL)	X	X	X	X
Gamma energy analysis	X	X	X	X
Hydrazine	X	X	X	X
Ion chromatography	X	X	X	X
Lead	X	X	X	X
Low-energy photon detection	X			
Mercury	X	X	X	X
pH-field	X	X	X	X
Plutonium isotopes	X	X	X	X
Selenium	X	X	X	X
Semivolatile organics (GC/MS)	X	X	X	X
Strontium beta counting	X	X	X	X
Sulfide	X	X	X	X
Suspended solids	X	X	X	X
Temperature-field	X	X	X	X
Thallium	X	X	X	X
Total carbon	X	X	X	X
Total dissolved solids	X	X	X	X
Total organic carbon	X	X	X	X
Total organic halides (LDL)	X	X	X	X
Total radium alpha counting	X	X	X	X
Tritium		X		X
Uranium	X	X	X	X
Uranium isotopes	X	X	X	X
Volatile organics (GC/MS)	X	X	X	X

LEAD#	50689B	50709B	50796B	50891B
C of C#	50690	50710	50797	50892
Volatile organics (GC/MS)	X	X	X	X

LEAD#	50689T	50709T	50796T
C of C#	50691	50711	50798
Volatile organics (GC/MS)	X	X	X

Table 3-2. Analytical Procedures for the CSL During Routine Operation. (sheet 2 of 3)

LEAD#	50689E	50709E	50796E
C of C#	50692	50712	50799
Atomic emission spectroscopy	X	X	X
Ignitability	X	X	X
Mercury (mixed matrix)	X	X	X
Reactive cyanide	X	X	X
Reactive sulfide	X	X	X

LEAD#	50939	50955
C of C#	50939	50955
Alkalinity	X	X
Alpha counting		
^{241}Am		
Ammonia	X	X
Arsenic	X	X
Atomic emission spectroscopy	X	X
Beta counting		
^{14}C		
Conductivity-field		X
Curium isotopes		
Cyanide	X	X
Direct aqueous injection (GC)	X	X
Fluoride (LDL)	X	X
Gamma energy analysis		
Hydrazine	X	X
Ion chromatography	X	X
Lead	X	X
Low-energy photon detection		
Mercury	X	X
pH-field		X
Selenium	X	X
Semivolatile organics (GC/MS)	X	X
Strontium beta counting		
Sulfide	X	X
Suspended solids	X	X
Temperature-field		X
Thallium	X	X
Total carbon	X	X
Total dissolved solids	X	X
Total organic carbon	X	X
Total organic halides (LDL)	X	X
Total radium alpha counting		
Tritium		
Uranium		
Uranium isotopes		
Volatile organics (GC/MS)	X	X

Table 3-2. Analytical Procedures for the CSL During Routine Operation. (sheet 3 of 3)

LEAD#	50939B	50955B
C of C#	50940	50956
Volatile organics (GC/MS)	X	X
LEAD#	50939T	50955T
C of C#	50941	50957
Volatile organics (GC/MS)	X	X
LEAD#	50939E	50955E
C of C#	50942	50958
Atomic emission spectroscopy	X	X
Ignitability	X	X
Mercury (mixed matrix)	X	X
Reactive cyanide	X	X
Reactive sulfide	X	X

Notes: Procedures that were performed for a given sample are identified by an "X". Procedure references appear with the data.

LEAD# is the Liquid Effluent Analytical Data number that appears in the data reports. C of C# is the chain-of-custody number.

Abbreviations:
- gas chromatography (GC)
- low-detection limit (LDL)
- mass spectrometry (MS).

3.2 DATA PRESENTATION

3.2.1 Wastestream Data

Appendix B contains the results of individual analyses for chemicals and radionuclides. Table 3-3 presents a summary of the CSL data during regeneration. Table 3-4 presents a summary of the CSL data for routine operation.

3.2.2 Background Data

The CSL is largely a mixture of the 200 East Area raw water, 200 East Area sanitary water, and condensed steam. Consequently, these three streams compose appropriate background data. Table 3-5 presents a summary of the background data for the 200 East Area raw water and the 200 East Area sanitary water. Table 3-6 presents a summary of additional data on organic substances in the 200 East sanitary water. Table 3-7 presents a summary of the data for 2724-W laundry steam condensate.

Table 3-3. Statistics for PUREX CSL--Ion Exchanger Regeneration.

Analyte	N	MDA	Method	Mean	StdErr	90%CILim	Maximum
Aluminum	5	2	LM	2.04E+02	1.56E+02	4.99E+02	6.08E+02
Barium	5	0	N/A	8.14E+01	2.09E+01	1.13E+02	1.48E+02
Cadmium	5	2	LM	5.46E+00	2.82E+00	1.08E+01	1.30E+01
Calcium	5	0	N/A	3.92E+04	1.32E+04	5.94E+04	9.09E+04
Chloride	5	2	DL	1.14E+04	7.48E+03	2.55E+04	2.54E+04
Copper	5	2	DL	6.26E+02	3.62E+02	1.31E+03	1.19E+03
Cyanide	5	4	DL	1.04E+01	N/A	N/A	1.19E+01
Fluoride (IC)	5	4	DL	1.23E+04	N/A	N/A	3.39E+03
Fluoride (ISE)	1	0	N/A	2.13E+02	N/A	N/A	2.13E+02
Iron	5	0	N/A	4.58E+02	1.42E+02	6.75E+02	9.37E+02
Lead	4	1	LM	2.19E+01	4.33E+00	3.01E+01	3.12E+01
Magnesium	5	0	N/A	8.36E+03	2.64E+03	1.24E+04	1.86E+04
Manganese	5	0	N/A	3.30E+01	1.61E+01	5.77E+01	9.70E+01
Mercury	5	0	N/A	1.01E+00	4.27E-01	1.67E+00	2.52E+00
Nickel	5	3	DL	1.10E+01	1.26E+00	1.49E+01	1.30E+01
Nitrate	5	3	DL	1.27E+04	1.87E+04	7.03E+04	5.19E+03
Potassium	5	0	N/A	2.30E+03	6.94E+02	3.36E+03	4.09E+03
Silver	5	4	DL	8.00E+00	N/A	N/A	1.70E+01
Sodium	5	0	N/A	2.05E+05	1.26E+05	3.99E+05	7.05E+05
Strontium	5	4	DL	3.11E+02	N/A	N/A	3.53E+02
Sulfate	5	0	N/A	7.65E+05	4.57E+05	1.47E+06	2.53E+06
Uranium	5	0	N/A	8.40E-01	2.78E-01	1.27E+00	1.94E+00
Zinc	5	0	N/A	2.58E+02	1.03E+02	4.16E+02	4.88E+02
Acetone	3	0	N/A	9.03E+01	3.08E+01	1.48E+02	1.50E+02
Ammonia	5	3	DL	5.46E+01	7.79E+00	7.86E+01	7.00E+01
Dichloromethane	5	4	DL	1.10E+01	N/A	N/A	1.50E+01
Chloroform	5	3	DL	4.32E+01	6.41E+01	2.40E+02	1.71E+02
Alpha (pCi/L)	5	0	N/A	2.37E+00	1.23E+00	4.26E+00	7.24E+00
Beta (pCi/L)	5	0	N/A	8.99E+00	1.37E+00	1.11E+01	1.38E+01
Conductivity (μS)	5	0	N/A	2.85E+03	7.47E+02	3.99E+03	4.83E+03
pH (dimensionless)	5	0	N/A	4.34E+00	1.47E+00	6.60E+00	9.98E+00
Temperature (°C)	5	0	N/A	2.27E+01	4.38E+00	2.94E+01	3.76E+01
TOC (μg/g)	5	0	N/A	6.56E+03	2.76E+03	1.08E+04	1.72E+04
TOX (μg (Cl)/L)	5	0	N/A	1.89E+02	5.06E+01	2.66E+02	3.07E+02

The column headed MDA (minimum detectable amount) is the number of results in each data set below the detection limit.

The column headed Method shows the MDA replacement method used: replacement by the detection limit (DL) and replacement of single-valued MDAs by the log-normal plotting position method (LM).

The column headed "90%CILim" (90% Confidence Interval Limit) is the upper limit of the one-tailed 90% confidence limit.

Units are parts per billion (ppb) unless otherwise indicated.

Table 3-4. Statistics for PUREX CSL-Routine. (sheet 1 of 2)

Constituent	N	MDA	Method	Mean	StdErr	90%CILim	Maximum
Aluminum	6	5	DL	2.27E+02	7.73E+01	3.41E+02	6.14E+02
Arsenic (EP Toxic)	6	6	n/a	<5.00E+02	0.00E+00	<5.00E+02	<5.00E+02
Barium	6	0	n/a	3.13E+01	1.73E+00	3.39E+01	3.90E+01
Barium (EP Toxic)	6	6	n/a	<1.00E+03	0.00E+00	<1.00E+03	<1.00E+03
Boron	6	4	DL	1.60E+01	4.20E+00	2.22E+01	3.50E+01
Cadmium (EP Toxic)	6	6	n/a	<1.00E+02	2.79E-06	<1.00E+02	<1.00E+02
Calcium	6	0	n/a	1.84E+04	3.74E+02	1.90E+04	1.94E+04
Chloride	6	0	n/a	1.55E+03	1.34E+02	1.75E+03	2.00E+03
Chromium (EP Toxic)	6	6	n/a	<5.00E+02	0.00E+00	<5.00E+02	<5.00E+02
Copper	6	2	LM	2.93E+01	6.91E+00	3.95E+01	5.30E+01
Fluoride	6	0	n/a	1.40E+02	9.41E+00	1.54E+02	1.80E+02
Iron	6	0	n/a	2.16E+02	1.53E+02	4.43E+02	9.80E+02
Lead	6	5	DL	5.50E+00	5.00E-01	6.24E+00	8.00E+00
Lead (EP Toxic)	6	6	n/a	<5.00E+02	0.00E+00	<5.00E+02	<5.00E+02
Magnesium	6	0	n/a	4.21E+03	9.56E+01	4.35E+03	4.52E+03
Manganese	6	4	DL	1.57E+01	9.52E+00	2.97E+01	6.30E+01
Mercury	6	5	DL	1.10E-01	1.00E-02	1.25E-01	1.60E-01
Mercury (EP Toxic)	6	6	n/a	<2.00E+01	6.96E-07	<2.00E+01	<2.00E+01
Nitrate	6	2	LM	5.16E+02	4.83E+01	5.88E+02	7.00E+02
Potassium	6	0	n/a	7.19E+02	1.44E+01	7.40E+02	7.63E+02
Selenium (EP Toxic)	6	6	n/a	<5.00E+02	0.00E+00	<5.00E+02	<5.00E+02
Silicon	6	0	n/a	2.57E+03	2.30E+02	2.91E+03	3.71E+03
Silver (EP Toxic)	6	6	n/a	<5.00E+02	0.00E+00	<5.00E+02	<5.00E+02
Sodium	6	0	n/a	2.07E+03	6.12E+01	2.16E+03	2.26E+03
Strontium	6	0	n/a	9.08E+01	2.91E+00	9.51E+01	1.00E+02
Sulfate	6	0	n/a	1.12E+04	3.54E+02	1.17E+04	1.28E+04
Uranium	4	0	n/a	4.65E-01	5.91E-02	5.61E-01	6.40E-01
Zinc	6	1	LM	1.47E+01	6.98E+00	2.50E+01	4.90E+01
Ammonia	6	3	DL	5.77E+01	3.58E+00	6.30E+01	6.90E+01
Butylated hydroxy toluene	1	0	n/a	1.00E+01	n/a	n/a	1.00E+01
Trichloromethane	6	3	DL	8.83E+00	3.45E+00	1.39E+01	2.20E+01
Alkalinity (Method B)	6	0	n/a	5.95E+04	4.08E+03	6.55E+04	7.90E+04
Alpha Activity (pCi/L)	4	1	DL	9.84E-01	3.00E-01	1.47E+00	1.36E+00
Beta Activity (pCi/L)	4	1	DL	2.22E+00	1.38E-01	2.45E+00	2.49E+00
Conductivity (µS)	5	0	n/a	1.51E+02	4.01E+00	1.58E+02	1.61E+02
Ignitability (°F)	6	0	n/a	2.10E+02	1.31E+00	2.08E+02	2.04E+02
pH (dimensionless)	5	0	n/a	7.65E+00	1.28E-01	7.84E+00	8.10E+00
Reactivity Cyanide (mg/kg)	6	6	n/a	<1.00E+02	2.79E-06	<1.00E+02	<1.00E+02
Reactivity Sulfide (mg/kg)	6	6	n/a	<1.00E+02	2.79E-06	<1.00E+02	<1.00E+02
TDS	6	0	n/a	5.63E+04	5.87E+03	6.50E+04	7.00E+04
Temperature (°C)	5	0	n/a	2.50E+01	2.02E+00	2.81E+01	3.00E+01
Total Carbon	6	0	n/a	1.44E+04	4.82E+02	1.51E+04	1.60E+04
TOX (as Cl)	6	0	n/a	7.05E+01	1.96E+01	9.94E+01	1.50E+02

Table 3-4. Statistics for PUREX CSL-Routine. (sheet 2 of 2)

Constituent	N	MDA	Method	Mean	StdErr	90%CILim	Maximum
^{241}Am (pCi/L)	4	0	n/a	1.03E-01	6.13E-02	2.03E-01	2.73E-01
^{137}Cs (pCi/L)	4	3	DL	2.85E-01	1.04E-01	4.55E-01	5.78E-01
^{14}C (pCi/L)	3	2	DL	3.33E+00	5.03E-01	4.28E+00	4.14E+00
^{3}H (pCi/L)	2	1	DL	2.29E+02	8.35E+01	4.87E+02	3.13E+02
^{238}Pu (pCi/L)	3	1	DL	7.62E-03	4.55E-03	1.62E-02	1.58E-02
$^{239,240}Pu$ (pCi/L)	4	0	n/a	3.09E-01	1.37E-01	5.33E-01	6.59E-01
Radium Total (pCi/L)	4	3	DL	9.74E-02	5.81E-02	1.93E-01	2.66E-01
^{234}U (pCi/L)	4	0	n/a	1.71E-01	1.39E-02	1.94E-01	2.06E-01
^{238}U (pCi/L)	4	0	n/a	1.50E-01	7.75E-03	1.63E-01	1.70E-01

NOTES:

Mean values, standard errors, confidence interval limits and maxima are in ppb (parts per billion) unless indicated otherwise.

The column headed MDA (Minimum Detectable Amount) is the number of results in each data set below the detection limit.

The column headed Method shows the MDA replacement method used: replacement by the detection limit (DL), replacement of single-valued MDAs by the log-normal plotting position method (LM), or replacement of multiple valued MDAs by the normal plotting position method (MR).

The column headed "90%CILim" (90% Confidence Interval Limit) is the lower limit of the one-tailed 90% confidence interval for all ignitability data sets and pH data sets with mean values below 7.25. For all other data sets it is the upper limit of the one-tailed 90% confidence interval.

The column headed "Maximum" is the minimum value in the data set for ignitability, the value furthest from 7.25 for pH, and the maximum value for all other analytes.

Table 3-5. Summary of 200 East Area Raw Water and Sanitary Water Data (1985-1988).

Constituent/Parameter [all ppb, exceptions noted]	Raw Water[a] (1986-1987)			Sanitary Water[b] (1985-1988)		
	N[c]	AVG	STD DEV	N	AVG	STD DEV
Arsenic				4	<5.00E+00	NA
Barium	5	2.80E+01	3.40E+00	4	*1.05E+02	1.00E+01
Cadmium	5	2.40E+00	8.94E-01	4	<5.00E-01	NA
Calcium	5	1.84E+04	1.47E+03			
Chromium				4	<1.00E+01	NA
Chloride	5	8.71E+02	2.37E+02	4	3.05E+03	6.76E+02
Conductivity-field (µS)	5	9.32E+01	4.61E+01			
Copper	5	1.06E+01	1.34E+00	4	*2.50E+01	1.00E+01
Color (units)				4	<5.00E+00	NA
Iron	5	6.36E+01	2.57E+01	4	*8.25E+01	5.19E+01
Fluoride				4	*1.13E+02	2.50E+01
Lead				4	<5.00E+00	NA
Magnesium	5	4.19E+03	4.83E+02			
Manganese	5	9.80E+00	3.49E+00	4	<1.00E+01	NA
Mercury				4	<5.00E-01	NA
Nickel	5	1.04E+01	8.94E-01			
Nitrate (as N)	5	9.96E+02	8.79E+02	4	*3.72E+02	5.44E+02
pH (dimensionless)	5	7.41E+00	1.18E+00			
Potassium	5	7.95E+02	6.24E+01			
Selenium				4	<5.00E+00	NA
Silver				4	<1.00E+01	NA
Sodium	5	2.26E+03	2.42E+02	4	2.28E+03	1.26E+02
Sulfate	5	1.06E+04	9.97E+02	4	1.68E+04	3.37E+03
Temperature-field (C)	5	1.64E+01	5.84E+00			
TOC (µg/g)	5	1.36E+03	2.53E+02			
TDS (mg/L)				4	8.10E+01	1.69E+01
Trichloromethane	5	1.18E+01	4.02E+00			
Uranium	4	7.26E-01	2.22E-01			
Zinc	5	2.00E+01	2.12E+01	4	<1.00E+02	NA
Radionuclides (pCi/L)						
Alpha Activity	4	8.85E-01	5.30E-01			
Beta Activity	4	4.47E+00	1.76E+00			

NOTES: Averages denoted by an asterisk include a mix of above- and below-detection limit in computations when the actual values are below the detection limit.

See companion table for inorganic detection limits as compiled from Hanford Environmental Health Foundation.

[a]Compiled from "Substance Toxicity Evaluation of Waste Data Base" provided by F. M. Jungfleisch (this data is an update of the data presented in Preliminary Evaluation of Hanford Liquid Discharges (WHC 1988).

[b]Compiled from Hanford Sanitary Water Quality Surveillance for calendar years 1985, 1986, 1987, and 1988 (Somers 1986, 1987, 1988, 1989).

[c]N is defined as the number of test results available for a particular analyte; N may reflect both single and multiple data sets.

pCi/L = picoCuries per liter.
ppb = parts per billion.
TDS = total dissolved solids.
TOC = total organic carbon.
TOX = total organic halides.
µS = microsiemen.
µg = microgram.

9 1 1 1 5 0 3 5 6

Table 3-6. 200 East Sanitary Water--Organic Data (1987-1988).

Constituent/Parameter [all ppb, exceptions noted]	200 East[a]		
	N[b]	AVG	STD DEV
1,1,1-Trichloromethane	1	<DL[c]	NA
1,1 Dichloroethylene	1	<DL	NA
1,2,-Dichloroethane	1	<DL	NA
1,3,5-Trimethylbenzene	1	<DL	NA
Benzene	1	<DL	NA
Bromodichloromethane	5	1.76E+00	6.68E-01
Bromoform	5	<DL	NA
Carbon Tetrachloride	1	<DL	NA
Chlorodibromomethane	5	<DL	NA
Chloroform	5	2.65E+01	1.27E+01
Difluorodichloromethane	2	<DL	NA
Ethlylbenzene	1	<DL	NA
o-Xylene	1	<DL	NA
p-Chlorotoluene	1	<DL	NA
p-Dichlorobenzene	1	<DL	NA
Tetrachloroethylene	1	<DL	NA
Toluene	1	<DL	NA
Trichloroethylene	1	<DL	NA
Vinyl Chloride	1	<DL	NA

[a]The data given in this table were compiled by Hanford Environmental Health Foundation (HEHF). Data sets included first quarter 1987 and quarterly 1988 data. The total trihalomethane concentration for the 200 and 300 Areas appear in the *Hanford Water Quality Surveillance Report for CY 1988* (Somers 1989), and the *Hanford Water Quality Surveillance Report for CY 1989* (Thurman 1990).

[b]N is defined as the number of test results available for a particular analyte; N may reflect both single and multiple data sets. For N = 1 the sole available data entry is listed as "avg."

[c]See companion table for organic detection limits as compiled from HEHF data.

DL = detection limit
pbb = parts per billion.

Table 3-7. Summary of 2724-W Laundry Steam Condensate Data.
(sheet 1 of 2)

Constituent/Parameter [All ppb, exceptions noted]	2724-W Laundry Steam Condensate (1) (1989) N(2)	 AVG	 STD DEV.
Acetone	4	1.10E+01	1.73E+00
Alkalinity (Method B)	4	2.95E+04	1.01E+04
Aluminum	4	5.63E+02	6.86E+02
Ammonia	4	6.92E+01	1.19E+01
Arsenic (EP Toxic)	4	<5.00E+02	0.00E+00
Barium	4	1.80E+01	8.92E+00
Barium (EP Toxic)	4	<1.00E+03	0.00E+00
Boron	4	2.30E+01	8.52E+00
1-Butanol	1	3.90E+01	
Cadmium	4	<2.00E+00	0.00E+00
Cadmium (EP Toxic)	4	<1.00E+02	0.00E+00
Calcium	4	7.65E+03	6.43E+03
Chromium (EP Toxic)	4	<5.00E+02	0.00E+00
Chloride	4	1.35E+03	8.61E+02
Conductivity-field (µS)	4	6.32E+01	5.39E+01
Copper	4	8.17E+02	6.11E+02
Ignitability (°F)	4	2.06E+02	4.76E+00
Iron	4	2.06E+03	2.48E+03
Fluoride	4	7.50E+01	
Lead	4	1.55E+01	7.72E+00
Lead (EP Toxic)	4	<5.00E+02	0.00E+00
Magnesium	4	1.82E+03	1.39E+01
Manganese	4	1.57E+01	1.59E+01
Mercury (EP Toxic)	4	<2.00E+01	0.00E+00
pH (dimensionless)	4	6.98E+00	8.42E-01
Potassium	4	3.27E+02	1.94E+02
Reactivity Cyanide (mg/kg)	4	<1.00E+02	0.00E+00
Reactivity Sulfide (mg/kg)	4	<1.00E+02	0.00E+00
Selenium (EP Toxic)	4	<5.00E+02	0.00E+00
Silicon	4	1.75E+03	8.49E+02
Silver (EP Toxic)	4	<5.00E+02	0.00E+00
Sodium	4	8.85E+02	6.15E+02
Strontium	4	3.92E+01	3.15E+01
Sulfate	4	5.50E+03	4.88E+03
Suspended Solids (mg/L)	4	2.02E+04	1.61E+03
Temperature-field (°C)	4	6.63E+01	8.66E+00
Titanium	4	8.75E+01	4.76E+01
Total Carbon (µg/g)	4	4.53E+03	2.77E+03
TOX (µg (Cl)/L)	4	2.52E+01	2.79E+01
TDS (mg/L)	4	2.70E+04	2.25E+04
Trichloromethane	4	1.17E+01	1.17E+01
Uranium	3	3.45E-01	1.43E-01
Zinc	4	3.02E+01	2.44E+01

Table 3-7. Summary of 2724-W Laundry Steam Condensate Data.
(sheet 2 of 2)

Radionuclides (pCi/L)			
^{241}Am	2	5.77E-03	1.66E-03
^{60}Co	3	7.13E-01	3.14E-01
^{137}Cs	3	1.80E+00	1.21E+00
^{129}I	3	1.19E-01	6.94E-02
^{238}Pu	2	1.57E-03	1.27E-03
^{239}Pu	4	7.82E-03	6.27E-03
^{90}Sr	4	1.80E-01	1.60E-01
^{234}U	4	8.90E-02	6.65E-02
^{235}U	3	1.43E-02	7.13E-03
^{238}U	3	9.39E-02	2.16E-02

NOTES:

1) Data from sampling campaign conducted October 1, 1989, to March 30, 1990 in support of Stream Specific Reports.

2) N is defined as the number of test results available for a particular analyte. N may reflect both single and multiple data sets

ABBREVIATIONS:

ppb = parts per billion
μS = microsiemens
μg = micrograms
TOC = Total Organic Carbon
TOX = Total Organic Halides
TDS = Total Dissolved Solids
pCi/L = picocuries per liter

This page intentionally left blank.

4.0 DATA OVERVIEW

4.1 DATA COMPARISON

Table 4-1 compares the composition of the CSL during routine operation to the drinking water standards (SV1) and (in the case of radionuclides) the derived concentration guides (SV2). The presence of aluminum in the CSL stream is believed to be due to the use of flocculants in the sanitary water system.

Tables 4-2 and 4-3 compare the composition of the CSL during regeneration and routine operation, respectively, to the background water sources: 200 East Area raw water, 200 East Area sanitary water, and laundry steam condensate (standing in for PUREX condensed steam, which has not been sampled).

4.2 STREAM DEPOSITION RATES

Table 4-4 presents calculated stream deposition rates for the CSL. These deposition rates are based on the composition of the CSL during routine operation, and on flow data from the current period.

Table 4-1. CSL During Routine Operation versus Drinking Water Standards and Derived Concentration Guide Values.

Constituent	Result[a]	SV1[b]	SV2[c]
Aluminum	2.3E-01	5.0E-02 f *	
Barium	3.1E-02	5.0E+00 g	
Chloride	1.6E+00	2.5E+02 h	
Copper	2.9E-02	1.0E+00 h	
Fluoride	1.4E-01	2.0E+00 g	
Iron	2.2E-01	3.0E-01 h	
Lead	5.5E-03	5.0E-02 g	
Manganese	1.6E-02	5.0E-02 h	
Mercury	1.1E-04	2.0E-03 g	
Nitrate	5.2E-01	4.5E+01 e	
Sulfate	1.1E+01	2.5E+02 h	
Zinc	1.5E-02	5.0E+00 h	
Trichloromethane[d]	8.8E-03	1.0E-01 g	
Alpha Activity (pCi/L)[e]	9.8E-01	1.5E+01 g	3.0E+01
^{241}Am (pCi/L)	1.0E-01	4.0E+00 e	3.0E+01
Beta Activity (pCi/L)[f]	2.2E+00		1.0E+03
^{137}Cs (pCi/L)	2.8E-01	1.0E+02 e	3.0E+03
^{14}C (pCi/L)	3.3E+00	3.0E+03 e	7.0E+04
^{3}H (pCi/L)	2.3E+02	9.0E+04 e	2.0E+06
^{238}Pu (pCi/L)	7.6E-03		4.0E+01
^{239,240}Pu (pCi/L)[g]	3.1E-01	4.0E+01 e	3.0E+01
^{234}U (pCi/L)	1.7E-01		5.0E+02
^{238}U (pCi/L)	1.5E-01		6.0E+02
TDS	5.6E+01	5.0E+02 h	

[a]Units of results are mg/L unless indicated otherwise. The results are the mean values reported in the statistics table of Chapter 3.0.

[b]Screening Value 1 (SV1) lists the value first, basis second and an asterisk (*) third if the result exceeds the regulatory value. The basis is the proposed primary MCL (e), the proposed secondary MCL (f), the primary MCL (g), or the secondary MCL (h). The value is the smaller of two MCLs: the proposed primary MCL (or the primary MCL as a default) or the proposed secondary MCL (or the secondary MCL as a default). See the "parent" document.

[c]Screening Value 2 (SV2) lists the value first and an asterisk (*) second if the result exceeds the SV2). These values are derived concentration guides obtained from Appendix A of WHC-CM-7-5, *Environmental Compliance Manual*, Revision 1, January 1990.

[d]The SV1 value for trihalomethanes is used to evaluate trichloromethane results.

[e]The SV1 and SV2 values for Gross Alpha are used to evaluate Alpha Activity.

[f]The SV2 for Gross Beta is used to evaluate Beta Activity.

[g]The SV1 value for ^{239}Pu is used to evaluate ^{239,240}Pu.

Table 4-2. CSL During Regeneration versus Background.

Analyte	CSL Regen.	Raw Water	Sanitary Water	Steam Cond.
Aluminum	2.04E+02			5.63E+02
Barium	8.14E+01	2.80E+01	< 1.05E+02	1.80E+01
Cadmium	5.46E+00	2.40E+00	< 5.00E-01	< 2.00E+00
Calcium	3.92E+04	1.84E+04		7.65E+03
Chloride	1.14E+04	8.71E+02		1.35E+03
Copper	6.26E+02	1.06E+01	< 5.50E+01	8.17E+02
Cyanide	1.04E+01			< 1.00E+02
Fluoride (IC)	1.23E+04		< 1.13E+02	7.50E+01
Fluoride (ISE)	2.13E+02			
Iron	4.58E+02		< 5.00E+00	2.06E+03
Lead	2.19E+01	4.19E+03		1.55E+01
Magnesium	8.36E+03	9.80E+00	< 1.00E+01	1.82E+03
Manganese	3.30E+01		< 5.00E-01	1.57E+01
Mercury	1.01E+00	1.04E+01		< 2.00E+01
Nickel	1.10E+01	9.96E+02	< 3.72E+02	
Nitrate	1.27E+04			
Potassium	2.30E+03	7.95E+02		3.27E+02
Silver	8.00E+00		< 6.25E+00	< 5.00E+02
Sodium	2.05E+05	2.26E+03	2.28E+03	8.85E+02
Strontium	3.11E+02			3.92E+01
Sulfate	7.65E+05	1.06E+04	1.68E+04	5.50E+03
Uranium	8.40E-01	7.26E-01		3.45E-01
Zinc	2.58E+02	2.00E+01	< 6.25E+01	3.02E+01
Acetone	9.03E+01			1.10E+01
Ammonia	5.46E+01			
Dichloromethane	1.10E+01			
Chloroform	4.32E+01	1.18E+01	2.65E+01	1.17E+01
Alpha (pCi/L)	2.37E+00	8.85E-01		
Beta (pCi/L)	8.99E+00	4.47E+00		
Conductivity (μS)	2.85E+03	9.32E+01		6.32E+01
pH (dimensionless)	4.34E+00	7.41E+00		6.98E+00
Temperature (°C)	2.27E+01	1.64E+01		6.63E+01
TOC (μg/g)	6.56E+03	1.36E+03		
TOX (μg (Cl)/L)	1.89E+02			2.52E+01

Table 4-3. CSL During Routine Operation versus Background.
(sheet 1 of 2)

Constituent	Routine CSL	Raw Water	Sanitary Water	Steam Condensate
Aluminum	2.27E+02			5.63E+02
Arsenic (EP Toxic)	<5.00E+02		<5.00E+00	<5.00E+02
Barium	3.13E+01	2.80E+01	<1.05E+02	1.80E+01
Barium (EP Toxic)	<1.00E+03			<1.00E+03
Boron	1.60E+01			2.30E+01
Cadmium (EP Toxic)	<1.00E+02	2.40E+00	<5.00E-01	<1.00E+02
Calcium	1.84E+04	1.84E+04		7.65E+03
Chloride	1.55E+03	8.71E+02		1.35E+03
Chromium (EP Toxic)	<5.00E+02		<6.25E+00	<5.00E+02
Copper	2.93E+01	1.06E+01	<5.50E+01	8.17E+02
Fluoride	1.40E+02		<1.13E+02	7.50E+01
Iron	2.16E+02	6.36E+01	<8.25E+01	2.06E+03
Lead	5.50E+00		<5.00E+00	1.55E+01
Lead (EP Toxic)	<5.00E+02			<5.00E+02
Magnesium	4.21E+03	4.19E+03		1.82E+03
Manganese	1.57E+01	9.80E+00	<1.00E+01	1.57E+01
Mercury	1.10E-01		<5.00E-01	
Mercury (EP Toxic)	<2.00E+01			<2.00E+01
Nitrate	5.16E+02	9.96E+02	<3.72E+02	
Potassium	7.19E+02	7.95E+02		3.27E+02
Selenium (EP Toxic)	<5.00E+02		<4.25E+00	<5.00E+02
Silicon	2.57E+03			1.75E+03
Silver (EP Toxic)	<5.00E+02		<6.25E+00	<5.00E+02
Sodium	2.07E+03	2.26E+03	2.28E+03	8.85E+02
Strontium	9.08E+01			3.92E+01
Sulfate	1.12E+04	1.06E+04	1.68E+04	5.50E+03
Uranium	4.65E-01	7.26E-01		3.45E-01
Zinc	1.47E+01	2.00E+01	<6.25E+01	3.02E+01
Ammonia	5.77E+01			
Butylated hydroxytoluene	1.00E+01			
Chloroform	8.83E+00	1.18E+01		1.17E+01
Alkalinity (Method B)	5.95E+03			2.95E+04
Alpha Activity (pCi/L)	9.84E-01	8.85E-01		
Beta Activity (pCi/L)	2.22E+00	4.47E+00		
Conductivity (μS)	1.51E+02			6.32E+01
Ignitability (°F)	2.10E+02			2.06E+02
pH (dimensionless)	7.65E+00	7.41E+00		6.98E+00
Reactivity Cyanide (mg/kg)	<1.00E+02			<1.00E+02
Reactivity Sulfide (mg/kg)	<1.00E+02			<1.00E+02
TDS (mg/L)	5.63E+04		8.10E+04	2.70E+04
Temperature (°C)	2.50E+01	1.64E+01		6.63E+01
Total Carbon (mg/kg)	1.44E+04			4.53E+03
TOX (μg (Cl)/L)	7.05E+01			2.52E+01

Table 4-3. CSL During Routine Operation versus Background.
(sheet 2 of 2)

Constituent	Routine CSL	Raw Water	Sanitary Water	Steam Condensate
^{241}Am (pCi/L)	1.03E-01			5.77E-03
^{137}Cs (pCi/L)	2.85E-01			1.80E+00
^{14}C (pCi/L)	3.33E+00			
^{3}H (pCi/L)	2.29E+02			
^{238}Pu (pCi/L)	7.62E-03			1.57E-03
^{239}Pu & ^{240}Pu (pCi/L)	3.09E-01			
Radium Total (pCi/L)	9.74E-02			
^{234}U (pCi/L)	1.71E-01			8.90E-02
^{238}U (pCi/L)	1.50E-01			9.39E-02

Table 4-4. CSL Stream Deposition Rates.

Average flowrate: 7.67E+07 L/mo		
Constituent	Kg/L*	Kg/mo*
Aluminum	2.27E-07	1.74E+01
Barium	3.13E-08	2.40E+00
Boron	1.60E-08	1.23E+00
Calcium	1.84E-05	1.41E+03
Chloride	1.55E-06	1.19E+02
Copper	2.93E-08	2.25E+00
Fluoride	1.40E-07	1.07E+01
Iron	2.16E-07	1.66E+01
Lead	5.50E-09	4.22E-01
Magnesium	4.21E-06	3.23E+02
Manganese	1.57E-08	1.20E+00
Mercury	1.10E-10	8.43E-03
Nitrate	5.16E-07	3.96E+01
Potassium	7.19E-07	5.51E+01
Silicon	2.57E-06	1.97E+02
Sodium	2.07E-06	1.59E+02
Strontium	9.08E-08	6.96E+00
Sulfate	1.12E-05	8.59E+02
Uranium	4.65E-10	3.57E-02
Zinc	1.47E-08	1.13E+00
Ammonia	5.77E-08	4.42E+00
Butylated hydroxy toluene	1.00E-08	7.67E-01
Trichloromethane	8.83E-09	6.77E-01
Alpha Activity *	9.84E-13	7.54E-05
Beta Activity *	2.22E-12	1.70E-04
TDS	5.63E-05	4.32E+03
Total Carbon	1.44E-05	1.10E+03
TOX (as Cl)	7.05E-08	5.41E+00
^{241}Am *	1.03E-13	7.90E-06
^{137}Cs *	2.85E-13	2.19E-05
^{14}C *	3.33E-12	2.55E-04
^{3}H *	2.29E-10	1.76E-02
^{238}Pu *	7.62E-15	5.84E-07
^{239,240}Pu *	3.09E-13	2.37E-05
Radium Total *	9.74E-14	7.47E-06
^{234}U *	1.71E-13	1.31E-05
^{238}U *	1.50E-13	1.15E-05

Data collected from October 1989 through March 1990. Flowrate is the average of rates from Section 2.0. Constituent concentrations are average values from the statistics report in Section 3.0. Concentration units of flagged (*) constituents are reported as curies per liter. Deposition rate units of flagged (*) constituents are reported as curies per month.

5.0 DESIGNATION

This section proposes that the CSL Wastewater Wastestream not be designated a dangerous waste. This proposed designation uses data from both the effluent source description and sample data (Sections 2.0 through 4.0) and complies with the designation requirements of WAC 173-303-070.

The WAC 173-303-070 contains the procedure for determining if a waste is dangerous. This procedure is illustrated in Figure 5-1 and includes the following:

- Dangerous Waste Lists (WAC 173-303-080)
- Dangerous Waste Characteristics (WAC 173-303-090)
- Dangerous Waste Criteria (WAC 173-303-100).

5.1 DANGEROUS WASTE LISTS

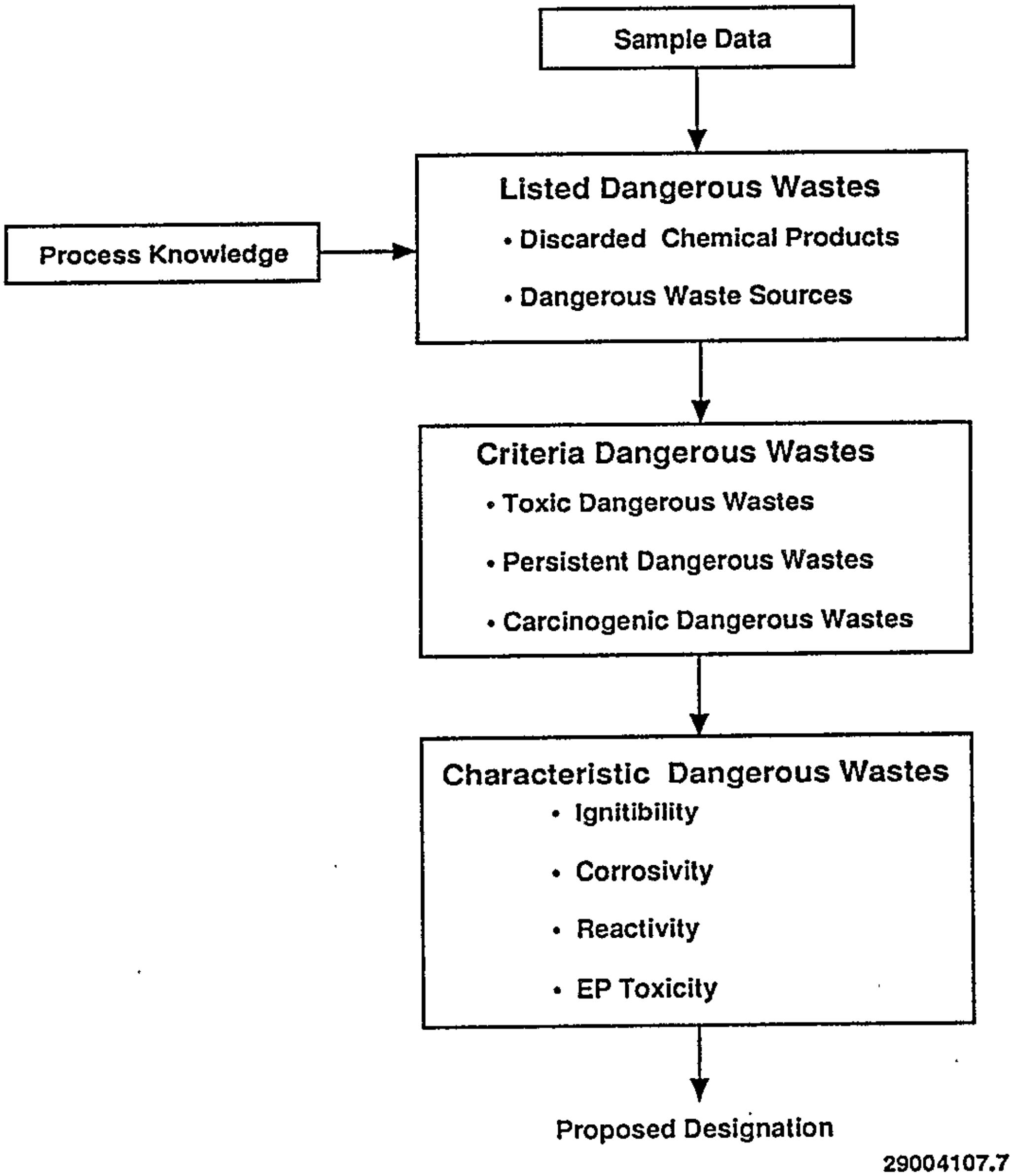
A waste is considered a listed dangerous waste if it either contains a discarded chemical product or originates from a dangerous waste source (per WAC 173-303-082). The proposed designation was based on a combination of process knowledge and sampling data.

5.1.1 Discarded Chemical Product

A wastestream constituent is a discarded chemical product (WAC 173-303-081) if it is listed in WAC 173-303-9903 and is characterized by one or all of the following descriptions.

- The listed constituent was the sole active ingredient in a commercial chemical product which has been discarded. Commercial chemical products which, as purchased, contained two or more active ingredients were not designated as discarded chemical products. Products which contained nonactive components such as water, however, were designated if the sole active ingredient in the mixture was listed in WAC 173-303-9903.

Figure 5-1. Illustration of the Designation Procedure.



- The constituent results from a spill of unused commercial chemical products. (A spill of a discarded chemical product would cause a wastestream to be designated during the time that the discharge is occurring. The approach taken is that the current wastestream would not be designated unless a review of past spill events indicates that the spills are predictable, systematic events that are ongoing or are reasonably anticipated to occur in the future. In this report, the evaluation of this criterion is based on a review of spill data in accordance with the *Comprehensive Environmental Response, Compensation, and Liability Act*.

- The constituent is discarded in the form of a residue resulting from cleanup of a spill of an unused commercial chemical product on the discarded chemical products list. (A chemical product that is used in a process and then released to the wastestream is not a discarded chemical product. Off-specification, unused chemicals, and chemicals that have exceeded a shelf life but have not been used are considered discarded chemical products.)

5.1.2 Dangerous Waste Sources

A list of dangerous waste sources is contained in WAC 173-303-9904, pursuant to WAC 173-303-082. There are three major categories of sources in WAC 173-303-9904. The first is nonspecific sources from routine operations occurring at many industries. The second is specific sources (e.g., wastes from ink formulation, etc.), none of which occur at the PUREX Plant. The third is state sources, which are limited to polychlorinated biphenyl (PCB)-contaminated transformers and capacitors resulting from salvaging, rebuilding, or discarding activities.

5.2 LISTED WASTE DATA CONSIDERATIONS

The proposed designation of the wastestream described in this report is based on an evaluation of process and sampling data. The following sections describe the types of information used in this designation.

5.2.1 Process Evaluation

Processes were reviewed and compared with the dangerous waste source list (no chemicals are discarded into the stream). This process evaluation is necessary because the stream could be a listed waste if a listed waste was known to have been added at any upstream location, even if a listed constituent was not detected at the sample point. The process evaluation included a review of process diagrams and operating procedures. It should be noted that no laboratory drains are connected to the CSL.

Additionally, waste handling practices at PUREX were reviewed. The PUREX Plant has a very aggressive program of proper waste handling including training, certification, oversight, and technical support that ensures hazardous wastes are disposed of properly. Administrative controls are disucssed in Section 2.3.1.3.

If a potentially listed source was identified, the process was evaluated to determine if it resulted in the generation of a listed waste.

5.2.2 Sampling Data

Sampling data were used as screening tools to enhance and support the results of the process evaluation. This step compared the results of the sampling data to the WAC 173-303-9903 and -9904 lists. If a constituent was cited on one or both of these lists, an engineering evaluation was performed to determine if the constituent had entered the wastestream as a discarded chemical product or came from a dangerous waste source.

Screening organic constituents is a relatively simple procedure because analytical data for organic constituents are reported as substances and are easily compared to the WAC 173-303-9903 and -9904 lists. It is not as simple to screen inorganic analytical data because inorganic data are reported as ions or elements rather than as substances. For example, an analysis may show that a wastestream contains the cations sodium and calcium along with the anions chloride and nitrate. The possible combinations of substances include sodium chloride, sodium nitrate, calcium chloride, and calcium nitrate. In a situation with many cation and anions, however, the list of possible combinations is extensive.

A procedure was developed by the Westinghouse Hanford Company for combining the inorganic constituents into substances. This screening procedure is described in WHC-EP-0275 (WHC 1990a) and is intended to be a tool in the evaluation of a wastestream. The listing of the inorganic substances that developed this screening procedure is not intended to be an indication that the substance was discharged to the wastestream, only that the necessary cations and anions are present and an investigation should be conducted to determine how they entered the wastestream. Table 5-1 presents the results of this screening procedure.

5.3 PROPOSED LISTED WASTE DESIGNATIONS

A process evaluation, along with a review of sampling data, indicated that the CSL wastewater stream did not contain a discarded chemical product or a listed waste source. The following sections discuss the evaluation that was conducted to substantiate this conclusion.

Table 5-1. Inorganic Chemistry Report for the CSL--Routine Operation. (sheet 1 of 2)

Constituent	ppb	Ion	Eq/g	Normalized
Charge normalization:				
Aluminum	3.41E+02	Al+3	3.80E-08	
Barium	3.39E+01	Ba+2	4.93E-10	
Boron	2.22E+01	B407-2	1.03E-09	2.93E-09
Calcium	1.90E+04	Ca+2	9.47E-07	
Chloride	1.75E+03	Cl-1	4.93E-08	1.41E-07
Copper	3.95E+01	Cu+2	1.24E-09	
Fluoride	1.54E+02	F-1	8.10E-09	2.31E-08
Iron	4.43E+02	Fe+3	2.38E-08	
Lead	6.24E+00	Pb+2	6.02E-11	
Magnesium	4.35E+03	Mg+2	3.58E-07	
Manganese	2.97E+01	Mn+2	1.08E-09	
Mercury	1.25E-01	Hg+2	1.24E-12	
Nitrate	5.88E+02	NO3-1	9.48E-09	2.71E-08
Potassium	7.40E+02	K+1	1.89E-08	
Silicon	2.91E+03	SiO3-2	2.07E-07	5.93E-07
Sodium	2.16E+03	Na+1	9.40E-08	
Strontium	9.51E+01	Sr+2	2.17E-09	
Sulfate	1.17E+04	SO4-2	2.44E-07	6.97E-07
Uranium	5.61E-01	UO2+2	4.72E-12	
Zinc	2.50E+01	Zn+2	7.64E-10	
Hydrogen Ion (from pH 7.8)		H+	(1.43E-11)	
Hydroxide Ion (from pH)		OH-	(6.98E-10)	
Cation total			1.49E-06	
Anion total			5.20E-07	
Anion normalization factor:	2.858			

Substance formation:

Substance	%	Cation out	Anion out
Copper(II) chloride	8.37E-06	0.00E+00	1.40E-07
Mercury(II) chloride	1.69E-08	0.00E+00	1.40E-07
Uranyl nitrate	9.30E-08	0.00E+00	2.71E-08
Iron(III) fluoride	8.71E-05	6.26E-10	0.00E+00
Lead chloride	8.38E-07	0.00E+00	1.40E-07
Barium chloride	5.14E-06	0.00E+00	1.39E-07
Zinc nitrate	7.24E-06	0.00E+00	2.63E-08
Iron(III) chloride	3.39E-06	0.00E+00	1.38E-07
Aluminum nitrate	3.29E-04	1.17E-08	0.00E+00
Magnesium chloride	6.59E-04	2.20E-07	0.00E+00
Calcium tetraborate	2.87E-05	9.44E-07	0.00E+00
Magnesium sulfate	1.32E-03	0.00E+00	4.77E-07
Sodium metasilicate	5.74E-04	0.00E+00	4.99E-07

Table 5-1. Inorganic Chemistry Report for the CSL--Routine Operation. (sheet 2 of 2)

Substance formation: Substance	%	Cation out	Anion out
Aluminum sulfate	3.50E-05	0.00E+00	4.65E-07
Potassium metasilicate	1.46E-04	0.00E+00	4.80E-07
Manganese(II) metasilicate	7.09E-06	0.00E+00	4.79E-07
Strontium sulfate	1.99E-05	0.00E+00	4.63E-07
Calcium sulfate	3.15E-03	4.81E-07	0.00E+00

Statistics based on a single datum are noted by an asterisk (*). With the exception of hydrogen ion and hydroxide, others report the upper limit of the one-tailed 90% confidence interval. Hydrogen ion is based on the lower limit of the one-tailed 90% confidence interval for pH sets with mean values below 7.25 and on the upper limit of the one-tailed 90% confidence interval for pH data sets with mean values of 7.25 or higher. The hydroxide magnitude is equal to 1.00E-20 (Eq/g)**2 divided by the hydrogen ion value (in Eq/g).

Ion concentrations in equivalents per gram (Eq/g) are based on the statistic. Conversions include scale (ppb to g/g), molecular weight (constituent form to ionic form), and equivalents (charges per ion). The column headed "Normalized" shows normalized concentrations (also in Eq/g) calculated by increasing concentrations of cations, excluding Hydrogen ion, or anions, excluding hydroxide, by the normalization factor. The normalization factor is the larger of the cation total, including Hydrogen ion, or anion total, including hydroxide, divided by the smaller total.

Substance names may include MB (monobasic), DB (dibasic), TB (tribasic) to identify the equivalents of hydrogen ion that have been neutralized from polycrotic weak acids to form their conjugate bases.

Substances are formulated in the order listed. The column headed "%" is the percent of the substance in the waste (gms/100gms). Substances formulated with oxygen are based on the residual concentration of the counterion. Other substance concentrations are based on the limiting residual concentration of the cation or anion. The columns headed "Cation Out" and "Anion Out" indicate the residual concentrations (in Eq/g) of each ion after a substance concentration has been calculated.

5.3.1 Discarded Chemical Products

With the exception of acetone, chloroform, mercury, and methylene chloride, all of the substances in Tables 5-2 and 5-3 are ionic and will be treated as a group following the nonionic substances. The nonionic substances will be treated separately in this section.

Tables 5-2 and 5-3 contain a listing of the 16 potential discarded chemical products identified from sampling data (using the screening procedure described in Section 5.2).

Based on the considerations and data presented in the following sections, it is concluded that the wastestream does not contain any discarded chemical products.

5.3.1.1 Acetone. Acetone has been used in PUREX in laboratory operations. Interviews with laboratory personnel provided no evidence that acetone had been disposed of into the CSL. It is noted that waste acetone from the PUREX laboratory is handled as radioactive waste; the disposal of radioactive materials into the CSL is prevented through physical controls and administrative procedures and would be readily detected by routine plant radiation surveys. It is concluded that the acetone seen in the CSL is not the result of the discard of a chemical product.

The presence of acetone in the CSL is associated with the regeneration of the ion exchangers. Acetone was seen in three of the five regeneration samples taken of the CSL at an average concentration of 90 ppb. It was not seen in any of the six samples taken of the CSL at times when ion exchange regeneration was not occurring. The ion exchangers contain an organic resin which can break down in the presence of oxidizing agents to yield simpler oxygenated compounds such as acetone. Analyses of demineralized water from the 222-S Facility lend credence to the suggestion that the ion exchange resins used to produce demineralized water at the PUREX Plant could also be degrading to produce acetone in the amounts seen in CSL samples (Bergmann 1989).

5.3.1.2 Chloroform (Trichloromethane). Chloroform is used in PUREX laboratory operations. Interviews with laboratory personnel provided no evidence that chloroform had been disposed to the CSL stream. A review of CERCLA spill records did not reveal any spills of chloroform during the current period. It is noted that waste chloroform from the PUREX laboratory is handled as radioactive waste; the disposal of radioactive materials into the CSL is prevented through physical controls and administrative procedures, and would be readily detected by routine plant radiation surveys. It is concluded that the chloroform seen in the CSL stream is not the result of the discard of a chemical product.

The maximum concentration of chloroform seen in the CSL during routine operation is 22 ppb. The threshold value for chloroform based on water supplied to PUREX is 50 ppb as presented in Section 5.2 of the "parent" document. As the concentration of chloroform seen in this wastestream is

Table 5-2. Dangerous Waste Designation Report for the CSL--Ion Exchanger Regeneration. (sheet 1 of 3)

Dangerous Waste Designation Report for PUREX Chemical Sewer-Ion Exchanger Regenerate

Finding:

Discarded Chemical Products - WAC 173-303-081

Substance	Review Number
Barium cyanide	P013(EHW)
Calcium chromate(VI)	U032(EHW)
Calcium cyanide	P021(EHW)
Copper(II) cyanide	P029(EHW)
Hydrogen cyanide	P063(EHW)
Hydrogen fluoride	U134(DW)
Nickel(II) cyanide	P074(EHW)
Potassium cyanide	P098(EHW)
Silver cyanide	P104(EHW)
Sodium cyanide	P106(EHW)
Zinc cyanide	P121(EHW)
Acetone	U002(DW)
Chloroform	U044(EHW)
Methylene chloride	U080(EHW)
Cyanides(soluble salts),NOS	P030(EHW)

Dangerous Waste Sources - WAC 173-303-082

Substance	Review Number
Acetone	F003
Cyanides(soluble salts),NOS	F007 thru F012

Infectious Dangerous Waste - WAC 173-303-083

No regulatory guidance

Dangerous Waste Mixtures - WAC 173-303-084

Substance	Toxic EC%	Persistant HH%	Persistant PAH%	Carcinogenic Total%
Aluminum nitrate	1.08E-08	0.00E+00	0.00E+00	0.00E+00
Barium chloride	3.49E-10	0.00E+00	0.00E+00	0.00E+00
Cadmium chloride	2.80E-10	0.00E+00	0.00E+00	2.80E-08
Calcium chromate(VI)	3.15E-11	0.00E+00	0.00E+00	3.15E-08
Copper(II) chloride	4.37E-07	0.00E+00	0.00E+00	0.00E+00
Iron(III) fluoride	2.76E-08	0.00E+00	0.00E+00	0.00E+00
Lead sulfate	8.46E-10	0.00E+00	0.00E+00	0.00E+00
Magnesium chloride	2.22E-09	0.00E+00	0.00E+00	0.00E+00
Magnesium sulfate	9.67E-09	0.00E+00	0.00E+00	0.00E+00
Mercury(II) chloride	4.57E-10	0.00E+00	0.00E+00	0.00E+00
Nickel(II) cyanide	2.33E-08	0.00E+00	0.00E+00	0.00E+00
Nickel(II) hydroxide	1.88E-11	0.00E+00	0.00E+00	1.88E-08
Potassium fluoride	1.01E-08	0.00E+00	0.00E+00	0.00E+00
Silver nitrate	4.33E-08	0.00E+00	0.00E+00	0.00E+00
Sodium fluoride	3.83E-08	0.00E+00	0.00E+00	0.00E+00
Sodium nitrate	2.63E-09	0.00E+00	0.00E+00	0.00E+00
Strontium nitrate	1.60E-10	0.00E+00	0.00E+00	0.00E+00
Uranyl nitrate	4.25E-11	0.00E+00	0.00E+00	0.00E+00
Zinc nitrate	2.44E-09	0.00E+00	0.00E+00	0.00E+00
Acetone	1.48E-07	0.00E+00	0.00E+00	0.00E+00
Ammonia	6.06E-08	0.00E+00	0.00E+00	0.00E+00
Chloroform	9.23E-07	9.23E-06	0.00E+00	9.23E-06
Methylene chloride	1.25E-07	1.25E-06	0.00E+00	1.25E-06
Total	1.87E-06	1.05E-05	0.00E+00	1.06E-05
DW Number	Undesignated	Undesignated	Undesignated	Undesignated

Table 5-2. Dangerous Waste Designation Report for the CSL--Ion Exchanger Regeneration. (sheet 2 of 3)

Dangerous Waste Designation Report for PUREX Chemical Sewer-Ion Exchanger Regenerate

Dangerous Waste Characteristics - WAC 173-303-090

Characteristic	Value	DW Number
Ignitables % (Calc)	1.48E-05	Undesignated
Corrosivity-pH	2.08	Undesignated
Reactivity Cyanide (mg/kg)	1.14E-02	Undesignated
Reactivity Sulfide (mg/kg)	0.00E+00	Undesignated
EP Toxic Barium (mg/L)	1.13E-01	Undesignated
EP Toxic Cadmium (mg/L)	8.47E-03	Undesignated
EP Toxic Chromium (mg/L)	1.05E-02	Undesignated
EP Toxic Lead (mg/L)	2.85E-02	Undesignated
EP Toxic Mercury (mg/L)	1.67E-03	Undesignated
EP Toxic Silver (mg/L)	1.35E-02	Undesignated

Dangerous Waste Criteria - WAC 173-303-100

	Toxic	Persistant		Carcinogenic	
Substance	EC%	HH%	PAH%	Total%	DW Number-Positive
Aluminum nitrate	1.08E-08	0.00E+00	0.00E+00	0.00E+00	
Barium chloride	3.49E-10	0.00E+00	0.00E+00	0.00E+00	
Cadmium chloride	2.80E-10	0.00E+00	0.00E+00	2.80E-08	Undesignated
Calcium chromate(VI)	3.15E-11	0.00E+00	0.00E+00	3.15E-08	Undesignated
Copper(II) chloride	4.37E-07	0.00E+00	0.00E+00	0.00E+00	
Iron(III) fluoride	2.76E-08	0.00E+00	0.00E+00	0.00E+00	
Lead sulfate	8.46E-10	0.00E+00	0.00E+00	0.00E+00	
Magnesium chloride	2.22E-09	0.00E+00	0.00E+00	0.00E+00	
Magnesium sulfate	9.67E-09	0.00E+00	0.00E+00	0.00E+00	
Mercury(II) chloride	4.57E-10	0.00E+00	0.00E+00	0.00E+00	
Nickel(II) cyanide	2.33E-08	0.00E+00	0.00E+00	0.00E+00	
Nickel(II) hydroxide	1.88E-11	0.00E+00	0.00E+00	1.88E-08	Undesignated
Potassium fluoride	1.01E-08	0.00E+00	0.00E+00	0.00E+00	
Silver nitrate	4.33E-08	0.00E+00	0.00E+00	0.00E+00	
Sodium fluoride	3.83E-08	0.00E+00	0.00E+00	0.00E+00	
Sodium nitrate	2.63E-09	0.00E+00	0.00E+00	0.00E+00	
Strontium nitrate	1.60E-10	0.00E+00	0.00E+00	0.00E+00	
Uranyl nitrate	4.25E-11	0.00E+00	0.00E+00	0.00E+00	
Zinc nitrate	2.44E-09	0.00E+00	0.00E+00	0.00E+00	
Acetone	1.48E-07	0.00E+00	0.00E+00	0.00E+00	
Ammonia	6.06E-08	0.00E+00	0.00E+00	0.00E+00	
Chloroform	9.23E-07	9.23E-06	0.00E+00	9.23E-06	Undesignated
Methylene chloride	1.25E-07	1.25E-06	0.00E+00	1.25E-06	Undesignated
Total	1.87E-06	1.05E-05	0.00E+00	1.06E-05	
DW Number	Undesignated	Undesignated	Undesignated	Undesignated	

Table 5-2. Dangerous Waste Designation Report for the CSL--Ion Exchanger Regeneration. (sheet 3 of 3)

Dangerous Waste Designation Report for PUREX Chemical Sewer-Ion Exchanger Regenerate

Dangerous Waste Constituents - WAC 173-303-9905

Substance
Barium cyanide
Calcium chromate(VI)
Calcium cyanide
Copper(II) cyanide
Hydrogen cyanide
Hydrogen fluoride
Nickel(II) cyanide
Potassium cyanide
Silver cyanide
Sodium cyanide
Zinc cyanide
Chloroform
Methylene chloride
Barium and compounds,NOS
Cadmium and compounds,NOS
Chromium and compounds,NOS
Cyanides(soluble salts),NOS
Lead and compounds,NOS
Mercury and compounds,NOS
Nickel and compounds,NOS
Silver and compounds,NOS

Substance names may include MB (monobasic), DB (dibasic), and TB (tribasic) to identify the equivalence of hydrogen ion that have been nutralized from polyprotic weak acids to form their conjugate bases.
Results based on a single datum are noted by an asterisk. Others are based on the upper limit of the 80% confidence interval. The pH is the single datum or the 80% confidence interval limit that is farthest from 7.25.
Igniteability and reactivity are calculated results. In lieu of closed cup ignition results, igniteability is estimated from the sum of the contributions of all substances that are ignitable when pure. A waste is flagged as dangerous if the sum of the ignitable substances exceeds one percent. Reactivity is by SW-846: 250 mg of cyanide as hydrogen cyanide per kg of waste or 500 mg of sulfide as hydrogen sulfide per kg of waste. Total cyanide and total sulfide are used in lieu of amenable cyanide and amenable sulfide.

Table 5-3. Dangerous Waste Designation Report for the CSL--Routine Operation. (sheet 1 of 2)

Dangerous Waste Designation Report for PUREX Chemical Sewer-Routine Operation

Dangerous Waste Criteria - WAC 173-303-100

Substance	Toxic EC%	Persistant HH%	Persistant PAH%	Carcinogenic Total%	DW Number-Positive
Aluminum nitrate	3.29E-07	0.00E+00	0.00E+00	0.00E+00	
Aluminum sulfate	3.50E-09	0.00E+00	0.00E+00	0.00E+00	
Barium chloride	5.14E-09	0.00E+00	0.00E+00	0.00E+00	
Calcium tetraborate	2.87E-09	0.00E+00	0.00E+00	0.00E+00	
Copper(II) chloride	8.37E-07	0.00E+00	0.00E+00	0.00E+00	
Iron(III) chloride	3.39E-09	0.00E+00	0.00E+00	0.00E+00	
Iron(III) fluoride	8.71E-07	0.00E+00	0.00E+00	0.00E+00	
Lead chloride	8.38E-09	0.00E+00	0.00E+00	0.00E+00	
Magnesium chloride	6.59E-08	0.00E+00	0.00E+00	0.00E+00	
Magnesium sulfate	1.32E-07	0.00E+00	0.00E+00	0.00E+00	
Mercury(II) chloride	1.69E-09	0.00E+00	0.00E+00	0.00E+00	
Sodium metasilicate	5.74E-08	0.00E+00	0.00E+00	0.00E+00	
Uranyl nitrate	9.30E-10	0.00E+00	0.00E+00	0.00E+00	
Zinc nitrate	7.24E-09	0.00E+00	0.00E+00	0.00E+00	
Ammonia	6.30E-08	0.00E+00	0.00E+00	0.00E+00	
Trichloromethane	1.39E-07	1.39E-06	0.00E+00	1.39E-06	Undesignated
Total	2.53E-06	1.39E-06	0.00E+00	1.39E-06	
DW Number	Undesignated	Undesignated	Undesignated	Undesignated	

Dangerous Waste Constituents - WAC 173-303-9905

Substance
Hydrogen fluoride
Trichloromethane
Barium and compounds,NOS
Lead and compounds,NOS
Mercury and compounds,NOS

Substance names may include MB (monobasic), DB (dibasic), or TB (tribasic) to identify the equivalence of hydrogen ion that have been nutralized from polyprotic weak acids to form their conjugate bases.

Results based on a single datum are noted by an asterisk (*). Others are based on the lower limit of the one-tailed 90% confidence interval for pH data sets with mean values below 7.25 or by the upper limit of the one-tailed 90% confidence interval for all other data sets.

EP Toxic contaminants, ignitability, and reactivity are reported by standard methods when available. In the absence of EP Toxicity data, total contaminant concentrations are evaluated. In lieu of closed cup ignition results, ignitability is estimated from the sum of the contributions of all substances that are ignitable when pure. A waste is flagged as dangerous if sum of the ignitable substances exceeds one percent. Reactivity is by SW-846: 250 mg of cyanide as hydrogen cyanide per kg of waste or 500 mg of sulfide as hydrogen sulfide per kg of waste. Total cyanide and total sulfide are used in lieu of amenable cyanide and amenable sulfide.

Inorganic substances are fomulated and their possible concentrations calculated for designation purposes only. The actual existance in the waste of these substances is not implied and should not be infered.

Table 5-3. Dangerous Waste Designation Report for the CSL--Routine Operation. (sheet 2 of 2)

Dangerous Waste Designation Report for PUREX Chemical Sewer-Routine Operation

Finding: Undesignated

Discarded Chemical Products - WAC 173-303-081

Substance	Review Number	Status	DW Number
Hydrogen fluoride	U134(DW)	Not Discarded	Undesignated
Mercury	U151(EHW)	Not Discarded	Undesignated
Trichloromethane	U044(EHW)	Not Discarded	Undesignated

Dangerous Waste Sources - WAC 173-303-082

Substance	Review Number	Status	DW Number
None	None	Not applicable	None

Infectous Dangerous Waste - WAC 173-303-083

No regulatory guidance

Dangerous Waste Mixtures - WAC 173-303-084

	Toxic	Persistant		Carcinogenic
Substance	EC%	HH%	PAH%	Total%
Aluminum nitrate	3.29E-07	0.00E+00	0.00E+00	0.00E+00
Aluminum sulfate	3.50E-09	0.00E+00	0.00E+00	0.00E+00
Barium chloride	5.14E-09	0.00E+00	0.00E+00	0.00E+00
Calcium tetraborate	2.87E-09	0.00E+00	0.00E+00	0.00E+00
Copper(II) chloride	8.37E-07	0.00E+00	0.00E+00	0.00E+00
Iron(III) chloride	3.39E-09	0.00E+00	0.00E+00	0.00E+00
Iron(III) fluoride	8.71E-07	0.00E+00	0.00E+00	0.00E+00
Lead chloride	8.38E-09	0.00E+00	0.00E+00	0.00E+00
Magnesium chloride	6.59E-08	0.00E+00	0.00E+00	0.00E+00
Magnesium sulfate	1.32E-07	0.00E+00	0.00E+00	0.00E+00
Mercury(II) chloride	1.69E-09	0.00E+00	0.00E+00	0.00E+00
Sodium metasilicate	5.74E-08	0.00E+00	0.00E+00	0.00E+00
Uranyl nitrate	9.30E-10	0.00E+00	0.00E+00	0.00E+00
Zinc nitrate	7.24E-09	0.00E+00	0.00E+00	0.00E+00
Ammonia	6.30E-08	0.00E+00	0.00E+00	0.00E+00
Trichloromethane	1.39E-07	1.39E-06	0.00E+00	1.39E-06
Total	2.53E-06	1.39E-06	0.00E+00	1.39E-06
DW Number	Undesignated	Undesignated	Undesignated	Undesignated

Dangerous Waste Characteristics - WAC 173-303-090

Characteristic	Value	DW Number
Ignitability (Degrees F)	>207	Undesignated
Corrosivity-pH	7.84	Undesignated
Reactivity Cyanide (mg/kg)	<1.00E+02	Undesignated
Reactivity Sulfide (mg/kg)	<1.00E+02	Undesignated
EP Toxic Arsenic (mg/L)	<5.00E-01	Undesignated
EP Toxic Barium (mg/L)	<1.00E+00	Undesignated
EP Toxic Cadmium (mg/L)	<1.00E-01	Undesignated
EP Toxic Chromium (mg/L)	<5.00E-01	Undesignated
EP Toxic Lead (mg/L)	<5.00E-01	Undesignated
EP Toxic Mercury (mg/L)	<2.00E-02	Undesignated
EP Toxic Selenium (mg/L)	<5.00E-01	Undesignated
EP Toxic Silver (mg/L)	<5.00E-01	Undesignated

less than the threshold value, these data will not be considered in the designation of the wastestream as it is likely that chloroform is present in these wastestream samples due to the presence of chloroform in the facility water supply.

The average concentration of chloroform seen in the CSL during regeneration of the ion exchangers is 95.0 ppb; chloroform was detected in two of the five samples taken during regeneration of the ion exchangers. While this value exceeds the amount of chloroform normally present in facility water supplies, it is not unexpected. Chloroform is a relatively small, polar molecule which would be expected to behave somewhat like an ionic species. Some loading of chloroform onto the ion exchange columns would be expected; during regeneration of the column, the chloroform would be stripped from the resin bed and would be released in concentrations substantially higher than those present in the facility water supply.

5.3.1.3 Mercury. Metallic mercury is used in instruments in the PUREX Plant. Interviews with maintenance personnel provided no evidence that mercury had been disposed to the CSL stream.

A review of CERCLA spill records did not reveal any spills of mercury during the current period.

Mercury appeared in one of the six samples taken of the CSL stream during normal operation at a concentration of 0.16 ppb. The threshold value for mercury based on water supplied to the PUREX Plant is 0.5 ppb as presented in Section 5.2 of the "parent" document. As the concentration of mercury in this single sample of the wastestream is less than the threshold value, this data will not be considered in the designation of the wastestream as it is likely that mercury found in this wastestream sample is due to the presence of mercury in the facility water supply.

During regeneration, the average concentration of mercury in the wastestream was 1.0 ppb. This is expected as explained in Section 5.3.1.6. Mercury is collected and concentrated during normal operation of the exchanger system and eluted from the bed during regeneration.

5.3.1.4 Hydrogen Fluoride. Hydrogen fluoride is used in the PUREX Plant laboratory operations as a complexant for photometric analyses. Interviews with laboratory personnel provided no evidence that hydrogen fluoride had been disposed to the CSL stream. A review of CERCLA spill records did not reveal any spills of hydrogen fluoride during the current period. It is noted that hydrogen fluoride from the PUREX laboratory is handled as radioactive material; the disposal of radioactive materials into the CSL is prevented through physical controls and administrative procedures and would be readily detected by routine plant radiation surveys. It is concluded that hydrogen fluoride seen in the CSL stream is not the result of the discard of chemical product.

The average concentration of fluorides in the CSL is 140 ppb during routine operation. The threshold value for hydrogen fluoride based on water supplied to PUREX is 143 ppb as presented in Section 5.2 of the "parent" document. As the concentration of hydrogen fluoride seen in this wastewater stream is less than the threshold value, these data will not be considered in the designation of the wastestream as it is likely that hydrogen fluoride is present in these wastestream samples because of the presence of fluorides in the facility water supply.

The average concentration of fluorides seen in the CSL during ion exchanger regeneration is 12,300 ppb. As explained in the discussion of ionic substances in Section 5.3.1.6, this higher concentration is to be expected, as fluorides are collected and concentrated on the ion exchange resin during normal operation of the exchanger system and are eluted from the bed during regeneration.

5.3.1.5 Methylene Chloride. Methylene chloride is used in PUREX Plant laboratory operations, and may be present in some paints. Interviews with laboratory and maintenance personnel provided no evidence that methylene chloride had been disposed to the CSL stream.

A review of CERCLA spill records revealed that there had been a solvent spill to the ground during the current period. However, none of the spill entered the CSL. The spill occurred over 100 yards from the nearest entry point to the CSL.

Methylene chloride appeared in one of the eleven samples taken of the wastewater stream in both the regeneration and routine operation modes. The concentration of methylene chloride in this sample was 15 ppb. The blank which accompanied the one positive sample was reported to have a concentration of 11 ppb. The threshold value for methylene chloride based on analyses of current data blanks taken site-wide is 1,147 ppb as presented in Section 5.2 of the "parent" document. As the concentration of methylene chloride seen in this single sample of the wastewater stream is less than the threshold value, this data will not be considered in the designation of the wastestream as it is likely that methylene chloride is present in these wastestream samples because of sample contamination.

5.3.1.6 Ionic substances. With the exception of hydrogen fluoride, all of the postulated ionic substances were possible only during ion exchanger regeneration. The ion exchangers (demineralizers) remove ions from the sanitary water and then release these ions during regeneration. Therefore, it is to be expected that regeneration would release detectable quantities of ions derived from sanitary water supplies.

Based upon the considerations and data presented in the previous section, the wastestream does not contain any discarded chemical products.

5.3.2 Dangerous Waste Sources

The process evaluation (see Section 2.0) was also used to determine if the wastestream included any specific waste sources (K and W wastes) or any nonspecific waste sources (F wastes) in WAC 173-303-9904. The process evaluation did not discover any dangerous waste sources in the CSL. Sampling data were utilized to enhance the process evaluation. These data reported acetone and cyanide salts in the CSL during ion exchanger (demineralizer) regeneration. If the acetone was introduced into the CSL as a spent solvent, then the CSL would contain a dangerous waste source. As discussed in Section 5.3.1.1, the acetone was associated with ion exchanger regeneration and is believed to be a reaction product, which is not a spent solvent. If the cyanide salts entered the CSL as a result of metal plating or metal heat treatment operations, then the CSL would contain waste from a dangerous waste source. However, these operations are not carried out at the PUREX Plant. As discussed in Section 5.3.1.6, concentrations of ions elevated above detection limits are expected during regeneration. It is concluded that the wastestream is not a dangerous waste source and does not contain any dangerous waste sources.

5.4 DANGEROUS WASTE CRITERIA

A waste is considered a dangerous waste if it meets any of the following criteria categories (WAC 173-303-100): toxic dangerous waste, persistent dangerous waste, or carcinogenic dangerous waste. A description of the methods used to test the sampling data against the criteria is contained in WHC-EP-0275 (WHC 1990a). Summaries of the methods, along with the results, are contained in the following sections.

5.4.1 Toxic Dangerous Wastes

The procedure for determining if a wastestream is a toxic dangerous waste is as follows (WAC 173-303-101):

- Collect and analyze multiple samples from the wastestream.
- Calculate the upper limit of the one-sided 90% confidence interval (90%CI) for each analyte in the wastestream (WHC 1990b).
- Formulate substances from the analytical data. NOTE: This step is only required for inorganic analytes because it is not possible to complete the evaluation based on the concentration of cations and anions. This methodology is described in WHC-EP-0275 (WHC 1990a) and is based on an evaluation of the most toxic substances that can exist in an aqueous environment under normal temperatures and pressures.
- Assign toxic categories to the substances detected or, in the case of inorganic analytes, postulated to be in the wastestream.
- Calculate the contribution of each substance to the percent equivalent concentration (EC%).

- Calculate the EC% by summing the contributions of each substance.
- Designate the wastestream as a toxic dangerous waste if the EC% is greater than 0.001%, per WAC 173-303-9906.

5.4.1.1 Ion Exchanger Regeneration. Twenty-three substances potentially present in the CSL wastewater stream during ion exchanger regeneration were determined to have toxic categories associated with them. These substances are listed in Table 5-2, along with their toxic categories.

The individual and sum EC% values for these chemical compounds are listed in Table 5-2. Because the EC% is 1.87 E-06, which is less than the designation limit of 0.001%, the wastestream is not a toxic dangerous waste.

The three highest contributors to the EC% are copper (II) chloride, acetone, and chloroform.

5.4.1.2 Routine Operation. Sixteen substances potentially present in the CSL wastewater stream during routine operation were determined to have toxic categories associated with them. These substances are listed in Table 5-3, along with their toxic categories. The individual and sum EC% values for these chemical compounds are listed in Table 5-3. Because the EC% is 2.53 E-06 (0.00000253%), which is less than the designation limit of 0.001%, the wastestream is not a toxic dangerous waste.

The three highest contributors to the EC% are iron (III) fluoride, copper (II) chloride, and aluminum nitrate.

5.4.2 Persistent Dangerous Wastes

The procedure for determining if a wastestream is a persistent dangerous waste is as follows (WAC 173-303-102).

- Collect multiple grab samples of the wastestream.
- Determine which substances in the wastestream are halogenated hydrocarbons (HH) and which are polycyclic aromatic hydrocarbons (PAH).
- Determine the upper limit of the one-sided 90%CI for the substances of interest (WHC 1990b).
- Calculate weight percent (wt%) contributions of each HH% and PAH% separately.
- Sum the resulting HH% and PAH% separately.

- Designate the wastestream as persistent if the HH% concentration is greater than 0.01% or if the PAH% concentration is greater than 1.0%, per WAC 173-303-9907.

5.4.2.1 Ion Exchanger Regeneration. Two substances potentially present in the CSL wastewater stream were determined to be HH and no substances were determined to be PAH. The individual and sum HH% values for these chemical compounds are listed in Table 5-2. Because the HH% is 1.05 E-05, which is less than the 0.01%, the CSL wastestream is not a persistent dangerous waste. The two contributors to the HH% are chloroform and methylene chloride.

5.4.2.2 Routine Operation. One substance detected in the CSL during routine operation, chloroform, was determined to be HH. No substances were determined to be PAH. Because the concentration of chloroform was 0.00000139%, which is less than 0.01%, the CSL is not persistent hazardous waste during routine operation.

5.4.3 Carcinogenic Dangerous Wastes

The procedure for determining if a wastestream is a carcinogenic dangerous waste is as follows (WAC 173-303-103).

- Collect multiple grab samples of the wastestream.
- Determine the upper limit of the one-sided 90%CI for the compounds of interest (WHC 1990b).
- Formulate substances from the analytical data. NOTE: This step is only required for inorganic analytes since it is not possible to complete the evaluation based on the concentration of cations and anions. This methodology is described in WHC-EP-0275 (WHC 1990a) and is based on an evaluation of the most toxic substances that can exist in an aqueous environment under normal temperatures and pressures.
- Determine which substances in the wastestream are human or animal carcinogens according to the International Agency for Research on Cancer.
- Calculate the weight percent concentration for each carcinogen.
- Sum the resulting weight percent.
- Designate the wastestream as carcinogenic if any of the positive carcinogens is above 0.01% or if the total concentration of positive and suspected carcinogens are above 1.0%.

5.4.3.1 Ion Exchanger Regeneration. Five substances potentially present in the CSL wastewater stream during ion exchanger regeneration were determined to be carcinogenic substances. These substances are cadmium chloride, calcium chromate, nickel (II) hydroxide, chloroform, and methylene chloride. The individual and sum percent carcinogens for these chemicals are listed in Table 5-2. Because none of the positive carcinogens exceed 1.00 E-02% (i.e., 0.01%) and the sum is less than 1.0%, the CSL wastestream is not a carcinogenic dangerous waste. The three highest contributors to the percent carcinogens are chloroform, methylene chloride, and calcium chromate (VI).

5.4.3.2 Routine Operation. One substance present in the CSL during routine operation was determined to be a carcinogenic substance. The concentration of that one substance, chloroform (trichloromethane), was 0.00000139%. Because the concentration of chloroform was less than 0.01% (and 1.0%), the CSL is not a carcinogenic dangerous waste during routine operation.

5.5 DANGEROUS WASTE CHARACTERISTICS

A waste is considered a dangerous waste if it is ignitable, corrosive, reactive, or extraction procedure (EP) toxic (WAC 173-303-090). A description of the methods used to evaluate the data in terms of these characteristics is contained in WHC-EP-0275 (WHC 1990a). Summaries of the methods, along with the results, are contained in the following sections.

5.5.1 Ignitability

Because of the dilute aqueous nature of these wastes, flashpoint testing was not performed during the initial samples collected from the wastestream; instead an ignitability index was calculated for the samples and was based on the sum of the percent contributions of all ignitable contributors in the waste. Pure substances with a flashpoint <140°F were considered ignitable. Using best professional judgment, samples with an ignitability index below 1% were not considered ignitable.

Since July 1989, flashpoint testing has been performed on many of the liquid effluent samples. All samples were lost at the boiling temperature of water without igniting.

5.5.1.1 Ion Exchanger Regeneration. Two substances potentially present in the CSL during ion exchanger regeneration are ignitable substances. These substances are hydrogen cyanide and acetone. The value of the index calculated from these constituents (presented in Table 5-2) is 1.48 E-05%. Therefore, the CSL is not an ignitable waste during regeneration.

5.5.1.2 Routine Operation. Samples of the CSL collected during routine operation were tested for ignitability. The flashpoint testing demonstrated that the CSL during routine operation does not have a flashpoint below 207 °F. Therefore, the CSL is not an ignitable waste during routine operation.

5.5.2 Corrosivity

A waste is a corrosive dangerous waste if it has a pH of ≤ 2.0 or ≥ 12.5. No pH value was derived from the process data, and dilution does not have a significant effect on the pH of the CSL. The pH of this wastestream is monitored, and if the pH begins to approach either 2.5 or 12, the stream is diverted to the 216-A-42 Diversion Basin (downstream of the sampling and monitoring point). If necessary, the diverted waste is then neutralized. Consequently, the released CSL is not a corrosive dangerous waste.

5.5.3 Reactivity

An aqueous waste is reactive if the waste contains an amount of cyanide or sulfide under conditions near corrosivity to threaten human health or the environment (WAC 173-303-090[7]). A recent revision to the SW-846 (EPA 1986) procedure provides more quantitative "indicator" levels for cyanide and sulfide. These indicator levels for hydrogen cyanide and hydrogen sulfide are 250 mg/kg and 500 mg/kg, respectively. If the upper 90%CI for the compounds in the effluent streams was below these levels, the streams was considered not regulated based on reactivity.

For samples collected before July 1989, total cyanide and total sulfide were used for comparison. After July 1989, the revised SW-846 procedure was used in comparing the data.

5.5.3.1 Ion Exchanger Regeneration. No total sulfide and 1.14 E-02 ppm total CN^- were found in the sample data in Table 5-2. Because the equivalent HCN concentration (assuming all CN^- present can form HCN) is 1.10 E-02 ppm and the H_2S concentration is below the detection limit of 1 ppm, the CSL is not a reactive dangerous waste during regeneration.

5.5.3.2 Routine Operation. Using the SW-846 procedure, both the cyanide and sulfide concentrations in the CSL during routine operation were determined to be less than 100 ppb. Therefore, the CSL is not a reactive dangerous waste during routine operation.

5.5.4 Extraction Procedure Toxicity

An effluent stream was considered regulated under the EP toxicity criteria (WAC 173-303-090[8]) if the upper 90%CI for the specific compounds in the wastestream exceeded the EP toxicity concentration limits. The SW-846 procedure provides specific guidance for obtaining data results for comparison against the EPA toxicity limits. Until July 1989, total compound concentrations were compared against the limits, resulting in a more conservative designation. Since that time, the sampling data have been collected and analyzed according to the EP toxicity method specified in SW-846.

5.5.4.1 Ion Exchanger Regeneration. Six analytes with concentrations above detection limits that are on the EP toxic list were found in the CSL during ion exchanger regeneration. The concentrations of these six analytes are listed in Table 5-2. Because the barium concentration of 1.13 E-01 mg/L does not exceed the limit of 100 mg/L, the cadmium concentration of 8.47 E-03 mg/L does not exceed the limit of 1 mg/L, the chromium concentration of 1.05 E-02 mg/L does not exceed the limit of 5 mg/L, the lead concentration of 2.85 E-02 mg/L does not exceed the limit of 5 mg/L, the mercury concentration of 1.67 E-03 mg/L does not exceed the limit of 0.2 mg/L, and the silver concentration of 1.35 E-02 mg/L does not exceed the limit of 5 mg/L, the CSL is not an EP toxic dangerous waste.

5.5.4.2 Routine Operation. No analytes were found to have concentrations above detection limits of the extraction procedure in the CSL during routine operation. Therefore, the CSL during routine operation is not an EP toxic dangerous waste.

5.6 PROPOSED DESIGNATIONS

Because the CSL wastestream does not contain any dangerous waste, as defined in WAC 173-303-070, it is proposed that the wastestream not be designated a dangerous waste.

6.0 ACTION PLAN

This chapter addresses recommendations for future waste characterization tasks for the CSL that are within the scope of the *Liquid Effluent Study Project Plan* (WHC 1990a). The final extent of and schedule for any recommended tasks are subject to negotiation between Ecology, EPA, and DOE. An implementation schedule for the completion of these tasks will give consideration to other compliance actions already under way as part of the Tri-Party Agreement (Ecology et al. 1989), and on the availability of funding. All effluent monitoring and sampling will be conducted according to DOE Order 5400.1 (DOE 1988).

6.1 FUTURE SAMPLING

The random sampling conducted during the October 1989 to March 1990 time period covered the routine operation process configurations. The regeneration configuration was not sampled during this period.

Further sampling should be undertaken to better characterize the CSL during regeneration. Samples of the regenerant itself would be particularly informative.

6.2 TECHNICAL ISSUES

As described in Section 2.0, the CSL was sampled at the 295-AC Sampling and Monitoring Building. This sample point was chosen because it is a common, accessible location downstream of all the contributing wastestreams.

Although most of the individual contributors to the CSL are inaccessible, they are mostly either of little interest or rarely (if ever) exist, and therefore are not amenable to sampling. The major exception is the demineralizer regenerant. Any sampling of the regenerant should be upstream of the neutralization package, with the understanding that the pH of such samples would be meaningless for designation purposes. Such sampling, if combined with simultaneous samples of the 200 East Area sanitary water, could be particularly useful for further evaluation of acetone in the CSL. However, the use of such sampling might be limited because the ion exchange resin was found to be badly deteriorated and was therefore replaced after the existing regeneration samples were collected.

Further sampling of the 200 East Area raw water and analysis for fluoride is recommended. The fluoride analysis used for the existing samples did not detect any fluoride concentrations less than 500 ppb. Fluoride has been detected in many pass-through streams at concentrations of less than 500 ppb. These detections form the only basis of suggestions that listed hydrogen fluoride may have been disposed into the streams.

Sampling of representative steam condensate would be useful because steam is a major influent to the PUREX Plant and is a major contributor to the CSL.

The samples collected at the 295-AC Sampling and Monitoring Building are representative of the CSL, and are in agreement with the expected composition of the CSL as estimated from process knowledge. As a result, the data presented in this report are considered to be representative of the CSL and its contributors.

7.0 REFERENCES

APHA, 1985, *Standard Methods for the Examination of Water and Wastewater*, Sixteenth Edition, American Public Health Association, American Water Works Association and Water Pollution Control Federal, Washington, D.C.

ASTM, 1986, *1986 Book of ASTM Standards*, American Society of Testing and Materials, Philadelphia, Pennsylvania.

Bergmann, D.W., 1989, *Sources of n-Butanol and Acetone in the PUREX Process*, WHC-SD-TO-154, p. F-5, Westinghouse Hanford Company, Richland, Washington.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, Public Law 96-510, 94 Stat. 2767, 42 USC 9601 et seq.

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

Ecology, 1989, *Dangerous Waste Regulations*, Washington (State) Administrative Code 173-303, Washington State Department of Ecology, Olympia, Washington.

Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, Washington State Department of Ecology U.S. Environmental Protection Agency, and U.S. Department of Energy, Richland, Washington.

EPA, 1986, *Test Methods For Evaluating Solid Waste: Physical/Chemical Methods*, SW-846, 3rd Edition, U.S. Environmental Protection Agency, Washington D.C.

Horton, M.A., 1985, *Notice of Violation No. DE 85-677*, Washington State Department of Ecology, Olympia, Washington.

Jungfleisch, F. M., 1988, *Preliminary Evaluation of Hanford Liquid Discharges to Ground*, WHC-EP-0052, Westinghouse Hanford Company, Richland, Washington.

Lawrence, M. J., 1989, *Liquid Effluent Study*, (External letter to 89021606 to C. Gregoire, Washington State Department of Ecology; and R. Russell, U.S. Environmental Protection Agency, May 13, 1989), U.S. Department of Energy-Richland Operations Office, Richland, Washington.

Somers, S., 1986, *Hanford Sanitary Water Quality Surveillance, CY 1985*, HEHF-55, Hanford Environmental Health Foundation, Richland, Washington.

Somers, S., 1987, *Hanford Sanitary Water Quality Surveillance, CY 1986*, HEHF-59, Hanford Environmental Health Foundation, Richland, Washington.

Somers, S., 1988, *Hanford Sanitary Water Quality Surveillance, CY 1987*, HEHF-71, Hanford Environmental Health Foundation, Richland, Washington.

Somers, S., 1989, *Hanford Sanitary Water Quality Surveillance, CY 1988*, HEHF-74, Hanford Environmental Health Foundation, Richland, Washington.

Thurman, P. A., 1990, *Hanford Sanitary Water Quality Surveillance, CY 1989*, HEHF-76, Hanford Environmental Health Foundation, Richland, Washington.

WHC, 1988, *Preliminary Evaluation of Hanford Liquid Discharges to the Ground*, WHC-EP-0052, Westinghouse Hanford Company, Richland, Washington.

WHC, 1989, *Waste Stream Characterization Report*, WHC-EP-0287, Volumes 1 through 4, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990a, *Liquid Effluent Study Project Plan*, WHC-EP-0275, Revision 2, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990b, *Wastestream Designation of Liquid Effluent Analytical Data*, WHC-EP-0334, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990c, *Environmental Compliance Manual*, WHC-CM-7-5, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990d, *Liquid Effluent Study Characterization Data*, WHC-EP-0355, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A

FILMEEN MATERIAL SAFETY DATA SHEET

This page intentionally left blank.

Figure A-1. Material Safety Data Sheet. (sheet 1 of 2)

Material Safety Data Sheet

MSDS #12387

Emergency Phone 312-438-8241

Section 1 Product Identification

TRADE NAME	PRODUCT TYPE	CODE IDENT.
SUPER FILMEEN 14	Return line treatment	12-174

DOT SHIPPING NAME: Compound Boiler Cleansing, Preserving, Scale Removing Liquid

Section 2 Hazardous Ingredients

	CAS NUMBER	%	EXPOSURE CRITERIA
Does not contain hazardous constituents under 29 CFR 1910.1200, d(3) & (4).			

HIMS 2-0-0

Section 3 Physical Data

BOILING POINT, 760 mm Hg	ND	MELTING POINT	NA
FREEZING POINT	32 F	VAPOR PRESSURE	ND
SPECIFIC GRAVITY ($H_2O = 1$)	0.98	SOLUBILITY IN H_2O	Emulsion
VAPOR DENSITY (AIR = 1)	ND	EVAPORATION RATE (By Ac = 1)	< 1
% VOLATILES BY VOLUME	ND	pH	8-9

APPEARANCE & ODOR

White emulsion/characteristic odor

Section 4 Fire & Explosion Hazard Data

FLASH POINT (& METHOD USED)	FLAMMABLE LIMITS IN AIR % BY VOLUME LOWER	UPPER	AUTO IGNITION TEMPERATURE
NA, water-based product	NA	NA	NA

EXTINGUISHING MEDIA: FOAM CO2 DRY CHEMICAL

SPECIAL FIRE FIGHTING PROCEDURES:

Firefighters should wear full protective gear.

UNUSUAL FIRE AND EXPLOSION HAZARD:

None known

Section 5 Reactivity Data

STABILITY (NORMAL CONDITIONS)	CONDITIONS TO AVOID
Stable	Extreme heat

INCOMPATABILITY (MATERIALS TO AVOID)

Strong oxidizing agents

HAZARDOUS DECOMPOSITION PRODUCTS

CO, CO2, nitrogen oxides

HAZARDOUS POLYMERIZATION	CONDITIONS TO AVOID
Will not occur	NA

GRACE Dearborn

Dearborn Division W. R. Grace & Co., 300 Genesee Street, Lake Zurich, IL 60047

Figure A-1. Material Safety Data Sheet. (sheet 2 of 2)

Section 6 Health Hazard Information

TOXICITY INFORMATION:

No TLV established for product.

MSDS #12387

EFFECTS OF OVEREXPOSURE:

INHALATION: Inhalation of vapors or mist may irritate nasal passages.

INGESTION: Harmful if swallowed.

SKIN OR EYE CONTACT: Prolonged or frequent skin contact may cause irritation.

EMERGENCY AND FIRST AID PROCEDURES

INHALATION: Remove affected persons to fresh air and treat symptoms.

INGESTION: If conscious, induce vomiting and feed citrus juice. Contact physician.

SKIN CONTACT: Wash with soap and water. Remove and wash contaminated clothing.

EYE CONTACT: Flush eyes with water and seek medical attention.

Section 7 Special Protection Information

VENTILATION REQUIREMENTS

Use adequate mechanical ventilation

RESPIRATORY PROTECTION (SPECIFY TYPE)

None special

EYE PROTECTION

Safety glasses or goggles

GLOVES

Recommended

OTHER PROTECTIVE CLOTHING AND EQUIPMENT

Long sleeve work shirt and pants

Section 8 Spill or Leak Procedures

STEPS TO TAKE IF MATERIAL IS RELEASED OR SPILLED

Collect using absorbent, place in container for proper disposal. Flush area of spill with water.

WASTE DISPOSAL METHOD

Dispose using authorized scavenger service in authorized landfill. For additional disposal instruction, contact your state water pollution control agency. This product is NOT an EPA Hazardous Waste.

Section 9 Special Precautions

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

Keep container closed to prevent contamination or loss of water from emulsion by evaporation. Keep from freezing.

OTHER PRECAUTIONS

For industrial use only. Keep out of reach of children.

PREPARED BY: S. Norss DATE: 6/20/88

GRACE Dearborn

Dearborn Division W. R. Grace & Co., 300 Genesee Street Lake Zurich, IL 60047 (312) 438-8241

APPENDIX B

CHEMICAL SAMPLE DATA

This page intentionally left blank.

Table B-1. Data for PUREX Chemical Sewer-Routine. (sheet 1 of 10)

Constituent	Sample #	Date	Method	Result
Aluminum	50689	10/16/89	ICP	6.14E+02
Aluminum	50709	10/19/89	ICP	<1.50E+02
Aluminum	50796	11/27/89	ICP	<1.50E+02
Aluminum	50891	1/17/90	ICP	<1.50E+02
Aluminum	50939	2/13/90	ICP	<1.50E+02
Aluminum	50955	2/20/90	ICP	<1.50E+02
Arsenic (EP Toxic)	50689E	10/16/89	ICP	<5.00E+02
Arsenic (EP Toxic)	50709E	10/19/89	ICP	<5.00E+02
Arsenic (EP Toxic)	50796E	11/27/89	ICP	<5.00E+02
Arsenic (EP Toxic)	50891E	1/17/90	ICP	<5.00E+02
Arsenic (EP Toxic)	50939E	2/13/90	ICP	<5.00E+02
Arsenic (EP Toxic)	50955E	2/20/90	ICP	<5.00E+02
Barium	50689	10/16/89	ICP	3.90E+01
Barium	50709	10/19/89	ICP	3.20E+01
Barium	50796	11/27/89	ICP	2.90E+01
Barium	50891	1/17/90	ICP	3.20E+01
Barium	50939	2/13/90	ICP	2.90E+01
Barium	50955	2/20/90	ICP	2.70E+01
Barium (EP Toxic)	50689E	10/16/89	ICP	<1.00E+03
Barium (EP Toxic)	50709E	10/19/89	ICP	<1.00E+03
Barium (EP Toxic)	50796E	11/27/89	ICP	<1.00E+03
Barium (EP Toxic)	50891E	1/17/90	ICP	<1.00E+03
Barium (EP Toxic)	50939E	2/13/90	ICP	<1.00E+03
Barium (EP Toxic)	50955E	2/20/90	ICP	<1.00E+03
Boron	50689	10/16/89	ICP	<1.00E+01
Boron	50709	10/19/89	ICP	<1.00E+01
Boron	50796	11/27/89	ICP	<1.00E+01
Boron	50891	1/17/90	ICP	<1.00E+01
Boron	50939	2/13/90	ICP	3.50E+01
Boron	50955	2/20/90	ICP	2.10E+01
Cadmium (EP Toxic)	50689E	10/16/89	ICP	<1.00E+02
Cadmium (EP Toxic)	50709E	10/19/89	ICP	<1.00E+02
Cadmium (EP Toxic)	50796E	11/27/89	ICP	<1.00E+02
Cadmium (EP Toxic)	50891E	1/17/90	ICP	<1.00E+02
Cadmium (EP Toxic)	50939E	2/13/90	ICP	<1.00E+02
Cadmium (EP Toxic)	50955E	2/20/90	ICP	<1.00E+02
Calcium	50689	10/16/89	ICP	1.86E+04
Calcium	50709	10/19/89	ICP	1.91E+04
Calcium	50796	11/27/89	ICP	1.68E+04
Calcium	50891	1/17/90	ICP	1.94E+04
Calcium	50939	2/13/90	ICP	1.85E+04
Calcium	50955	2/20/90	ICP	1.81E+04
Chloride	50689	10/16/89	IC	1.40E+03
Chloride	50709	10/19/89	IC	1.50E+03
Chloride	50796	11/27/89	IC	1.90E+03
Chloride	50891	1/17/90	IC	2.00E+03
Chloride	50939	2/13/90	IC	1.20E+03

Table B-1. Data for PUREX Chemical Sewer-Routine. (sheet 2 of 10)

Constituent	Sample #	Date	Method	Result
Chloride	50955	2/20/90	IC	1.30E+03
Chromium (EP Toxic)	50689E	10/16/89	ICP	<5.00E+02
Chromium (EP Toxic)	50709E	10/19/89	ICP	<5.00E+02
Chromium (EP Toxic)	50796E	11/27/89	ICP	<5.00E+02
Chromium (EP Toxic)	50891E	1/17/90	ICP	<5.00E+02
Chromium (EP Toxic)	50939E	2/13/90	ICP	<5.00E+02
Chromium (EP Toxic)	50955E	2/20/90	ICP	<5.00E+02
Copper	50689	10/16/89	ICP	5.30E+01
Copper	50709	10/19/89	ICP	3.50E+01
Copper	50796	11/27/89	ICP	3.90E+01
Copper	50891	1/17/90	ICP	2.90E+01
Copper	50939	2/13/90	ICP	<1.00E+01
Copper	50955	2/20/90	ICP	<1.00E+01
Fluoride	50689	10/16/89	IC	<5.00E+02
Fluoride	50689	10/16/89	ISE	1.80E+02
Fluoride	50709	10/19/89	IC	<5.00E+02
Fluoride	50709	10/19/89	ISE	1.44E+02
Fluoride	50796	11/27/89	IC	<5.00E+02
Fluoride	50796	11/27/89	ISE	1.44E+02
Fluoride	50891	1/17/90	IC	<5.00E+02
Fluoride	50891	1/17/90	ISE	1.37E+02
Fluoride	50939	2/13/90	IC	<5.00E+02
Fluoride	50939	2/13/90	ISE	1.17E+02
Fluoride	50955	2/20/90	IC	<5.00E+02
Fluoride	50955	2/20/90	ISE	1.18E+02
Iron	50689	10/16/89	ICP	9.80E+02
Iron	50709	10/19/89	ICP	1.26E+02
Iron	50796	11/27/89	ICP	4.60E+01
Iron	50891	1/17/90	ICP	3.20E+01
Iron	50939	2/13/90	ICP	5.20E+01
Iron	50955	2/20/90	ICP	6.20E+01
Lead	50689	10/16/89	GFAA	8.00E+00
Lead	50709	10/19/89	GFAA	<5.00E+00
Lead	50796	11/27/89	GFAA	<5.00E+00
Lead	50891	1/17/90	GFAA	<5.00E+00
Lead	50939	2/13/90	GFAA	<5.00E+00
Lead	50955	2/20/90	GFAA	<5.00E+00
Lead (EP Toxic)	50689E	10/16/89	ICP	<5.00E+02
Lead (EP Toxic)	50709E	10/19/89	ICP	<5.00E+02
Lead (EP Toxic)	50796E	11/27/89	ICP	<5.00E+02
Lead (EP Toxic)	50891E	1/17/90	ICP	<5.00E+02
Lead (EP Toxic)	50939E	2/13/90	ICP	<5.00E+02
Lead (EP Toxic)	50955E	2/20/90	ICP	<5.00E+02
Magnesium	50689	10/16/89	ICP	4.21E+03
Magnesium	50709	10/19/89	ICP	4.19E+03
Magnesium	50796	11/27/89	ICP	3.80E+03
Magnesium	50891	1/17/90	ICP	4.52E+03

Table B-1. Data for PUREX Chemical Sewer-Routine. (sheet 3 of 10)

Constituent	Sample #	Date	Method	Result
Magnesium	50939	2/13/90	ICP	4.28E+03
Magnesium	50955	2/20/90	ICP	4.28E+03
Magnesium	50939	2/13/90	ICP	4.28E+03
Magnesium	50955	2/20/90	ICP	4.28E+03
Manganese	50689	10/16/89	ICP	6.30E+01
Manganese	50709	10/19/89	ICP	1.10E+01
Manganese	50796	11/27/89	ICP	<5.00E+00
Manganese	50891	1/17/90	ICP	<5.00E+00
Manganese	50939	2/13/90	ICP	<5.00E+00
Manganese	50955	2/20/90	ICP	<5.00E+00
Mercury	50689	10/16/89	CVAA	1.60E-01
Mercury	50709	10/19/89	CVAA	<1.00E-01
Mercury	50796	11/27/89	CVAA	<1.00E-01
Mercury	50891	1/17/90	CVAA	<1.00E-01
Mercury	50939	2/13/90	CVAA	<1.00E-01
Mercury	50955	2/20/90	CVAA	<1.00E-01
Mercury (EP Toxic)	50689E	10/16/89	CVAA/M	<2.00E+01
Mercury (EP Toxic)	50709E	10/19/89	CVAA/M	<2.00E+01
Mercury (EP Toxic)	50796E	11/27/89	CVAA/M	<2.00E+01
Mercury (EP Toxic)	50891E	1/17/90	CVAA/M	<2.00E+01
Mercury (EP Toxic)	50939E	2/13/90	CVAA/M	<2.00E+01
Mercury (EP Toxic)	50955E	2/20/90	CVAA/M	<2.00E+01
Nitrate	50689	10/16/89	IC	5.00E+02
Nitrate	50709	10/19/89	IC	<5.00E+02
Nitrate	50796	11/27/89	IC	5.00E+02
Nitrate	50891	1/17/90	IC	7.00E+02
Nitrate	50939	2/13/90	IC	<5.00E+02
Nitrate	50955	2/20/90	IC	6.00E+02
Potassium	50689	10/16/89	ICP	7.63E+02
Potassium	50709	10/19/89	ICP	7.18E+02
Potassium	50796	11/27/89	ICP	6.98E+02
Potassium	50891	1/17/90	ICP	7.60E+02
Potassium	50939	2/13/90	ICP	6.78E+02
Potassium	50955	2/20/90	ICP	6.98E+02
Selenium (EP Toxic)	50689E	10/16/89	ICP	<5.00E+02
Selenium (EP Toxic)	50709E	10/19/89	ICP	<5.00E+02
Selenium (EP Toxic)	50796E	11/27/89	ICP	<5.00E+02
Selenium (EP Toxic)	50891E	1/17/90	ICP	<5.00E+02
Selenium (EP Toxic)	50939E	2/13/90	ICP	<5.00E+02
Selenium (EP Toxic)	50955E	2/20/90	ICP	<5.00E+02
Silicon	50689	10/16/89	ICP	3.71E+03
Silicon	50709	10/19/89	ICP	2.40E+03
Silicon	50796	11/27/89	ICP	2.18E+03
Silicon	50891	1/17/90	ICP	2.41E+03
Silicon	50939	2/13/90	ICP	2.36E+03
Silicon	50955	2/20/90	ICP	2.38E+03
Silver (EP Toxic)	50689E	10/16/89	ICP	<5.00E+02

Table B-1. Data for PUREX Chemical Sewer-Routine. (sheet 4 of 10)

Constituent	Sample #	Date	Method	Result
Silver (EP Toxic)	50709E	10/19/89	ICP	<5.00E+02
Silver (EP Toxic)	50796E	11/27/89	ICP	<5.00E+02
Silver (EP Toxic)	50891E	1/17/90	ICP	<5.00E+02
Silver (EP Toxic)	50939E	2/13/90	ICP	<5.00E+02
Silver (EP Toxic)	50955E	2/20/90	ICP	<5.00E+02
Sodium	50689	10/16/89	ICP	2.14E+03
Sodium	50709	10/19/89	ICP	2.19E+03
Sodium	50796	11/27/89	ICP	1.96E+03
Sodium	50891	1/17/90	ICP	2.26E+03
Sodium	50939	2/13/90	ICP	2.00E+03
Sodium	50955	2/20/90	ICP	1.87E+03
Strontium	50689	10/16/89	ICP	1.00E+02
Strontium	50709	10/19/89	ICP	9.90E+01
Strontium	50796	11/27/89	ICP	8.40E+01
Strontium	50891	1/17/90	ICP	8.60E+01
Strontium	50939	2/13/90	ICP	8.50E+01
Strontium	50955	2/20/90	ICP	9.10E+01
Sulfate	50689	10/16/89	IC	1.11E+04
Sulfate	50709	10/19/89	IC	1.14E+04
Sulfate	50796	11/27/89	IC	1.06E+04
Sulfate	50891	1/17/90	IC	1.28E+04
Sulfate	50939	2/13/90	IC	1.08E+04
Sulfate	50955	2/20/90	IC	1.04E+04
Uranium	50689	10/16/89	FLUOR	3.93E-01
Uranium	50709	10/19/89	FLUOR	4.31E-01
Uranium	50796	11/27/89	FLUOR	3.95E-01
Uranium	50891	1/17/90	FLUOR	6.40E-01
Zinc	50689	10/16/89	ICP	4.90E+01
Zinc	50709	10/19/89	ICP	1.00E+01
Zinc	50796	11/27/89	ICP	<5.00E+00
Zinc	50891	1/17/90	ICP	6.00E+00
Zinc	50939	2/13/90	ICP	1.20E+01
Zinc	50955	2/20/90	ICP	8.00E+00
Acetone	50689	10/16/89	VOA	<9.00E+00
Acetone	50689	10/16/89	ABN	<1.00E+01
Acetone	50689B	10/16/89	VOA	1.40E+01
Acetone	50689T	10/16/89	VOA	<1.00E+01
Acetone	50709	10/19/89	VOA	<9.00E+00
Acetone	50709	10/19/89	ABN	<1.00E+01
Acetone	50709B	10/19/89	VOA	<1.00E+01
Acetone	50709T	10/19/89	VOA	<1.00E+01
Acetone	50796	11/27/89	VOA	<1.00E+01
Acetone	50796	11/27/89	ABN	<1.00E+01
Acetone	50796B	11/27/89	VOA	<1.00E+01
Acetone	50796T	11/27/89	VOA	<7.00E+00
Acetone	50891	1/17/90	VOA	<7.00E+00
Acetone	50891	1/17/90	ABN	<1.00E+01

Table B-1. Data for PUREX Chemical Sewer-Routine. (sheet 5 of 10)

Constituent	Sample #	Date	Method	Result
Acetone	50891B	1/17/90	VOA	<1.00E+01
Acetone	50891T	1/17/90	VOA	<1.00E+01
Acetone	50939	2/13/90	VOA	<1.00E+01
Acetone	50939	2/13/90	ABN	<1.00E+01
Acetone	50939B	2/13/90	VOA	<1.00E+01
Acetone	50939T	2/13/90	VOA	<1.00E+01
Acetone	50955	2/20/90	VOA	<1.00E+01
Acetone	50955	2/20/90	ABN	<1.00E+01
Acetone	50955B	2/20/90	VOA	1.30E+01
Acetone	50955T	2/20/90	VOA	<1.00E+01
Ammonia	50689	10/16/89	ISE	6.60E+01
Ammonia	50709	10/19/89	ISE	6.10E+01
Ammonia	50796	11/27/89	ISE	<5.00E+01
Ammonia	50891	1/17/90	ISE	6.90E+01
Ammonia	50939	2/13/90	ISE	<5.00E+01
Ammonia	50955	2/20/90	ISE	<5.00E+01
1-Butanol	50689	10/16/89	DIGC	<1.00E+04
1-Butanol	50709	10/19/89	DIGC	<1.00E+04
1-Butanol	50796	11/27/89	DIGC	<1.00E+04
1-Butanol	50891	1/17/90	DIGC	<1.00E+04
1-Butanol	50939	2/13/90	DIGC	<1.00E+04
1-Butanol	50955	2/20/90	DIGC	<1.00E+04
1-Butanol	50955B	2/20/90	VOA	7.00E+00
1-Butanol	50955T	2/20/90	VOA	8.00E+00
2-Butanone	50689	10/16/89	VOA	<1.00E+01
2-Butanone	50689B	10/16/89	VOA	<1.00E+01
2-Butanone	50689T	10/16/89	VOA	<1.00E+01
2-Butanone	50709	10/19/89	VOA	<7.00E+00
2-Butanone	50709B	10/19/89	VOA	<1.00E+01
2-Butanone	50709T	10/19/89	VOA	<1.00E+01
2-Butanone	50796	11/27/89	VOA	<1.00E+01
2-Butanone	50796B	11/27/89	VOA	<5.00E+00
2-Butanone	50796T	11/27/89	VOA	<5.00E+00
2-Butanone	50891	1/17/90	VOA	<1.00E+01
2-Butanone	50891B	1/17/90	VOA	<1.00E+01
2-Butanone	50891T	1/17/90	VOA	<1.00E+01
2-Butanone	50939	2/13/90	VOA	<1.00E+01
2-Butanone	50939B	2/13/90	VOA	<8.00E+00
2-Butanone	50939T	2/13/90	VOA	<8.00E+00
2-Butanone	50955	2/20/90	VOA	<1.00E+01
2-Butanone	50955B	2/20/90	VOA	1.40E+01
2-Butanone	50955T	2/20/90	VOA	1.30E+01
Butylated hydroxy toluene	50955	2/20/90	ABN	1.00E+01
Dichloromethane	50689	10/16/89	VOA	<5.00E+00
Dichloromethane	50689B	10/16/89	VOA	4.40E+02
Dichloromethane	50689T	10/16/89	VOA	5.41E+02
Dichloromethane	50709	10/19/89	VOA	<5.00E+00

Table B-1. Data for PUREX Chemical Sewer-Routine. (sheet 6 of 10)

Constituent	Sample #	Date	Method	Result
Dichloromethane	50709B	10/19/89	VOA	<4.00E+00
Dichloromethane	50709T	10/19/89	VOA	1.30E+01
Dichloromethane	50796	11/27/89	VOA	<5.00E+00
Dichloromethane	50796B	11/27/89	VOA	<3.00E+00
Dichloromethane	50796T	11/27/89	VOA	<4.00E+00
Dichloromethane	50891	1/17/90	VOA	<5.00E+00
Dichloromethane	50891B	1/17/90	VOA	<4.00E+00
Dichloromethane	50891T	1/17/90	VOA	1.50E+01
Dichloromethane	50939	2/13/90	VOA	<5.00E+00
Dichloromethane	50939B	2/13/90	VOA	<5.00E+00
Dichloromethane	50939T	2/13/90	VOA	<5.00E+00
Dichloromethane	50955	2/20/90	VOA	<5.00E+00
Dichloromethane	50955B	2/20/90	VOA	6.00E+00
Dichloromethane	50955T	2/20/90	VOA	<5.00E+00
Tetrahydrofuran	50689	10/16/89	VOA	<1.00E+01
Tetrahydrofuran	50689B	10/16/89	VOA	<1.00E+01
Tetrahydrofuran	50689T	10/16/89	VOA	<1.00E+01
Tetrahydrofuran	50709	10/19/89	VOA	<1.00E+01
Tetrahydrofuran	50709B	10/19/89	VOA	1.90E+01
Tetrahydrofuran	50709T	10/19/89	VOA	<1.00E+01
Tetrahydrofuran	50796	11/27/89	VOA	<1.00E+01
Tetrahydrofuran	50796B	11/27/89	VOA	<1.00E+01
Tetrahydrofuran	50796T	11/27/89	VOA	<1.00E+01
Tetrahydrofuran	50891	1/17/90	VOA	<1.00E+00
Tetrahydrofuran	50891B	1/17/90	VOA	<5.00E+00
Tetrahydrofuran	50891T	1/17/90	VOA	<1.00E+01
Tetrahydrofuran	50939	2/13/90	VOA	<1.00E+01
Tetrahydrofuran	50939B	2/13/90	VOA	<7.00E+00
Tetrahydrofuran	50939T	2/13/90	VOA	<9.00E+00
Tetrahydrofuran	50955	2/20/90	VOA	<1.00E+01
Tetrahydrofuran	50955B	2/20/90	VOA	<1.00E+01
Tetrahydrofuran	50955T	2/20/90	VOA	<8.00E+00
Trichloromethane	50689	10/16/89	VOA	<3.00E+00
Trichloromethane	50689B	10/16/89	VOA	<5.00E+00
Trichloromethane	50689T	10/16/89	VOA	<5.00E+00
Trichloromethane	50709	10/19/89	VOA	<3.00E+00
Trichloromethane	50709B	10/19/89	VOA	<5.00E+00
Trichloromethane	50709T	10/19/89	VOA	<5.00E+00
Trichloromethane	50796	11/27/89	VOA	2.20E+01
Trichloromethane	50796B	11/27/89	VOA	<5.00E+00
Trichloromethane	50796T	11/27/89	VOA	1.20E+01
Trichloromethane	50891	1/17/90	VOA	1.70E+01
Trichloromethane	50891B	1/17/90	VOA	<5.00E+00
Trichloromethane	50891T	1/17/90	VOA	5.00E+00
Trichloromethane	50939	2/13/90	VOA	<3.00E+00
Trichloromethane	50939B	2/13/90	VOA	<3.00E+00
Trichloromethane	50939T	2/13/90	VOA	<5.00E+00

Table B-1. Data for PUREX Chemical Sewer-Routine. (sheet 7 of 10)

Constituent	Sample #	Date	Method	Result
Trichloromethane	50955	2/20/90	VOA	5.00E+00
Trichloromethane	50955B	2/20/90	VOA	6.00E+00
Trichloromethane	50955T	2/20/90	VOA	5.00E+00
Alkalinity (Method B)	50689	10/16/89	TITRA	5.60E+04
Alkalinity (Method B)	50709	10/19/89	TITRA	5.60E+04
Alkalinity (Method B)	50796	11/27/89	TITRA	5.00E+04
Alkalinity (Method B)	50891	1/17/90	TITRA	5.80E+04
Alkalinity (Method B)	50939	2/13/90	TITRA	5.80E+04
Alkalinity (Method B)	50955	2/20/90	TITRA	7.90E+04
Alpha Activity (pCi/L)	50689	10/16/89	Alpha	1.36E+00
Alpha Activity (pCi/L)	50709	10/19/89	Alpha	1.33E+00
Alpha Activity (pCi/L)	50796	11/27/89	Alpha	1.15E+00
Alpha Activity (pCi/L)	50891	1/17/90	Alpha	<9.62E-02
Beta Activity (pCi/L)	50689	10/16/89	Beta	2.19E+00
Beta Activity (pCi/L)	50709	10/19/89	Beta	<1.85E+00
Beta Activity (pCi/L)	50796	11/27/89	Beta	2.49E+00
Beta Activity (pCi/L)	50891	1/17/90	Beta	2.35E+00
Conductivity (µS)	50689	10/16/89	COND-Fld	1.47E+02
Conductivity (µS)	50709	10/19/89	COND-Fld	1.40E+02
Conductivity (µS)	50796	11/27/89	COND-Fld	1.61E+02
Conductivity (µS)	50891	1/17/90	COND-Fld	1.60E+02
Conductivity (µS)	50955	2/20/90	COND-Fld	1.49E+02
Ignitability (°F)	50689E	10/16/89	IGNIT	2.10E+02
Ignitability (°F)	50709E	10/19/89	IGNIT	2.10E+02
Ignitability (°F)	50796E	11/27/89	IGNIT	2.10E+02
Ignitability (°F)	50891E	1/17/90	IGNIT	2.14E+02
Ignitability (°F)	50939E	2/13/90	IGNIT	2.04E+02
Ignitability (°F)	50955E	2/20/90	IGNIT	2.10E+02
pH (dimensionless)	50689	10/16/89	PH-Fld	7.70E+00
pH (dimensionless)	50709	10/19/89	PH-Fld	8.10E+00
pH (dimensionless)	50796	11/27/89	PH-Fld	7.60E+00
pH (dimensionless)	50891	1/17/90	PH-Fld	7.50E+00
pH (dimensionless)	50955	2/20/90	PH-Fld	7.34E+00
Reactivity Cyanide (mg/kg)	50689E	10/16/89	DSPEC	<1.00E+02
Reactivity Cyanide (mg/kg)	50709E	10/19/89	DSPEC	<1.00E+02
Reactivity Cyanide (mg/kg)	50796E	11/27/89	DSPEC	<1.00E+02
Reactivity Cyanide (mg/kg)	50891E	1/17/90	DSPEC	<1.00E+02
Reactivity Cyanide (mg/kg)	50939E	2/13/90	DSPEC	<1.00E+02
Reactivity Cyanide (mg/kg)	50955E	2/20/90	DSPEC	<1.00E+02
Reactivity Sulfide (mg/kg)	50689E	10/16/89	DTITRA	<1.00E+02
Reactivity Sulfide (mg/kg)	50709E	10/19/89	DTITRA	<1.00E+02
Reactivity Sulfide (mg/kg)	50796E	11/27/89	DTITRA	<1.00E+02
Reactivity Sulfide (mg/kg)	50891E	1/17/90	DTITRA	<1.00E+02
Reactivity Sulfide (mg/kg)	50939E	2/13/90	DTITRA	<1.00E+02
Reactivity Sulfide (mg/kg)	50955E	2/20/90	DTITRA	<1.00E+02
TDS	50689	10/16/89	TDS	3.90E+04
TDS	50709	10/19/89	TDS	3.80E+04

Table B-1. Data for PUREX Chemical Sewer-Routine. (sheet 8 of 10)

Constituent	Sample #	Date	Method	Result
TDS	50796	11/27/89	TDS	5.90E+04
TDS	50891	1/17/90	TDS	6.90E+04
TDS	50939	2/13/90	TDS	7.00E+04
TDS	50955	2/20/90	TDS	6.30E+04
Temperature (°C)	50689	10/16/89	TEMP-Fld	3.00E+01
Temperature (°C)	50709	10/19/89	TEMP-Fld	2.50E+01
Temperature (°C)	50796	11/27/89	TEMP-Fld	2.87E+01
Temperature (°C)	50891	1/17/90	TEMP-Fld	2.24E+01
Temperature (°C)	50955	2/20/90	TEMP-Fld	1.90E+01
Total Carbon	50689	10/16/89	TC	1.50E+04
Total Carbon	50709	10/19/89	TC	1.60E+04
Total Carbon	50796	11/27/89	TC	1.35E+04
Total Carbon	50891	1/17/90	TC	1.27E+04
Total Carbon	50939	2/13/90	TC	1.44E+04
Total Carbon	50955	2/20/90	TC	1.50E+04
TOX (as Cl)	50689	10/16/89	LTOX	2.90E+01
TOX (as Cl)	50709	10/19/89	LTOX	3.50E+01
TOX (as Cl)	50796	11/27/89	LTOX	1.50E+02
TOX (as Cl)	50891	1/17/90	LTOX	1.06E+02
TOX (as Cl)	50939	2/13/90	LTOX	4.10E+01
TOX (as Cl)	50955	2/20/90	LTOX	6.20E+01
^{241}Am (pCi/L)	50689	10/16/89	AEA	1.67E-02
^{241}Am (pCi/L)	50709	10/19/89	AEA	1.12E-01
^{241}Am (pCi/L)	50796	11/27/89	AEA	2.73E-01
^{241}Am (pCi/L)	50891	1/17/90	AEA	9.98E-03
^{137}Cs (pCi/L)	50689	10/16/89	GEA	<2.85E-01
^{137}Cs (pCi/L)	50709	10/19/89	GEA	<1.18E-01
^{137}Cs (pCi/L)	50796	11/27/89	GEA	<1.59E-01
^{137}Cs (pCi/L)	50891	1/17/90	GEA	5.78E-01
^{14}C (pCi/L)	50689	10/16/89	LSC	<2.41E+00
^{14}C (pCi/L)	50796	11/27/89	LSC	<3.45E+00
^{14}C (pCi/L)	50891	1/17/90	LSC	4.14E+00
^{3}H (pCi/L)	50709	10/19/89	LSC	<1.46E+02
^{3}H (pCi/L)	50891	1/17/90	LSC	3.13E+02
^{238}Pu (pCi/L)	50689	10/16/89	AEA	<9.34E-05
^{238}Pu (pCi/L)	50709	10/19/89	AEA	6.97E-03
^{238}Pu (pCi/L)	50796	11/27/89	AEA	1.58E-02
^{239,240}Pu (pCi/L)	50689	10/16/89	AEA	1.86E-01
^{239,240}Pu (pCi/L)	50709	10/19/89	AEA	3.71E-01
^{239,240}Pu (pCi/L)	50796	11/27/89	AEA	6.59E-01
^{239,240}Pu (pCi/L)	50891	1/17/90	AEA	2.17E-02
Radium Total (pCi/L)	50689	10/16/89	Alpha-Ra	<3.58E-02
Radium Total (pCi/L)	50709	10/19/89	Alpha-Ra	<8.00E-02
Radium Total (pCi/L)	50796	11/27/89	Alpha-Ra	2.66E-01
Radium Total (pCi/L)	50891	1/17/90	Alpha-Ra	<7.68E-03
^{234}U (pCi/L)	50689	10/16/89	AEA	1.53E-01
^{234}U (pCi/L)	50709	10/19/89	AEA	1.80E-01

Table B-1. Data for PUREX Chemical Sewer-Routine. (sheet 9 of 10)

Constituent	Sample #	Date	Method	Result
^{234}U (pCi/L)	50796	11/27/89	AEA	1.45E-01
^{234}U (pCi/L)	50891	1/17/90	AEA	2.06E-01
^{238}U (pCi/L)	50689	10/16/89	AEA	1.40E-01
^{238}U (pCi/L)	50709	10/19/89	AEA	1.55E-01
^{238}U (pCi/L)	50796	11/27/89	AEA	1.36E-01
^{238}U (pCi/L)	50891	1/17/90	AEA	1.70E-01

Sample# is the number of the sample. See chapter three for corresponding chain-of-custody number. Date is the sampling date. Results are in ppb (parts per billion) unless otherwise indicated. The following table lists the methods that are coded in the method column.

Code	Analytical Method	Reference
ABN	Semivolatile Organics (GC/MS)	USEPA-8270
AEA	^{241}Am	UST-20Am01
AEA	Curium Isotopes	UST-20Am/Cm01
AEA	Plutonium Isotopes	UST-20Pu01
AEA	Uranium Isotopes	UST-20U01
ALPHA	Alpha Counting	EPA-680/4-75/1
ALPHA-Ra	Total Radium Alpha Counting	ASTM-D2460
BETA	Beta Counting	EPA-680/4-75/1
BETA	^{90}Sr	UST-20Sr02
COLIF	Coliform Bacteria	USEPA-9131
COLIFMF	Coliform Bacteria (Membrane Filter)	USEPA-9132
COND-Fld	Conductivity-Field	ASTM-D1125A
COND-Lab	Conductivity-Laboratory	ASTM-D1125A
CVAA	Mercury	USEPA-7470
CVAA/M	Mercury-Mixed Matrix	USEPA-7470
DIGC	Direct Aqueous Injection (GC)	UST-70DIGC
DIMS	Direct Aqueous Injection (GC/MS)	"USEPA-8240"
DSPEC	Reactive Cyanide (Distillation, Spectroscopy)	USEPA-CHAPTER 7
DTITRA	Reactive Sulfide (Distillation, Titration)	USEPA-CHAPTER 7
FLUOR	Uranium (Fluorometry)	ASTM-D2907-83
GEA	Gamma Energy Analysis Spectroscopy	ASTM-D3649-85
GFAA	Arsenic (AA, Furnace Technique)	USEPA-7060
GFAA	Lead (AA, Furnace Technique)	USEPA-7421
GFAA	Selenium (AA, Furnace Technique)	USEPA-7740
GFAA	Thallium (AA, Furnace Technique)	USEPA-7841
IC	Ion Chromatography	EPA-600/4-84-01
ICP	Atomic Emission Spectroscopy (ICP)	USEPA-6010
ICP/M	Atomic Emission Spectroscopy (ICP)-Mixed Matrix	USEPA-6010
IGNIT	Pensky-Martens Closed-Cup Ignitability	USEPA-1010
ISE	Fluoride-Low Detection Limit	ASTM-D1179-80-B
ISE	Ammonium Ion	ASTM-D1426-D
LALPHA	Alpha Activity-Low Detection Limit	EPA-680/4-75/1
LEPD	^{129}I	UST-20I02

Table B-1. Data for PUREX Chemical Sewer-Routine. (sheet 10 of 10)

Constituent	Sample #	Date	Method	Result

Code	Analytical Method	Reference
LSC	^{14}C	UST-20C01
LSC	Tritium	UST-20H03
LTOX	Total Organic Halides-Low Detection Limit	USEPA-9020
PH-Fld	pH-Field	USEPA-9040
PH-Lab	pH-Laboratory	USEPA-9040
SPEC	Total and Amenable Cyanide (Spectroscopy)	USEPA-9010
SPEC	Hydrazine-Low Detection Limit (Spectroscopy)	ASTM-D1385
SSOLID	Suspended Solids	SM-208D
TC	Total Carbon	USEPA-9060
TDS	Total Dissolved Solids	SM-208B
TEMP-Fld	Temperature-Field	Local
TITRA	Alkalinity-Method B (Titration)	ASTM-D1067B
TITRA	Sulfides (Titration)	USEPA-9030
TOC	Total Organic Carbon	USEPA-9060
TOX	Total Organic Halides	USEPA-9020
VOA	Volatile Organics (GC/MS)	USEPA-8240

Analytical Method Acronyms:
atomic absorption spectroscopy (AA)
gas chromatography (GC)
mass spectrometry (MS)
inductively-coupled plasma spectroscopy (ICP).

References:
ASTM - *1986 Annual Book of ASTM Standards*, American Society for Testing and Materials, Philadelphia, Pennsylvania.

EPA - Various methods of the U.S. Environmental Protection Agency, Washington, D.C.

UST - Methods of the contract laboratory.

SM - *Standard Methods for the Examination of Water and Wastewater*, 16th ed., American Public Health Association, American Water Works Association and Water Pollution Control Federation, Washington, D.C.

USEPA - *Test Methods for Evaluating Solid Waste Physical/Chemical Methods*, third edition, SW-846, U.S. Environmental Protection Agency, Washington, D.C.

Table B-2. Data for PUREX Chemical Sewer-Ion Exchanger Regenerate.
(sheet 1 of 6)

Constituent	Sample #	Date	Method	Result
Aluminum	50105	8/05/86	ICP	<1.50E+02
Aluminum	50194	12/05/86	ICP	1.91E+02
Aluminum	50254	3/12/87	ICP	2.16E+02
Aluminum	50313	6/12/87	ICP	<1.50E+02
Aluminum	50394	3/11/88	ICP	6.08E+02
Barium	50105	8/05/86	ICP	3.50E+01
Barium	50194	12/05/86	ICP	9.20E+01
Barium	50254	3/12/87	ICP	9.40E+01
Barium	50313	6/12/87	ICP	3.80E+01
Barium	50394	3/11/88	ICP	1.48E+02
Cadmium	50105	8/05/86	ICP	<2.00E+00
Cadmium	50194	12/05/86	ICP	5.00E+00
Cadmium	50254	3/12/87	ICP	5.00E+00
Cadmium	50313	6/12/87	ICP	<2.00E+00
Cadmium	50394	3/11/88	ICP	1.30E+01
Calcium	50105	8/05/86	ICP	1.77E+04
Calcium	50194	12/05/86	ICP	3.46E+04
Calcium	50254	3/12/87	ICP	2.83E+04
Calcium	50313	6/12/87	ICP	2.44E+04
Calcium	50394	3/11/88	ICP	9.09E+04
Chloride	50105	8/05/86	IC	1.10E+03
Chloride	50194	12/05/86	IC	<5.00E+04
Chloride	50254	3/12/87	IC	2.54E+04
Chloride	50313	6/12/87	IC	<2.50E+03
Chloride	50394	3/11/88	IC	2.31E+04
Chromium	50105	8/05/86	ICP	<1.00E+01
Chromium	50194	12/05/86	ICP	<1.00E+01
Chromium	50254	3/12/87	ICP	<1.00E+01
Chromium	50313	6/12/87	ICP	<1.00E+01
Chromium	50394	3/11/88	ICP	1.10E+01
Copper	50105	8/05/86	ICP	<1.00E+01
Copper	50194	12/05/86	ICP	1.19E+03
Copper	50254	3/12/87	ICP	8.91E+02
Copper	50313	6/12/87	ICP	<1.00E+01
Copper	50394	3/11/88	ICP	1.03E+03
Cyanide	50105	8/05/86	SPEC	<1.00E+01
Cyanide	50194	12/05/86	SPEC	<1.00E+01
Cyanide	50254	3/12/87	SPEC	1.19E+01
Cyanide	50313	6/12/87	SPEC	<1.00E+01
Cyanide	50394	3/11/88	SPEC	<1.00E+01
Fluoride	50105	8/05/86	IC	<5.00E+02
Fluoride	50194	12/05/86	IC	<5.00E+04
Fluoride	50254	3/12/87	IC	<5.00E+03
Fluoride	50313	6/12/87	IC	<2.50E+03
Fluoride	50394	3/11/88	IC	3.39E+03

Table B-2. Data for PUREX Chemical Sewer-Ion Exchanger Regenerate.
(sheet 2 of 6)

Constituent	Sample #	Date	Method	Result
Fluoride	50394	3/11/88	ISE	2.13E+02
Iron	50105	8/05/86	ICP	9.90E+01
Iron	50194	12/05/86	ICP	5.02E+02
Iron	50254	3/12/87	ICP	4.90E+02
Iron	50313	6/12/87	ICP	2.60E+02
Iron	50394	3/11/88	ICP	9.37E+02
Lead	50194	12/05/86	GFAA	3.12E+01
Lead	50254	3/12/87	GFAA	1.90E+01
Lead	50313	6/12/87	GFAA	<5.00E+00
Lead	50394	3/11/88	GFAA	2.30E+01
Magnesium	50105	8/05/86	ICP	3.89E+03
Magnesium	50194	12/05/86	ICP	7.81E+03
Magnesium	50254	3/12/87	ICP	6.37E+03
Magnesium	50313	6/12/87	ICP	5.15E+03
Magnesium	50394	3/11/88	ICP	1.86E+04
Manganese	50105	8/05/86	ICP	1.00E+01
Manganese	50194	12/05/86	ICP	2.00E+01
Manganese	50254	3/12/87	ICP	2.20E+01
Manganese	50313	6/12/87	ICP	1.60E+01
Manganese	50394	3/11/88	ICP	9.70E+01
Mercury	50105	8/05/86	CVAA	1.30E-01
Mercury	50194	12/05/86	CVAA	2.52E+00
Mercury	50254	3/12/87	CVAA	6.10E-01
Mercury	50313	6/12/87	CVAA	4.40E-01
Mercury	50394	3/11/88	CVAA	1.35E+00
Nickel	50105	8/05/86	ICP	<1.00E+01
Nickel	50194	12/05/86	ICP	<1.00E+01
Nickel	50254	3/12/87	ICP	1.20E+01
Nickel	50313	6/12/87	ICP	<1.00E+01
Nickel	50394	3/11/88	ICP	1.30E+01
Nitrate	50105	8/05/86	IC	1.03E+03
Nitrate	50194	12/05/86	IC	<5.00E+04
Nitrate	50254	3/12/87	IC	<5.00E+03
Nitrate	50313	6/12/87	IC	<2.50E+03
Nitrate	50394	3/11/88	IC	5.19E+03
Potassium	50105	8/05/86	ICP	7.50E+02
Potassium	50194	12/05/86	ICP	3.85E+03
Potassium	50254	3/12/87	ICP	1.48E+03
Potassium	50313	6/12/87	ICP	1.32E+03
Potassium	50394	3/11/88	ICP	4.09E+03
Silver	50105	8/05/86	ICP	<1.00E+01
Silver	50194	12/05/86	ICP	<1.00E+01
Silver	50254	3/12/87	ICP	<1.00E+01
Silver	50313	6/12/87	ICP	1.70E+01
Silver	50394	3/11/88	ICP	<1.00E+01

Table B-2. Data for PUREX Chemical Sewer-Ion Exchanger Regenerate.
(sheet 3 of 6)

Constituent	Sample #	Date	Method	Result
Sodium	50105	8/05/86	ICP	7.11E+04
Sodium	50194	12/05/86	ICP	3.24E+04
Sodium	50254	3/12/87	ICP	1.39E+05
Sodium	50313	6/12/87	ICP	7.95E+04
Sodium	50394	3/11/88	ICP	7.05E+05
Strontium	50105	8/05/86	ICP	<3.00E+02
Strontium	50194	12/05/86	ICP	<3.00E+02
Strontium	50254	3/12/87	ICP	<3.00E+02
Strontium	50313	6/12/87	ICP	<3.00E+02
Strontium	50394	3/11/88	ICP	3.53E+02
Sulfate	50105	8/05/86	IC	9.84E+03
Sulfate	50194	12/05/86	IC	2.36E+06
Sulfate	50254	3/12/87	IC	7.48E+05
Sulfate	50313	6/12/87	IC	2.99E+05
Sulfate	50394	3/11/88	IC	2.53E+06
Uranium	50105	8/05/86	FLUOR	6.15E-01
Uranium	50194	12/05/86	FLUOR	4.10E-01
Uranium	50254	3/12/87	FLUOR	6.48E-01
Uranium	50313	6/12/87	FLUOR	5.86E-01
Uranium	50394	3/11/88	FLUOR	1.94E+00
Zinc	50105	8/05/86	ICP	7.00E+00
Zinc	50194	12/05/86	ICP	3.23E+02
Zinc	50254	3/12/87	ICP	4.88E+02
Zinc	50313	6/12/87	ICP	2.20E+01
Zinc	50394	3/11/88	ICP	4.49E+02
Acetone	50105	8/05/86	VOA	1.50E+02
Acetone	50194	12/05/86	VOA	7.40E+01
Acetone	50254	3/12/87	VOA	4.70E+01
Ammonia	50105	8/05/86	ISE	<5.00E+01
Ammonia	50194	12/05/86	ISE	<5.00E+01
Ammonia	50254	3/12/87	ISE	5.30E+01
Ammonia	50313	6/12/87	ISE	<5.00E+01
Ammonia	50394	3/11/88	ISE	7.00E+01
Dichloromethane	50105	8/05/86	VOA	<1.00E+01
Dichloromethane	50105B	8/05/86	VOA	1.70E+02
Dichloromethane	50194	12/05/86	VOA	<1.00E+01
Dichloromethane	50194B	12/05/86	VOA	6.00E+01
Dichloromethane	50254	3/12/87	VOA	<1.00E+01
Dichloromethane	50254B	3/12/87	VOA	4.70E+01
Dichloromethane	50313	6/12/87	VOA	<1.00E+01

Table B-2. Data for PUREX Chemical Sewer-Ion Exchanger Regenerate.
(sheet 4 of 6)

Constituent	Sample #	Date	Method	Result
Dichloromethane	50313B	6/12/87	VOA	2.10E+01
Dichloromethane	50394	3/11/88	VOA	1.50E+01
Dichloromethane	50394B	3/11/88	VOA	1.10E+01
Trichloromethane	50105	8/05/86	VOA	2.00E+01
Trichloromethane	50105B	8/05/86	VOA	<1.00E+01
Trichloromethane	50194	12/05/86	VOA	1.71E+02
Trichloromethane	50194B	12/05/86	VOA	<1.00E+01
Trichloromethane	50254	3/12/87	VOA	<1.00E+01
Dichloromethane	50313B	6/12/87	VOA	2.10E+01
Dichloromethane	50394	3/11/88	VOA	1.50E+01
Dichloromethane	50394B	3/11/88	VOA	1.10E+01
Trichloromethane	50105	8/05/86	VOA	2.00E+01
Trichloromethane	50105B	8/05/86	VOA	<1.00E+01
Trichloromethane	50194	12/05/86	VOA	1.71E+02
Trichloromethane	50194B	12/05/86	VOA	<1.00E+01
Trichloromethane	50254	3/12/87	VOA	<1.00E+01
Trichloromethane	50254B	3/12/87	VOA	<1.00E+01
Trichloromethane	50313	6/12/87	VOA	<1.00E+01
Trichloromethane	50313B	6/12/87	VOA	<1.00E+01
Trichloromethane	50394	3/11/88	VOA	<5.00E+00
Trichloromethane	50394B	3/11/88	VOA	<5.00E+00
Alpha Activity (pCi/L)	50105	8/05/86	Alpha	7.88E-01
Alpha Activity (pCi/L)	50194	12/05/86	Alpha	6.83E-01
Alpha Activity (pCi/L)	50254	3/12/87	Alpha	1.68E+00
Alpha Activity (pCi/L)	50313	6/12/87	Alpha	1.44E+00
Alpha Activity (pCi/L)	50394	3/11/88	Alpha	7.24E+00
Beta Activity (pCi/L)	50105	8/05/86	Beta	5.33E+00
Beta Activity (pCi/L)	50194	12/05/86	Beta	8.85E+00
Beta Activity (pCi/L)	50254	3/12/87	Beta	9.09E+00
Beta Activity (pCi/L)	50313	6/12/87	Beta	7.90E+00
Beta Activity (pCi/L)	50394	3/11/88	Beta	1.38E+01
Conductivity (μS)	50105	8/05/86	COND-Fld	3.91E+03
Conductivity (μS)	50194	12/05/86	COND-Fld	1.68E+03
Conductivity (μS)	50254	3/12/87	COND-Fld	3.13E+03
Conductivity (μS)	50313	6/12/87	COND-Fld	6.91E+02
Conductivity (μS)	50394	3/11/88	COND-Fld	4.83E+03
pH (dimensionless)	50105	8/05/86	PH-Fld	4.34E+00
pH (dimensionless)	50194	12/05/86	PH-Fld	1.80E+00
pH (dimensionless)	50254	3/12/87	PH-Fld	2.39E+00
pH (dimensionless)	50313	6/12/87	PH-Fld	3.18E+00
pH (dimensionless)	50394	3/11/88	PH-Fld	9.98E+00
Temperature (°C)	50105	8/05/86	TEMP-Fld	3.76E+01
Temperature (°C)	50194	12/05/86	TEMP-Fld	1.85E+01
Temperature (°C)	50254	3/12/87	TEMP-Fld	1.29E+01
Temperature (°C)	50313	6/12/87	TEMP-Fld	2.72E+01
Temperature (°C)	50394	3/11/88	TEMP-Fld	1.75E+01

Table B-2. Data for PUREX Chemical Sewer-Ion Exchanger Regenerate. (sheet 5 of 6)

Constituent	Sample #	Date	Method	Result
TOC	50105	8/05/86	TOC	1.72E+04
TOC	50194	12/05/86	TOC	3.23E+03
TOC	50254	3/12/87	TOC	6.58E+03
TOC	50313	6/12/87	TOC	2.16E+03
TOC	50394	3/11/88	TOC	3.62E+03
TOX (as Cl)	50105	8/05/86	TOX	3.07E+02
TOX (as Cl)	50194	12/05/86	LTOX	3.01E+02
TOX (as Cl)	50254	3/12/87	LTOX	1.74E+02
TOX (as Cl)	50313	6/12/87	LTOX	5.66E+01
TOX (as Cl)	50394	3/11/88	LTOX	1.05E+02

Sample# is the number of the sample. See chapter three for corresponding chain-of-custody number. Date is the sampling date. Results are in ppb (parts per billion) unless otherwise indicated. The following table lists the methods that are coded in the method column.

Code	Analytical Method	Reference
ABN	Semivolatile Organics (GC/MS)	USEPA-8270
AEA	^{241}Am	UST-20Am01
AEA	Curium Isotopes	UST-20Am/Cm01
AEA	Plutonium Isotopes	UST-20Pu01
AEA	Uranium Isotopes	UST-20U01
ALPHA	Alpha Counting	EPA-680/4-75/1
ALPHA-Ra	Total Radium Alpha Counting	ASTM-D2460
BETA	Beta Counting	EPA-680/4-75/1
BETA	^{90}Sr	UST-20Sr02
COLIF	Coliform Bacteria	USEPA-9131
COLIFMF	Coliform Bacteria (Membrane Filter)	USEPA-9132
COND-Fld	Conductivity-Field	ASTM-D1125A
COND-Lab	Conductivity-Laboratory	ASTM-D1125A
CVAA	Mercury	USEPA-7470
CVAA/M	Mercury-Mixed Matrix	USEPA-7470
DIGC	Direct Aqueous Injection (GC)	UST-70DIGC
DIMS	Direct Aqueous Injection (GC/MS)	"USEPA-8240"
DSPEC	Reactive Cyanide (Distillation, Spectroscopy)	USEPA-CHAPTER 7
DTITRA	Reactive Sulfide (Distillation, Titration)	USEPA-CHAPTER 7
FLUOR	Uranium (Fluorometry)	ASTM-D2907-83
GEA	Gamma Energy Analysis Spectroscopy	ASTM-D3649-85
GFAA	Arsenic (AA, Furnace Technique)	USEPA-7060
GFAA	Lead (AA, Furnace Technique)	USEPA-7421
GFAA	Selenium (AA, Furnace Technique)	USEPA-7740
GFAA	Thallium (AA, Furnace Technique)	USEPA-7841
IC	Ion Chromatography	EPA-600/4-84-01

Table B-2. Data for PUREX Chemical Sewer-Ion Exchanger Regenerate.
(sheet 6 of 6)

Code	Analytical Method	Reference
ICP	Atomic Emission Spectroscopy (ICP)	USEPA-6010
ICP/M	Atomic Emission Spectroscopy (ICP)-Mixed Matrix	USEPA-6010
IGNIT	Pensky-Martens Closed-Cup Ignitability	USEPA-1010
ISE	Fluoride-Low Detection Limit	ASTM-D1179-80-B
ISE	Ammonium Ion	ASTM-D1426-D
LALPHA	Alpha Activity-Low Detection Limit	EPA-680/4-75/1
LEPD	^{129}I	UST-20I02
LSC	^{14}C	UST-20C01
LSC	Tritium	UST-20H03
LTOX	Total Organic Halides-Low Detection Limit	USEPA-9020
PH-Fld	pH-Field	USEPA-9040
PH-Lab	pH-Laboratory	USEPA-9040
SPEC	Total and Amenable Cyanide (Spectroscopy)	USEPA-9010
SPEC	Hydrazine-Low Detection Limit (Spectroscopy)	ASTM-D1385
SSOLID	Suspended Solids	SM-208D
TC	Total Carbon	USEPA-9060
TDS	Total Dissolved Solids	SM-208B
TEMP-Fld	Temperature-Field	Local
TITRA	Alkalinity-Method B (Titration)	ASTM-D1067B
TITRA	Sulfides (Titration)	USEPA-9030
TOC	Total Organic Carbon	USEPA-9060
TOX	Total Organic Halides	USEPA-9020
VOA	Volatile Organics (GC/MS)	USEPA-8240

Analytical Method Acronyms:
atomic absorption spectroscopy (AA)
gas chromatography (GC)
mass spectrometry (MS)
inductively-coupled plasma spectroscopy (ICP).

References:

ASTM - *1986 Annual Book of ASTM Standards*, American Society for Testing and Materials, Philadelphia, Pennsylvania.

EPA - Various methods of the U.S. Environmental Protection Agency, Washington, D.C.

UST - Methods of the contract laboratory.

SM - *Standard Methods for the Examination of Water and Wastewater*, 16th ed., American Public Health Association, American Water Works Association and Water Pollution Control Federation, Washington, D.C.

USEPA - *Test Methods for Evaluating Solid Waste Physical/Chemical Methods*, third edition, SW-846, U.S. Environmental Protection Agency, Washington, D.C.

APPENDIX C

HISTORICAL CHEMICAL/RADIOLOGICAL DATA

This page intentionally left blank.

Table C-1. PUREX CSL - Routine Operation.

Analyte	08/22/85	06/06/86	12/19/86	03/18/87	04/06/87
Alpha Activity (LDL, pCi/L)	4.90E-02	4.03E+00	5.97E-01	1.81E-01	4.22E-01
Beta Activity (pCi/L)	3.23E+00	2.26E+01	3.82E+00	4.87E+00	5.09E+00
Acetone (VOA)	6.70E+01	BDL	BDL	BDL	2.00E+02
Aluminum	BDL	1.98E+02	BDL	BDL	BDL
Ammonium	4.50E+02	BDL	1.24E+02	BDL	BDL
Barium	3.40E+01	2.40E+01	3.10E+01	2.60E+01	2.40E+01
Cadmium	7.00E+00	BDL	BDL	BDL	BDL
Calcium	1.90E+04	1.43E+04	2.02E+04	2.06E+04	1.89E+04
Chloride	1.16E+03	BDL	1.04E+03	1.23E+03	1.19E+03
Chromium	1.40E+01	BDL	BDL	BDL	BDL
Conductivity* (μS)	1.38E+02	1.25E+01	1.71E+02	1.14E+02	1.53E+02
Copper	BDL	BDL	2.80E+01	BDL	BDL
Di-n-butyl phthalate	2.00E+01	BDL	BDL	BDL	BDL
Iron	8.00E+01	2.22E+02	5.00E+01	6.80E+01	6.00E+01
Magnesium	4.31E+03	3.24E+03	4.66E+03	4.67E+03	4.24E+03
Manganese	1.00E+01	1.30E+01	BDL	5.00E+00	BDL
Mercury	BDL	BDL	BDL	1.50E-01	BDL
Nickel	1.60E+01	BDL	BDL	BDL	BDL
Nitrate	8.40E+02	BDL	5.42E+02	5.76E+02	BDL
pH*	8.14E+00	7.72E+00	8.56E+00	7.12E+00	8.52E+00
Potassium	3.46E+03	1.29E+03	8.21E+02	8.38E+02	7.41E+02
Sodium	3.14E+03	2.64E+03	1.17E+04	3.24E+03	2.02E+03
Sulfate	1.02E+04	8.03E+03	1.15E+04	1.28E+04	1.11E+04
Sulfide	BDL	1.28E+03	BDL	BDL	BDL
Temperature* (Celsius)	3.28E+01	3.09E+01	1.59E+01	1.34E+01	2.46E+01
TOC	1.18E+03	2.51E+03	1.26E+03	1.23E+03	1.34E+03
TOC	1.29E+03	2.53E+03			
TOX (LDL)	BDL	BDL	3.06E+01	2.82E+01	2.03E+01
Uranium	4.85E-01	4.06E-01	4.20E-01	4.20E-01	3.00E-01
Zinc	4.70E+01	5.00E+00	1.00E+01	1.30E+01	7.00E+00

*Measurements taken in the field.

Radioactive Component Analysis Considerations

Understanding the radiological sample results generated routinely at the Hanford Site is complicated by the traditional methods of reporting the results. These methods, although not ideal, are a direct outgrowth of the methods used to detect radionuclides, the physics of radioactive decay, and the ubiquity of ionizing radiation.

Radioactive decay is a random process: each radioactive nucleus has a certain probability of decaying during a certain period of time, and will either decay or not decay. Radioactivity is quantified by counting the number of decays observed during a measured period of time. Consequently, any measurement of radioactive decay rate includes a considerable amount of random error (experimental uncertainty). Specifically, the standard deviation of a measurement is equal to the square root of the number of decays expected during the counting period. The standard deviation can be approximated as the square root of the number of counts actually observed. Background radiation, which is always present, follows the same statistical rules as the radioactivity being measured.

To avoid reporting background radiation as radioactivity in a sample, each analysis consists of two counting periods of the same length. In the first, the background radiation is counted. In the second, the sample to be analyzed is inserted into the instrument, and the background and sample are counted together. The measured radioactivity of the sample is then the difference between the second and first measurements, divided by the time period. Because radiation production is a random process, it is possible for an individual measurement of the background to be greater than another measurement of the background plus the radioactivity of a sample, leading to a negative measured radioactivity for the sample. (Indeed, if the sample has negligible radioactivity, such negative results will occur about half of the time.)

Because it is physically impossible for a sample to actually contain a negative concentration of radioactive species, negative results have traditionally been reported as "less than" values. Similarly, counting results so low as to make it unclear whether any radioactivity was present in the sample have also often been reported as "less than" values. On some occasions, however, small positive results (below the confidence interval reported in "less than" results) have been reported as real numbers. Although the historical data resulting from such reporting methods are not as well suited as they might be for evaluating what has happened in the past, the data did serve their primary function for process control and environmental protection at the time they were generated.

Radiological Surveillance Results

The following tables present available radiological data on CSL (known as chemical sewer) discharges from 1976 through 1988. The data were obtained from monthly composite samples of the effluent actually released to the environment. The samples were obtained by a flow proportional sampler, and composited monthly using data from the CSL flow instrumentation. The data have been published on a yearly or quarterly basis, and made available to the public. The data have also been published in the *Waste Stream Characterization Report*.*

At the end of 1984, a change was made in the reporting of plutonium in liquid effluents released to the environment. Before that time, plutonium releases were reported in grams per liter. Subsequent to that time, they were reported in micro-Curies per liter. In producing the following table, the reported concentrations were multiplied by 1,000,000 to yield picocuries per liter (pCi/L) after 1984, and micrograms per liter before 1985. The pre-1985 plutonium results can be converted to picocuries per liter by multiplying by the specific activity of ^{239}Pu, which is 61,400 pCi/mg.

The graphs that follow the tables present the same data in graphic form. In the graphs, both "less than" results and real results are connected with lines. Each real result is marked with a plus sign ("+"). Thus, the graph for ^{241}Am shows only one instance in which ^{241}Am was actually detected in the CSL (November 1987). The rest of the line on the ^{241}Am graph is merely an upper bound for the actual emissions of ^{241}Am through the CSL. In the graphical presentation, the plutonium data are all in pCi/L.

When the SCD is diverted and subsequently found acceptable for release to a surface pond, the radionuclide content of the released liquid is sometimes included in the total for the CSL, instead of the PUREX steam condensate. Consequently, the historical radiological data do not reflect the composition and variability of the CSL as accurately as they might.

---

*WHC, 1989, *Waste Stream Characterization Report*, WHC-EP-0287, Volume II, Westinghouse Hanford Company, Richland, Washington.

Table C-2. CSL Radiological Release History
Units are pCi/L Except Volume in Liter. (sheet 1 of 4)

Crib Waste Management System
Wastestream Activity Detail
Units in pCi/L except Volume in L

Stream Code: PD PUREX Chemical Sewage

Date	VOLUME	ALPHA	BETA	SR-90	CS-137	PM-147	U(GROSS)	H-3	AM-241	PU-239
7601	1.08E+07		<4.20E+01				<3.85E+01			<1.11E-04
7602	1.08E+07		<4.40E+01				<3.85E+01			1.30E-04
7603	1.08E+07		<4.40E+01				<1.46E+02			<1.19E-04
7604	1.08E+07		<8.30E+01				2.70E+01			<5.50E-04
7605	1.08E+07		<4.30E+01				<3.80E+01			<1.60E-04
7606	1.08E+07		<3.80E+01				<3.84E+00			<6 80E-05
7607	1.08E+07		<2.60E+01				<3.85E+01			1.12E-04
7608	1.08E+07		<2.93E+01				<3.85E+01			<5.83E-05
7609	1.08E+07		<4.90E+01				<3.87E+01			<2.89E-04
7610	1.08E+07		<3.40E+01				<3.85E+01			<1.27E-04
7611	1.08E+07		<1.46E+01				<3.85E+01			<9 10E-05
7612	1.08E+07		<2 23E+01				<3.85E+01			1 87E-04
7701	1.08E+07		<4.20E+02				<3.80E+01			<1.30E-04
7702	1.08E+07		8.91E+01				<3.85E+01			2.47E-04
7703	1.08E+07		<2.07E+02				<3.85E+01			6.27E-04
7704	1.08E+07		<5.57E+02				<3.80E+01			<9.20E-04
7705	1.08E+07		<2.41E+02				<3.85E+01			<5.03E-04
7706	1.08E+07		<3.72E+01				<3.84E+01			<1.68E-04
7707	1.08E+07		<5.60E+01				<3.85E+01			<1.49E-04
7708	1.08E+07		<7.00E+01				<3.84E+01			<3.55E-04
7709	1.08E+07		<6.24E+01				<3.85E+01			<1.43E-03
7710	1.08E+07		<8.87E+01				<3.80E+01			<5.00E-04
7711	1.08E+07		<6.10E+01				<3.84E+01			<2.99E-04
7712	1.08E+07		<6.10E+01				<3.85E+01			5.00E-04
7801	1.08E+07		3.29E+01				<3.87E+01			2.07E-03
7802	1.08E+07		<2.60E+01				<3.86E+01			<9.93E-05
7803	1.08E+07		<4.90E+01				<3.85E+01			<2.21E-04
7804	1.08E+07		<8.30E+01				<3.85E+01			1 61E-04
7805	1.08E+07		<5.60E+01				<3.85E+01			1.30E-04
7806	1.08E+07		<3 12E+01				<3.85E+01			3.06E-04
7807	1.08E+07		<8.20E+01				<3.87E+01			3.99E-04
7808	1.80E+07		<3 90E+01				3.84E+01			<3.00E-04
7809	1.08E+07		<3.86E+01				<3.84E+01			<1.35E-04
7810	1.08E+07		<3.86E+01				<3.82E+01			<6.72E-05
7811	1.08E+07		<4.73E+01				<7.95E+01			<2.34E-04
7812	1.08E+07		<2.80E+02				<3.85E+01			<9.00E-05
7901	4.09E+07		5.54E+01				<1.00E+03			<9.22E-05
7902	4.09E+07		<1 93E+01				<1.00E+03			<6.19E-05
7903	4.09E+07		<1.38E+01				<1.00E+03			<3.47E-05
7904	4.09E+07		<2.40E+01				<1.00E+03			<4.23E-05
7905	4.09E+07		<3.28E+01				<1.00E+03			<1.14E-03
7906	4.09E+07		<3 03E+01				<1.00E+03			8.42E-05
7907	4.09E+07		<1 33E+01				<1.00E+03			<5.05E-05
7908	4.09E+07		<1.64E+01				<1.10E+03			<1.38E-04
7909	4.09E+07		2.25E+01				<1.00E+03			7.82E-05

Table C-2. CSL Radiological Release History
Units are pCi/L Except Volume in Liter. (sheet 2 of 4)

Crib Waste Management System
Wastestream Activity Detail
Units in pCi/L except Volume in L

Stream Code: PD PUREX Chemical Sewage

Date	VOLUME	ALPHA	BETA	SR-90	CS-137	PM-147	U(GROSS)	H-3	AM-241	PU-239
7910	4.09E+07		6.53E+01	3.45E+01	<2.20E+02		<1.00E+03			4.43E-05
7911	4.09E+07		<3.77E+00				<1.00E+03			1.11E-04
7912	4.09E+07		<2.34E+01				<1.00E+03			<8.47E-05
8001	3.60E+07		<3.60E+01	3.99E+01	3.51E+02					<4.89E-05
8002	3.60E+07		<3.40E+01							<3.96E-05
8003	3.60E+07		5.16E+02	2.33E+02	<3.80E+01					<6.35E-05
8004	3.60E+07		<3.23E+01	2 37E+01	<3.80E+01					<6.35E-05
8005	3.60E+07		1.56E+03	<2.80E+00	<3.80E+01					4.98E-05
8006	3.60E+07		<1.41E+01	<1.80E+01	<3.80E+01					<3.01E-05
8007	3.60E+07		<1.20E+01		<4.00E+01					<2.77E-05
8008	3.60E+07		<1.13E+00							<6.17E-06
8009	3.60E+07		5.30E+00							<1.66E-05
8010	3.60E+07		4.10E+01	<8.60E+00	<9.00E+01					2.36E-05
8011	3.60E+07		9.40E+01	3.20E+01	<4.00E+01					3.26E-05
8012	3.60E+07		9.50E+00	2.40E+00	<4.00E+01					3.91E-05
8101	3.60E+07		1.28E+01	<5.00E+00						2.77E-05
8102	3.60E+07		9.80E+00	<6.00E+00						3.58E-05
8103	3.60E+07		1.30E+01	<6.00E+00	<1.00E+01					4.40E-05
8104	4.13E+07		<8.00E+00	1.50E+01	<4.00E+01					4.07E-05
8105	3.33E+07		2.16E+02	<7.00E+00	<4.00E+01					2.13E-03
8106	4.62E+08		1.55E+02	<2.00E+01	<4.00E+01					1.56E-03
8107	4.15E+07		4.40E+02	1.40E+01	<4.00E+01					2.16E-03
8108	3.32E+07		9.58E+01	2.90E+01	<4.00E+01					2.34E-04
8109	4.15E+07		9.60E+01	1.50E+01	<4.00E+01					7.28E-04
8110	3.32E+07		6.92E+02	<2.10E+01	<4.40E+01					2.62E-03
8111	3.32E+07		6.80E+01	<9.00E+00	2.30E+02					5.05E-04
8112	4.16E+07		2.20E+01	<7.00E+00						9.28E-05
8201	3.32E+07	<4.00E+00	<6.20E+00							
8202	3.32E+07	9.55E+01	1.67E+02	4.00E+02	1.70E+02					
8203	4.16E+07	6.90E+01	1.50E+02	<1.00E+01	<1.00E+02					
8204	3.32E+07	<5 10E+00	<1.90E+01							
8205	3.32E+07	<6 20E+00	3.20E+01							
8206	4.16E+07	6.17E+01	3.53E+02	<1.00E+01	1.70E+02					
8207	3.32E+07	<3.40E+00	1.19E+01							
8208	3.32E+07	<5.50E+00	<1.90E+01							
8209	4.16E+07	<7.20E+01	1.04E+02	<9.00E+00	<1.00E+02					
8210	3.32E+07	<3 50E+00	<5.79E+01							
8211	3.32E+07	<1.45E+01	3.53E+02	1.80E+01	5.70E+02					
8212	8.97E+07	<4.20E+00	3.15E+01	<9 00E+00	<5.00E+01					
8301	1.46E+08	6.30E+00	1.90E+01							
8302	9.39E+07	<2.40E+01	<5.60E+01	<1.00E+01	<5.00E+01					
8303	1.31E+08	<1.90E+01	<4.50E+01	1.10E+01	<4.00E+01					
8304	6.10E+07	7.00E+01	1.33E+02	3.80E+02	<5.00E+01		2.10E+02	<2.00E+02		
8305	8.75E+07	1.91E+02	3.88E+01	<1 00E+01	<5.00E+01			<2.00E+02		
8306	1.03E+08	1.35E+02	3 50E+02	1.40E-01	4.20E+01		<2.00E+02			

Table C-2. CSL Radiological Release History
Units are pCi/L Except Volume in Liter. (sheet 3 of 4)

Crib Waste Management System
Wastestream Activity Detail
Units in pCi/L except Volume in L

Stream Code: PD PUREX Chemical Sewage

Date	VOLUME	ALPHA	BETA	SR-90	CS-137	PM-147	U(GROSS)	H-3	AM-241	PU-239
8307	4.78E+07	<8.50E+00	<3.70E+01				<1.00E+00	1.00E+03		
8308	6.31E+07	<2.80E+00	1.63E+02	1.50E+01	1.30E+02			6.92E+02		
8309	5.87E+07	<3.58E+00	<3.10E+01				<1.00E+00	3.60E+01		
8310	8.06E+07	<2.68E-01	<3.60E+01	<2.00E+02	<6.00E+01		<1.00E+00	<2.00E+02		
8311	1.34E+08	<1.61E+00	<1.33E+01					<2.00E+02		
8312	1.30E+08	<5.00E+00	3.95E+01	<6.00E+00	<6.00E+01		1.60E+01	2.20E+04		
8401	8.42E+07	1.73E+02	2.14E+02	1.94E+02	<5.10E+01	7.00E+01	<1.00E+00	1.20E+03		
8402	1.27E+08	2.48E+01	2.24E+02	<2.00E+01	<1.30E+02	6.40E+02	<1.00E+00	1.00E+00		
8403	1.17E+08	<2.40E+00	6.74E+02	6.20E+01	<5.30E+01	<2.00E+02	<1.00E+00	1.70E+03		
8404	1.09E+08	<3.80E+00	6.40E+03	4.18E+02	4.79E+02	7.31E+02	<1.00E+00	1.10E+06		
8405	1.19E+08	4.87E+01	4.57E+02	<2.30E+02	<4.70E+01	<2.00E+02	<2.00E+00	9.50E+04		
8406	1.07E+08	<2.19E+00	9.00E+01	<1.80E+01	<3.40E+01	<2.00E+02	<1.00E+00	4.30E+03		
8407	9.30E+07	<5.80E+00	3.96E+02	1.57E+02	<4.38E+01	<3.00E+03	<1.00E+00	4.03E+02		
8408	8.58E+07	<3.50E+00	<3.66E+01	<3.00E+01	<4.20E+01	<9.00E+01	<6.00E+01	2.30E+03		
8409	6.50E+07	<1.70E+01	1.05E+03	<1.02E+03	4.13E+02	1.10E+04	<1.00E+00	1.10E+04		
8410	2.65E+07	<6.20E+00	3.50E+02	<3.00E+01	4.40E+01	<3.00E+01	<2.00E+00	2.10E+03		
8411	4.47E+07	<5.10E+00	2.01E+02	<2.90E+01	<4.70E+01	<7.00E+03	<1.00E+00	2.50E+03		
8412	7.88E+07	<3.79E+01	<4.00E+02	<2.80E+01	<4.80E+01	<4.00E+02	<1.00E+00	7.60E+03		
8501	9.77E+07	<2.10E+00	1.42E+03	3.90E+01	6.10E+01	1.50E+03		7.30E+04		
8502	5.98E+07	<3.70E+00	6.24E+02	4.30E+01	<4.85E+01	<7.00E+02		6.70E+03		
8503	5.40E+07	<2.50E+00	<5.80E+01	2.50E+01	<4.40E+01	<4.00E+01		5.00E+02		
8504	1.51E+08	<2.10E+00	5.40E+01	<1.90E+01	<5.00E+01	<2.00E+02		1.00E+03		
8505	1.52E+08	<4.44E+00	<2.90E+01	<3.00E+01	<4.40E+01	<4.00E+02		1.20E+03		
8506	1.55E+08	<3.60E+00	5.60E+01	<1.50E+01	<4.29E+01	<4.00E+01		2.00E+03		
8507	2.72E+08	<1.41E+02	<4.00E+01	<1.60E+01	<4.70E+01	<2.00E+01		2.40E+03		
8508	1.91E+08	<5.00E+00	<5.00E+01	<2.90E+01	<4.90E+01	2.50E+02		<5.00E+02		
8509	1.46E+08	<4.30E+00	3.70E+01	<1.10E+01	<5.00E+01	<7.00E+01		2.10E+03		
8510	1.51E+08	<4.50E+00	1.67E+02	<3.00E+01	<6.00E+01	<4.00E+01		6.20E+04		
8511	1.87E+08	7.46E+02	<3.70E+01	<2.00E+01	<4.70E+01	4.20E+03		6.10E+03		
8512	1.32E+08	1.46E+01	1.45E+04	4.47E+02	4.70E+02	8.10E+02		9.00E+04		
8601	1.81E+08	1.70E+01	5.30E+02	<2.00E+01	<4.50E+01			1.30E+03		
8602	1.41E+08	<8.90E+00	3.90E+02	<1.80E+01	<4.30E+01			<5.00E+02		
8603	1.73E+08	<2.60E+00	1.24E+02	<2.90E+01	<6.10E+01			4.50E+03		
8604	1.55E+08	3.30E+01	2.30E+02	<2.70E+01	<5.00E+01			3.40E+04		
8605	1.33E+08	<3.83E+00	7.30E+01	<2.60E+01	<4.80E+01			<5.00E+02		
8606	1.15E+08	<3.30E+00	3.50E+01	<8.00E+00	<4.00E+01			3.00E+02		
8607	1.97E+08	<3.05E+01	2.11E+02	<3.90E+01	<4.70E+01			4.00E+03		
8608	2.05E+08	5.60E+00	4.71E+02	<5.20E+01	<4.85E+01			<5.00E+02		
8609	1.09E+08	<2.31E+01	<1.18E+02	<3.00E+01	<6.50E+01			7.00E+02		
8610	7.99E+07	<1.80E+00	<5.20E+01	2.02E+01	<4.11E+01			<2.80E+03		
8611	7.80E+07	7.50E+00	<9.60E+01	<1.80E+01	<7.90E+01			5.20E+02		
8612	1.19E+08	3.30E+00	1.08E+02	<2.10E+01	<4.20E+01			<5.00E+02		
8701	4.05E+07	<2.20E+00	4.14E+01	<2.00E+01	<4.40E+01			2.50E+03		
8702	3.83E+07	<4.10E+00	6.50E+01	<3.00E+01	<4.40E+01			3.30E+03		
8703	6.48E+07	<1.32E+01	2.33E+02	<1.80E+01	<5.10E+01			<8.90E+02	<7.00E+02	7.89E+01

9 1 1 5 0 1 1

Table C-2. CSL Radiological Release History
Units are pCi/L Except Volume in Liter. (sheet 4 of 4)

Crib Waste Management System
Wastestream Activity Detail
Units in pCi/L except Volume in L

Stream Code: PD PUREX Chemical Sewage

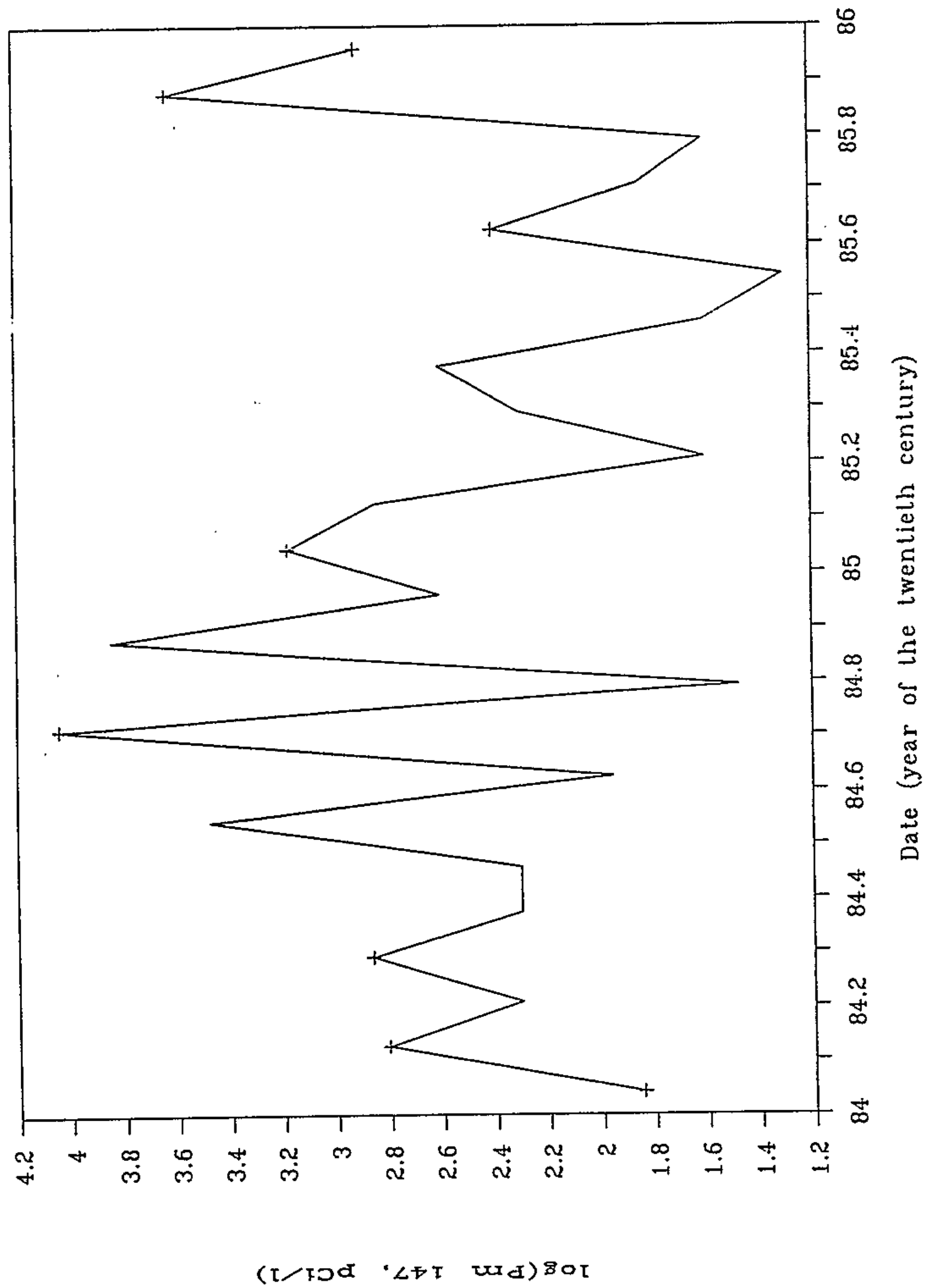
Date	VOLUME	ALPHA	BETA	SR-90	CS-137	PM-147	U(GROSS)	H-3	AM-241	PU-239
8704	1.10E+08	<2.10E+00	3.79E+01	<1.71E+01	<4.80E+01			<4.00E+02	<1.40E+03	8.50E+00
8705	4.11E+07	<3.60E+00	<2.40E+01	<2.50E+01	<4.40E+01			1.40E+03	<6.49E+02	1.14E+01
8706	7.41E+07	<3.00E+00	2.90E+01	<1.80E+01	<4.60E+01			<4.50E+02	<1.51E+02	7.54E+00
8707	1.89E+08	<3.25E+00	<1.81E+01	<1.92E+01	<4.51E+01			2.20E+03	<8.95E+01	<1.00E+01
8708	9.69E+07	<3.28E+00	1.54E+01	<1.62E+01	<4.70E+01			<4.50E+02	<8.00E+01	<1.20E+01
8709	1.26E+08	<2.64E+00	<1.74E+01	<1.65E+01	<4.88E+01			<4.50E+02	<8.00E+01	<1.07E+01
8710	2.82E+07	<3.79E+00	<2.01E+01	<1.87E+01	<4.97E+01			<4.50E+02	<5.95E+01	<4.50E+01
8711	1.15E+07	<2.39E+00	2.64E+01	<3.64E+01	<4.46E+01			<4.50E+02	4.80E+01	<1.00E+01
8712	2.36E+07	<3.18E+00	2.04E+01	<3.49E+01	<1.09E+03			<7.85E+02	<6.00E+01	<1.00E+01
8801	6.19E+07	<1.43E+01	<1.26E+03	<2.69E+01	<6.52E+01			1.28E+03	<6.21E+01	<1.08E+01
8802	1.53E+08	<7.16E+00	<1.29E+02	<3.04E+01	<5.88E+01			<4.56E+02	<8.12E+01	<1.00E+01
8803	1.63E+08	<3.35E+00	<3.35E+02	<6.00E+01	<8.25E+01			6.40E+02	<2.41E+01	<4.81E+01
8804	7.62E+07	<3.80E+00	<4.62E+01	<3.28E+01	<5.36E+01			1.39E+03	<5.92E+01	<2.40E+01
8805	7.07E+07	<2.62E+00	<2.32E+01	<1.67E+01	<4.78E+01			<4.50E+02	<6.69E+01	<1.00E+01
8806	1.34E+08	<5.03E+00	<1.86E+02	<5.21E+01	<7.57E+01			1.87E+03	<7.40E+01	<1.33E+01
8807	1.02E+07	<1.31E+01	<1.50E+01	<2.39E+01	<4.52E+01			<4.50E+02	<6.50E+01	<1.64E+01
8808	1.73E+08	<7.33E+01	<6.87E+03	<3.31E+02	<4.65E+02			8.91E+02	<5.32E+01	<7.97E+01
8809	1.31E+08	<1.85E+01	<2.52E+02	<6.86E+01	<1.12E+02			5.72E+02	<8.92E+01	<2.20E+01
8810	1.06E+08	<2.26E+00	<1.19E+01	<1.65E+01	<7.59E+01			3.18E+04	<5.91E+01	<1.48E+01
8811	1.31E+08	<2.39E+01	<2.89E+01	<1.40E+01	<5.59E+01			3.67E+02	<5.52E+01	<1.38E+01
8812	7.98E+07	<4.84E+00	<3.00E+00	<2.10E+01	<5.27E+01			9.80E+02	<6.39E+01	<1.60E+01

Total volume: 1.04E+10

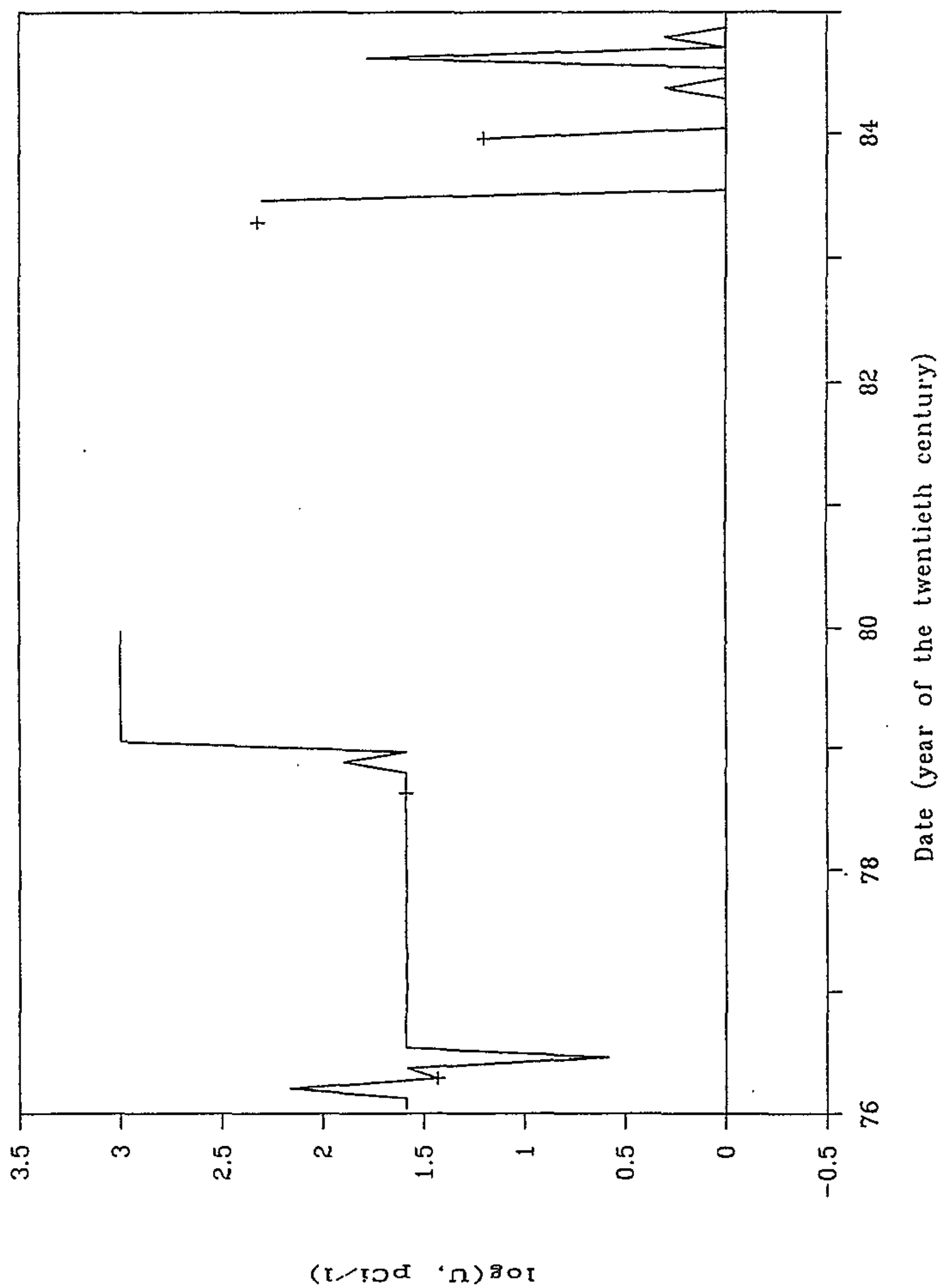
This page intentionally left blank.

**PUREX Plant CSL Radiological
Release History Graphs**

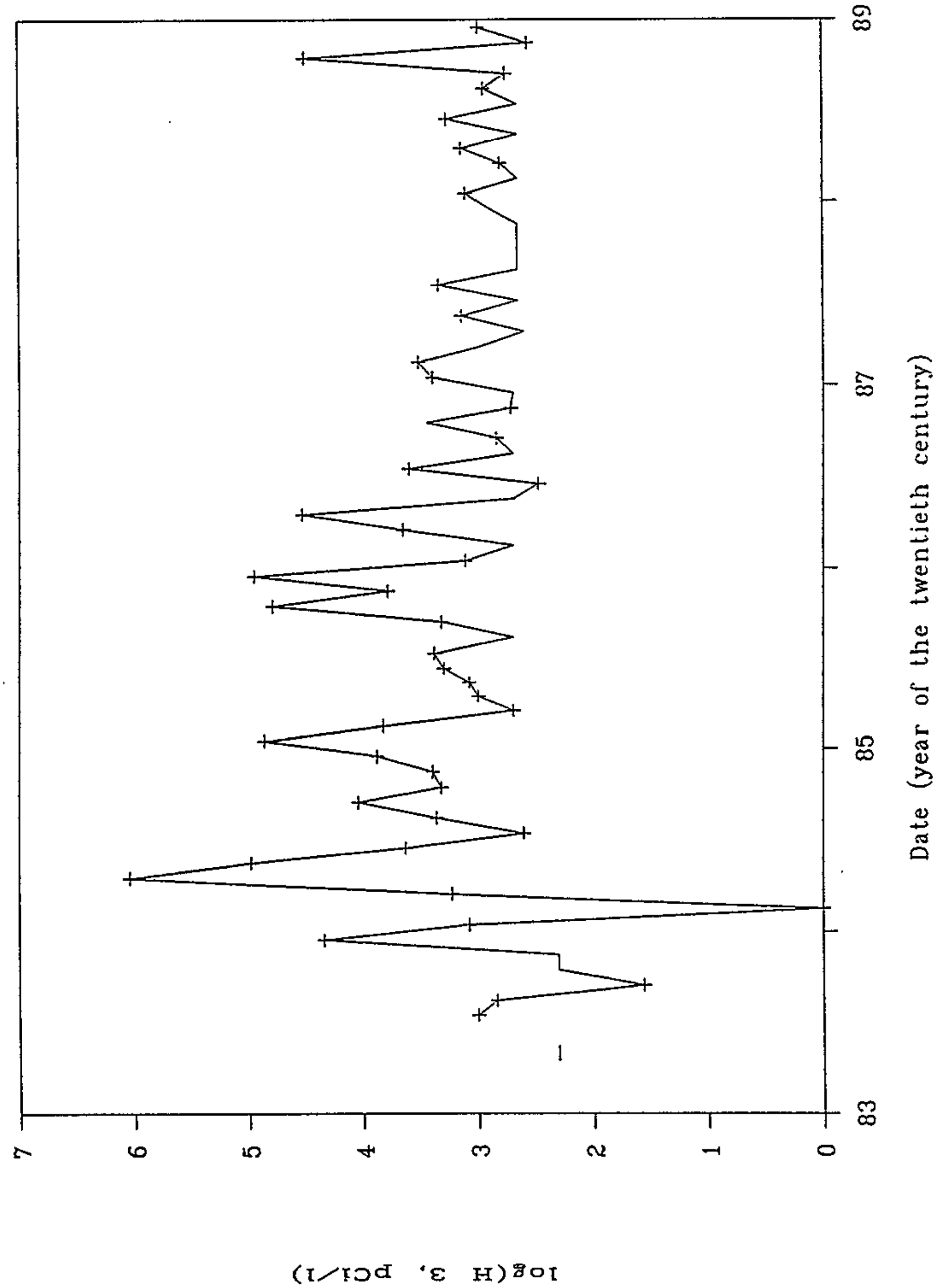
PUREX Plant CSL Radiological Release History.
Promethium-147.



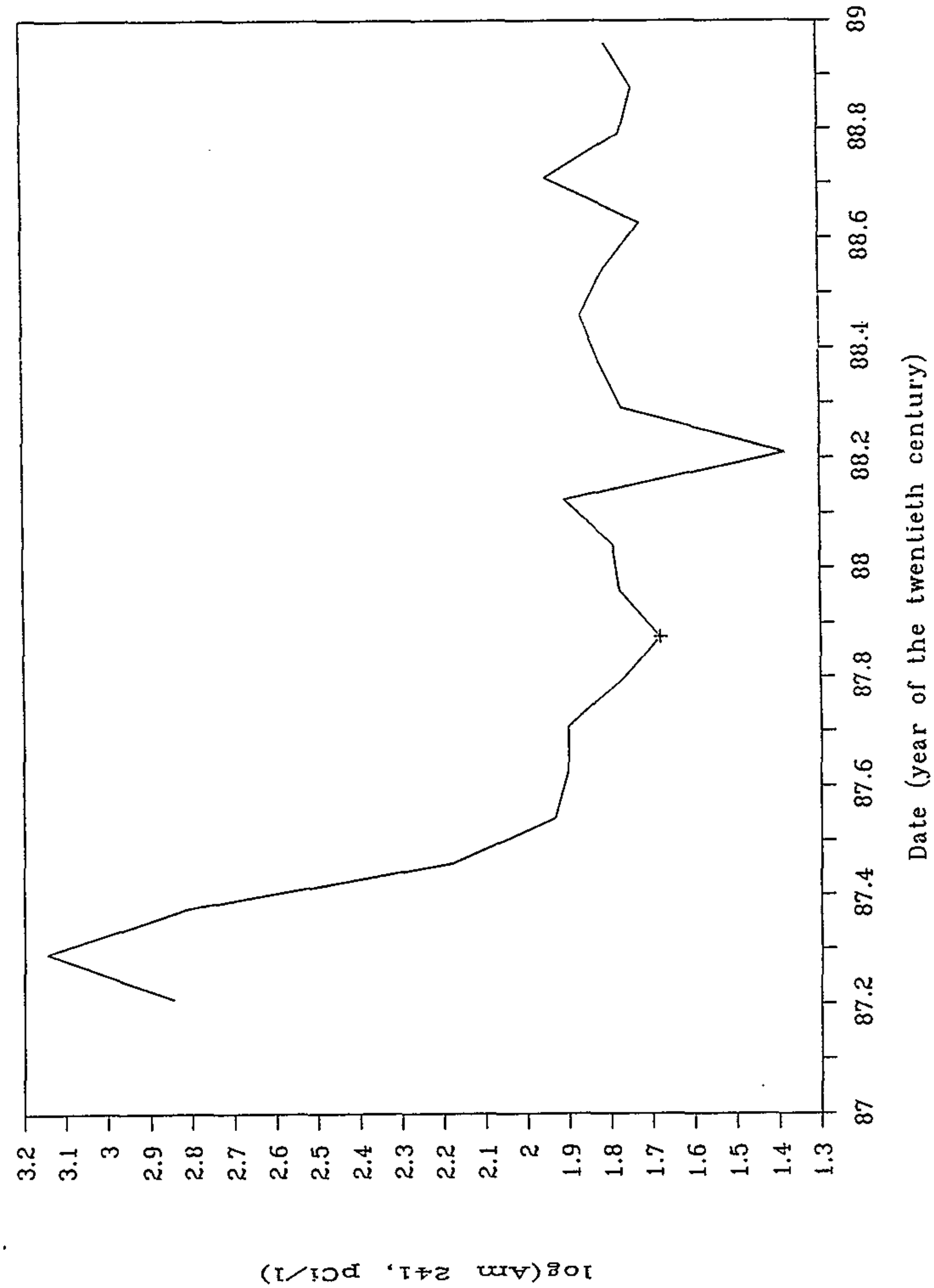
PUREX Plant CSL Radiological Release History.
Uranium.



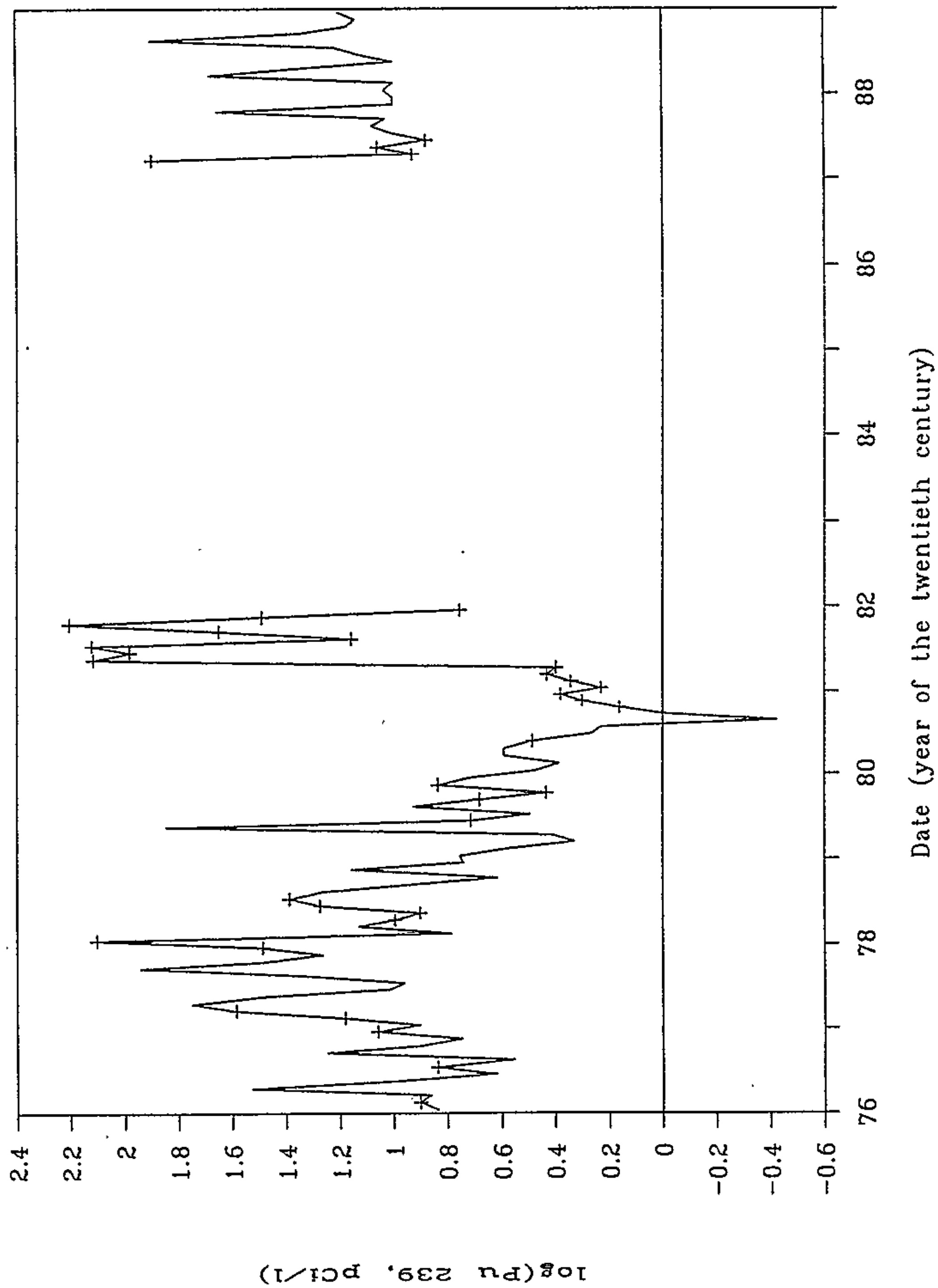
PUREX Plant CSL Radiological Release History.
Tritium.



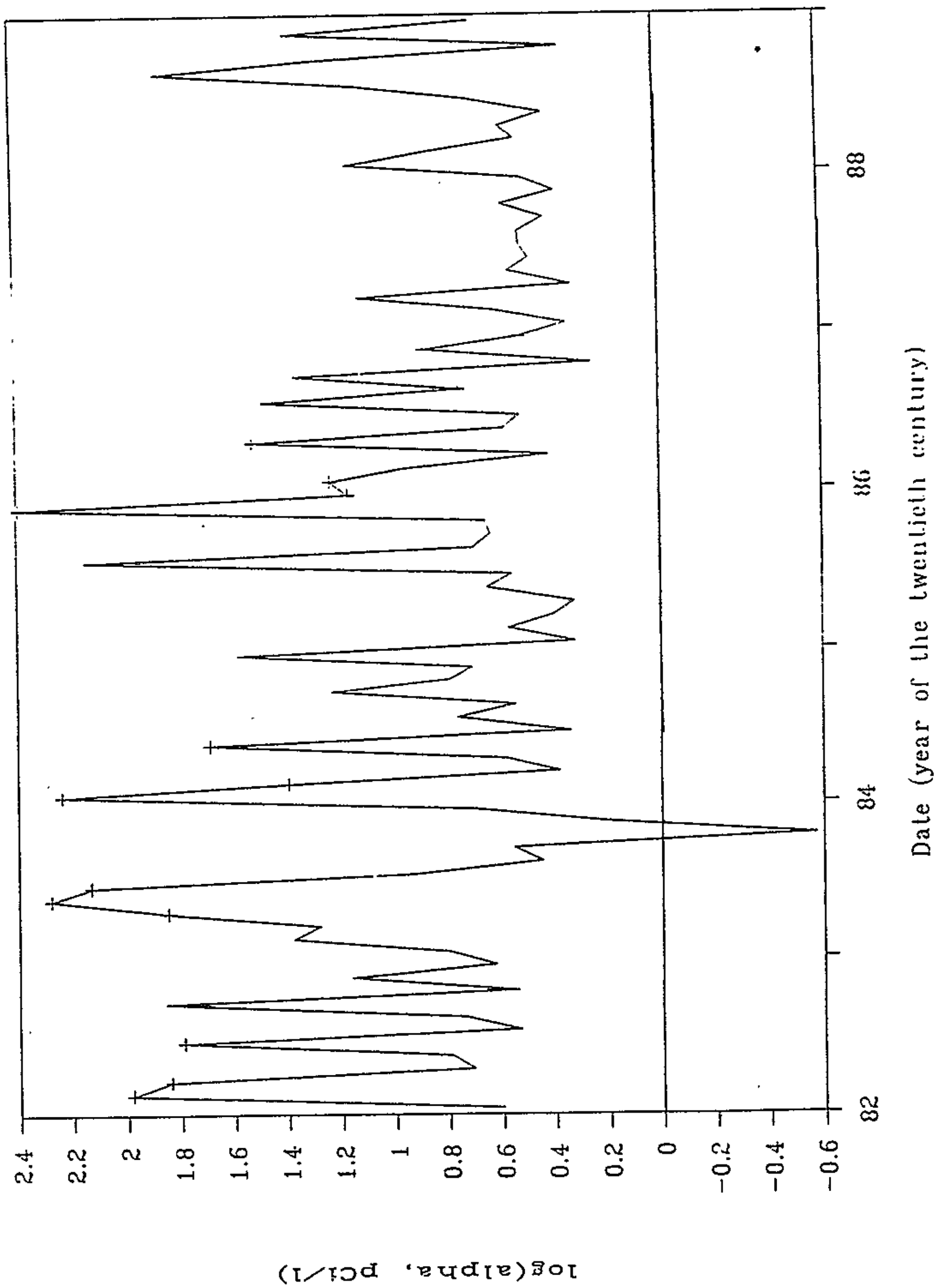
PUREX Plant CSL Radiological Release History.
Americium-241.



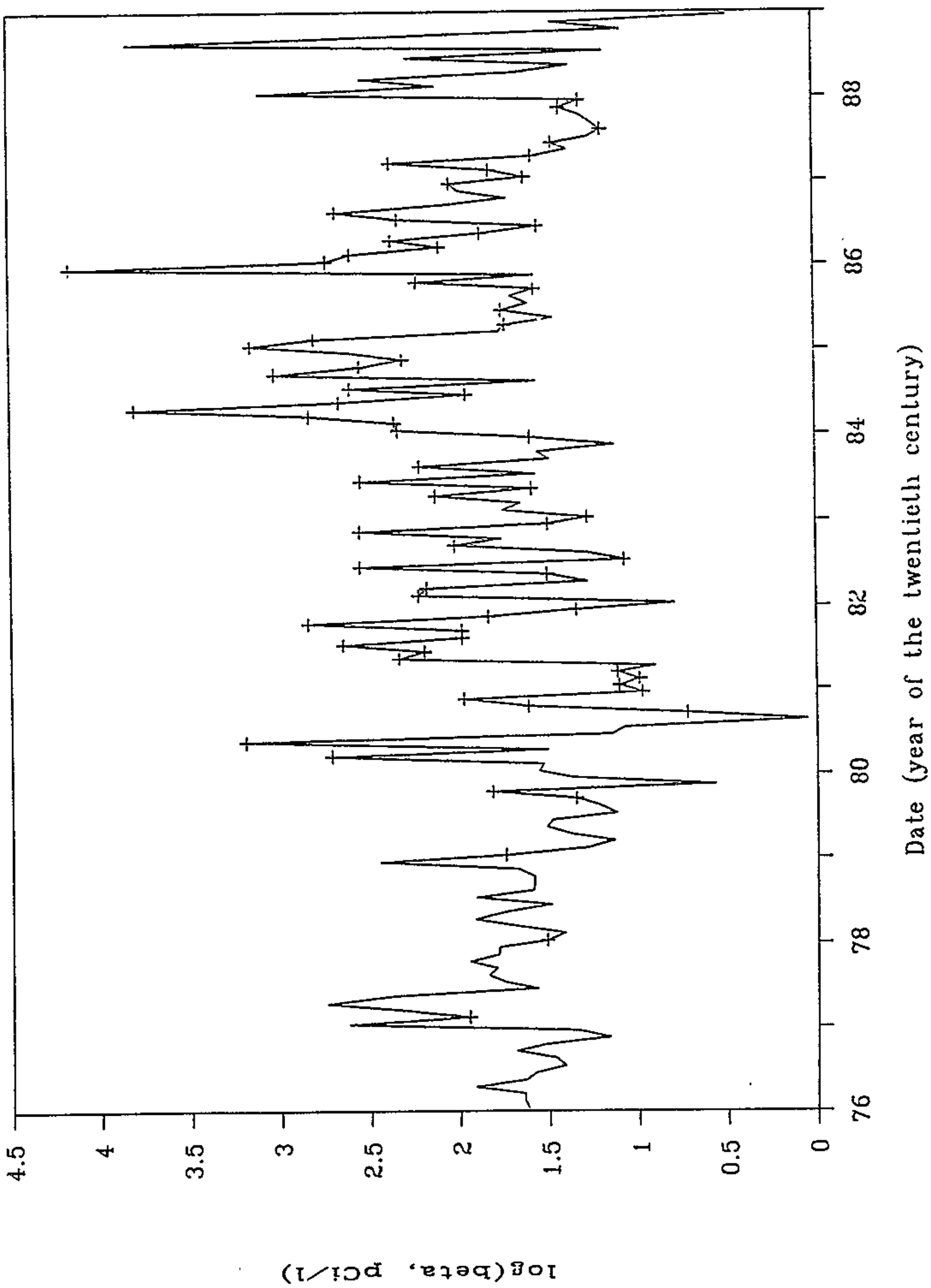
PUREX Plant CSL Radiological Release History.
Plutonium-239.



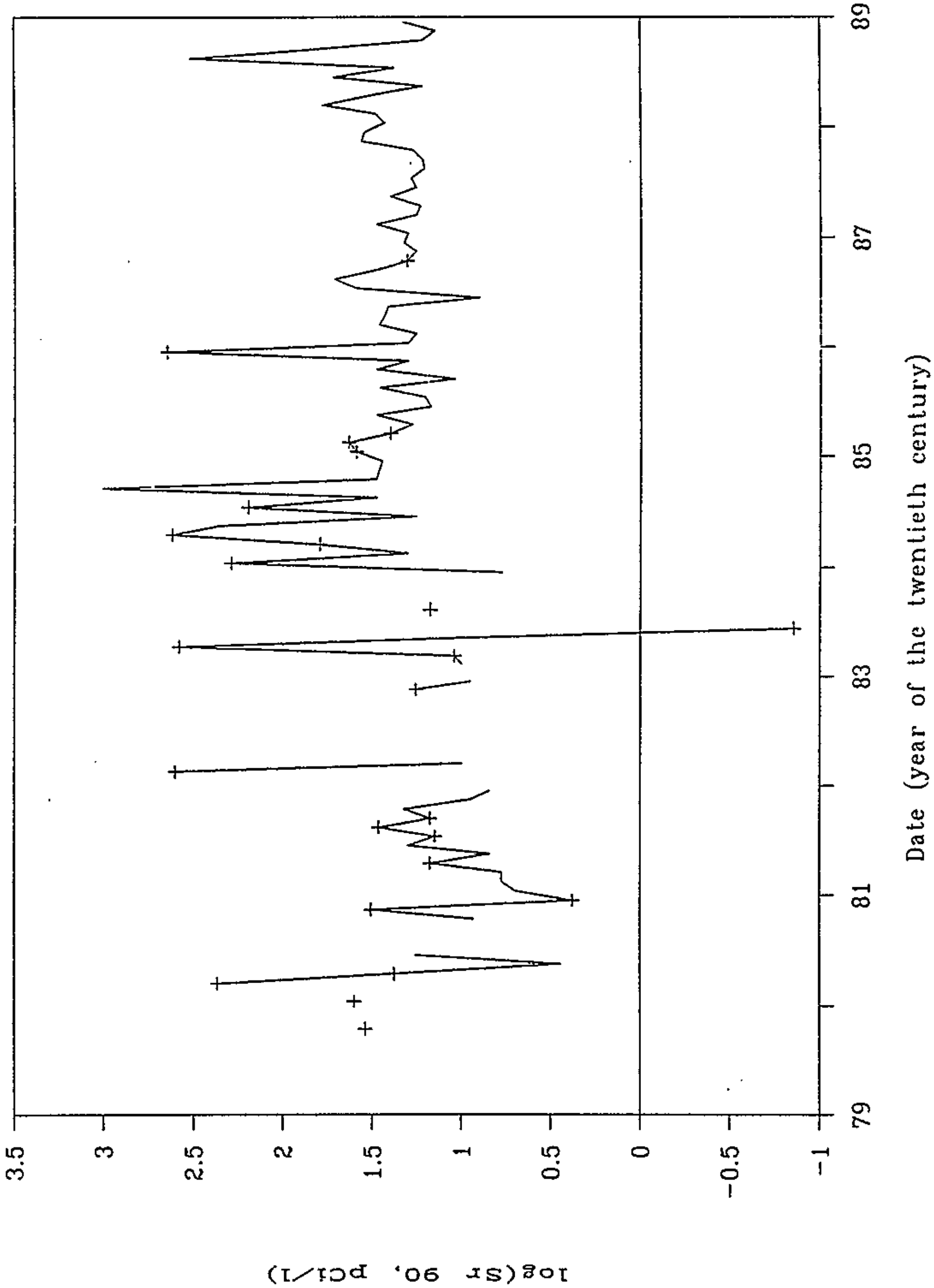
PUREX Plant CSL Radiological Release History.
Alpha Emitting Nuclides.



PUREX Plant CSL Radiological Release History.
Beta Emitting Nuclides.



PUREX Plant CSL Radiological Release History.
Strontium-90.



PUREX Plant CSL Radiological Release History.
Cesium-137.