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WHC-EP-0342
Addendum 28

400 Area Secondary Cooling Water Stream-Specific Report

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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

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400 Area Secondary Cooling Water Stream-Specific Report

R. W. Bloom

Date Published
August 1990

Prepared for the U.S. Department of Energy
Office of Environmental Restoration
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Westinghouse Hanford Company
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ABSTRACT

The proposed wastestream designation for the 400 Area Secondary Cooling Water 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.*

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

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EXECUTIVE SUMMARY

The proposed dangerous waste designation for the 400 Area Secondary Cooling Water wastestream is that the 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 processing and sampling data to the WAC 173-303 requirements. Process data was developed based on Material Safety Data Sheets (MSDS) and supplemental vendor-supplied information for all chemical products introduced into the water by current operations supplemented with data available for 400 Area Sanitary Water. Sampling data consists of four random samples taken downstream of all process contributors between October 1989 and January 1990. The "listed" dangerous waste (WAC 173-303-080) determination was made with process knowledge supplemented with sampling data; the "criteria" (WAC 173-303-100) and "characteristic" (WAC 173-303-90) dangerous waste determinations were made primarily based on sampling data, supplemented with process information.

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

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LIST OF TERMS

AA	atomic absorption spectroscopy
DOE	U.S. Department of Energy
%EC	percent equivalent concentration
Ecology	Washington State Department of Ecology
EP	Extraction Procedure Toxicity Test
EPA	U.S. Environmental Protection Agency
EWC	electric water cooler
FAA	Fuel Assembly Area
FFTF	Fast Flux Test Facility
FMEF	Fuels and Materials Examination Facility
GC	gas chromatography
H&V	heating and ventilating
HEHF	Hanford Environmental Health Foundation
HH	halogenated hydrocarbon
HVAC	heating, ventilation, and air conditioning
ICP	inductively-coupled plasma spectroscopy
MASF	Maintenance and Storage Facility
MCL	minimum concentration limit
MS	mass spectrometry
MSDS	Material Safety Data Sheets
PAH	polycyclic aromatic hydrocarbon
ppb	parts per billion
ppm	parts per million
PVC	polyvinyl chloride
RPSF	Radioisotope Power System Facility
SAF	Secure Automated Fabrication
SARA	Superfund Amendments and Reauthorization Act
SP	specific (positive) carcinogen
TDS	total dissolved solids
TOC	total organic carbon
TOX	total organic halides
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
WAC	Washington (State) Administrative Code

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CONTENTS

1.0 INTRODUCTION 1-1
1.1 BACKGROUND 1-1
1.2 APPROACH 1-1
1.3 SCOPE 1-4

2.0 PROCESS KNOWLEDGE 2-1
2.1 PHYSICAL LAYOUT 2-1
2.1.1 Fuels and Materials Examination Facility Physical Layout 2-3
2.1.2 Maintenance and Storage Facility Physical Layout . . 2-3
2.1.3 The 481-A Pump House Physical Layout 2-6
2.1.4 The Fast Flux Test Facility Cooling Towers and Pad 483 Physical Layout 2-6
2.1.5 The 4608 Percolation Ponds B and C Physical Layout . 2-6
2.2 CONTRIBUTORS 2-6
2.2.1 The Fuels and Materials Examination Facility Contributors 2-14
2.2.2 Maintenance and Storage Facility Contributors 2-16
2.2.3 The 481-A Pump House Contributors 2-16
2.2.4 The Fast Flux Test Facility Cooling Towers 2-16
2.3 PROCESS DESCRIPTION 2-17
2.3.1 Present Activities 2-17
2.3.2 Past Activities 2-20
2.3.3 Future Activities 2-20
2.4 PROCESS DATA 2-20

3.0 SAMPLING DATA 3-1
3.1 DATA SOURCE 3-1
3.1.1 Wastestream Data 3-1
3.1.2 Background Data 3-3
3.2 DATA PRESENTATION 3-3
3.2.1 Chemical Constituents 3-3
3.2.2 Radiological Constituents 3-16

4.0 DATA OVERVIEW 4-1
4.1 DATA COMPARISON 4-1
4.2 STREAM DEPOSITION RATES 4-1
4.3 PROCESS DATA INTEGRATION 4-1

5.0 DESIGNATION 5-1
5.1 DANGEROUS WASTE LISTS 5-1
5.1.1 Discarded Chemical Products 5-1
5.1.2 Dangerous Waste Sources 5-3
5.2 LISTED WASTE DATA CONSIDERATIONS 5-3
5.2.1 Process Evaluation 5-3
5.2.2 Sampling Data 5-4

CONTENTS (continued)

5.3 PROPOSED LISTED WASTE DESIGNATION 5-4
5.3.1 Discarded Chemical Products 5-5
5.3.2 Dangerous Waste Sources 5-7
5.4 DANGEROUS WASTE CRITERIA 5-7
5.4.1 Toxic Dangerous Wastes 5-8
5.4.2 Persistent Dangerous Wastes 5-14
5.4.3 Carcinogenic Dangerous Wastes 5-15
5.5 DANGEROUS WASTE CHARACTERISTICS 5-16
5.5.1 Ignitibility 5-16
5.5.2 Corrosivity 5-16
5.5.3 Reactivity 5-17
5.5.4 Extraction Procedure Toxicity 5-17
5.6 PROPOSED DESIGNATION 5-17

6.0 ACTION PLAN 6-1
6.1 FUTURE SAMPLING 6-1
6.2 TECHNICAL ISSUES 6-1

7.0 REFERENCES 7-1

APPENDIXES:

A FUELS AND MATERIALS EXAMINATION FACILITY A-1
B DEARBORN MATERIAL SAFETY DATA SHEET B-1
C HANFORD SANITARY WATER QUALITY SURVEILLANCE C-1
D OLD AND NEW DATA D-1

LIST OF FIGURES

1-1 Characterization Strategy 1-3

1-2 Aerial View of the 400 Area 1-5

2-1 The 400 Area Process Sewer 2-2

2-2 Fuels and Materials Examination Facility 2-4

2-3 Maintenance and Storage Facility 2-5

2-4 The 481-A Pump House 2-7

2-5 The Fast Flux Test Facility Cooling Water System Equipment Location 2-8

2-6 The 4608 Percolation Pond 2-9

2-7 Fuels and Maintenance Examination Facility Retention Liquid Waste System 2-15

3-1 Sample Data Strategy 3-2

5-1 Designation Procedure 5-2

9 1 1 2 0 4 7 0 6 7 2

LIST OF TABLES

1-1 Stream-Specific Report List 1-2

2-1 List of Routine Contributors 2-10

2-2 List of Contributors to 400 Area Process Sewer 2-11

2-3 Hanford Environmental Health Foundation Summary Report on 400 Area Sanitary Water Supply for Calendar Year 1988 2-22

2-4 Summary Report of Estimated Concentration of Wastestream Constituents 2-23

3-1 Analytical Methods for Samples. 3-4

3-2 400 Area Secondary Cooling Water Data 3-6

3-3 Statistical Summary of Data 3-14

4-1 Effluent Constituent Comparison to Maximum Containment Levels and Derived Concentration Guides 4-2

4-2 Stream Deposition Rate 4-3

4-3 Comparison of Sampling Data to Process Data 4-4

5-1 Organic Chemistry Report 5-9

5-2 Dangerous Waste Designation Report 5-11

400 AREA SECONDARY COOLING WATER 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 regarding reduction of the discharge of liquid effluents into the soil column. As a result, the U.S. Department of Energy (DOE), with 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 1990b), 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): processing data, sampling data, and dangerous waste regulations.

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

1.2 APPROACH

This report characterizes the 400 Area Secondary Cooling Water wastestream in sufficient detail so that a wastestream designation, in accordance with WAC 173-303, *Dangerous Waste Regulations*, can be proposed. The 400 Area Secondary Cooling Water System is more commonly referred to as the 400 Area Process Sewer, and this nomenclature will be used henceforth in this document. Both titles describe the same system and are interchangeable.

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

1. Describe both processing and sampling data (Sections 2.0 and 3.0, respectively).

2. Integrate the data (Section 4.0).

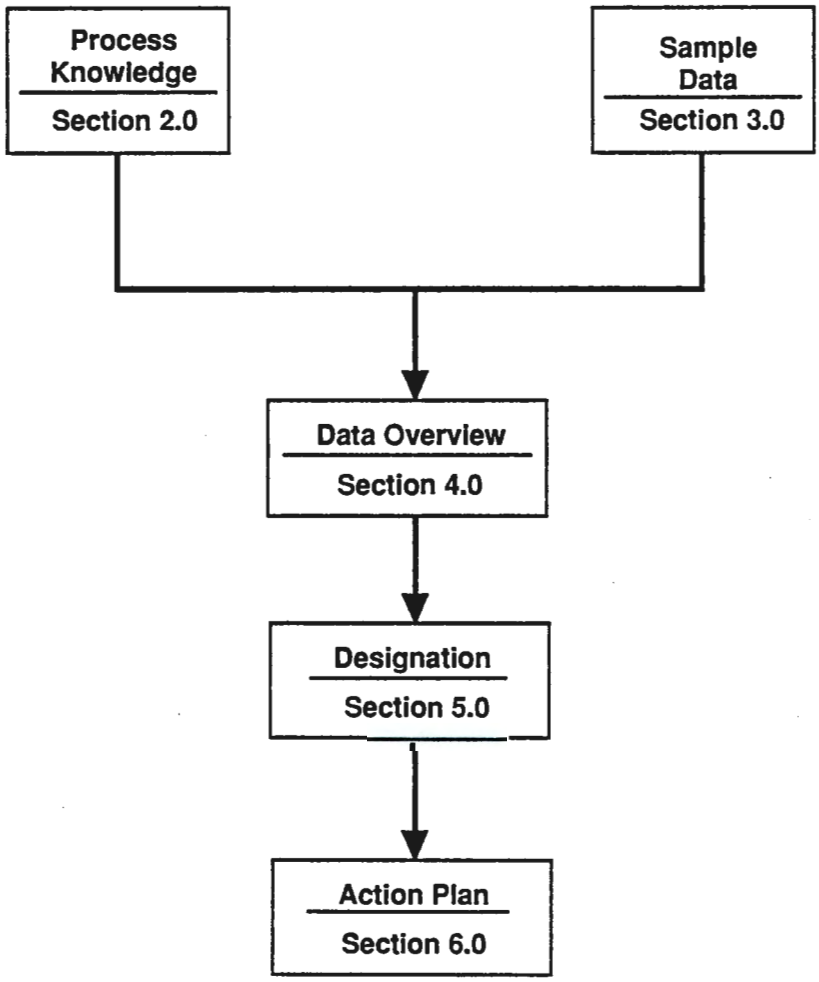
3. Propose a designation (Section 5.0).

4. Design an action plan, if needed, to obtain additional characterization data (Section 6.0).

Table 1-1. Stream-Specific Report List.

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.



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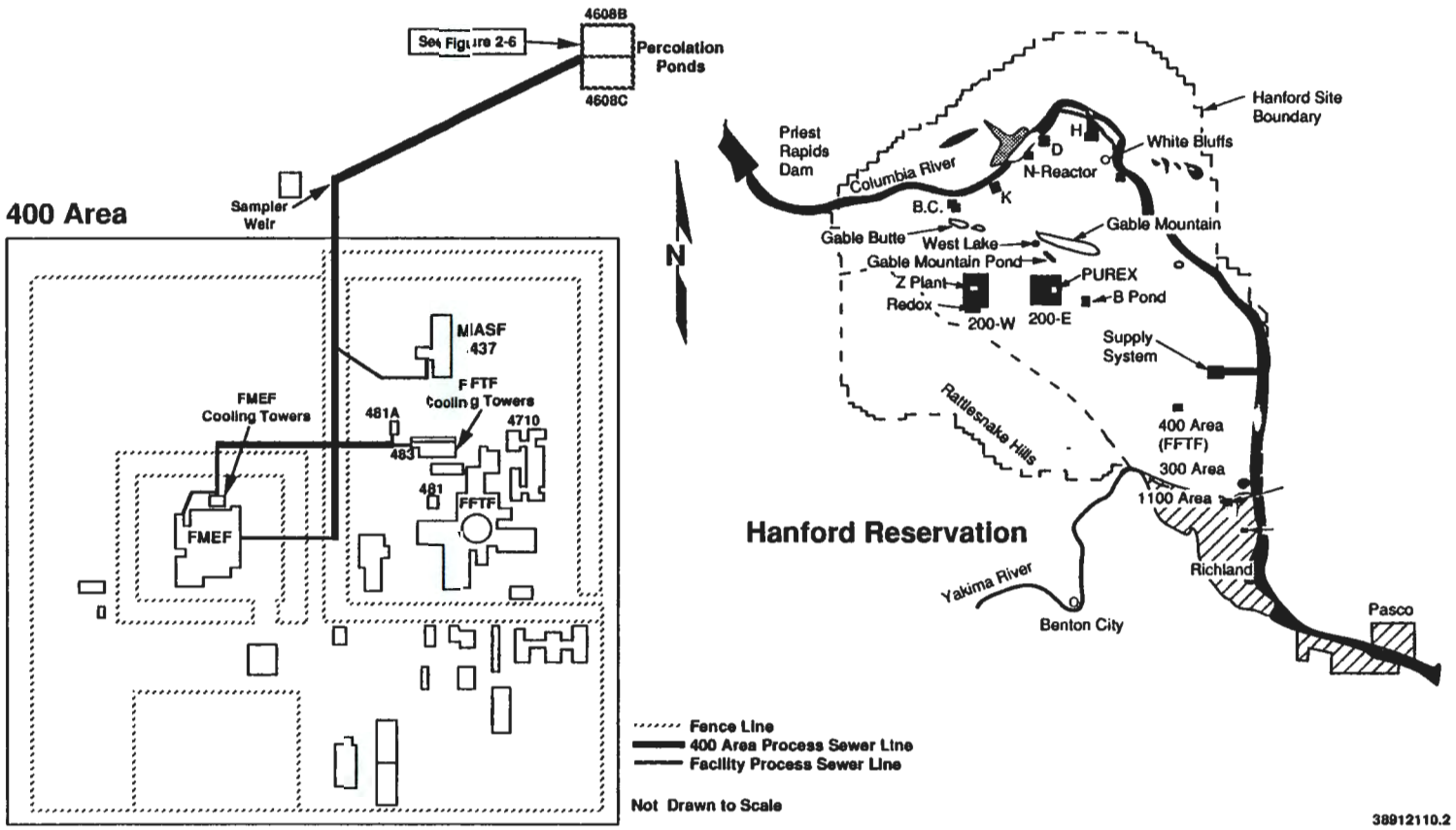
1.3 SCOPE

The scope of this document is the characterization of the wastewater effluent stream that currently enters the soil column at the 4608 Percolation Ponds B and C. Currently, the only effluent wastestream entering these ponds through the 400 Area Process Sewer comes from four facilities located in the 400 Area. They are the Fuels and Materials Examination Facility (FMEF), Maintenance and Storage Facility (MASF), the 437 Building; Water Pump House, the 481-A Building; and the Fast Flux Test Facility (FFTF) Cooling Towers, Pad 483. An aerial view of the 400 Area is shown in Figure 1-2. This document does not address any other wastestream leaving the 400 Area, such as solid, gaseous, or sanitary waste.

The focus of this document is on activities between October 1989 and March 1990, although a wider time span or "horizon" will be evaluated. Sampling data for the period in question consists of four random samples which will be used as the basis for analyzing the stream. Historical process changes and other sampling data are considered only if they are relevant to the characterization of the wastestream as it presently exists. Future configuration and process modifications are addressed if they will significantly alter the present effluent portrait. Since the 4608 Percolation Ponds and the Process Sewer began operation in 1979, the lower limit of the time horizon is set at approximately 1979. The upper limit of the time horizon is set at 1991, because information on activities beyond this timeframe would only be speculative.

This characterization effort is primarily intended to support the designation of the stream based on the regulatory requirements and secondarily to determine if any followup process changes, treatment, or alternate disposal practices are indicated.

Figure 1-2. Aerial View of the 400 Area.



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2.0 PROCESS KNOWLEDGE

This section presents a qualitative and quantitative process-knowledge-based characterization of the chemical and radiological constituents of the 400 Area Process Sewer. These processing 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 and concentration of the constituents of each contributor.

This estimate is attained through three steps: (1) identifying the routine and infrequent contributors that make up the wastestream (Section 2.2), (2) identifying the probable constituents contained in those contributors (Section 2.3), and (3) estimating the concentration of those constituents (Section 2.4). Background information for the contributors is given in the description of the physical layout (Section 2.1) and, for the constituents, in the description of the process (Section 2.3).

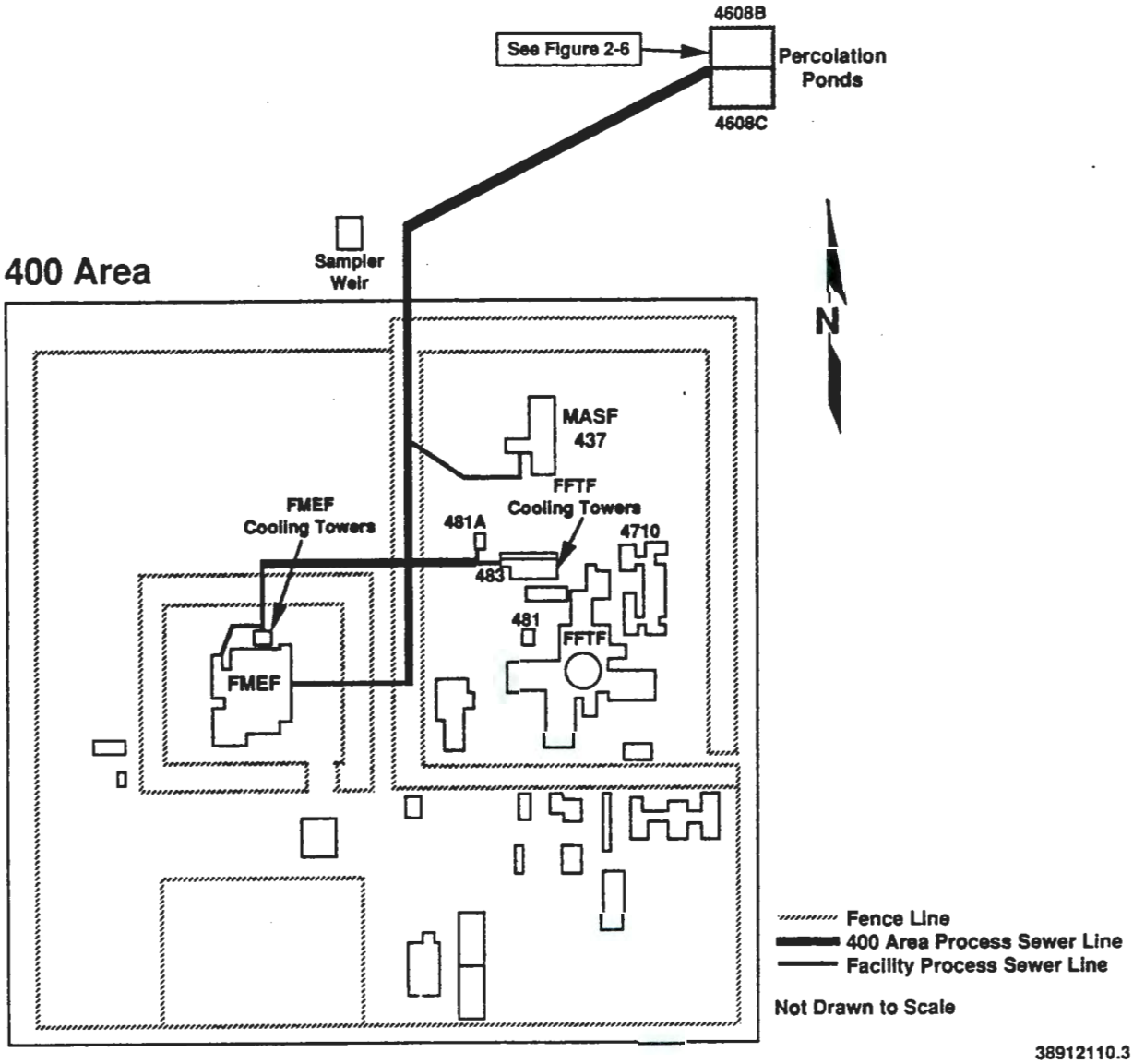
2.1 PHYSICAL LAYOUT

The 400 Area Process Sewer is a 12-in.-diameter pipe originating in the approximate center of the 400 Area. At its origin, the Process Sewer forms a "T" with east and west legs to serve adjacent facilities before extending north just beyond the 400 Area security fence. At this point, the 400 Area Process Sewer turns north-northeast to the 4608 Percolation Ponds. The effluent wastewater generated in the four facilities enters the 400 Area Process Sewer through the five 6-in.-diameter facility process sewers. The four facilities served by the 400 Area Process Sewer are the FMEF, MASF, 481A Pump House, and FFTF Cooling Towers. An aerial view of these facilities is shown in Figure 2-1.

The water supply for the 400 Area is pumped from deep wells located within the area. The water is chlorinated with liquid sodium hypochlorite and stored in three 300,000-gal-capacity storage tanks, which supply the sanitary, process, and fire protection water systems in the area.

Monitoring of the effluent stream is provided at a monitoring station located at a sample weir shown on Figure 2-1. The monitoring capabilities include continuous pH and conductivity measurements recording, as well as a composite sampler. This monitoring station was installed in 1989 and is used only to provide a secondary check over the steam effluent to detect upset conditions which otherwise would go unnoticed. No automatic action is

Figure 2-1. The 400 Area Process Sewer.



initiated as a result of this equipment. As a result of the limited nature of the activities within the areas that contribute to the stream, the composite sampler is analyzed on a monthly basis. No process upsets associated with current operations have been identified which rely on this monitoring as the sole method of detection.

2.1.1 Fuels and Materials Examination Facility Physical Layout

The FMEF consists of Buildings 427 and 4862 and supporting facilities, including the FMEF Cooling Towers. The 427 Building consists of the Process Building, Mechanical Equipment Wing, and Emergency Equipment Wing and contains a total of 178,700 ft^2 (approximately 16,595 m^2) of floor space. The building is constructed of reinforced concrete. The 4862 Building is composed of the Entry Wing and the Fuel Assembly Area (FAA) and contains 38,974 ft^2 (approximately 3,593 m^2) of floor space. Construction of this building is of split concrete block and smooth concrete. Construction of the facility was completed in 1984. An aerial diagram showing the main feature of the FMEF can be seen in Figure 2-2.

The FMEF was designed and constructed as a secure, protected, multistoried structure with the capability to handle low- and high-exposure radioactive materials. Because of program and funding changes since the completion of construction, with the exception of the Secure Automated Fabrication (SAF) line, most of the specialized equipment the FMEF was designed to house has never been installed, nor has any radioactive material ever been introduced into the facility, as of this report. A longitudinal view showing the elevations of the FMEF is shown in Appendix Figure A-1. Detailed floor plans of the various elevations are shown in Appendix Figures A-2 through A-10. While functions are assigned to the various rooms and spaces, with the exception of the basic building support systems, none of the equipment has been placed in operation.

2.1.2 Maintenance and Storage Facility Physical Layout

The MASF consists of a main building and a two-story service wing. Figure 2-3 shows the basic layout of the facility. The MASF is constructed of bolted steel sections and concrete panels on a concrete foundation. The ground floor, including the service wing, covers 33,236 ft^2 (approximately 3,022 m^2). Construction was completed in 1984.

The function of the MASF is to provide maintenance and repair facilities and a storage area for radioactive or specialized maintenance equipment used in support of the FFTF. The areas served by the MASF process sewer are the Process Equipment Room and the area adjacent to Decon 1 in the High Bay.

Figure 2-2. Fuels and Materials Examination Facility.

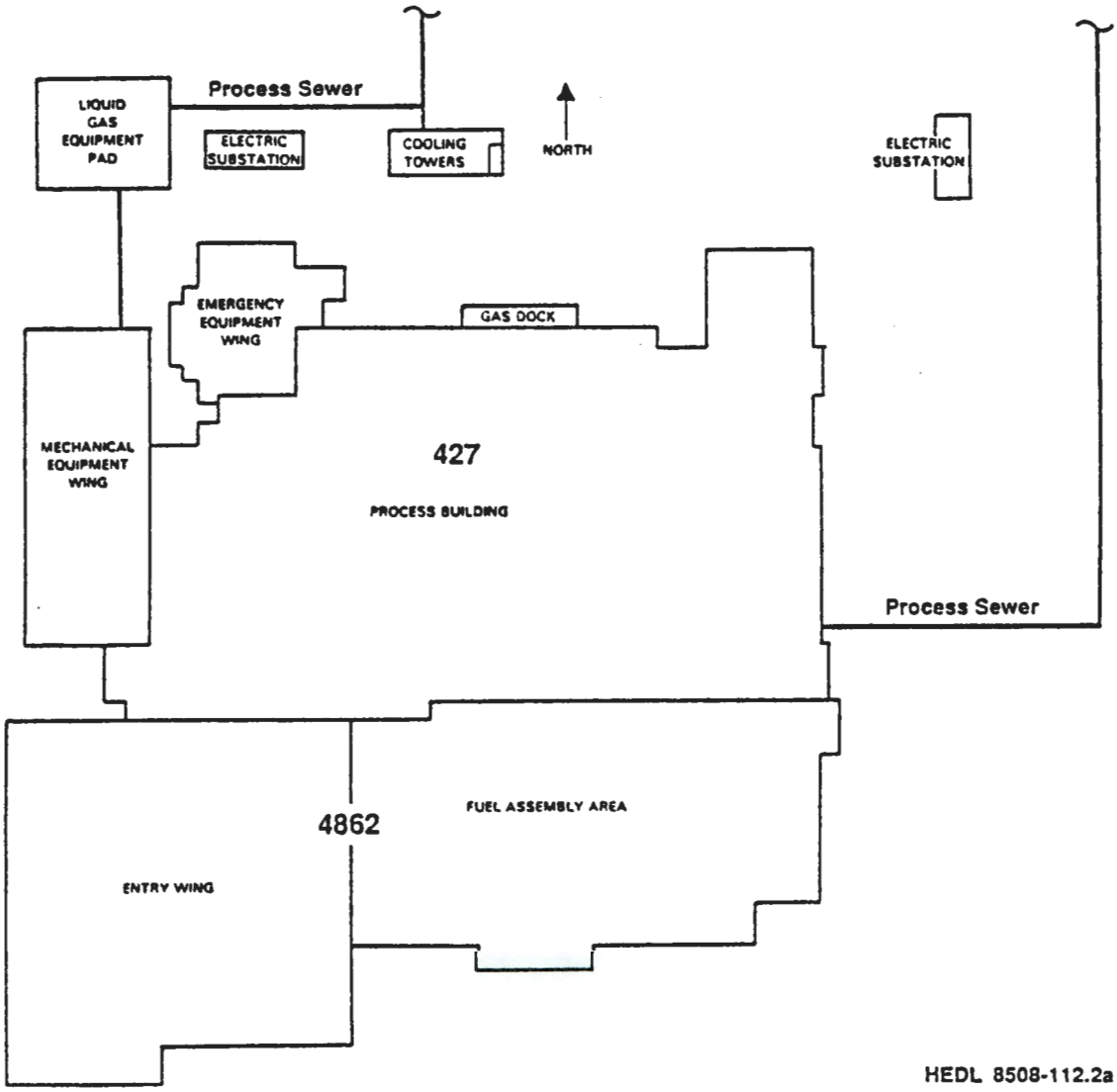
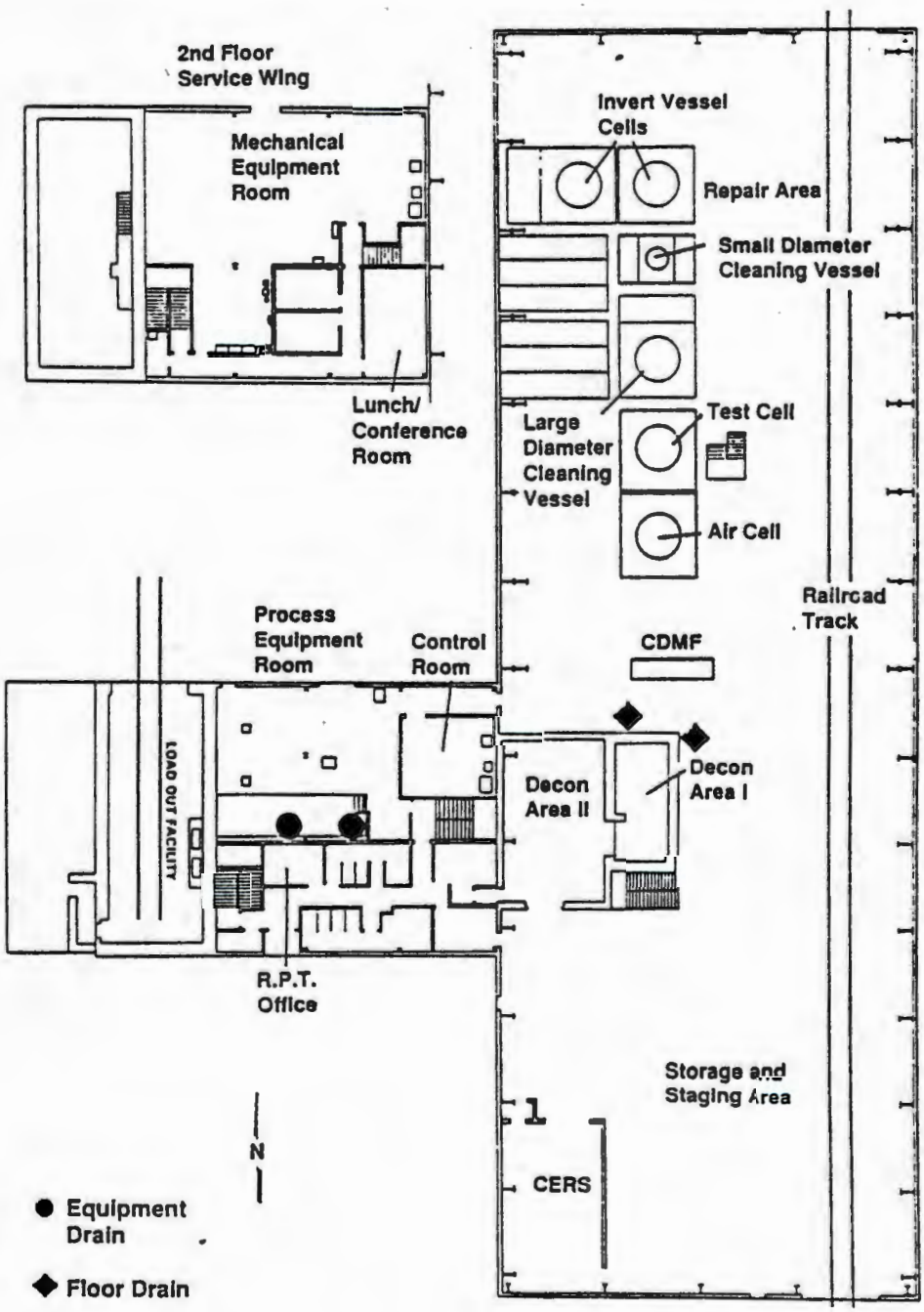


Figure 2-3. Maintenance and Storage Facility.



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2.1.3 The 481-A Pump House Physical Layout

The 481-A Pump House is constructed of a split-face concrete block on a concrete base and has 1,608 ft^2 (approximately 146 m^2) of floor space. Construction was completed in 1984. The 481-A Pump House provides space for a diesel fire pump and two sanitary water pumps. The layout of the 481-A Pump House is shown in Figure 2-4.

2.1.4 The Fast Flux Test Facility Cooling Towers and Pad 483 Physical Layout

The eight FFTF Cooling Towers are mounted on a large concrete slab. Adjacent to the FFTF Cooling Towers is the support building (Cell 611) that contains the water treatment equipment, water quality monitoring instrumentation, and the process drain for the blowdown valves associated with the towers.

The main function of the FFTF Cooling Towers is to reject the heat generated in equipment supporting the FFTF auxiliary systems, such as the heating, ventilation, and air conditioning (HVAC) systems. The layout of the FFTF Cooling Towers and Cell 611 is shown in Figure 2-5. The Material Safety Data Sheets (MSDS) associated with the chemicals used in conjunction with the cooling towers are contained in Appendix B.

2.1.5 The 4608 Percolation Ponds B and C Physical Layout

The 4608 Percolation Ponds B and C (Figure 2-6) are located north-northeast of the 400 Area. The unlined ponds are 50 ft by 100 ft at the base and have 4-ft-thick earth walls as shown in Figure 2-6. The 400 Area Process Sewer empties into a diversion box built into the wall dividing the two ponds. Manually operated slide gates located on either side of the diversion box determine the direction of flow. The ability to isolate either pond is provided to allow for maintenance, should it be required. The data presented is Section 3.0 is based on samples taken at this diversion box.

2.2 CONTRIBUTORS

The nine routine contributors to the 400 Area Process Sewer, summarized in Table 2-1, feed into the 400 Area Process Sewer from the major facilities as shown in Figure 2-1. Volumes generated by these routine contributors represent greater than 99% of the total volume of water currently discharged to the process sewer. Variation in flow from these sources is primarily dependent on ambient temperature. All 72 potential contributors (i.e., points of entry) to the 400 Area Process Sewer are listed in Table 2-2. Table 2-2 lists the type of entry, the location (including facility, figure reference, and room number or location), type of contributor, source of the water, and approximate flow associated with each source. The FMEF has the greatest number of contributors with 61, the MASF and the 481-A Pump House have 4 each, and 3 are associated with the FFTF Cooling Towers.

Figure 2-4. The 481-A Pump House.

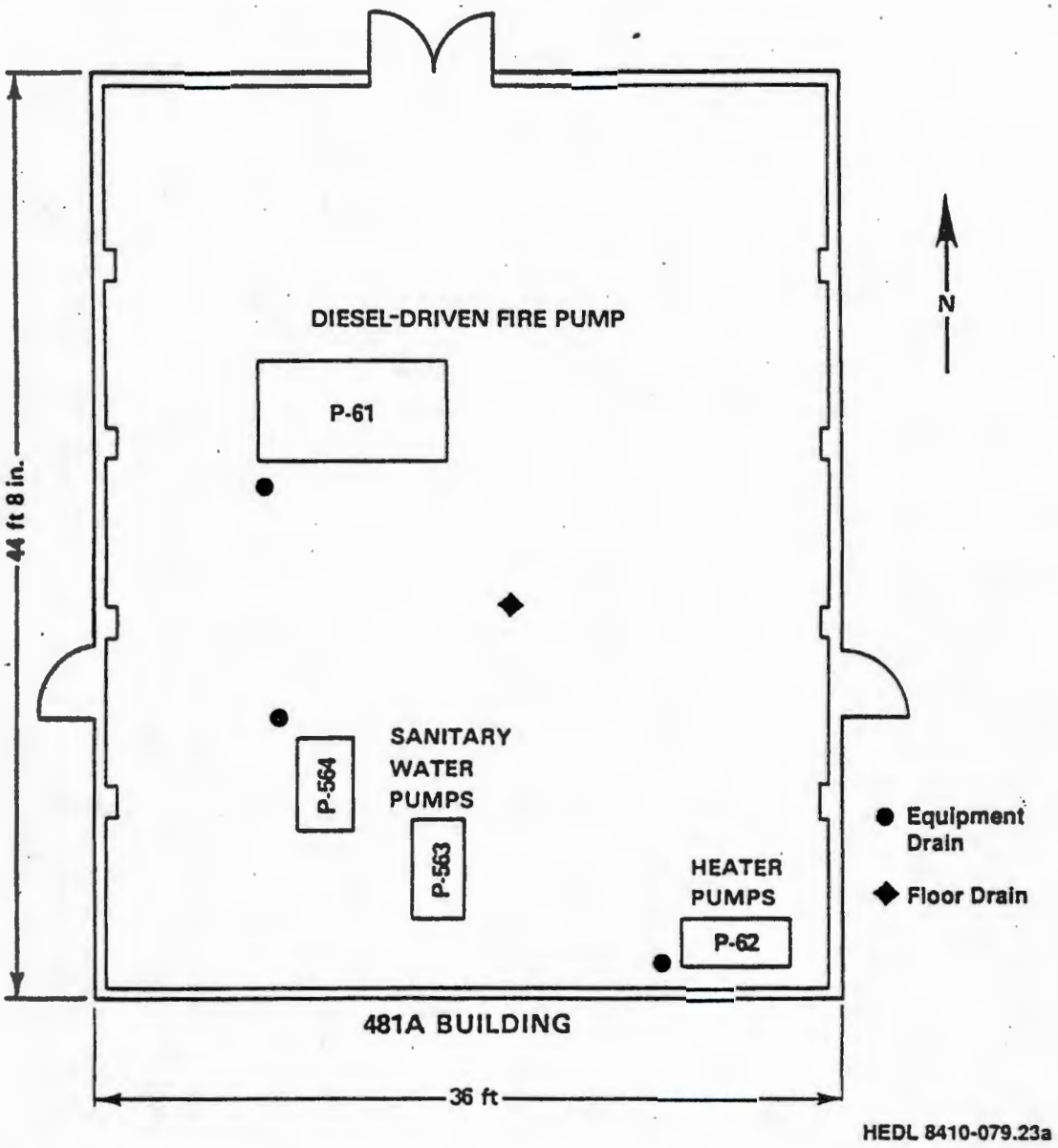


Figure 2-5. The Fast Flux Test Facility Cooling Water System Equipment Location.

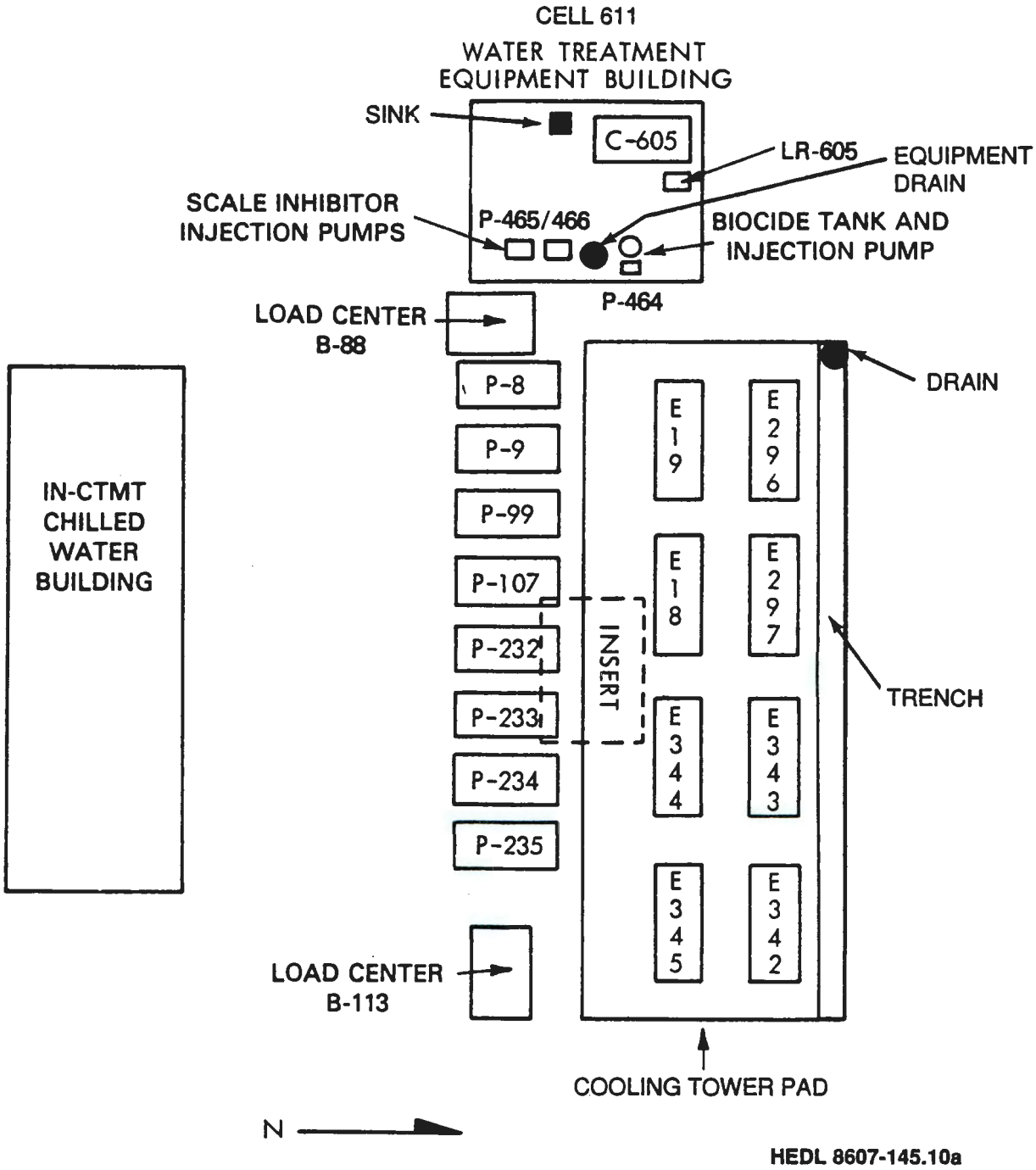


Figure 2-6. The 4608 Percolation Ponds.

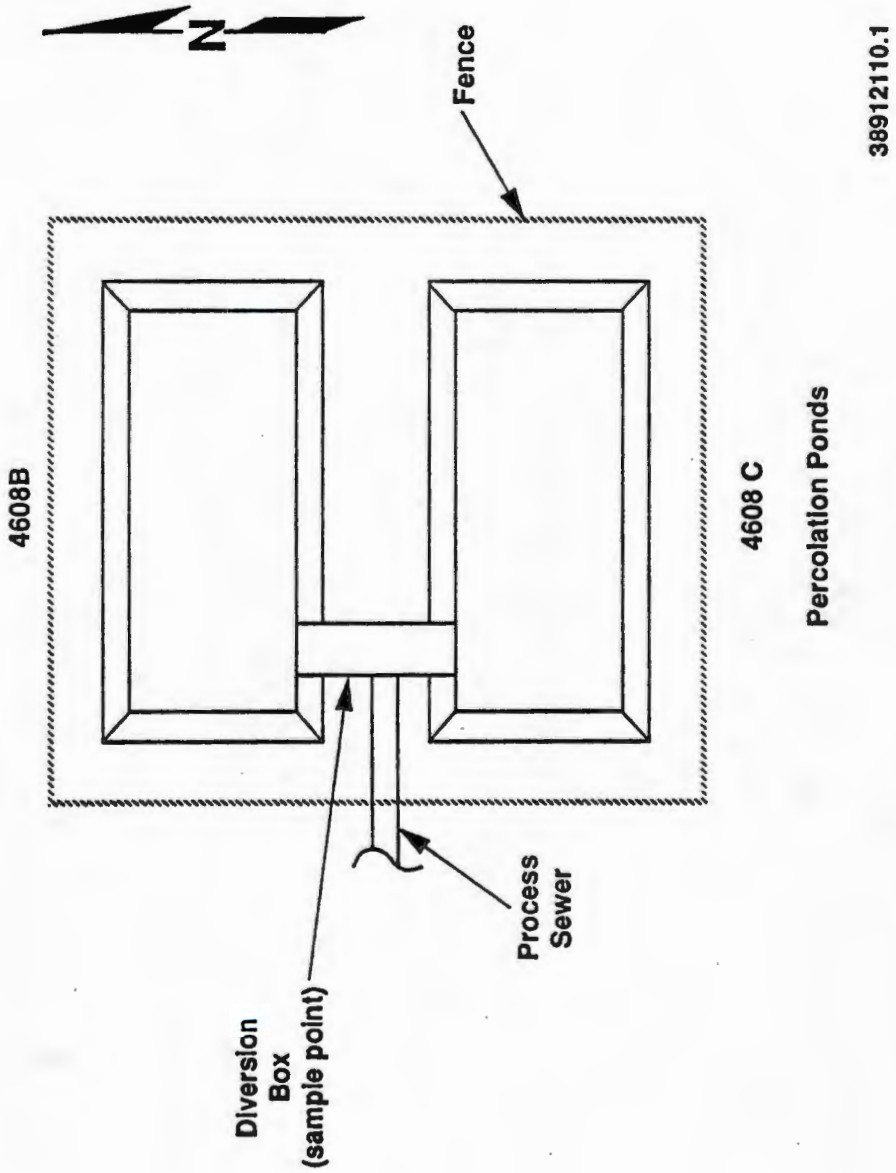


Table 2-1. List of Routine Contributors.

Entry point	Location facility-building/area	Source	Flow (gal/min) Range	Flow (gal/min) Average
Sink	FMEF/CT	Personnel	<1	<1
Floor drain	FMEF/MEW	Process water pressure regulator, relief drain	<1	<1
Equipment drain	FMEF/ED	Computer room air conditioning unit, cooling water	0-3	<1
Equipment drain	FMEF/CT	Blowdown system, cooling spray water	0-10[a]	4[b]
Equipment drain	MASF/ED	Air compressor cooling water	0-12	2
Equipment drain	481-A Pump House	Sanitary water pump packing leakage	<1	<1
Sink	FFTF/CT	Personnel	<1	<1
Equipment drain	FFTF/CT	Blowdown system cooling water	4-25[a]	10
Equipment drain	FFTF/CT	Drain trench cooling water	1-5	1
	Total flow	All sources	6-56	18

[a] Variance because of ambient conditions.
[b] Tower cooling water drained October through April.
ED = equipment drain
CT = cooling towers
FFTF = Fast Flux Test Facility
FMEF = Fuels and Materials Examination Facility
MASF = Maintenance and Storage Facility
MEW = Mechanical Equipment Wing

Table 2-2. List of Contributors to 400 Area Process Sewer. (Sheet 1 of 3)

Item	Contributor Entry Type	Contributor Location	Fig Ref	Room	Type Routine	Type Infrequent	Retention liquid waste system[a]	Source	Flow Range (gal/min)	Estimated avg flow (gal/min)
1	EWC	PB-FMEF	A-5	600		X	X	Personnel	--	--
2	EWC	PB-FMEF	A-5	608		X	X	Personnel	--	--
3	EWC	PB-FMEF	A-6	515		X	X	Personnel	--	--
4	EWC	PB-FMEF	A-7	409		X	X	Personnel	--	--
5	EWC	PB-FMEF	A-7	430		X	X	Personnel	--	--
6	EWC	PB-FMEF	A-10	117		X	X	Personnel	--	--
7	EWC	PB-FMEF	A-9	223		X	X	Personnel	--	--
8	EWC	FAA-FMEF	A-2	E105		X	X	Personnel	--	--
9	JS	PB-FMEF	A-6	504		X	X	Personnel	--	--
10	JS	PB-FMEF	A-7	408		X	X	Personnel	--	--
11	JS	PB-FMEF	A-8	309		X	X	Personnel	--	--
12	JS	PB-FMEF	A-10	149		X	X	Personnel	--	--
13	JS	FAA-FMEF	A-3	E278		X	X	Personnel	--	--
14	JS	CT-FMEF	2-2	N.yard	X			Personnel	<1	<1
15	FD	PB-FMEF	A-7	404		X	X	Process water/condensate	--	--
16	FD	PB-FMEF	A-9	238		X	X	Process water/condensate	--	--
17	FD	PB-FMEF	A-8	302		X	X	Process water/condensate	--	--
18	FD	PB-FMEF	A-8	307		X	X	Process Water/condensate	--	--
19	FD	PB-FMEF	A-8	308		X	X	Process water/condensate	--	--
20	FD	PB-FMEF	A-8	313		X	X	Process water/condensate	--	--
21	FD	PB-FMEF	A-9	224		X	X	Process water/condensate	--	--
22	FD	PB-FMEF	A-9	213		X	X	Process water/condensate	--	--
23	FD	PB-FMEF	A-9	213		X	X	Process water/condensate	--	--
24	FD	PB-FMEF	A-9	204		X	X	Process water/condensate	--	--
25	FD	PB-FMEF	A-9	206		X	X	Process water/condensate	--	--
26	FD	PB-FMEF	A-8	321		X	X	Process water/condensate	--	--
27	FD	PB-FMEF	A-9	209		X	X	Process water/condensate	--	--
28	FD	PB-FMEF	A-8	300		X		Equipment/Vehicles	--	--
29	FD	MEW-FMEF	A-4	352		X		Process water/condensate	--	--
30	FD	MEW-FMEF	A-4	352		X		Process water/condensate	--	--
31	FD	MEW-FMEF	A-4	352		X		Process water/condensate	--	--
32	FD	MEW-FMEF	A-4	352		X		Process water/condensate	--	--
33	FD	MEW-FMEF	A-4	352		X		Process water/condensate	--	--
34	FD	MEW-FMEF	A-4	352		X		Process water/condensate	--	--
35	FD	MEW-FMEF	A-4	352		X		Process water/condensate	--	--
36	FD	MEW-FMEF	A-4	352		X		Process water/condensate	--	--
37	FD	MEW-FMEF	A-4	352		X		Process water/condensate	--	--
38	FD	MEW-FMEF	A-4	352		X		Process water/condensate	--	--
39	FD	MEW-FMEF	A-4	352		X		Process water/condensate	--	--
40	FD	MEW-FMEF	A-4	352		X		Process water/condensate	--	--
41	FD	MEW-FMEF	A-4	352		X		Process water/condensate	--	--
42	FD	MEW-FMEF	A-4	352		X		Process water/condensate	--	--
43	FD	MEW-FMEF	A-4	352		X		Process water/condensate	--	--
44	FD	MEW-FMEF	A-4	352		X		Process water/condensate	--	

Table 2-2. List of Contributors to 400 Area Process Sewer. (Sheet 2 of 3)

Item	Contributor Entry Type	Contributor Location	Fig Ref	Room	Type Routine	Type Infrequent	Retention liquid waste system[a]	Source	Flow Range (gal/min)	Estimated avg flow (gal/min)
45	FD	MEW-FMEF	A-4	352		X		Process water/condensate	--	--
46	FD	MEW-FMEF	A-4	352		X		Process water/condensate	--	--
47	FD	MEW-FMEF	A-4	352		X		Process water/condensate	--	--
48	FD	MEW-FMEF	A-4	352	X			Process water pressure regulator	<1	<1
49	FD	EEW-FMEF	A-8	355		X		--	--	--
50	FD	EEW-FMEF	A-8	355		X		--	--	--
51	FD	FAA-FMEF	A-2	E104		X	X	--	--	--
52	FD	FAA-FMEF	A-2	E104		X	X	--	--	--
53	FD	FAA-FMEF	A-2	E104		X	X	--	--	--
54	FD	FAA-FMEF	A-2	E104		X	X	--	--	--
55	FD	FAA-FMEF	A-2	E300		X	X	--	--	--
56	FD	CT-FMEF	2-2	N.yard		X		Empty CT chemical drum wash	--	--
57	ED	PB-FMEF	A-9	204		X	X	--	--	--
58	ED	PB-FMEF	A-9	238		X		--	--	--
59	ED	EW-FMEF	A-3	E215	X			Computer room AC cooling	0-3	<1
60	ED	CT-FMEF	2-2	N.yard		X		--	--	--
61	ED	CT-FMEF	2-2	N.yard	X			CT drains	0-10[b]	4[b]
62	FD	HB-MASF	2-3	High bay		X		Steam cleaner drain	--	--
63	FD	HB-MASF	2-3	High bay		X		--	--	--
64	ED	ER-MASF	2-3	Equip.RM	X			Air compressor cooling water	0-12	2[c]
65	FD	ER-MASF	2-3	Equip.RM		X		--	--	--
66	FD	PH-481-A	2-4	--		X		--	--	--
67	ED	PH-481-A	2-4	--	X			Sanitary water pump	<1	<1
68	ED	PH-481-A	2-4	--		X		--	--	--
69	ED	PH-481-A	2-4	--		X		--	--	--
70	JS	CT-FFTF	2-5	611	X			Personnel	<1	<1
71	ED	CT-FFTF	2-5	611	X			CT blowdown	4-25[b]	10
72	ED	CT-FFTF	2-5	PAD	X			Overflow and drains	0-10	1

Table 2-2. List of Contributors to 400 Area Process Sewer. (Sheet 3 of 3)

[a]Effluent wastewater collected and stored in FMEF retention liquid waste tanks. Allows sampling (future) before discharge to process sewer.

[b]Variance results from ambient conditions (FMEF Cooling Tower 0 flow for November through March).

[c]Facility support system intermittent operation.

AC = air conditioning
CT = cooling towers
CT-FFTF = FFTF cooling tower area on 483 pad
CT-FMEF = FMEF cooling towers area
ED = equipment drain
EEW-FMEF = 427 Emergency Equipment Wing
ER-MASF = equipment room of 437 Building
EW-FMEF = 4862 Entry Wing
EWC = electric water cooler (drinking fountain)
FAA-FMEF = 4862 Fuel Assembly Area
FD = floor drain
HB-MASF = high-bay area of 437 Building
JS = Janitorial sink
MEW-FMEF = 427 Mechanical Equipment Wing
PB-FMEF = 427 Process Building
PH-481-A = 481-A Pump House
RM = room

Of the 72 potential contributors, 63 (i.e., 88%) are infrequent contributors to the 400 Area Process Sewer. Three of the infrequent contributors are in the MASF, 3 in the Pump House, and the remaining 57 are in the FMEF. Infrequent contributors are drains that receive or have the potential to receive batch or noncontinuous effluents. An example is a drain that receives waste associated with repair or testing of the water distribution system, condensate from heating and ventilating (H&V) cooling coils, or testing of fire water systems.

Of the potential contributors listed in Table 2-2, nine (12%) may be considered routine contributors. However, because many are dependent on ambient conditions, 400 Area Process Sewer flow rates from these contributors vary significantly during the year and time of day. Of the nine routine contributors, the two associated with the FMEF Cooling Towers are in service only 7 mo of the year, which corresponds to the seasonal cooling demand. Due to the nature of the source of the water as discussed later, the variation in the flow does not correlate with any significant variation in the constituents in the waste stream.

2.2.1 The Fuels and Materials Examination Facility Contributors

There are 61 contributors in FMEF: 4 may be considered routine contributors and the remaining 57 may be considered infrequent contributors.

2.2.1.1 Routine Contributors. Of the four routine contributors, two are associated with the operation of the FMEF Cooling Towers: one receives the cooling water from the Entry Wing computer room air conditioning unit, and one is associated with relief of pressure from the process water supply system necessitated by low system demand.

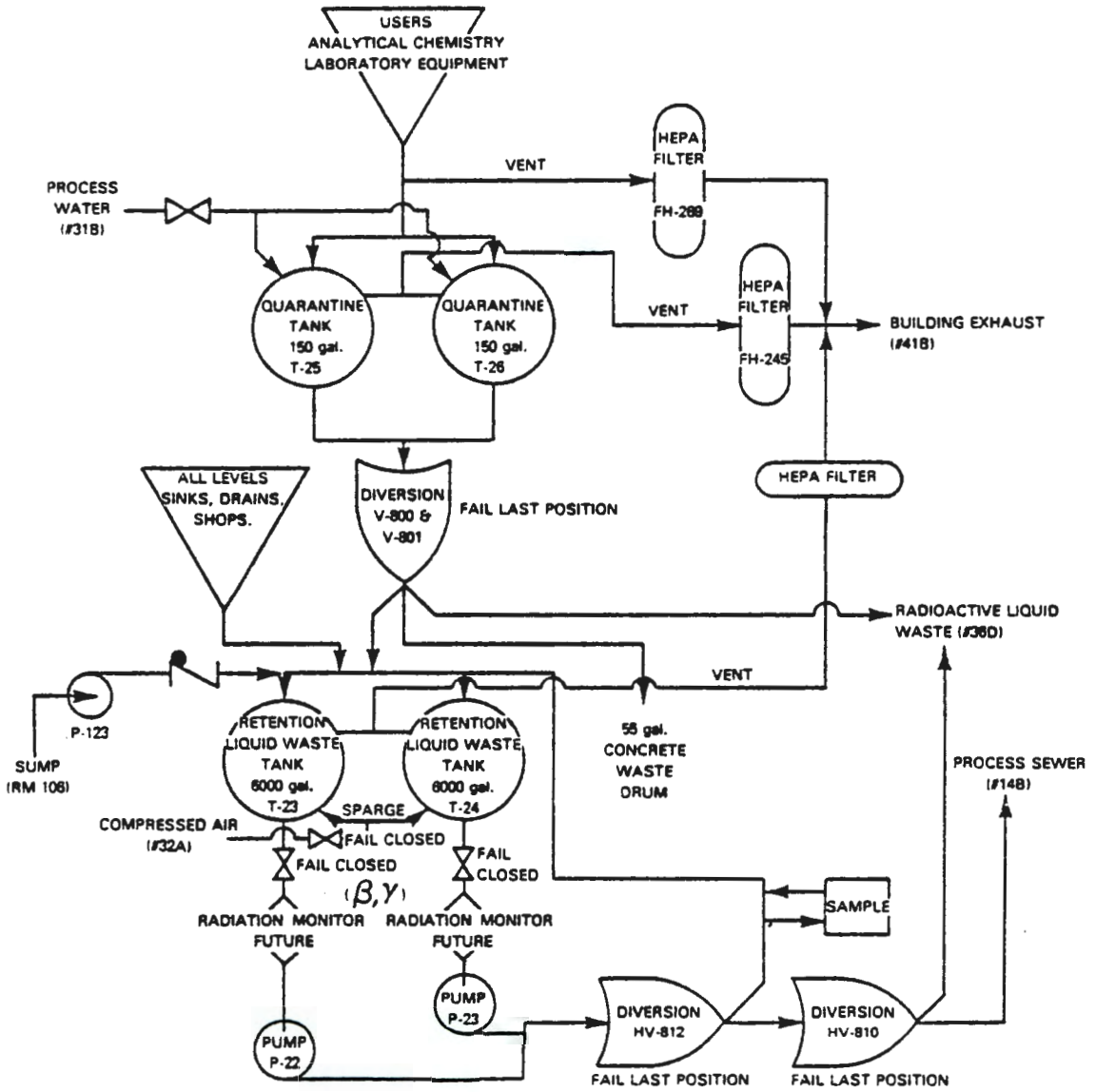
2.2.1.2 Infrequent Contributors. Of the 57 infrequent contributors in the FMEF, 32 are collected and stored in the Retention Liquid Waste System tanks. These 32 comprise the 7 drains in the FAA and 25 of the 27 drains in the Process Building.

The infrequent contributors, including those in the FMEF Retention Liquid Waste system, consist of 8 electric water coolers (EWC), 5 janitorial sinks, 41 floor drains, and 3 equipment drains.

The Mechanical Equipment Wing houses the centrifugal refrigeration chillers used from the building H&V system. These chillers use R-11 (trichloromonofluoromethane) as a refrigerant. The consequences of a release to the drains from these chillers are discussed in Section 5.3.1.1.

2.2.1.3 Retention Liquid Waste System. The Retention Liquid Waste System, as shown in Figure 2-7, provides a capability for maintaining a positive control on a normally clean wastestream that must be considered suspect because of a potential for containing radioactive material. To date, no radioactive material has ever been introduced into the FMEF. All aqueous waste generated in the areas served by the Retention Liquid Waste System

Figure 2-7. Fuels and Maintenance Examination Facility Retention Liquid Waste System.



collects in one of the two 6,000-gal-capacity (22,700-L) tanks as shown in Figure 2-4. Currently, there is no activity in these areas with the exception of the H&V systems, EWC, and the routine testing of fire systems. For this reason, the tank contents are discharged into the 400 Area Process Sewer only one to two times a year because of the low level of accumulation.

2.2.2 Maintenance and Storage Facility Contributors

There are four potential contributors in the MASF as shown in Figure 2-3. One is a routine contributor and the remaining three are infrequent contributors.

2.2.2.1 Routine Contributor. There is only one routine contributor to the 400 Area Process Sewer in the MASF. This is the equipment drain into which the cooling water from the Process Equipment Room air compressor discharges.

2.2.2.2 Infrequent Contributors. The infrequent contributors are composed of the two floor drains in the main building and an equipment drain in the Process Equipment Room. One floor drain receives the hot water generated during startup by the steam cleaner located outside of Decon Area 1. The other floor drain has no designated use. The equipment room drain is used only during startup of the deionized water system after deionizing tank changeout.

2.2.3 The 481-A Pump House Contributors

There are four potential contributors in the 481-A Pump House as shown in Figure 2-4. One is a routine contributor and the remaining three are infrequent contributors.

2.2.3.1 Routine Contributor. The routine contributor receives leakage from the sanitary pump packing. By not having the packing too tight, the life of the pump is significantly extended.

2.2.3.2 Infrequent Contributors. The infrequent contributors in the Pump House consist of a floor drain and two equipment drains. The only wastewater entering the drains is from equipment leaks or equipment maintenance.

2.2.4 The Fast Flux Test Facility Cooling Towers

The three potential contributors associated with the FFTF Cooling Towers are shown in Figure 2-5. All three are considered routine contributors.

2.2.4.1 Routine Contributor. The routine contributors consist of (1) the equipment drain in Cell 611, which receives the effluent wastewater discharged by the FFTF Cooling Tower blowdown system; (2) the drain trench on the north side of the FFTF Cooling Tower pad, which handles tower overflow, equipment drains, and precipitation runoff; and (3) the sink in Cell 611, which the operators use to wash their gloves, glassware, small equipment, and hands.

2.2.4.2 Infrequent Contributors. The FFTF Cooling Towers represent a very efficient air scrubber. This results in the addition of many airborne materials (dust) into the process. In addition, as a result of proximity of the towers to the centrifugal chillers located in the In-Containment Chilled Water Building (see Figure 2-5) which provide refrigerated cooling for the containment portion of the FFTF, the potential exists for fugitive emissions of refrigerant entering the FFTF Cooling Towers and being entrained in the process water. Historically, failure of this system has resulted in the release of quantities of refrigerant R-12 (dichlorodifluoromethane). The consequences of a release to the process sewer is discussed in Section 5.3.1.1.

2.3 PROCESS DESCRIPTION

Most of the effluent wastewater entering the 400 Area Process Sewer is associated with the FFTF and FMEF Cooling Towers, but other sources discharge wastewater that has the basic constituents of the 400 Area Sanitary Water supply.

2.3.1 Present Activities (October 1989 to March 1990)

The sources of routine water discharges to the 400 Area Process Sewer for the period between October 1989 and March 1990 are described in the following sections.

2.3.1.1 The 400 Area Sanitary Water Supply. All of the water used in the 400 Area is pumped from deep wells located within the 400 Area. The primary source is Well 499-S1-8J with two standby wells available. In 1988, this well supplied 93% of the 400 Area requirements. The well water is chlorinated by injecting sodium hypochlorite at the rate of 1 parts per million (ppm) into the stream as it is pumped into one of three 300,000-gal-capacity storage tanks. The storage tanks supply water for both sanitary water and fire protection systems. The chemical and microbiological status of this system is monitored by the Hanford Environmental Health Foundation (HEHF) and the basis of raw water information used in this report is the *Hanford Sanitary Waster Quality Surveillance CY 1988* (HEHF 1989).

The sanitary water and fire protection water supply systems are composed of piping fabricated from carbon steel, polyvinyl chloride (PVC), and copper as required. The water used in process application is diverted from the sanitary water system through the use of back-flow preventors.

The process application water supply is used in systems such as the FMEF H&V, FMEF equipment, and MASF air compressors and comprises approximately 15% of the effluent wastestream. The remaining 85% of the effluent wastestream is from the cooling tower systems.

2.3.1.2 Cooling Tower Process. Cooling towers at the FFTF and the FMEF represent the source of the majority of the water that is eventually discharged to the 400 Area Process Sewer. This was the reason for describing the discharge as "400 Area Secondary Cooling Water." The cooling tower operations at FMEF and FFTF differ both in demand and the methods used to introduce chemicals into the process. As a result of ambient conditions, the FMEF cooling towers were drained during much of this sampling period (October to March). The basic design of the cooling towers and the chemicals used at both facilities are essentially the same. The cooling towers at both facilities are galvanized-steel closed-loop evaporative cooling towers. The cooling systems for the facilities circulate a 40% ethylene glycol solution from the buildings through cooling coils in the cooling towers. Water is sprayed over the coils as air is blown up the cooling towers by fans. The evaporation of the spray water provides the cooling effect, which is transferred through the cooling coils to the recirculated ethylene glycol solution. The evaporation tends to concentrate the nonvolatile constituents in the cooling water. The three FMEF cooling towers and the eight FFTF cooling towers each have a sump capacity of approximately 2,000 gal, which periodically requires draining for maintenance.

The chemical control systems have two objectives (1) control biological growth within the cooling tower and (2) protect the cooling tower from the effects of scale formation.

Biological control is accomplished by use of two different chemicals, a biocide (Dearborn 702*) and a microbicide (Dearborn 717*). Biological growth within the cooling tower is controlled for two reasons: (1) control of detrimental biological species that would potentially thrive in a warm, moist environment causing offensive odors or health risks to personnel; and (2) control of potential coating of the heat transfer tubes with a growth that would inhibit heat transfer from the recirculated loop to the spray water.

Control is accomplished by adding the biocide (Dearborn 702) to the sump water at a 25 ppm concentration on a regular basis. At the FFTF, the biocide (Dearborn 702) is continuously added by a metering pump into the makeup water provided to the cooling towers. However, at the FMEF the biocide is added via the metering pump into a recirculated stream of water from each cooling tower sump. The microbicide (Dearborn 717) addition at the FMEF is done weekly to each operating tower by the metering pump via the sump recirculation loop described above. At the FFTF, microbicide addition is done manually to "shock" the cooling tower only when maintenance requires personnel to physically enter the cooling towers for cleaning (normally during the spring and summer months) or when the normal 702 addition is inoperative. The microbicide (Dearborn 717) concentration of 80 ppm is used to perform this treatment.

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*Dearborn Products, Dearborn Division, W.R. Grace & Co. (See Appendix B)

Scale formation protection is required because of an increasing concentration of naturally occurring salts (typically calcium carbonate) that result from the evaporation of the cooling tower water. This protection is accomplished in both the FMEF and the FFTF primarily by monitoring the electrical conductivity of the water in the sump. When the water conductivity approaches 1,100 μS, automatic valving opens to discharge water. This conductivity limit is approximately 3.5 times the average concentration of the incoming water, which corresponds to about 2.5 cycles (uses) of the water through the cooling towers. Therefore, the concentration of nonvolatile constituents is expected to be 2.5 times that of the well water. Because of the discharge of water, the cooling tower sump water level control system will initiate the addition of makeup water. The discharge of water continues until the conductivity of the sump water has fallen to approximately 900 μS because of the addition of fresh water.

The scale inhibitor (Dearborn 727) concentration is controlled in the cooling towers between 100 and 200 ppm in order to prevent the formation of scale at these levels. Scale inhibitor concentration control at the FFTF is accomplished by metering the chemical into the makeup water at a rate of approximately 80 ppm. This concentration increases to the required range in the cooling tower because of the evaporation of the water. At the FMEF, the control is accomplished by metering the chemical directly into the cooling tower when the conductivity control system opens the valve that blows down the sump water. As an independent operational check, a chemical analysis is performed in the field by the operator to ensure that the proper balance between addition to and discharges from the cooling towers is being maintained.

The chemical testing for scale inhibitor concentration involves the use of the following Dearborn products:

- Dearborn Code 595--Hydrochloric Acid Solution
- Dearborn Code 904--Thorium Nitrate Solution
- Dearborn Code 550--Sodium Thiosulfate/Borate Solution
- Dearborn Code 562--Xylenol Orange Indicator
- Dearborn Code 899--Beryllium Sulfate Solution.

The resultant solution from the test (approximately 50 mL each test) has been designated a dangerous waste (WCO2) because the beryllium concentration is in excess of 0.01% and is accumulated in containers for offsite disposal. In conjunction with washing gloves, glassware, equipment, and hands, trace quantities of these products, along with the other cooling tower chemicals, are subject to disposal via the sinks located in each respective cooling tower building.

2.3.2 Past Activities (Before October 1989)

From 1979 to the present, some minor changes have taken place. The addition of FMEF and MASF wastestreams constituted a slight increase in flow to the ponds. The use of sulfuric acid to lower pH in the cooling towers from a range of 8.4 to 9.0 to a range of 7.5 to 8.5 was eliminated in 1986 at the FFTF. Neither of these changes represented a significant change in the effluent from the cooling towers.

2.3.3 Future Activities (After March 1990)

Startup of operations at the FMEF associated with the Radioisotope Power System Facility (RPSF) and the FAA will result in an increase in monitoring requirements for the retention waste system at the FMEF. This will be necessary to preclude the potential for radioactive contributions from these operations to the 400 Area Process Sewer. Neither of these operations is anticipated to change the nature or significantly change the quantity of contributions to the Retention Liquid Waste System in the FMEF as described in Section 2.2.1.3.

Expanded operations in the MASF may increase the amount of effluent associated with startup testing of facilities that support the MASF Sodium Removal Systems. These effluents are anticipated to be composed of flush water from the systems and dilute nonradioactive sodium hydroxide solutions discharged from the initial system testing.

Changes in cooling tower chemistry are anticipated to occur in the near term as a result of recent review of scale formation within the cooling towers. It is anticipated that Dearborn 727 will be replaced by a different product, Dearborn 876, which would better meet the needs of the facility. This change may also necessitate elimination of the use of the microbicide Dearborn 717 due to material incompatibility. Replacement microbicide products are currently under evaluation and include sodium hypochlorite shock treatment as well as other Dearborn microbicides.

While significant modification to the 400 Area Sanitary Sewer is planned, no major modification to the 400 Area Process Sewer are being proposed. Neither the sanitary nor the process sewer is subject to any established Tri-Party Agreement Milestones.

2.4 PROCESS DATA

Because the process of evaporative cooling results in the concentration of nonvolatile constituents that are in the water pumped from the wells (e.g., sodium and calcium) as well as those that are added to the system (sodium hypochlorite, cooling tower chemicals, and wind-blown dust scrubbed from the air by the cooling towers), the chemical constituents in the

wastestream are anticipated to vary. An exact correlation or mass balance for chemical constituent is very unlikely because of the following factors: the limited sampling data on the constituents in the raw water from the 400 area wells (Table 2-3), the difficulty associated with any realistic correlation between samples taken at the well head and samples taken at the discharge to the process sewer, variations in the process ambient temperature conditions, and additions to the system as a result of airborne dust.

Constituents found in the well water are expected to be in the wastestream at a concentration of 2.5 times their original value at the well head because of evaporation in the towers as described in Section 2.3.1.2. Normal cooling tower chemical concentrations will be evaluated in Section 5.4.1.2. Radionuclide concentration in the effluent is limited to those which can be attributed to the source of the raw water. The tritium level is normally in the 4,000 to 7,000 pCi range (Table 2-3).

The anticipated concentrations of chemicals shown in Table 2-4 ignore the dilution of sanitary water. These concentrations represent the upper boundary of what could be expected in an average grab sample. The contributions of Dearborn 702 and Dearborn 727 were included because they are continuously in the process stream. The Dearborn 717 is not included in the expected average effluent because of the infrequency of use. The contribution of Dearborn 717 is addressed separately in Section 5.4.1.2.

Table 2-3. Hanford Environmental Health Foundation Summary Report on 400 Area Sanitary Water Supply for Calendar Year 1988.

Primary inorganic chemical	Concentration (ppm)
Arsenic	<0.005
Barium	0.16
Cadmium	<0.0005
Chromium	<0.005
Fluoride	0.33
Lead	<0.005
Mercury	<0.0005
Nitrate (as N)	0.14
Selenium	<0.005
Silver	<0.005
Sodium	29.0
Secondary chemical/ physical contaminant	**Concentration (ppm)**
Color (units)	<5
Chloride	11.9
Copper	0.11
Iron	<0.03
Manganese	<0.01
Solids, total dissolved	209
Sulfate	34
Zinc	<0.1
Radiological activity	**Concentration (pCi/L)**
Alpha	0.05 ± 0.12
Beta	7.2 ± 2.2
Tritium	4,100 ± 2,400
^{131}I	0.0046 ± 0.0009
^{90}Sr	0.01 ± 0.02

Note: Value expressed as < reflects detection limit.

See Appendix C for complete HEHF report.

Table 2-4. Summary Report of Estimated Concentration of Wastestream Constituents.

Primary inorganic chemical	Concentration (ppm)
Arsenic	<0.0125
Barium	0.4
Cadmium	<0.00125
Chromium	<0.0125
Fluoride	0.825
Lead	<0.0125
Mercury	<0.00125
Nitrate (as N)	0.35
Selenium	<0.0125
Silver	<0.0125
Sodium	72.5
Secondary chemical/ physical contaminant	**Concentration (ppm)**
Color (units)	NA
Chloride	29.75
Copper	0.275
Iron	<0.075
Manganese	<0.023
Solids, total dissolved	522
Sulfate	85
Zinc	<0.25
Cooling tower chemical	**Concentration (ppm)**
Dearborn 727	200
Potassium hydroxide	<20
Other proprietary chemicals	<180
Dearborn 702	25
5-chloro-2-methyl-4-isothiazoline-3-one	0.3
2-methyl-4-isothiazoline-3-one	0.1
Magnesium chloride	0.5
Magnesium nitrate	0.75

Note: Value expressed as < reflects dependence on a detection limit.
NA = not applicable

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9 1 1 2 0 4 7 0 7 0 3

3.0 SAMPLING DATA

This section provides an evaluation of the sampling data pertaining to the 400 Area Process Sewer wastestream. These data are divided into two categories--wastestream data and background data--each of which is further subdivided into chemical data and radiological data. The discussion identifies the source of the samplings (Section 3.1), addresses data reduction (Section 3.2), and analyzes reduced data (Section 3.3). A tabular comparison of the wastestream and background data is also given. This approach is illustrated in Figure 3-1.

3.1 DATA SOURCE

Two sources of sampling data were used in this analysis: wastestream data for 400 Area Process Sewer and background data for 400 Area Sanitary Water System.

3.1.1 Wastestream Data

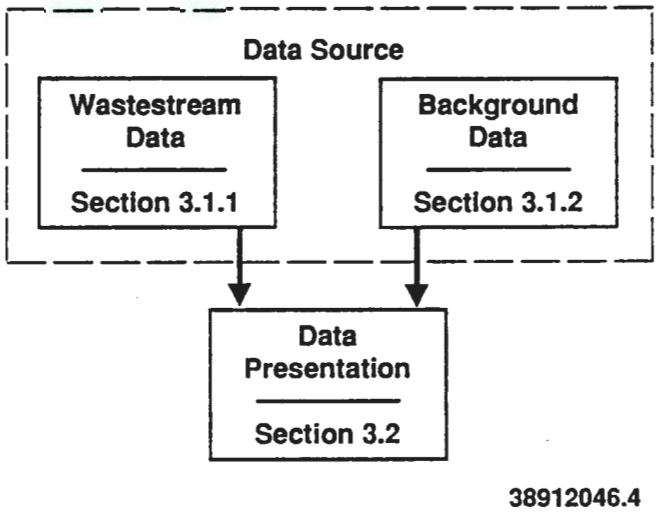
The wastestream data set used in this subsection is contained in *Liquid Effluent Study Characterization Data* (WHC 1990a).

This data set is composed of four samples that were taken over a 4-mo period. Four samples (October 20, 1989, November 21, 1989, December 6, 1989, and January 9, 1990) were taken at a diversion box between the 4608 B and C ponds (Figure 2-6).

The sampling scheme took representative samples by following SW-846 (EPA 1986) sampling and analytical protocol. This protocol requires that a sufficient number of samples be taken in a random manner over a period sufficient to characterize variability or uniformity of the stream. Grab samples were taken on a partitioned time-random basis. The sampling was randomized splitting the workdays of the month to be sampled into two 4-h time periods and choosing one of the time periods by using a random number generator. All samples were taken to U.S. Testing Company for analysis. The details of the sampling, analytical, quality control, and quality assurance procedures are contained in Volume 4 of the *Waste Stream Characterization Report* (WHC 1989).

The sampling location represents the end-of-the pipe point for the system and as such represents the effluent discharged to the ponds. As discussed previously in Section 2.0, very small variations in constituents are anticipated from the various sources. As shown in Section 4.3, correlation of the sampling data taken at this point with process information demonstrates the adequacy of this sampling location to properly characterizes the current waste stream.

Figure 3-1. Sample Data Strategy.



3.1.2 Background Data

The 400 Area sanitary water system is the source of all process water. As discussed previously, in Section 2.3.1.1, the origin of this water is one of three deep wells. Water from the wells is chlorinated and stored in one of three storage tanks. The background constituents contained in this water were listed in Section 2.4. Presented in Appendix C is the basis of this analysis previously published in the *CY-1988 HEHF Sanitary Water Report* (HEHF 1989). It should be noted that the data presented in the reference report reflects the use of the primary supply well which was also in use during the period of stream samplings.

3.2 DATA PRESENTATION

The sampling methods used for the characterization effort are summarized in Table 3-1 and the results of the sampling are presented in Table 3-2. A statistical summary of the data used in evaluating the data is presented in Table 3-3. Presented as Appendix D is a complete listing of all data associated with this effort, previously published in the *Liquid Effluent Study Characterization Data* (WHC 1990a) and data taken between February and August 1987, published in Volume 2 of the *Waste Stream Characterization Report* (WHC 1989).

Data reported by the laboratory under the primary sample number (see Section 3.0) are listed in the data reports with the primary sample number. Data for VOA blanks are listed in the data reports by the primary sample number and the suffix "B." Data for VOA transfer blanks are listed in the data reports by the primary sample number and the suffix "T." Data from Extraction Procedure Toxicity Testing (listed as EP Toxic in the tables) ignitability testing, reactivity testing and laboratory measurements of pH and conductivity are listed in the data reports by the primary sample number with the suffix "E" (for "extract," a term only applicable to the EP Toxicity Testing portion).

3.2.1 Chemical Constituents

More than 40,000 chemical analytes were of interest. The bulk of these analytes were compiled from a combined mass spectral library from the EPA, the National Institute for Occupational Safety and Health, and the National Bureau of Standards. This library was composed of approximately 40,000 chemical constituents, each with a unique signature on a gas chromatograph and mass spectrometer analysis.

Detection is defined as the U.S. Testing Company contract detection limits. These limits are usually moderately higher than the instrument detection limits or "state-of-the-art" detection limits currently reported in the scientific literature. The number of chemical analytes detected was 20, including conductivity and pH.

Table 3-1. Analytical Methods for Samples. (sheet 1 of 2).

LEAD# CofC#	50713 50713	50784 50784	50826 50826	50876 50876
Alkalinity	X	X	X	X
Alpha counting	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
Conductivity-field	X	X	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
Mercury	X	X	X	X
pH-field	X	X	X	X
Selenium	X	X	X	X
Semivolatile organics (GC/MS)	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
Tritium	X	X	X	X
Uranium	X	X	X	X
Volatile organics (GC/MS)	X	X	X	X
LEAD# CofC#	50713B 50714	50784B 50785	50826B 50827	50876B 50877
Volatile organics (GC/MS)	X	X	X	X
LEAD# CofC#	50713T 50715	50784T 50786	50826T 50828	50876T 50878
Volatile organics (GC/MS)	X	X	X	X

Table 3-1. Analytical Methods for Samples. (sheet 2 of 2)

LEAD# CofC#	50713E 50716	50784E 50787	50826E 50829	50876E 50879
Atomic emission spectroscopy	X	X	X	X
Ignitability	X	X	X	X
Mercury (mixed matrix)	X	X	X	X
Reactive cyanide	X	X	X	X
Reactive sulfide	X	X	X	X

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

Sample number suffixes:

B = blank
E = extract
T = transfer blank
CofC# = chain-of-custody number
GC = gas chromatography
LEAD# = liquid effluent analytical data number that appears in the data reports
LDL = low-detection limit
MS = mass spectrometry

9 1 1 2 0 4 7 0 7 0 3

Table 3-2. 400 Area Secondary Cooling Water Data. (sheet 1 of 8)

Constituent	Sample number[a]	Sampling date	Method[c]	Result (ppb)
Arsenic (EP Toxic)	50713E	10/20/89	ICP	<5.00 E+02
Arsenic (EP Toxic)	50784E	11/21/89	ICP	<5.00 E+02
Arsenic (EP Toxic)	50826E	12/06/89	ICP	<5.00 E+02
Arsenic (EP Toxic)	50876E	01/09/90	ICP	<5.00 E+02
Barium	50713	10/20/89	ICP	3.00 E+01
Barium	50784	11/21/89	ICP	4.00 E+01
Barium	50826	12/06/89	ICP	3.80 E+01
Barium	50876	01/09/90	ICP	3.00 E+01
Barium (EP Toxic)	50713E	10/20/89	ICP	<1.00 E+03
Barium (EP Toxic)	50784E	11/21/89	ICP	<1.00 E+03
Barium (EP Toxic)	50826E	12/06/89	ICP	<1.00 E+03
Barium (EP Toxic)	50876E	01/09/90	ICP	<1.00 E+03
Boron	50713	10/20/89	ICP	4.60 E+01
Boron	50784	11/21/89	ICP	5.50 E+01
Boron	50826	12/06/89	ICP	5.20 E+01
Boron	50876	01/09/90	ICP	4.10 E+01
Cadmium (EP Toxic)	50713E	10/20/89	ICP	<1.00 E+02
Cadmium (EP Toxic)	50784E	11/21/89	ICP	<1.00 E+02
Cadmium (EP Toxic)	50826E	12/06/89	ICP	<1.00 E+02
Cadmium (EP Toxic)	50876E	01/09/90	ICP	<1.00 E+02
Calcium	50713	10/20/89	ICP	4.89 E+04
Calcium	50784	11/21/89	ICP	6.79 E+04
Calcium	50826	12/06/89	ICP	5.47 E+04
Calcium	50876	01/09/90	ICP	4.89 E+04
Chloride	50713	10/20/89	IC	1.90 E+04
Chloride	50784	11/21/89	IC	1.51 E+04
Chloride	50826	12/06/89	IC	2.72 E+04
Chloride	50876	01/09/90	IC	2.10 E+04
Chromium (EP Toxic)	50713E	10/20/89	ICP	<5.00 E+02
Chromium (EP Toxic)	50784E	11/21/89	ICP	<5.00 E+02
Chromium (EP Toxic)	50826E	12/06/89	ICP	<5.00 E+02
Chromium (EP Toxic)	50876E	01/09/90	ICP	<5.00 E+02
Copper	50713	10/20/89	ICP	<1.00 E+01
Copper	50784	11/21/89	ICP	<1.00 E+01
Copper	50826	12/06/89	ICP	<1.00 E+01
Copper	50876	01/09/90	ICP	1.10 E+01
Fluoride	50713	10/20/89	IC	7.00 E+02
Fluoride	50713	10/20/89	ISE	6.22 E+02
Fluoride	50784	11/21/89	IC	5.35 E+02
Fluoride	50784	11/21/89	ISE	7.50 E+02
Fluoride	50826	12/06/89	IC	7.00 E+02
Fluoride	50826	12/06/89	ISE	6.88 E+02
Fluoride	50876	01/09/90	IC	7.00 E+02
Fluoride	50876	01/09/90	ISE	6.55 E+02
Iron	50713	10/20/89	ICP	3.40 E+01
Iron	50784	11/21/89	ICP	<3.00 E+01

Table 3-2. 400 Area Secondary Cooling Water Data. (sheet 2 of 8)

Constituent	Sample number[a]	Sampling date	Method[c]	Result (ppb)
Iron	50826	12/06/89	ICP	7.90 E+01
Iron	50876	01/09/90	ICP	7.20 E+01
Lead (EP Toxic)	50713E	10/20/89	ICP	<5.00 E+02
Lead (EP Toxic)	50784E	11/21/89	ICP	<5.00 E+02
Lead (EP Toxic)	50826E	12/06/89	ICP	<5.00 E+02
Lead (EP Toxic)	50876E	01/09/90	ICP	<5.00 E+02
Lithium	50713	10/20/89	ICP	2.50 E+01
Lithium	50784	11/21/89	ICP	3.40 E+01
Lithium	50826	12/06/89	ICP	3.00 E+01
Lithium	50876	01/09/90	ICP	2.60 E+01
Magnesium	50713	10/20/89	ICP	1.45 E+04
Magnesium	50784	11/21/89	ICP	1.83 E+04
Magnesium	50826	12/06/89	ICP	1.64 E+04
Magnesium	50876	01/09/90	ICP	1.38 E+04
Manganese	50713	10/20/89	ICP	1.80 E+01
Manganese	50784	11/21/89	ICP	8.00 E+00
Manganese	50826	12/06/89	ICP	1.50 E+01
Manganese	50876	01/09/90	ICP	1.20 E+01
Mercury (EP Toxic)	50713E	10/20/89	CVAA/M	<2.00 E+01
Mercury (EP Toxic)	50784E	11/21/89	CVAA/M	<2.00 E+01
Mercury (EP Toxic)	50826E	12/06/89	CVAA/M	<2.00 E+01
Mercury (EP Toxic)	50876E	01/09/90	CVAA/M	<2.00 E+01
Nitrate	50713	10/20/89	IC	1.10 E+03
Nitrate	50784	11/21/89	IC	9.37 E+02
Nitrate	50826	12/06/89	IC	1.40 E+03
Nitrate	50876	01/09/90	IC	1.00 E+03
Potassium	50713	10/20/89	ICP	1.43 E+04
Potassium	50784	11/21/89	ICP	1.95 E+04
Potassium	50826	12/06/89	ICP	1.71 E+04
Potassium	50876	01/09/90	ICP	1.41 E+04
Selenium (EP Toxic)	50713E	10/20/89	ICP	<5.00 E+02
Selenium (EP Toxic)	50784E	11/21/89	ICP	<5.00 E+02
Selenium (EP Toxic)	50826E	12/06/89	ICP	<5.00 E+02
Selenium (EP Toxic)	50876E	01/09/90	ICP	<5.00 E+02
Silicon	50713	10/20/89	ICP	3.46 E+04
Silicon	50784	11/21/89	ICP	4.41 E+04
Silicon	50826	12/06/89	ICP	3.87 E+04
Silicon	50876	01/09/90	ICP	3.21 E+04
Silver (EP Toxic)	50713E	10/20/89	ICP	<5.00 E+02
Silver (EP Toxic)	50784E	11/21/89	ICP	<5.00 E+02
Silver (EP Toxic)	50826E	12/06/89	ICP	<5.00 E+02
Silver (EP Toxic)	50876E	01/09/90	ICP	<5.00 E+02
Sodium	50713	10/20/89	ICP	5.91 E+04
Sodium	50784	11/21/89	ICP	7.61 E+04
Sodium	50826	12/06/89	ICP	6.75 E+04
Sodium	50876	01/09/90	ICP	5.58 E+04

Table 3-2. 400 Area Secondary Cooling Water Data. (sheet 3 of 8)

Constituent	Sample number[a]	Sampling date	Method[c]	Result (ppb)
Strontium	50713	10/20/89	ICP	2.57 E+02
Strontium	50784	11/21/89	ICP	3.42 E+02
Strontium	50826	12/06/89	ICP	2.94 E+02
Strontium	50876	01/09/90	ICP	2.49 E+02
Sulfate	50713	10/20/89	IC	6.40 E+04
Sulfate	50784	11/21/89	IC	5.12 E+04
Sulfate	50826	12/06/89	IC	6.88 E+04
Sulfate	50876	01/09/90	IC	7.19 E+04
Uranium	50713	10/20/89	FLUOR	1.85 E-01
Uranium	50784	11/21/89	FLUOR	2.14 E-01
Uranium	50826	12/06/89	FLUOR	5.68 E-01
Uranium	50876	01/09/90	FLUOR	3.08 E-01
Zinc	50713	10/20/89	ICP	4.20 E+01
Zinc	50784	11/21/89	ICP	2.00 E+01
Zinc	50826	12/06/89	ICP	2.60 E+01
Zinc	50876	01/09/90	ICP	4.80 E+01
Acetone	50713	10/20/89	VOA	2.70 E+01
Acetone	50713	10/20/89	ABN	<1.00 E+01
Acetone	50713B	10/20/89	VOA	<1.00 E+01
Acetone	50713T	10/20/89	VOA	<1.00 E+01
Acetone	50784	11/21/89	VOA	<1.00 E+01
Acetone	50784	11/21/89	ABN	<1.00 E+01
Acetone	50784B	11/21/89	VOA	<1.00 E+01
Acetone	50784T	11/21/89	VOA	<1.00 E+01
Acetone	50826	12/06/89	VOA	<1.00 E+01
Acetone	50826	12/06/89	ABN	<1.00 E+01
Acetone	50826B	12/06/89	VOA	<1.00 E+01
Acetone	50826T	12/06/89	VOA	<1.00 E+01
Acetone	50876	01/09/90	VOA	<1.00 E+01
Acetone	50876	01/09/90	ABN	<1.00 E+01
Acetone	50876B	01/09/90	VOA	<6.00 E+00
Acetone	50876T	01/09/90	VOA	<1.00 E+01
Ammonia	50713	10/20/89	ISE	1.00 E+02
Ammonia	50784	11/21/89	ISE	<5.00 E+01
Ammonia	50826	12/06/89	ISE	<5.00 E+01
Ammonia	50876	01/09/90	ISE	1.20 E+02
Bromodichloromethane	50713	10/20/89	VOA	<5.00 E+00
Bromodichloromethane	50713B	10/20/89	VOA	<5.00 E+00
Bromodichloromethane	50713T	10/20/89	VOA	<5.00 E+00
Bromodichloromethane	50784	11/21/89	VOA	<5.00 E+00
Bromodichloromethane	50784B	11/21/89	VOA	<5.00 E+00
Bromodichloromethane	50784T	11/21/89	VOA	<5.00 E+00
Bromodichloromethane	50826	12/06/89	VOA	5.00 E+00
Bromodichloromethane	50826B	12/06/89	VOA	<5.00 E+00
Bromodichloromethane	50826T	12/06/89	VOA	<5.00 E+00
Bromodichloromethane	50876	01/09/90	VOA	<5.00 E+00

Table 3-2. 400 Area Secondary Cooling Water Data. (sheet 4 of 8)

Constituent	Sample number[a]	Sampling date	Method[c]	Result (ppb)
Bromodichloromethane	50876B	01/09/90	VOA	<5.00 E+00
Bromodichloromethane	50876T	01/09/90	VOA	<5.00 E+00
2-butanone	50713	10/20/89	VOA	1.20 E+01
2-butanone	50713B	10/20/89	VOA	2.30 E+01
2-butanone	50713T	10/20/89	VOA	1.90 E+01
2-butanone	50784	11/21/89	VOA	<1.00 E+01
2-butanone	50784B	11/21/89	VOA	<1.00 E+01
2-butanone	50784T	11/21/89	VOA	<1.00 E+01
2-butanone	50826	12/06/89	VOA	<6.00 E+00
2-butanone	50826B	12/06/89	VOA	<7.00 E+00
2-butanone	50826T	12/06/89	VOA	<1.00 E+01
2-butanone	50876	01/09/90	VOA	<1.00 E+01
2-butanone	50876B	01/09/90	VOA	<1.00 E+01
2-butanone	50876T	01/09/90	VOA	<1.00 E+01
Dichloromethane	50713	10/20/89	VOA	<5.00 E+00
Dichloromethane	50713B	10/20/89	VOA	1.00 E+01
Dichloromethane	50713T	10/20/89	VOA	7.90 E+01
Dichloromethane	50784	11/21/89	VOA	<5.00 E+00
Dichloromethane	50784B	11/21/89	VOA	<3.00 E+00
Dichloromethane	50784T	11/21/89	VOA	<3.00 E+00
Dichloromethane	50826	12/06/89	VOA	<5.00 E+00
Dichloromethane	50826B	12/06/89	VOA	<5.00 E+00
Dichloromethane	50826T	12/06/89	VOA	<5.00 E+00
Dichloromethane	50876	01/09/90	VOA	<5.00 E+00
Dichloromethane	50876B	01/09/90	VOA	<5.00 E+00
Dichloromethane	50876T	01/09/90	VOA	<5.00 E+00
Tetrahydrofuran	50713	10/20/89	VOA	<1.00 E+01
Tetrahydrofuran	50713B	10/20/89	VOA	2.00 E+01
Tetrahydrofuran	50713T	10/20/89	VOA	<1.00 E+01
Tetrahydrofuran	50784	11/21/89	VOA	<1.00 E+01
Tetrahydrofuran	50784B	11/21/89	VOA	<1.00 E+01
Tetrahydrofuran	50784T	11/21/89	VOA	<1.00 E+01
Tetrahydrofuran	50826	12/06/89	VOA	<1.00 E+01
Tetrahydrofuran	50826B	12/06/89	VOA	<1.00 E+01
Tetrahydrofuran	50826T	12/06/89	VOA	<1.00 E+01
Tetrahydrofuran	50876	01/09/90	VOA	<1.00 E+01
Tetrahydrofuran	50876B	01/09/90	VOA	<1.00 E+01
Tetrahydrofuran	50876T	01/09/90	VOA	<6.00 E+00
Trichloromethane	50713	10/20/89	VOA	<5.00 E+00
Trichloromethane	50713B	10/20/89	VOA	<5.00 E+00
Trichloromethane	50713T	10/20/89	VOA	<5.00 E+00
Trichloromethane	50784	11/21/89	VOA	<5.00 E+00
Trichloromethane	50784B	11/21/89	VOA	<4.00 E+00
Trichloromethane	50784T	11/21/89	VOA	1.10 E+01
Trichloromethane	50826	12/06/89	VOA	8.00 E+00
Trichloromethane	50826B	12/06/89	VOA	<4.00 E+00

Table 3-2. 400 Area Secondary Cooling Water Data. (sheet 5 of 8)

Constituent	Sample number[a]	Sampling date	Method[c]	Result (ppb)
Trichloromethane	50826T	12/06/89	VOA	<4.00 E+00
Trichloromethane	50876	01/09/90	VOA	<5.00 E+00
Trichloromethane	50876B	01/09/90	VOA	<3.00 E+00
Trichloromethane	50876T	01/09/90	VOA	<3.00 E+00
Alkalinity (method B)	50713	10/20/89	TITRA	2.42 E+05
Alkalinity (method B)	50784	11/21/89	TITRA	3.09 E+05
Alkalinity (method B)	50826	12/06/89	TITRA	2.73 E+05
Alkalinity (method B)	50876	01/09/90	TITRA	2.86 E+05
Beta activity (pCi/L)	50713	10/20/89	Beta	1.22 E+01
Beta activity (pCi/L)	50784	11/21/89	Beta	2.02 E+01
Beta activity (pCi/L)	50826	12/06/89	Beta	3.12 E+01
Beta activity (pCi/L)	50876	01/09/90	Beta	1.26 E+01
Conductivity (µS)	50713	10/20/89	COND-Fld	5.27 E+02
Conductivity (µS)	50784	11/21/89	COND-Fld	7.53 E+02
Conductivity (µS)	50826	12/06/89	COND-Fld	6.85 E+02
Conductivity (µS)	50876	01/09/90	COND-Fld	6.98 E+02
Ignitability (°F)[b]	50713E	10/20/89	IGNIT	2.12 E+02
Ignitability (°F)[b]	50784E	11/21/89	IGNIT	2.14 E+02
Ignitability (°F)[b]	50826E	12/06/89	IGNIT	2.10 E+02
Ignitability (°F)[b]	50876E	01/09/90	IGNIT	2.12 E+02
pH (dimensionless)	50713	10/20/89	PH-Fld	8.85 E+00
pH (dimensionless)	50784	11/21/89	PH-Fld	8.80 E+00
pH (dimensionless)	50826	12/06/89	PH-Fld	7.25 E+00
pH (dimensionless)	50876	01/09/90	PH-Fld	8.80 E+00
Reactivity cyanide (mg/kg)	50713E	10/20/89	DSPEC	<1.00 E+02
Reactivity cyanide (mg/kg)	50784E	11/21/89	DSPEC	<1.00 E+02
Reactivity cyanide (mg/kg)	50826E	12/06/89	DSPEC	<1.00 E+02
Reactivity cyanide (mg/kg)	50876E	01/09/90	DSPEC	<1.00 E+02
Reactivity sulfide (mg/kg)	50713E	10/20/89	DTITRA	<1.00 E+02
Reactivity sulfide (mg/kg)	50784E	11/21/89	DTITRA	<1.00 E+02
Reactivity sulfide (mg/kg)	50826E	12/06/89	DTITRA	<1.00 E+02
Reactivity sulfide (mg/kg)	50876E	01/09/90	DTITRA	<1.00 E+02
TDS	50713	10/20/89	TDS	4.01 E+05
TDS	50784	11/21/89	TDS	5.53 E+05
TDS	50826	12/06/89	TDS	4.65 E+05
TDS	50876	01/09/90	TDS	4.11 E+05
Temperature (°C)	50713	10/20/89	TEMP-Fld	1.93 E+01
Temperature (°C)	50784	11/21/89	TEMP-Fld	1.86 E+01
Temperature (°C)	50826	12/06/89	TEMP-Fld	1.63 E+01
Temperature (°C)	50876	01/09/90	TEMP-Fld	1.77 E+01
TOC	50713	10/20/89	TOC	2.40 E+03
TOC	50784	11/21/89	TOC	<1.90 E+03
TOC	50826	12/06/89	TOC	2.30 E+03
TOC	50876	01/09/90	TOC	2.10 E+03
Total carbon	50713	10/20/89	TC	6.00 E+04
Total carbon	50784	11/21/89	TC	6.95 E+04

Table 3-2. 400 Area Secondary Cooling Water Data. (sheet 6 of 8)

Constituent	Sample number[a]	Sampling date	Method[c]	Result (ppb)
Total carbon	50826	12/06/89	TC	6.28 E+04
Total carbon	50876	01/09/90	TC	5.14 E+04
TOX (as Cl)	50713	10/20/89	LTOX	7.30 E+01
TOX (as Cl)	50784	11/21/89	LTOX	1.54 E+02
TOX (as Cl)	50826	12/06/89	LTOX	2.61 E+02
TOX (as Cl)	50876	01/09/90	LTOX	7.90 E+01
^{60}Co (pCi/L)	50713	10/20/89	GEA	<4.02 E-01
^{60}Co (pCi/L)	50784	11/21/89	GEA	9.16 E+01
^{60}Co (pCi/L)	50826	12/06/89	GEA	<2.36 E-01
^{60}Co (pCi/L)	50876	01/09/90	GEA	<5.94 E-01
^{137}Cs (pCi/L)	50713	10/20/89	GEA	<3.48 E-01
^{137}Cs (pCi/L)	50784	11/21/89	GEA	9.48 E+01
^{137}Cs (pCi/L)	50826	12/06/89	GEA	<6.67 E-01
^{3}H (pCi/L)	50713	10/20/89	LSC	6.65 E+03
^{3}H (pCi/L)	50784	11/21/89	LSC	6.31 E+03
^{3}H (pCi/L)	50826	12/06/89	LSC	6.89 E+03
^{3}H (pCi/L)	50876	01/09/90	LSC	6.31 E+03
Radium total (pCi/L)	50713	10/20/89	Alpha-Ra	1.82 E-01
Radium total (pCi/L)	50784	11/21/89	Alpha-Ra	1.70 E-01
Radium total (pCi/L)	50826	12/06/89	Alpha-Ra	<1.32 E-01
Radium total (pCi/L)	50876	01/09/90	Alpha-Ra	<7.35 E-02

NOTE: Measurements are in ppb unless noted.
AA = atomic absorption spectroscopy
EP = Extraction Procedure Toxicity Test
GC = gas chromatography
ICP = inductively-coupled plasma spectroscopy
MS = mass spectrometry
TDS = total dissolved solids
TOC = total organic carbon
TOX = total organic halides

[a]See Table 3-1 for corresponding chain-of-custody number and explanations of sample number suffix.

[b]Ignitability is the maximum temperature of the test (no sample actually ignited).

[c]Methods code:

Code	Analytical Method	Reference[d]
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

Table 3-2. 400 Area Secondary Cooling Water Data. (sheet 7 of 8)

Code	Analytical Method	Reference[d]
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
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

Table 3-2. 400 Area Secondary Cooling Water Data. (sheet 8 of 8)

[d]Reference:

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*, 3rd ed., SW-846, U.S. Environmental Protection Agency, Washington, D.C.

9 1 1 2 0 4 7 0 7 1 5

Table 3-3. Statistical Summary of Data. (sheet 1 of 2)

Constituent	N[a]	MDA[b]	Method[c]	Mean value (ppb)	Standard error (ppb)	90%CI limit[d] (ppb)	Maximum[e] (ppb)
Arsenic (EP Toxic)	4	4	NA	<5.00 E+02	0.00 E+00	<5.00 E+02	<5.00 E+02
Barium	4	0	NA	3.45 E+01	2.63 E+00	3.88 E+01	4.00 E+01
Barium (EP Toxic)	4	4	NA	<1.00 E+03	0.00 E+00	<1.00 E+03	<1.00 E+03
Boron	4	0	NA	4.85 E+01	3.12 E+00	5.36 E+01	5.50 E+01
Cadmium (EP Toxic)	4	4	NA	<1.00 E+02	0.00 E+00	<1.00 E+02	<1.00 E+02
Calcium	4	0	NA	5.51 E+04	4.48 E+03	6.24 E+04	6.79 E+04
Chloride	4	0	NA	2.06 E+04	2.53 E+03	2.47 E+04	2.72 E+04
Chromium (EP Toxic)	4	4	NA	<5.00 E+02	0.00 E+00	<5.00 E+02	<5.00 E+02
Copper	4	3	DL	1.02 E+01	2.50 E-01	1.07 E+01	1.10 E+01
Fluoride	4	0	NA	6.69 E+02	1.10 E+01	6.87 E+02	6.94 E+02
Iron	4	1	DL	5.37 E+01	1.27 E+01	7.45 E+01	7.90 E+01
Lead (EP Toxic)	4	4	NA	<5.00 E+02	0.00 E+00	<5.00 E+02	<5.00 E+02
Lithium	4	0	NA	2.87 E+01	2.06 E+00	3.21 E+01	3.40 E+01
Magnesium	4	0	NA	1.57 E+04	1.01 E+03	1.74 E+04	1.83 E+04
Manganese	4	0	NA	1.32 E+01	2.14 E+00	1.67 E+01	1.80 E+01
Mercury (EP Toxic)	4	4	NA	<2.00 E+01	0.00 E+00	<2.00 E+01	<2.00 E+01
Nitrate	4	0	NA	1.11 E+03	1.03 E+02	1.28 E+03	1.40 E+03
Potassium	4	0	NA	1.62 E+04	1.28 E+03	1.83 E+04	1.95 E+04
Selenium (EP Toxic)	4	4	NA	<5.00 E+02	0.00 E+00	<5.00 E+02	<5.00 E+02
Silicon	4	0	NA	3.74 E+04	2.62 E+03	4.17 E+04	4.41 E+04
Silver (EP Toxic)	4	4	NA	<5.00 E+02	0.00 E+00	<5.00 E+02	<5.00 E+02
Sodium	4	0	NA	6.46 E+04	4.55 E+03	7.21 E+04	7.61 E+04
Strontium	4	0	NA	2.85 E+02	2.12 E+01	3.20 E+02	3.42 E+02
Sulfate	4	0	NA	6.40 E+04	4.56 E+03	7.14 E+04	7.19 E+04
Uranium	4	0	NA	3.19 E-01	8.71 E-02	4.61 E-01	5.68 E-01
Zinc	4	0	NA	3.40 E+01	6.58 E+00	4.48 E+01	4.80 E+01
Acetone	4	3	DL	1.42 E+01	4.25 E+00	2.12 E+01	2.70 E+01
Ammonia	4	2	DL	8.00 E+01	1.78 E+01	1.09 E+02	1.20 E+02
Bromodichloromethane	4	3	DL	5.00 E+00	0.00 E+00	5.00 E+00	5.00 E+00
2-butanone	4	3	DL	9.50 E+00	1.26 E+00	1.16 E+01	1.20 E+01
Trichloromethane	4	3	DL	5.75 E+00	7.50 E-01	6.98 E+00	8.00 E+00
Alkalinity (method B)	4	0	NA	2.77 E+05	1.40 E+04	3.00 E+05	3.09 E+05
Beta Activity (pCi/L)	4	0	NA	1.90 E+01	4.45 E+00	2.63 E+01	3.12 E+01
Conductivity (μS)	4	0	NA	6.66 E+02	4.85 E+01	7.45 E+02	7.53 E+02
Ignitability (°F)[f]	4	0	NA	2.12 E+02	8.16 E-01	2.11 E+02	2.10 E+02
pH (dimensionless)	4	0	NA	8.42 E+00	3.92 E-01	9.07 E+00	8.85 E+00
Reactivity cyanide (mg/kg)	4	4	NA	<1.00 E+02	0.00 E+00	<1.00 E+02	<1.00 E+02
Reactivity sulfide (mg/kg)	4	4	NA	<1.00 E+02	0.00 E+00	<1.00 E+02	<1.00 E+02
TDS	4	0	NA	4.57 E+05	3.48 E+04	5.14 E+05	5.53 E+05
Temperature (°C)	4	0	NA	1.80 E+01	6.47 E-01	1.90 E+01	1.93 E+01
TOC	4	1	DL	2.17 E+03	1.11 E+02	2.36 E+03	2.40 E+03
Total Carbon	4	0	NA	6.09 E+04	3.75 E+03	6.71 E+04	6.95 E+04

Table 3-3. Statistical Summary of Data. (sheet 2 of 2)

Constituent	N[a]	MDA[b]	Method[c]	Mean value (ppb)	Standard error (ppb)	90%CI limit[d] (ppb)	Maximum[e] (ppb)
TOX (as Cl)	4	0	NA	1.42 E+02	4.38 E+01	2.14 E+02	2.61 E+02
^{60}Co (pCi/L)	4	3	DL	2.32 E+01	2.28 E+01	6.06 E+01	9.16 E+01
^{137}Cs (pCi/L)	3	2	DL	3.19 E+01	3.14 E+01	9.12 E+01	9.48 E+01
^{3}H (pCi/L)	4	0	NA	6.54 E+03	1.42 E+02	6.77 E+03	6.89 E+03
Radium total (pCi/L)	4	2	DL	1.39 E-01	2.44 E-02	1.79 E-01	1.82 E-01

NOTE: Measurements are in ppb except where noted.

[a]N = Number--the total number of results in each data set reported for this stream configuration.

[b]MDA = minimum detectable amount--the number of results in each data set below the detection limit.

[c]Method = replacement method used:

DL = replacement by the detection limit

LM = replacement of single-valued MDAs by the log-normal plotting position method

MR = replacement of multiple valued MDAs by the normal plotting position method

NA = not applicable.

[d]90%CI limit = 90% confidence interval limit--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.

[e]Maximum = 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.

[f]Ignitability is the maximum temperature of the test (no sample actually ignited).

EP = Extraction Procedure Toxicity Test

TOC = total organic caron

TOX = total organic halides

Twenty-three chemical analytes were identified in the sampling program at above detection level. Of these 23 analytes, five (acetone, 2-butanone, bromodichloromethane, trichloromethane, and copper) were below detection level for all but one sample analysis. Ammonia was the only analyte detected in two of the four samples.

3.2.2 Radiological Constituents

The radiological constituents of the wastestream identified in the four samples were in general limited to tritium (^{3}H), total radium alpha and gross beta data. Cobalt 60 and cesium 137 were reported to be detected in the sample taken on November 21, 1989. The statistical summary in Table 3-2 includes the radiological data. The sampling data for gross beta and ^{3}H, corresponds well with the 400 Area pond activity as reported in the *Hanford Site Environmental Report for Calendar Year 1988* (PNL 1989). It should be noted that the November 21, 1989, data sample, which identified two specific beta-emitting radionuclides ^{60}Co and ^{137}Cs (91 and 95 pCi/L, respectively), is not consistent with the gross beta activity (20 pCi/L) reported for the same sampling data. These radionuclides were not identified in any of the other three samples which had gross beta activity between 12 and 31 pCi/L. The implications of this will be discussed further in Section 4.0.

4.0 DATA OVERVIEW

The purpose of this section is to evaluate characterization data obtained through sampling. This will be accomplished through comparison of the sampling data to established water contaminant standards, evaluate the overall stream information to provide a stream-loading estimate and to compare the processing data to the sampling data.

4.1 DATA COMPARISON

Table 4-1 presents a comparison of the average wastestream analytes to various screening criteria. These criteria are not used for compliance purposes relative to the stream discharge. One of these criteria is the maximum contaminant levels (MCL) addressed by the drinking water standard. The average pH of the stream which exceeds the secondary drinking water standards is not unexpected because of the source of the water (wells), which is high in salts, and the nature of evaporative cooling process, which tends to concentrate these salts. Additionally, the radionuclides are compared to both the MCL values and the Derived Concentration Guide (DCG) values established by the DOE. As previously discussed in Section 3.2.2 the identified ^{60}Co and ^{137}Cs activity is suspect as a result of the inconsistencies with the other radiological data, including the samples taken in 1987 which are contained in Appendix D.

4.2 STREAM DEPOSITION RATES

Table 4-2 uses the process flow information presented in Section 2.4 and the average analyte data from sampling data to calculate a deposition rate associated with the stream. The single sample analysis which indicated the presence of ^{60}Co and ^{137}Cs, discussed above in Section 4.1, is reflected in the data presented. While the average value for these radionuclides and the resulting deposition rate is relatively low, it should be considered as a very conservative approach. The process sewer is not a disposal system for process-derived radionuclides in the 400 Area. The reported detection of ^{60}Co and ^{137}Cs should not be construed as a normal occurrence which would result in a longterm deposition of these radionuclides in the soil.

4.3 PROCESS DATA INTEGRATION

This section presents a comparison of the processing data set (see Section 2.0) with the sampling data set (see Section 3.0) to determine the identity and concentration levels of the chemical analytes present in the 400 Area Process Sewer wastestream. Table 4-3 presents a side-by-side presentation of information given earlier in Tables 2-4 and 3-3.

Table 4-1. Effluent Constituent Comparison to Maximum Containment Levels and Derived Concentration Guides.

Constituent	Result (mg/L)[a]	SV1 (mg/L)[b]	SV2 (mg/L)[c]
Barium	3.5 E-02	5.0 E+00[b.3]	
Chloride	2.1 E+01	2.5 E+02[b.4]	
Copper	1.0 E-02	1.0 E+00[b.4]	
Fluoride	6.7 E-01	2.0 E+00[b.3]	
Iron	5.4 E-02	3.0 E-01[b.4]	
Manganese	1.3 E-02	5.0 E-02[b.4]	
Nitrate	1.1 E+00	4.5 E+01[b.1]	
Sulfate	6.4 E+01	2.5 E+02[b.4]	
Zinc	3.4 E-02	5.0 E+00[b.4]	
Trihalomethane[d]	1.1 E-02	1.0 E-01[b.3]	
Beta activity (pCi/L)[e]	1.9 E+01		1.0 E+03
^{60}Co (pCi/L)	2.3 E+01	2.0 E+02[b.1]	5.0 E+03
^{137}Cs (pCi/L)	3.2 E+01	1.0 E+02[b.1]	3.0 E+03
^{3}H (pCi/L)	6.5 E+03	9.0 E+04[b.1]	2.0 E+06
TDS	4.6 E+02	5.0 E+02[b.4]	

NOTE: Measurements are in mg/L except where noted.

[a]The results are the mean values reported in Table 3-3.

[b]Screening value 1 (SV1) lists the value first, basis second and an asterisk (*) third if the result exceeds the regulatory value; bases are listed below:

[b.1]The proposed primary MCL

[b.2]The proposed secondary MCL

[b.3]The primary MCL

[b.4]The secondary MCL.

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 WHC-EP-0342, *Hanford Site Stream-Specific Reports* (WHC 1990d).

[c]Screening value 2 (SV2) lists the value first and a plus (+) 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* (WHC 1990e).

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

[e]The SV2 for gross beta is used to evaluate beta activity.

Table 4-2. Stream Deposition Rate.

Constituent	Concentration (kg/L)[a]	Deposition rate (kg/mo)[b]
Barium	3.45 E-08	1.03 E-01
Boron	4.85 E-08	1.44 E-01
Calcium	5.51 E-05	1.64 E+02
Chloride	2.06 E-05	6.13 E+01
Copper	1.02 E-08	3.04 E-02
Fluoride	6.69 E-07	1.99 E+00
Iron	5.37 E-08	1.60 E-01
Lithium	2.87 E-08	8.54 E-02
Magnesium	1.57 E-05	4.67 E+01
Manganese	1.32 E-08	3.93 E-02
Nitrate	1.11 E-06	3.30 E+00
Potassium	1.62 E-05	4.82 E+01
Silicon	3.74 E-05	1.11 E+02
Sodium	6.46 E-05	1.92 E+02
Strontium	2.85 E-07	8.48 E-01
Sulfate	6.40 E-05	1.90 E+02
Uranium	3.19 E-10	9.49 E-04
Zinc	3.40 E-08	1.01 E-01
Acetone[c]	1.42 E-08	4.23 E-02
Ammonia	8.00 E-08	2.38 E-01
Bromodichloromethane[c]	5.00 E-09	1.49 E-02
2-butanone[c]	9.50 E-09	2.83 E-02
Trichloromethane[c]	5.75 E-09	1.71 E-02
Beta activity*	1.90 E-11	5.65 E-05
TDS	4.57 E-04	1.36 E+03
TOC	2.17 E-06	6.46 E+00
Total carbon	6.09 E-05	1.81 E+02
TOX (as Cl)	1.42 E-07	4.23 E-01
^{60}Co*	2.32 E-11	6.90 E-05
^{137}Cs*[c]	3.19 E-11	9.49 E-05
^{3}H*	6.54 E-09	1.95 E-02
Radium total*	1.39 E-13	4.14 E-07

NOTE: The stream flowrate is 2.98 E+06 L/mo. The flowrate is the average of rates from Section 2.0. The data was collected between October 1989 and March 1990.

[a]Constituent concentrations are average values from Table 3-2. Concentration units of flagged (*) constituents are reported as curies per liter.

[b]Deposition rate units of flagged (*) constituents are reported as curies per test.

[c]Constituents detected above detection limits only once during the sampling. The detection limit was used to establish an average value for the stream.

Table 4-3. Comparison of Sampling Data to Process Data.

Comparative analyte	Sample data[a] (ppb)	Process data (ppb)
Alpha activity (pCi/L)	0.2	0.4
Beta activity (pCi/L)	26	24
Barium	39	40
Chloride	24,700	30,250
Conductivity (μs)	745	1,100
Copper	10.7	275
Fluoride	687	825
Magnesium	17,400	1,250
Manganese	16.7	<25
Nitrate	1,280	1,100
Potassium	18,300	20,000
Sodium	72,100	72,500
Sulfate	71,400	85,000
Tritium	6,890	6,500
Zinc	45	<250
Noncomparative analyte	**Sample data[a]**	**Process data**
2-methyl-4-isothiazoline-3-one		100
5-chloro-2-methyl-4-isothiazoline-3-one		300
Acetone	21.2	
Ammonia	109	
Bromodichloromethane	5	
2-butanone	11.6	
Calcium	62,400	
Iron	75	
pH	9	
Silicon	4,170	
Strontium	320	
Trichloromethane	7	
TOC	2,360	
TOX (μg/g)	214	
Uranium	0.5	
Dearborn	727	180,000[b]

[a] 90% CI value used.

[b] Proprietary constituents (water and organic phosphates) not identified on Material Safety Data Sheets (MSDS) (Appendix B) as hazardous ingredients.

The sampling portion is composed of sufficient discrete data (i.e., individual grab sample results) to permit statistical summarization. The 90%CILim value from Table 3-3 was used. However, the process estimates are derived from a single data set. The peak process knowledge estimate was based upon the constituents in the cooling tower effluent (listed in Table 2-4), which represent 85% or more of the total water source. Although this ignores the contribution from noncooling tower water and potentially reduced cycling in the cooling towers because of equipment malfunctions (leaks), it offers a upper limit comparison.

In comparing sample data with process data, some parameters have values in one data set but do not have corresponding values in the other. The process data have a total of 13 constituents and the sampling data have a total of 27 analytes. The combination of these two data sets gives 30 unique parameters. Sanitary water detection limits (e.g., "less than" values) are used for the process variable for manganese and zinc, while other "less than" values (listed in Table 2-4), which did not have a corresponding analyte in the sample data, are ignored. The values chosen for the gross alpha and gross beta activity correspond to the activity data from the sanitary water data, which is multiplied by the 2.5 concentration factor anticipated in the cooling towers. Analytes for which a detection limit is not available to substitute for missing process data or sampling data are listed separately.

Of the 14 parameters, most were in relative agreement with the exception of magnesium, which suffers from incomplete process data. The 1,250 ppb identified in Table 4-3 is based only on the additions of biocide, Dearborn 702, to the tower and does not include any contribution from the sanitary water supply as a result of lack of data.

The maximum temperature of the discharge to the process pond was predicted by sampling data as 19 °C. This temperature represents an anticipated maximum for the current situation. Because this flow primarily represents an evaporative cooling wastestream, the water temperature mix would reflect conditions in the cooling tower sumps, with some small waste heat addition from direct cooling sources. The maximum temperature associated with the discharges from the cooling towers is primarily dependent on the maximum ambient wet bulb temperature, because the process involves evaporative cooling. Under high ambient temperatures and corresponding heat load, the sump temperature will be approximately 5 °C above the wet bulb temperature. The maximum anticipated wet bulb temperature is 21 °C on the Hanford Site.

The maximum pH of the effluent was predicted by sampling data to be 9. This does correspond well with anticipated conditions in cooling towers and other, less formal but more extensive, testing of effluent pH over the past 9 yr. A pH near 9.0 is consistent with process information.

The variance of the data does not allow for an exact quantitative mass balance. The major discrepancies between the two descriptions can be attributed primarily to the completeness of the process data and shown to be of little significance. A more complete raw water analysis would be expected to account for many of the unmatched constituents in the wastestream as well (e.g., calcium, iron, magnesium, silicon, strontium). However, a mass balance

would still be incomplete because many of these constituents are associated with the scale that is formed in the cooling towers and leaves the towers in solid form. Certain compounds that were detected sporadically at relatively low levels (e.g., acetone, bromodichloromethane, 2-butanone, trichloromethane) are not considered to represent items that are unmatched as a result of a lack of process data. These substances, which have other waste implications, will be discussed separately in Section 5.0.

The above discussion can be used to address the constituents contained in the scale inhibitor Dearborn 727. The potential 180,000 ppb of Dearborn 727, which is not specified in the product literature, does not appear to represent any significant issue because there are no corresponding analytes of significant concentration contained in the sample analysis. Even if these organic phosphate concentrations were readily available, the concentration could be affected by the cooling tower scale formation. An exact mass balance is not needed to designate this stream. The designation process requires only a conservative data set that accurately depicts the 400 Area Process Sewer wastewater. Because sampling data is in relatively good agreement for most of the parameters, the sampling point and resulting data can be considered a good representation of the chemical constituents in the 400 Area Process Sewer wastewater.

Process knowledge of transient conditions, e.g., application of microbicide in the cooling towers or discharges from infrequent sources, would not be characterized in this data set. For this reason, in the designation section, the application of the cooling tower chemicals, including the microbicide, is addressed separately. The current infrequent sources represent discharges of condensate or process water that under current facility conditions are inconsequential and do not justify further discussion. When operations in the FMEF are initiated, the contributions from these sources will require further evaluation and potential monitoring, but no constituents of significance are anticipated.

5.0 DESIGNATION

This section proposes that the 400 Area Process Sewer not be designated a dangerous waste. This proposed designation uses data from both the effluent source description and sampling data (Sections 2.0 through 4.0) and complies with the designation requirements of WAC 173-303-070.

The procedure for determining whether a waste is a dangerous or extremely hazardous waste is contained in the Washington State Dangerous Waste Regulations (WAC 173-303-070). This procedure is illustrated in Figure 5-1 and includes the following:

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

5.1 DANGEROUS WASTE LISTS

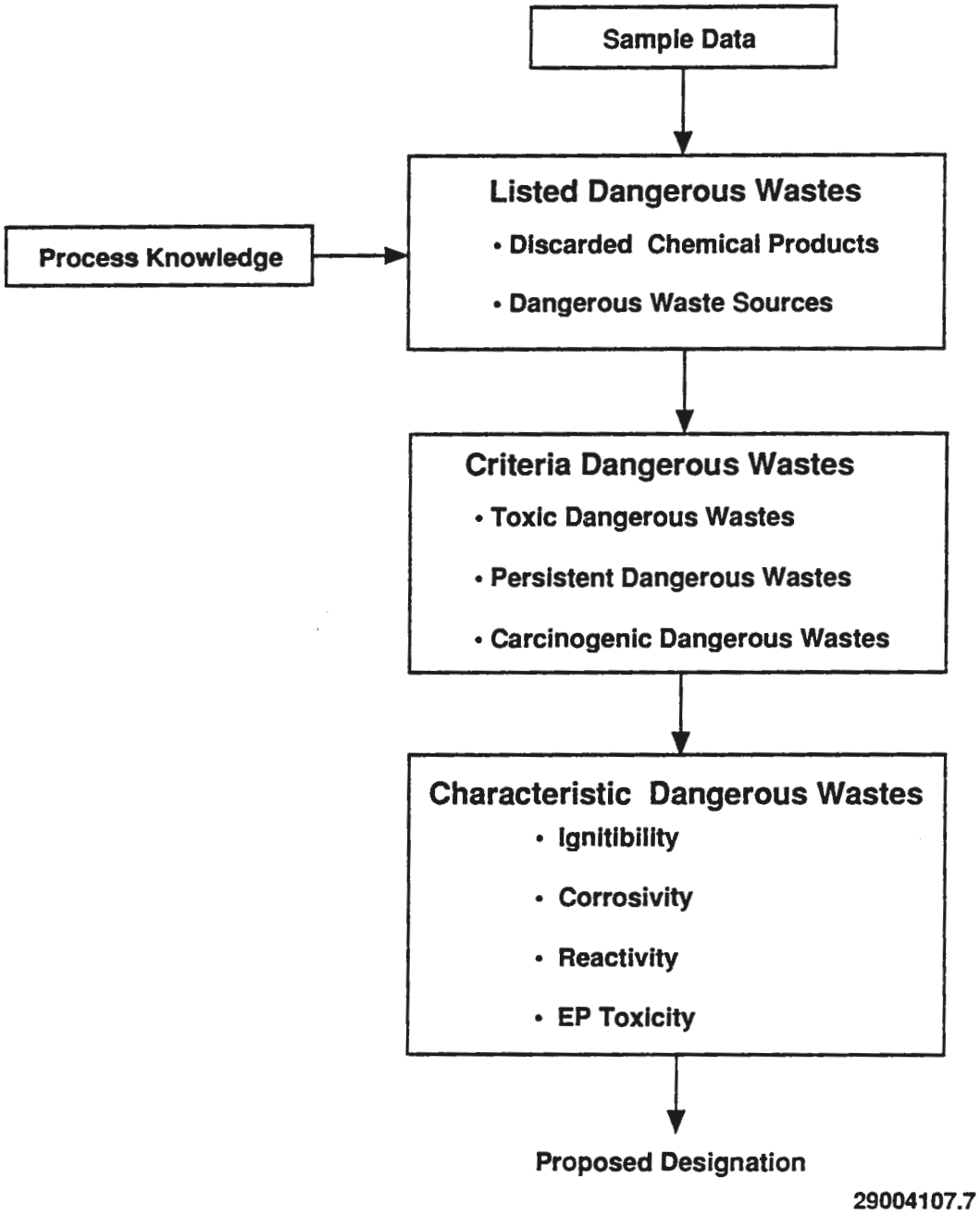
A waste is considered a listed dangerous waste if it either contains a discarded chemical product (WAC 173-303-081) or originates from a dangerous waste source (WAC 173-303-082). The proposed designation was based upon a combination of process knowledge and sampling data.

5.1.1 Discarded Chemical Products

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 had been discarded. Commercial chemical products which, as purchased, contain two or more active ingredients, and were not designated as potential discarded chemical products. Products which contain nonactive components, such as water, were designated if the sole active ingredient in the mixture was listed in WAC 173-303-9903.
- 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.

Figure 5-1. Designation Procedure.



In this report, the evaluation of this criterion is based on a review of spill data reported 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 when not disposed of in accordance with the regulations.

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. Two major categories of sources are found 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), none of which occur in the 400 Area.

5.2 LISTED WASTE DATA CONSIDERATIONS

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

5.2.1 Process Evaluation

The process evaluation began with a thorough review of the processes contributing to the wastestream. Processes were reviewed and compared with the discarded chemical products list and the dangerous waste source list. This process evaluation is necessary because the stream is a listed waste in accordance with the mixture rule if a listed waste is known to have been added at any upstream location, even if a listed constituent could not be detected at the sample point. The process evaluation included a review of the following information sources:

- MSDS
- Superfund Amendments and Reauthorization Act (SARA) 312 Inventory reports
- Operating procedures
- Chemical inventories
- Physical inspections.

Additionally, discussions with appropriate facility personnel were conducted to determine if any procedures associated with maintenance or operations generated a listed waste which may not have been evident during other portions of the process evaluation.

If a listed chemical was identified, the specific use of the chemical was evaluated to determine if such use resulted in the generation of a listed waste, which could have been discharged to the 400 Area Process Sewer.

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 chemical 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.

Westinghouse Hanford Company developed a procedure for combining the inorganic constituents into chemical substances. This screening procedure is described in *The Wastestream Designation of Liquid Effluent Analytical Data* (WHC 1990c) and is intended to be a tool in the evaluation of a wastestream. The listing of the inorganic substances developed by 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.

5.3 PROPOSED LISTED WASTE DESIGNATION

A process evaluation, along with a review and evaluation of sampling data, indicated that the 400 Area Process Sewer did not contain a discarded chemical product or any listed waste source. The following sections discuss the evaluation that was conducted to substantiate this conclusion.

5.3.1 Discarded Chemical Products

As discussed in Section 5.2, a process evaluation of the contributors to the 400 Area Process Sewer was conducted. This evaluation included a review of MSDSs at the plant and chemical inventories compiled for compliance with the SARA Title III requirements for possible listed waste contributors. Six maintenance chemicals and two chemical products, used as refrigerants at the FFTF and FMEF (see Sections 2.2.1.2 and 2.2.4.2) appear on the WAC 173-303-9903 list. The two refrigerants are used on a regular basis in areas served by drains associated with the sewer and could potentially be introduced into the 400 Area Process Sewer wastestream. The maintenance chemicals are not stored or used on a regular basis in the areas served by the drains. One additional potential discarded chemical was identified by sampling data.

The nine potential discarded chemical products identified in the process evaluation and review of material inventories on the 400 Area Site include dichlorodifluoromethane (U075) and trichloromonofluoromethane (U121); 1,1,1 trichloromethane (U226); xylene (U239); acetone (U002); methanol (U154); methyl isobutyl ketone (U161); methyl ethyl ketone (U159); and toluene (U220). Two of these chemicals, acetone and methyl ethyl ketone (2-Butanone), appeared in the sampling data. Additionally, the sample data did indicate the presence of two additional potential discarded chemicals: hydrogen fluoride (U134) as a result of ionic pairing described in Section 5.4.1.1 and trichloromethane (U044) from volatile organic analysis (VOA). Each of these will be discussed in section below.

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 Refrigerants. The chiller refrigerants dichlorodifluoromethane and trichloromonofluoromethane are the only substances used on a regular basis in areas served by drains associated with the 400 Area Process Sewer that contain sole active ingredients on the 9903 Lists. Dichlorodifluoromethane (R-12) is used in FFTF chillers, which are located in the 484 Building south of the FFTF cooling towers. Trichloromonofluoromethane (R-11) is used in the FMEF chillers, which are located in the mechanical equipment room, and is serviced by process sewer floor drains. Most of the materials are stored within the chillers and in process, being used for their intended purpose. As such, they would not be considered commercial chemical products. Chiller maintenance requires the addition of refrigerant to the machines. The refrigerant material qualifies as a commercial chemical product before it is added to the machine. It is not likely that either product would be discarded into the liquid wastestream. The R-12 is a gas at anticipated atmospheric conditions and, therefore, direct discharge into the wastestream would be difficult. While fugitive emissions of R-12 from storage in the chillers could be scrubbed from the air by the cooling towers, this action would not be considered discarding a chemical product because the substance being released would be a spent chemical and not a commercial chemical product

(*Federal Register*, 54 FR 3136, p. 31335 [EPA 1989]). The R-11, which is a liquid below normal room temperature, is purchased packaged in quantities consistent with the amount to be added to the chillers.

5.3.1.2 Maintenance Chemicals. The following 9903 List maintenance chemicals are available for use in the 400 Area in conjunction with maintenance activities: 1,1,1 trichloromethane (U226), xylene (U239), acetone (U002), methanol (U154), methyl isobutyl ketone (U161), methyl ethyl ketone (U159) and toluene (U220). None of the materials were stored in areas that would result in a spill to the 400 Area Process Sewer. The current use of these chemicals is limited to use in shop areas (Buildings 4722-C, 4713-B and 4713-D), which are not serviced by the 400 Area Process Sewer drains.

Two of these chemicals, acetone and methyl ethyl ketone (2-butanone), were each detected once by VOA testing at levels of 27 ppb and 12 ppb, respectively, on the same sample date October 20, 1989. On this same sample date, 2-butanone was detected at higher concentrations (23 ppb and 19 ppb) in the both the trip and blank samples associated with this stream. Two other chemicals were also detected by the VOA test in control samples that day, dichloromethane and tetrahydrofuran, yet not detected in the stream sample. The rejection criteria for acetone and methyl ethel ketone based on blank analysis are 37 ppb and 59 ppb, respectively, as presented in Section 5.2 of WHC-EP-0342. The concentration of both acetone and methyl ethyl ketone reported in the October 20, 1989, sample were below these values; therefore, the reporting of the two substances on October 20, 1989 in the stream as detected by VOA testing does not conclusively indicate their presence. The process information did not indicate these or any other 9903 List chemicals were entering the 400 Area Process Sewer wastestream. Therefore, it is reasonable to conclude that no discarded maintenance chemical products are identified.

5.3.1.3 Hydrogen Fluoride. One discarded chemical product (per WAC-173-303-9903) was identified from sampling data of the 400 Area Process Sewer. This substance, hydrogen fluoride (U134), was identified by the ionic pairing of fluoride in the effluent stream. Because fluoride is found in the water as removed from the water supply wells (Table 2-3) and accounted for in the process evaluation (Table 4-3), the detection of fluoride does not suggest introduction of hydrogen fluoride to the wastestream by the process.

5.3.1.4 Trichloromethane. Trichloromethane (U044) was detected only once in the four samples taken at a concentration of 8 ppb in the wastestream. The process review did not indicate the storage or use of trichloromethane (chloroform) in the 400 Area. Although the value detected (8 ppb) exceeded the rejection criteria for chloroform based on the sanitary water supply to the 400 Area of 2.6 ppb as presented in Section 5.2 of WHC-EP-0342, additional information contained in the sampling data for the stream indicates that the detection can be reasonably attributed to the supply water.

The Hanford Sanitary Water Quality Surveillance (HEHF 1989) report (Appendix C) indicates a potential explanation for the detection of chloroform in the water. The report addresses and reports (page C-18) the concentration

of trihalomethanes (which reflects trichloromethane and bromodichloromethane primarily for the 400 Area water) in the sanitary water onsite. The report (page C-16) provides an explanation of the presence of these substances as a result of a interaction between the chlorine added for disinfection of the water and naturally occurring organic substances in the source water. The reported quarterly values for trihalomethane concentration shown on page C-18 for the 400 Area supply indicates that there is normally very near or below the detectable levels which is reflected in the value of 2.6 ppb for 400 Area chloroform presented in Section 5.2 of WHC-EP-0342. The reported values for two other analytes, bromodichloromethane and chloride, in the same sample that detected the chloroform (December 6, 1989) tend to indicate that the chloroform was a result of higher-than-normal chlorination of the water on that particular day of the sample. The chloride level detected in the December 6, 1989 sample (27,200 ppb) was 50% higher than the average (18,300 ppb) of the other three samples and approximately twice as high as the average chloride reported in the HEHF report (page C-17) (11,900 ppb) for the sanitary water. Considering that the expected concentration for chloroform is below the detection limit associated with the stream sampling (5 ppb) and that the only detection above the detection limit coincides with the only detection of another triholomethane (bromodichloromethane at 5 ppb) in a higher-than-normal chloride situation, it is reasonable to assume the sampling has detected a higher-than-normal chlorination of the 400 Area water supply. Based on this explanation and the fact that process information did not indicate this or any other 9903 List chemicals were entering the 400 Area Process Sewer wastestream, it is reasonable to conclude that no discarded chemical products are identified.

5.3.2 Dangerous Waste Sources

The process evaluation (see Section 5.2) was also used to determine if the wastestream included any specific waste sources (K wastes) or any nonspecific waste sources (F Wastes) in the Dangerous Waste Source List WAC 173-303-9904. As discussed in Section 5.2.1.3, use of chemicals which could potentially generate F wastes is limited to areas not serviced by 400 Area Process Sewer drains.

Sampling data were used to enhance the process evaluation. All potential listed solvents identified by the sampling data have been discussed previously in Sections 5.3.1.2 and 5.3.1.4.

Based on the discussions and data presented, it is concluded that the wastestream does not have a dangerous waste source.

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 *The Wastestream Designation of Liquid Effluent Analytical Data* (WHC 1990c).

Summaries of the methods, along with the results, are contained in the following sections. This evaluation addresses the issues associated with dangerous waste mixtures (WAC 173-303-84) which will not be addressed separately from this criteria waste discussion.

5.4.1 Toxic Dangerous Wastes

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

- Collect and analyze multiple samples from the wastestream.
- Calculate the upper limit of the 90%CI for each analyte in the wastestream.
- 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 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 inorganics, postulated to be in the wastestream.
- Calculate the contribution of 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.

This process not only accounts for known process contributions and permutations, but also evaluates contaminants that may be associated ancillary contributions to the stream, such as contaminants in the raw water or contaminants added from the external environment, e.g., dust. Table 5-1 documents how ion analytes were assigned to neutral substances which are required for designation. The table accounts for charge balancing the ion assemblage (from Table 3.3) and the subsequent formulation of neutral substances. A detailed discussion can be found in WHC-EP-0334 (WHC 1990c).

Sixteen substances potentially present in the 400 Area Process Sewer were determined to have toxic categories associated with them. These substances are listed in Table 5-2. Because the equivalent concentration sum is 3.53 E-06%, which is less than the cut off of 1.0 E-03% (i.e., 0.001%), the wastestream is not a toxic dangerous waste based on the sample analysis. This indicates that the effect of ancillary contributions from external sources (raw water and airborne) are negligible and the cooling tower chemical use dominates the designation of the material under this category.

Table 5-1. Organic Chemistry Report. (sheet 1 of 2)

Charge Normalization

Constituent	Value (ppb)[a]	Ion	Ion Concentration (Eq/g)[b]	Normalized (Eq/g)
Barium	3.88 E+01	Ba^{+2}	5.65 E-10	
Boron	5.36 E+01	$B_4O_7^{-2}$	2.48 E-09	3.88 E-09
Calcium	6.24 E+04	Ca^{+2}	3.12 E-06	
Chloride	2.47 E+04	Cl^{-1}	6.97 E-07	1.09 E-06
Copper	1.07 E+01	Cu^{+2}	3.36 E-10	
Fluoride	6.87 E+02	F^{-1}	3.61 E-08	5.66 E-08
Iron	7.45 E+01	Fe^{+3}	4.00 E-09	
Lithium	3.21 E+01	Li^{+1}	4.63 E-09	
Magnesium	1.74 E+04	Mg^{+2}	1.43 E-06	
Manganese	1.67 E+01	Mn^{+2}	6.10 E-10	
Nitrate	1.28 E+03	$NO3^{-1}$	2.06 E-08	3.22 E-08
Potassium	1.83 E+04	K^{+1}	4.69 E-07	
Silicon	4.17 E+04	S_iO3^{-2}	2.97 E-06	4.64 E-06
Sodium	7.21 E+04	Na^{+1}	3.14 E-06	
Strontium	3.20 E+02	Sr^{+2}	7.31 E-09	
Sulfate	7.14 E+04	$SO4^{-2}$	1.49 E-06	2.33 E-06
Uranium	4.61 E-01	$UO2^{+2}$	3.88 E-12	
Zinc	4.48 E+01	Zn^{+2}	1.37 E-09	
Hydrogen Ion (from pH 9.1)		H^+	(8.57 E-13)	
Hydroxide Ion (from pH)		OH^-	(1.17 E-08)	
Cation total			8.17 E-06	
Anion total			5.22 E-06	
Anion normalization factor	1.564			

Substance Formation

Substance[c]	Percent (g/100 g)[d]	Cation out[e]	Anion out[e]
Copper(II) chloride	2.26 E-06	0.00 E+00	1.09 E-06
Uranyl nitrate	7.64 E-08	0.00 E+00	3.22 E-08
Iron(III) fluoride	1.51 E-05	0.00 E+00	5.26 E-08
Potassium fluoride	3.05 E-04	4.17 E-07	0.00 E+00
Barium chloride	5.88 E-06	0.00 E+00	1.09 E-06
Zinc nitrate	1.30 E-05	0.00 E+00	3.09 E-08
Magnesium chloride	5.19 E-03	3.43 E-07	0.00 E+00
Magnesium nitrate	2.43 E-04	3.12 E-07	0.00 E+00
Calcium tetraborate	3.79 E-05	3.11 E-06	0.00 E+00
Magnesium sulfate	1.88 E-03	0.00 E+00	2.01 E-06
Sodium metasilicate	1.91 E-02	0.00 E+00	1.51 E-06
Lithium sulfate	2.54 E-05	0.00 E+00	2.01 E-06
Potassium metasilicate	3.21 E-03	0.00 E+00	1.09 E-06

Table 5-1. Organic Chemistry Report. (sheet 2 of 2)

Substance Formation			
Substance[c]	Percent (g/100 g)[d]	Cation out[e]	Anion out[e]
Manganese(II) metasilicate	3.99 E-06	0.00 E+00	1.09 E-06
Strontium sulfate	6.71 E-05	0.00 E+00	2.00 E-06
Calcium sulfate	1.36 E-02	1.11 E-06	0.00 E+00

[a]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 1.00 E-20 (Eq/g)**2 divided by the hydrogen ion value (in "Ion concentration [Eq/g]").

[b]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.

[c]Substance names may include MB (monobasic), DB (diasic), TB (tribasic) to identify the equivalents of hydrogen ion that have been neutralized from polyprotic weak acids to form their conjugate bases. Substances are formulated in the order listed.

[d]The percent of the substance in the waste (g/100 g).

[e]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 "Cation Out" and "Anion Out" columns indicate the residual concentrations (in Eq/g) of each ion after a substance concentration has been calculated.

Table 5-2. Dangerous Waste Designation Report. (sheet 1 of 2)

Dangerous Waste Data Designation Report for 400 Area Secondary Cooling Water

Finding: Undesignated

Discarded Chemical Products - WAC 173-303-081

Substance	Review Number	Status	DW Number
Hydrogen fluoride	U134(DW)	Not Discarded	Undesignated
Acetone	U002(DW)	Not Discarded	Undesignated
2-Butanone	U159(DW)	Not Discarded	Undesignated
Trichloromethane	U044(EHW)	Not Discarded	Undesignated

Dangerous Waste Sources - WAC 173-303-082

Substance	Review Number	Status	DW Number
Acetone	F003	Unlisted Source	Undesignated
2-Butanone	F005	Unlisted Source	Undesignated

Infectous 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%
Barium chloride	5.88E-09	0.00E+00	0.00E+00	0.00E+00
Calcium tetraborate	3.79E-09	0.00E+00	0.00E+00	0.00E+00
Copper(II) chloride	2.26E-07	0.00E+00	0.00E+00	0.00E+00
Iron(III) fluoride	1.51E-07	0.00E+00	0.00E+00	0.00E+00
Magnesium chloride	5.19E-07	0.00E+00	0.00E+00	0.00E+00
Magnesium nitrate	2.43E-08	0.00E+00	0.00E+00	0.00E+00
Magnesium sulfate	1.88E-07	0.00E+00	0.00E+00	0.00E+00
Potassium fluoride	3.05E-07	0.00E+00	0.00E+00	0.00E+00
Sodium metasilicate	1.91E-06	0.00E+00	0.00E+00	0.00E+00
Uranyl nitrate	7.64E-10	0.00E+00	0.00E+00	0.00E+00
Zinc nitrate	1.30E-08	0.00E+00	0.00E+00	0.00E+00
Acetone	2.12E-10	0.00E+00	0.00E+00	0.00E+00
Ammonia	1.09E-07	0.00E+00	0.00E+00	0.00E+00
Bromodichloromethane	0.00E+00	5.00E-07	0.00E+00	0.00E+00
2-Butanone	1.16E-10	0.00E+00	0.00E+00	0.00E+00
Trichloromethane	6.98E-08	6.98E-07	0.00E+00	6.98E-07
Total	3.53E-06	1.20E-06	0.00E+00	6.98E-07
DW Number	Undesignated	Undesignated	Undesignated	Undesignated

Dangerous Waste Characteristics - WAC 173-303-090

Characteristic	Value	DW Number
Ignitability (Degrees F)	>210	Undesignated
Corrosivity-pH	9.07	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

Table 5-2. Dangerous Waste Designation Report. (sheet 2 of 2)

Dangerous Waste Data Designation Report for 400 Area Secondary Cooling Water

Dangerous Waste Criteria - WAC 173-303-100

Substance	Toxic EC%	Persistant HH%	Persistant PAH%	Carcinogenic Total%	DW Number-Positive
Barium chloride	5.88E-09	0.00E+00	0.00E+00	0.00E+00	
Calcium tetraborate	3.79E-09	0.00E+00	0.00E+00	0.00E+00	
Copper(II) chloride	2.26E-07	0.00E+00	0.00E+00	0.00E+00	
Iron(III) fluoride	1.51E-07	0.00E+00	0.00E+00	0.00E+00	
Magnesium chloride	5.19E-07	0.00E+00	0.00E+00	0.00E+00	
Magnesium nitrate	2.43E-08	0.00E+00	0.00E+00	0.00E+00	
Magnesium sulfate	1.88E-07	0.00E+00	0.00E+00	0.00E+00	
Potassium fluoride	3.05E-07	0.00E+00	0.00E+00	0.00E+00	
Sodium metasilicate	1.91E-06	0.00E+00	0.00E+00	0.00E+00	
Uranyl nitrate	7.64E-10	0.00E+00	0.00E+00	0.00E+00	
Zinc nitrate	1.30E-08	0.00E+00	0.00E+00	0.00E+00	
Acetone	2.12E-10	0.00E+00	0.00E+00	0.00E+00	
Ammonia	1.09E-07	0.00E+00	0.00E+00	0.00E+00	
Bromodichloromethane	0.00E+00	5.00E-07	0.00E+00	0.00E+00	
2-Butanone	1.16E-10	0.00E+00	0.00E+00	0.00E+00	
Trichloromethane	6.98E-08	6.98E-07	0.00E+00	6.98E-07	Undesignated
Total	3.53E-06	1.20E-06	0.00E+00	6.98E-07	
DW Number	Undesignated	Undesignated	Undesignated	Undesignated	

Dangerous Waste Constituents - WAC 173-303-9905

Substance
Hydrogen fluoride
Acetone
Trichloromethane
Barium 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.

5.4.1.2 Process Data. The discharge to the 400 Area Process Sewer is primarily associated with the effluent from the FFTF and FMEF cooling towers. The other contributions to the stream can be considered negligible because they represent a very small percentage of the total discharge and do not contribute any identified substances to the stream.

The cooling tower effluent system process control information, along with vendor-supplied data, is used to establish a waste designation. Because the vendor-supplied data is product-related and not individual constituent-related, ancillary contributions from external sources (raw water and airborne) are used for evaluation of sample data in Section 5.3.1.2. As a conservative approach, the following additional assumptions will be made in establishing an equivalent concentration for the wastestream.

- From information on fish toxicity supplied by the cooling tower chemical supplier (see Dearborn Letter in Appendix B), the materials that are added to the cooling tower water can be given the following conservative toxic category assignments:

  - Dearborn 702 - Toxic Category B — 96 h LC_{50} = 8 ppm for fathead minnow
  - Dearborn 717 - Toxic Category A — 96 h LC_{50} = 0.28 ppm for rainbow trout
  - Dearborn 727 - Toxic Category D — 96 h LC_{50} > 1000 ppm for rainbow trout

- As a conservative approach, residual concentration of the chemical biocides (Dearborn 702 and 717) is assumed constant. Because of the biological interaction and the volatilization of the biocides added to the tower, the concentrations of materials are known to dissipate while in an operating tower. Since chemical addition to nonoperating towers is not precluded, it is assumed that no dissipation occurs and the concentration of biocide remains constant when discharged.

- The concentration of the chemical scale inhibitor (Dearborn 727) is assumed to triple during the evaporative cooling process. As described in Section 2.3.1.2, the towers are operated and instrumented to control the number of "cycles" for the water used to less than three. This could result in a tripling of the concentration of the chemicals constituents. This product is not known to dissipate in contrast to the biocides discussed previously.

Process inputs			Residual concentrations	
Dearborn 702	-	25 ppm	25 ppm	0.0025%
Dearborn 717	-	80 ppm	80 ppm	0.008%
Dearborn 727	-	80 ppm	240 ppm	0.024%

Equivalent Concentration (EC) = %X +%A/10 +%B/100 +%C/1000 +%D/10000

EC = 0 + 0.008/10 + 0.0025/100 + 0 + 0.024/10000

EC = 0.0008274%

Because the upper limit for the %EC sum associated with cooling tower operation can be assumed to be 0.00083%, which is less than 0.001%, cooling tower discharges to the 400 Area Process Sewer wastestream would not be considered a toxic dangerous waste.

Of the two %EC sums derived, one based on sample analysis and the other based on process knowledge, both are less than 0.001%. Therefore, the 400 Area Process Sewer wastestream is not a toxic dangerous waste. The higher sum, the process knowledge %EC, was dominated by the contribution from the Dearborn 717. It should be noted that this product is normally used only in a batch addition-type application to the towers during the summer and to the operating towers as a shock treatment. The inclusion of this product in the calculation for a %EC is intended to establish an upper bound.

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 90%CI for the substances of interest.
- Calculate the weight percent (wt%) contribution of each HH and PAH.
- Sum the resulting wt% of the contributors separately.
- Designate the wastestream as persistent if the wt% contribution of the HHs is greater than 0.01% or if the wt% contribution of the PAHs is greater than 1.0%, per WAC 173-303-9907.

Two HH and no PAH substances were identified by the sampling data. The two identified chemicals are bromodichloromethane and trichloromethane. The detection of trichloromethane has been discussed previously in Section 5.3.1.4 and could be considered a potential normal constituent of the wastestream. Bromodichloromethane is not known to be a substance contained in any process chemical used in the area and since it was only detected once at the detection limit of 5 ppb and never detected in any blank data sampling it could be considered a potential normal constituent of the waste stream. The weight presents based on the 90%CI for each of these substances are shown in Table 5-2 and result in a sum total wt% HH of 1.20E-06%. This is well below the specified 0.01% contained in WAC 173-303-9907.

As discussed in Section 5.3.1, there is the potential of scavenging refrigerant from fugitive chiller releases via the cooling towers. Because of the volume of water involved and the low coupling of the two systems, the potential for exceeding the concentration specified in WAC 173-303-9907 is considered implausible. Based on the sampling data and evaluation of process information the 400 Area Process Sewer wastestream is not a persistent dangerous waste.

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 90%CI for the substances of interest.
- 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 and is based on an evaluation of the carcinogenic substances that exist in an aqueous environment under normal temperatures and pressures.

- Determine which substances in the wastestream are carcinogenic according to the International Agency for Research on Cancer (IARC).
- Calculate the weight percent (wt%) concentration for each carcinogen.
- Sum the resulting wt%.
- Designate the wastestream as carcinogenic if any of the positive (human or animal) carcinogens are above 0.01% or if the total concentration of positive and suspected human/animal carcinogens are above 1.0%.

One carcinogenic substance, trichloromethane, was identified by sample analysis at a wt% of 8.33E-7% which is well below the 0.01% limit. The only identified carcinogen with a potential for entering the stream via the cooling tower sinks is an aqueous solution containing beryllium, which is used in conjunction with cooling tower chemical testing. The beryllium compound used in the test is a 5% aqueous solution of beryllium sulfate, which added (10 drops) to a 25-mL water sample. The resulting concentration of the sample solution is between 0.1% and 0.05% beryllium. This sample analyte, as discussed in Section 2.3.1.2, is collected and properly managed as a dangerous waste. A quantity of beryllium residual could conceivably be disposed of via the sinks in conjunction with testing cleanup and could enter the wastestream. Because of the concentration of the initial test material and total quantity of materials associated with the test, 50 mL (a blank sample tests performed with the actual test), the concentration of any residuals in the rinse water form would be well below the 0.01% level. The 400 Area Process Sewer wastestream is not a carcinogenic dangerous waste nor does it receive a carcinogenic dangerous waste.

5.5 DANGEROUS WASTE CHARACTERISTICS

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

5.5.1 Ignitibility

Because of the dilute aqueous nature of these wastes, the results of all flashpoint testing exceeded 210F. Therefore, the 400 Area Process Sewer is not an ignitible waste.

5.5.2 Corrosivity

A waste is a corrosive dangerous waste if it has a pH of $\leq$ 2.0 or $\geq$ 12.5. The comparison to this characteristic was based on the lower limit of the one-sided 90% confidence interval for a stream with a mean value of pH < 7.25 and the upper limit of the 90% confidence interval for a stream with a mean value of pH $\geq$ 7.25.

Because all observer pH measurements were greater than 7.25 (between 7.25 and 8.85) only an upper limit for the one sided 90%CI (9.07) was calculated. Based on this value being below 12.5, it can be concluded that the wastestream is not a corrosive waste.

5.5.3 Reactivity

An aqueous waste is reactive if the waste contains an amount of cyanide or sulfide which, when exposed to pH conditions between 2 and 12.5, can threaten human health or the environment (WAC 173-303-090[7]). A recent revision to the SW-846 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 were below these levels, the streams were considered not regulated based on reactivity.

No sulfide or cyanide were found in the sample data. Therefore it can be concluded that this wastestream is not a reactive dangerous waste.

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 sampling data have been collected and analyzed according to the EP toxicity method specified in SW-846. No analyte was detected above the limit by this test. The 400 Area Process Sewer wastestream is not an EP Toxic dangerous waste.

5.6 PROPOSED DESIGNATION

Based upon the analytical results of samples taken from November, 1989 through March, 1990, it is determined that the 400 Area Process Sewer 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.

9 1 1 2 0 4 7 0 7 1 2

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9 1 1 2 0 0 4 7 0 7 1 3

6.0 ACTION PLAN

The identification of additional waste characterization tasks will be negotiated between Ecology, the EPA, and the DOE. These negotiations will consider the contents of this report along with the results of the groundwater characterization and waste disposal site assessment aspects of the *Liquid Effluent Study Project Plan* (WHC 1990b). The implementation schedule for any additional characterization tasks will give consideration to other compliance actions already under way as part of the Tri-Party Agreement (Ecology et al. 1989).

6.1 FUTURE SAMPLING

The random sampling conducted during the October 1989 to March 1990 period reflected the normal system configurations as discussed in Section 2.0. During most of the sampling periods, the FMEF cooling towers were drained due to ambient conditions and operating in a dry mode. As a result of similarities in the operation of the FFTF and FMEF cooling towers, as described in Section 2.3.1.2, this only represents a reduced system flowrate rather than any change in stream constituents. No other alternate system configurations exist at this time. Minor changes in configurations which were not subjected to the sampling include the use of the sinks in the cooling tower building and batch transfers from the FMEF Retention Liquid Waste tanks. As explained previously, as a result of the limited activities in the FMEF building and activities associated with the cooling tower sinks, the sampling can be considered representative for the stream. No specific future sampling in support of this effort stream characterization effort is anticipate. Continued general monitoring of the effluent stream will continue and future sampling of the FMEF retention waste tank system and future streams from the MASF sodium removal system may be required once activities begin in these areas. The scope of any new sampling will be evaluated based on proposed activities.

6.2 TECHNICAL ISSUES

No technical issues are identified by the report. As described in Section 2.0, the effluent was sampled at the process pond diversion box. This sample point was chosen because it is a common, accessible location downstream of all the contributing wastestreams. As discussed in Section 3.1.1, samples collected at this point are considered to be representative of the types of constituents present in the contributing wastestreams. As a result, the characterization data presented in this report is considered to be representative of the effluent stream.

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9112270715

7.0 REFERENCES

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APPENDIX A

FUELS AND MATERIALS EXAMINATION FACILITY

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Figure A-1. Fuels and Materials Examination Facility Longitudinal Cutaway Section.

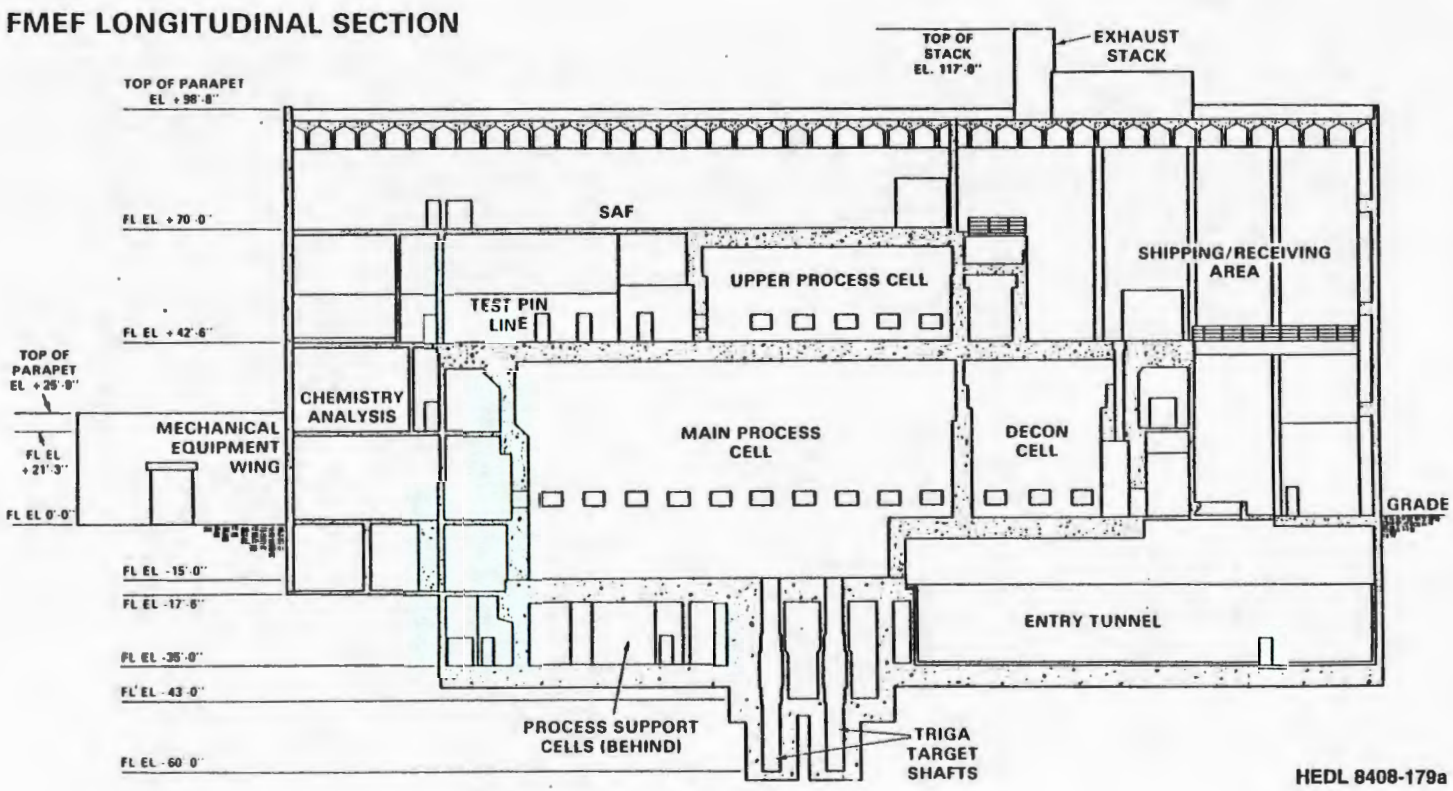
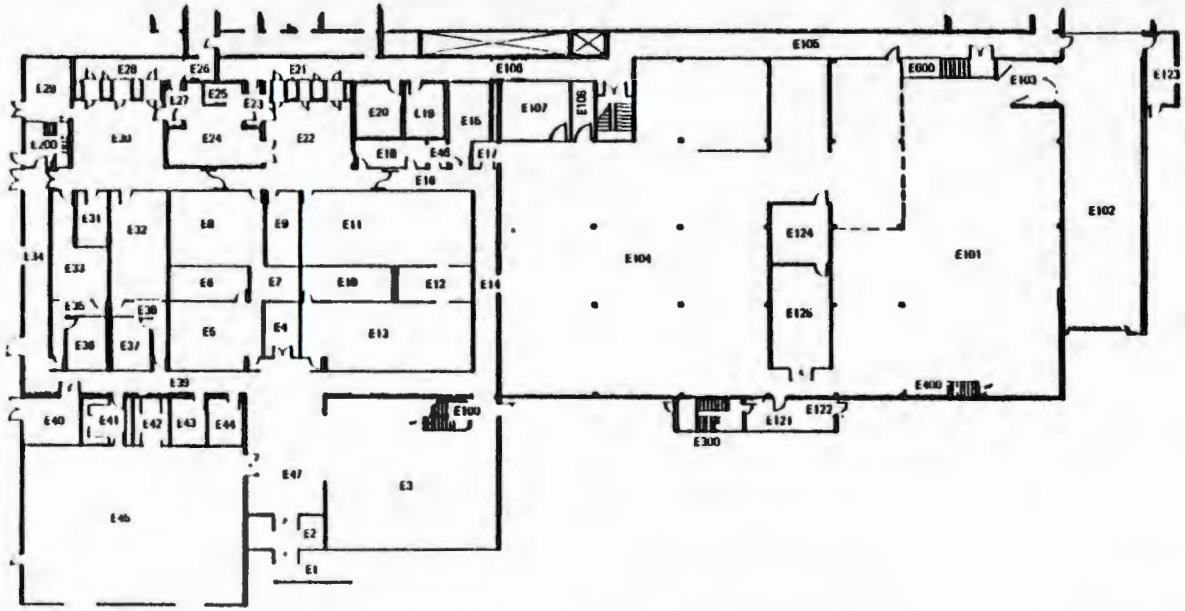


Figure A-2. Fuels and Materials Examination Facility/4862-Entry Wing and Fuel Assembly Area Floor 1.



FLOOR 1

		E17	JANITOR CLOSET				
E1	MAIN ENTRANCE	E18	VIP CHANGE ROOM	E34	CORRIDOR	E102	TRUCK LOCK
E2	VESTIBULE	E19	WOMEN'S TOILET	E35	CORRIDOR	E103	AIR LOCK
E3	LOBBY	E20	MEN'S TOILET	E36	WOMEN'S TOILET	E104	PIN INSPECTION
E4	CLEAN CLOTHING	E21	SWP CLOTHING ENTRY	E37	MEN'S TOILET	E105	CORRIDOR
E5	WOMEN'S PERSONAL LOCKERS	E22	ENTRY CONTROL AREA	E38	PASSAGE	E106	AIR LOCK
E6	WOMEN'S TOILET	E23	SWP ENTRY BYPASS	E39	CORRIDOR	E107	CONTROL ROOM
E7	WOMEN'S SHOWER	E24	SECURITY GUARD STATION	E40	CLEAN SWP CLOTHING	E121	VESTIBULE
E8	WOMEN'S SWP LOCKERS	E25	TOILET	E41	LUNCH BOX STORAGE	E122	EXIT
E9	SOILED SWP CLOTHING	E26	VESTIBULE	E42	KITCHEN	E123	EXIT
E10	MEN'S TOILET	E27	STREET CLOTHING ENTRY BYPASS	E43	OFFICE	E124	BATTERY ROOM UPS #2
E11	MEN'S SWP LOCKERS	E28	STREET CLOTHING ENTRY	E44	OFFICE	E125	ELECTRICAL EQUIPMENT
E12	MEN'S SHOWER	E29	SOILD SWP CLOTHING STORAGE	E45	LUNCH ROOM	E200	STAIRS
E13	MEN'S PERSONAL LOCKERS	E30	ENTRY CONTROL AREA	E46	DECONTAMINATION ROOM	E300	STAIRS
E14	CORRIDOR	E31	SOILD CLOTHING	E47	FOYER	E400	STAIRS
E15	TELEPHONE ROOM	E32	MEN'S STREET CLOTHING LOCKERS	E100	STAIR	E500	STAIRS
E16	CORRIDOR	E33	WOMEN'S STREET CLOTHING LOCKERS	E101	ASSEMBLY FABRICATION AND STORAGE	E600	STAIRS

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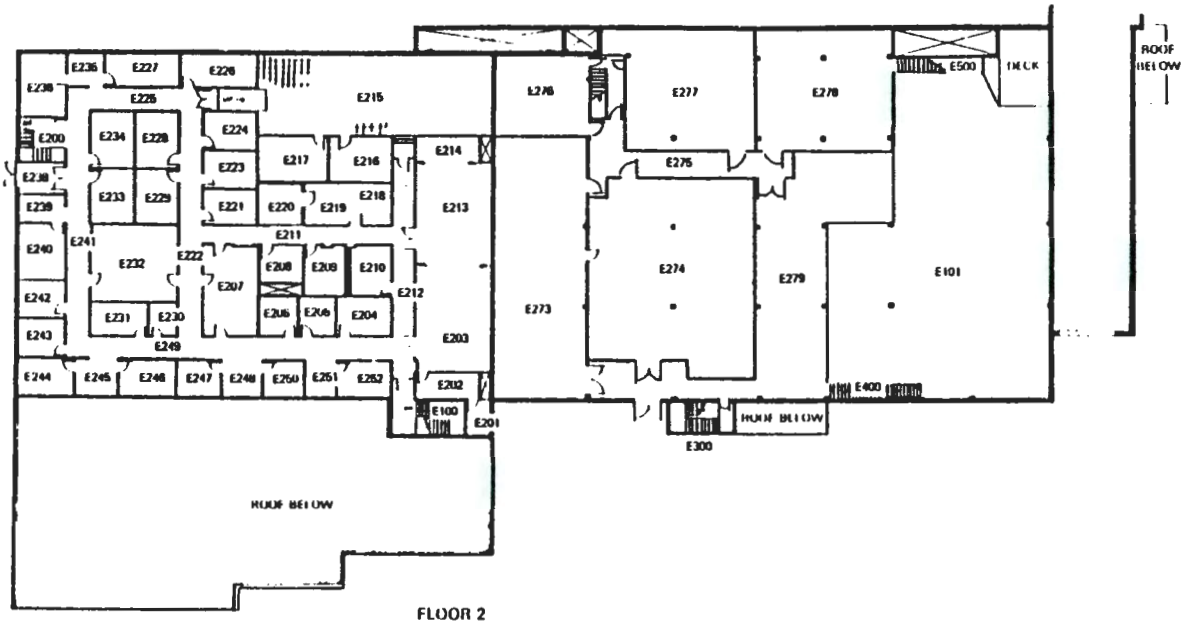
Figure A-3. Fuels and Materials Examination Facility/4862-Entry Wing and Fuel Assembly Area Floor 2.



FLOOR 2

E100 STAIRS
E101 ASSEMBLY FABRICATION AND STORAGE
E200 STAIRS
E201 STORAGE
E202 PROJECTION ROOM
E203 CONFERENCE ROOM
E204 OFFICE
E205 OFFICE
E206 OFFICE
E207 MAIL & DUPLICATING
E208 OFFICE
E209 WOMEN'S TOILET
E210 MEN'S TOILET
E211 CORRIDOR
E212 CORRIDOR
E213 ASSEMBLY & TRAINING AREA
E214 STORAGE
E215 SAFEGUARDS & SECURITY COMPUTER ROOM
E216 SPARE EQUIPMENT STORAGE
E217 STORAGE
E218 DRAWING SUPERVISOR
E219 DRAWING STORAGE CONTROL
E220 FIRE PROOF STORAGE
E221 OFFICE
E222 CORRIDOR
E223 OFFICE
E224 OFFICE
E225 CORRIDOR
E226 OFFICE
E227 OFFICE
E228 OFFICE
E229 OFFICE
E230 JANITOR CLOSET
E231 OFFICE
E232 TYPING POOL
E233 OFFICE
E234 OFFICE
E235 SECRETARY
E236 OFFICE
E238 VESTIBULE
E239 SECRETARY
E240 OFFICE
E241 CORRIDOR
E242 OFFICE
E243 OFFICE
E245 SECRETARY
E246 OFFICE
E247 OFFICE
E248 SECRETARY
E249 CORRIDOR
E250 OFFICE
E251 SECRETARY
E252 OFFICE
E271 STORAGE
E273 ZONE IV MECHANICAL EQUIPMENT
E274 HVAC MECHANICAL EQUIPMENT
E275 VESTIBULE
E276 SECURITY INSTRUMENT SHOP
E277 ELECTRICAL/INSTRUMENT SHOP
E278 BREAK ROOM
E279 TEST ARTICLE PREASSEMBLY
E300 STAIRS
E400 STAIRS
E500 STAIRS
E600 STAIRS

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Figure A-4. Fuels and Materials Examination Facility/427-Mechanical Equipment Wing.

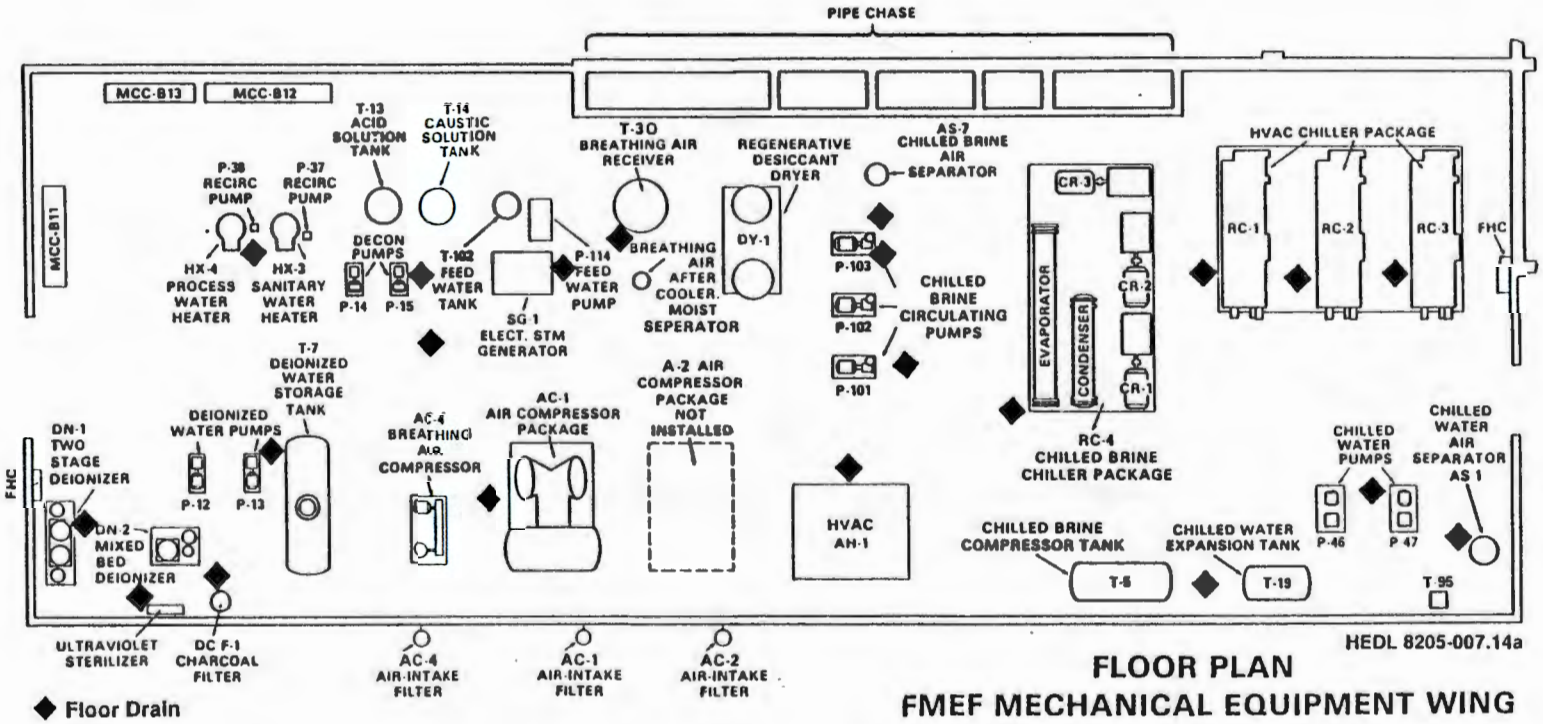
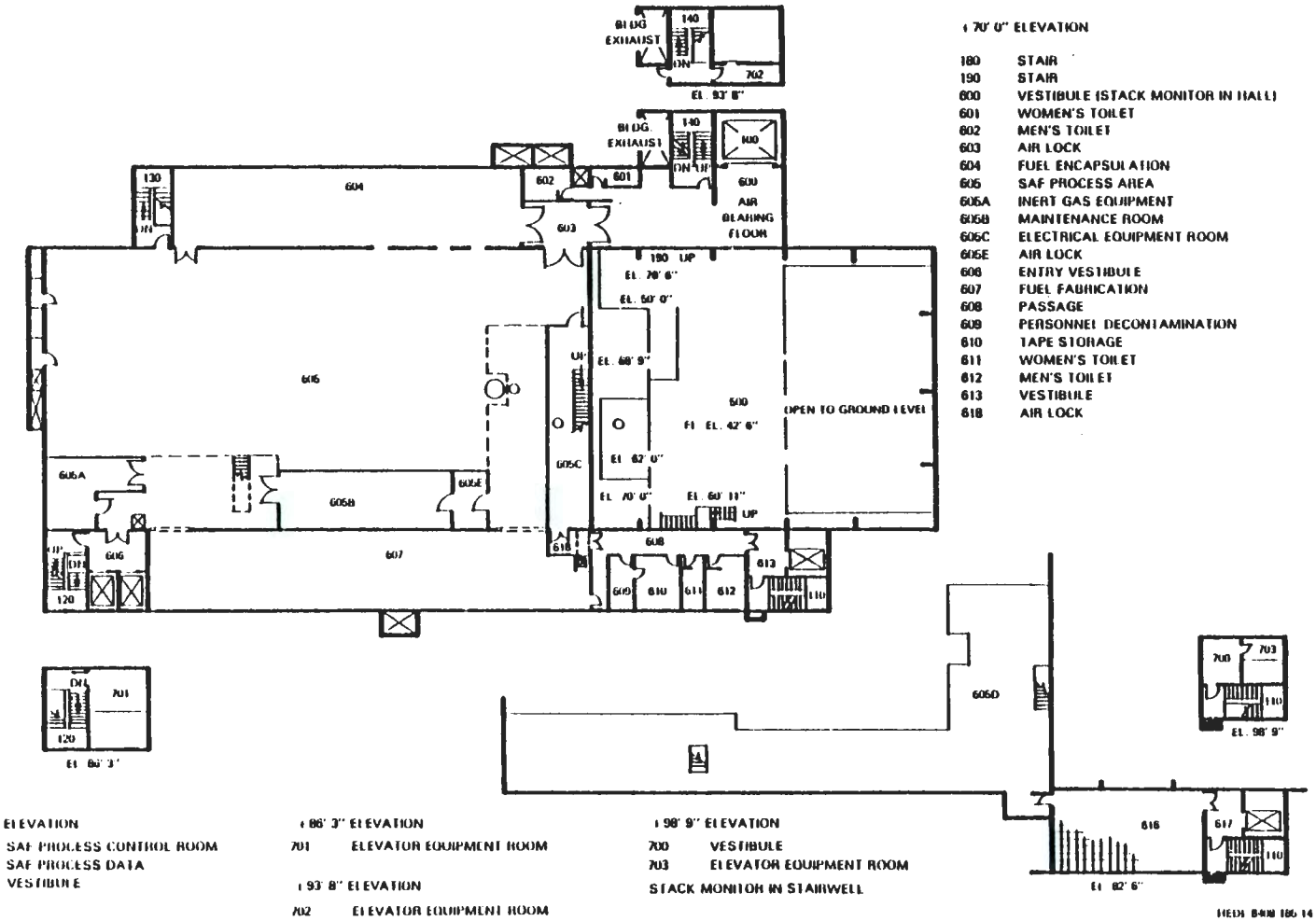


Figure A-5. Fuels and Materials Examination Facility/427-Secure Automated Fabrication Line Level Floor Plan.



180	STAIR
190	STAIR
600	VESTIBULE (STACK MONITOR IN HALL)
601	WOMEN'S TOILET
602	MEN'S TOILET
603	AIR LOCK
604	FUEL ENCAPSULATION
605	SAF PROCESS AREA
605A	INERT GAS EQUIPMENT
605B	MAINTENANCE ROOM
605C	ELECTRICAL EQUIPMENT ROOM
605E	AIR LOCK
606	ENTRY VESTIBULE
607	FUEL FABRICATION
608	PASSAGE
609	PERSONNEL DECONTAMINATION
610	TAPE STORAGE
611	WOMEN'S TOILET
612	MEN'S TOILET
613	VESTIBULE
618	AIR LOCK

(70' 0" ELEVATION

(82' 6" ELEVATION

605D	SAF PROCESS CONTROL ROOM
616	SAF PROCESS DATA
617	VESTIBULE

(86' 3" ELEVATION

701	ELEVATOR EQUIPMENT ROOM

(93' 8" ELEVATION

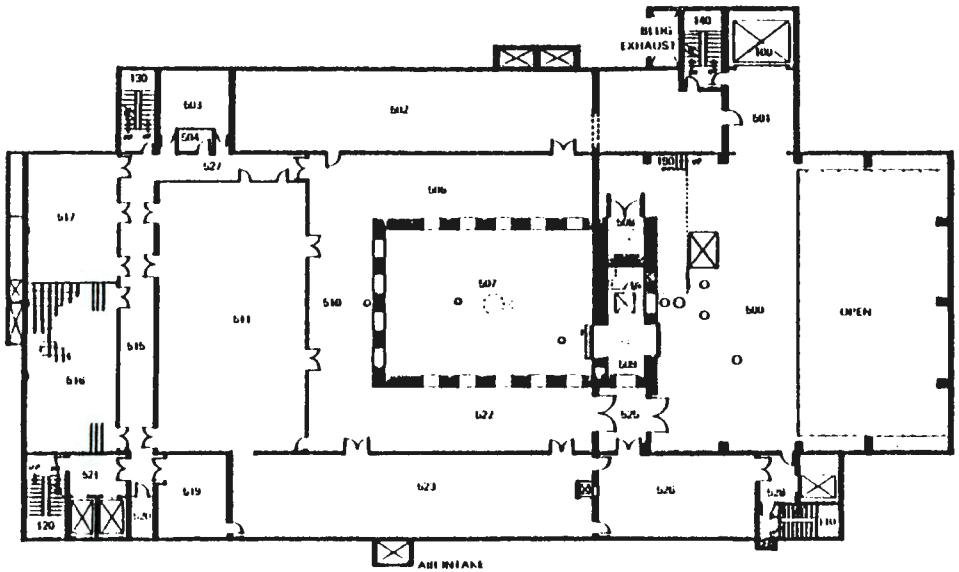
702	ELEVATOR EQUIPMENT ROOM

(98' 9" ELEVATION

700	VESTIBULE
703	ELEVATOR EQUIPMENT ROOM

STACK MONITOR IN STAIRWELL

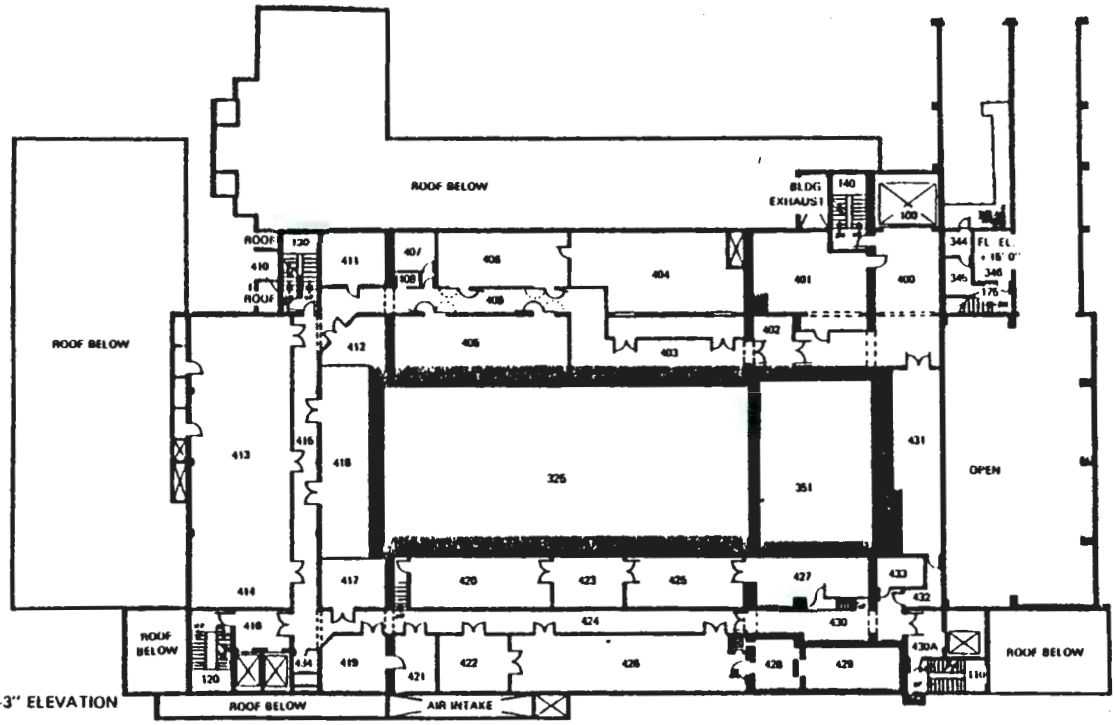
Figure A-6. Fuels and Materials Examination Facility/427-Fuel Fabrication Level Floor Plan.



+ 42' 6" ELEVATION

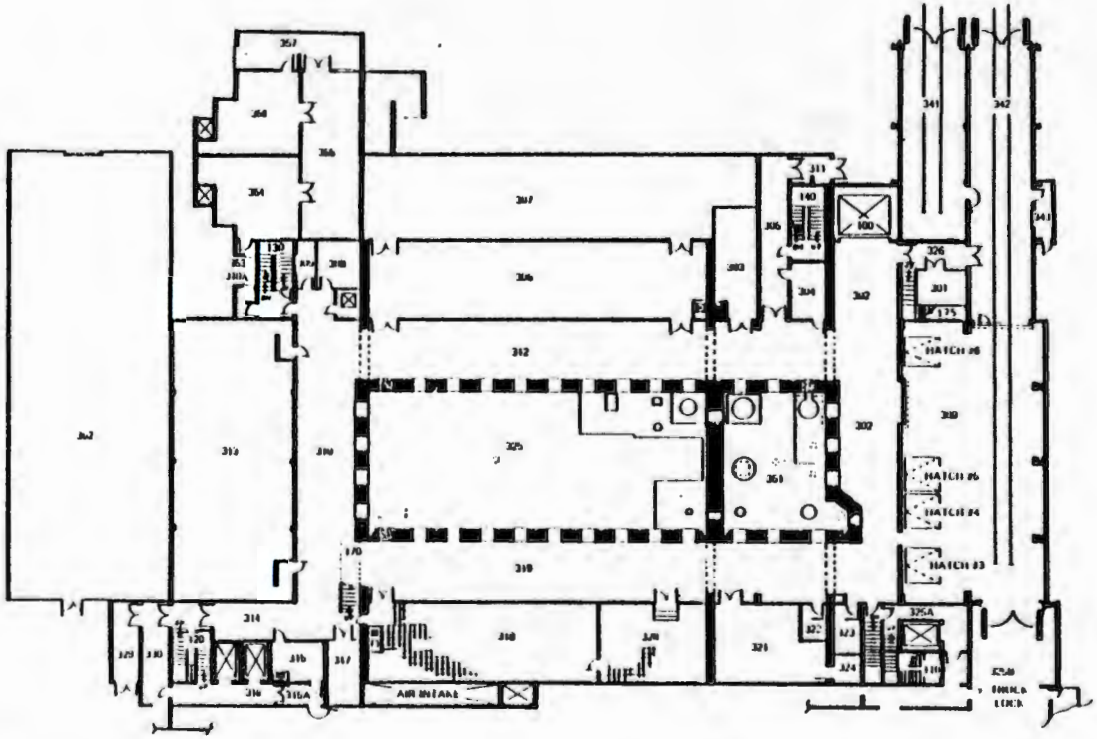
190	STAIR	515	CORRIDOR
600	CRANE BAY	516	PROCESS CONTROL
601	ELEVATOR CORRIDOR	617	PIN WELD & LEAK CHECK
602	RECIRCULATION EQUIPMENT	619	GRINDING
603	OHP LABORATORY	620	PERSONNEL DECONTAMINATION
604	JANITOR	621	VESTIBULE
606	OPERATING CORRIDOR	622	OPERATING CORRIDOR
607	UPPER PROCESS CELL	623	PELLET FABRICATION
608	ENTRY LOCK	625	AIR LOCK
609	TRANSFER LOCK	626	LOW GAMMA RECEIVING
610	OPERATING CORRIDOR	627	PASSAGE
611	PIN LOADING	628	VESTIBULE

Figure A-7. Fuels and Materials Examination Facility/427-Chemistry Level Floor Plan.



325	MAIN PROCESS CELL	413	CARBON/SULFER/O/M ANALYSIS/SAMPLE RECEIVING PREPARATION (SAF)	427	FUTURE CHEMICAL OPERATION
351	DECONTAMINATION CELL	414	CHEMISTRY ANALYSIS (SAF)	428	MAINTENANCE AREA
400	ELEVATOR VESTIBULE	415	PASSAGE	429	LOW GAMMA SNM STORE
401	PIN PREASSEMBLY	416	FUTURE CHEMICAL OPERATION	430	VESTIBULE
402	AIR LOCK	417	WASTE IMMOBILIZATION	430A	VESTIBULE
403	PASSAGE	418	AIR LOCK	431	DECONTAMINATION CELL FILTERS
404	CLEAN & PASSIVATE	419	OFF-GAS ANALYSIS (SAF)	432	AIR LOCK
405	FUTURE CHEMICAL OPERATION	420	FUTURE CHEMICAL OPERATION	433	FERTILE MATERIAL STORAGE
406	X RAY	421	SUPPLIES	434	PERSONNEL DECONTAMINATION
407	DARK ROOM	422	UO_2 STORAGE		
408	JANITOR	423	FUTURE CHEMICAL OPERATION		+ 16'-0" ELEVATION
409	PASSAGE	424	PASSAGE	175	STAIR
410	AIR LOCK	425	FUTURE CHEMICAL OPERATION	344	PERSONNEL DECONTAMINATION
411	FUTURE CHEMICAL OPERATION	426	NDA ASSAY	345	CHANGE ROOM
412	FUTURE CHEMICAL OPERATION			346	LIQUID WASTE LOADOUT CONTROL

Figure A-8. Fuels and Materials Examination Facility/427-Entry Level Floor Plan.

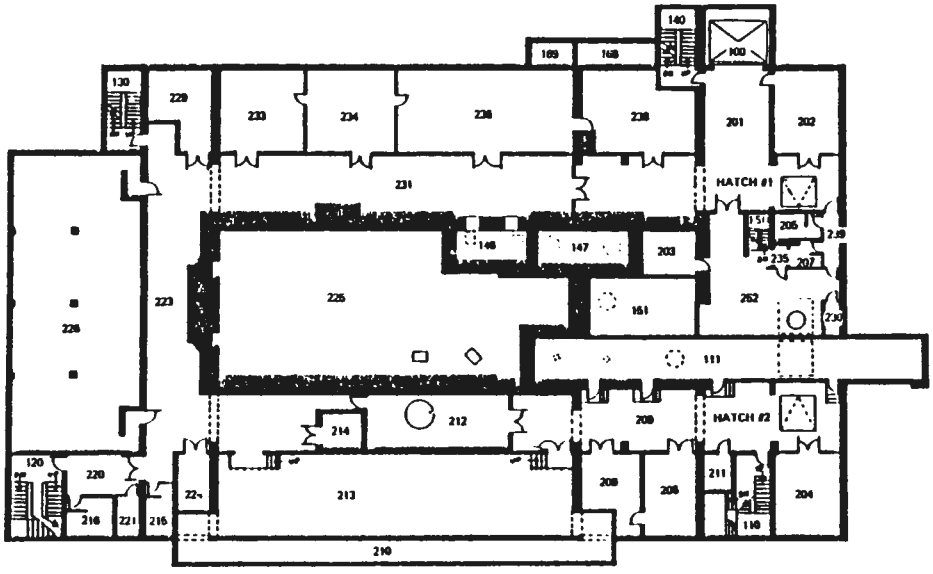


0' 0" ELEVATION

300	SHIPPING & RECEIVING	309	JANITOR'S CLOSET	316	VESTIBULE	326	MAIN PROCESS CELL	351	MAINTENANCE & DECONTAMINATION CELL
301	SOLID WASTE STORE	310	OPERATING CORRIDOR	317	RETENTION WASTE & ANALYSIS	326A	VESTIBULE	352	MECHANICAL EQUIPMENT WING
302	OPERATING CORRIDOR	310A	VESTIBULE	318	OPERATIONS CONTROL ROOM	326B	TRUCK LOCK	353	VESTIBULE
303	FUME HOOD SCRUBBER	311	VESTIBULE	319	OPERATING CORRIDOR	328	DOCK	354	EMERGENCY GENERATOR #2
304	OHP LABORATORY	312	OPERATING CORRIDOR	320	MP CONTROL ROOM	329	VESTIBULE	356	COOLING TOWER
305	VESTIBULE	313	MP CELL ATMOSPHERE EQUIP.	321	CLOSED LOOP COOLING	330	STORAGE	358	EMERGENCY GENERATOR #1
306	EXHAUST FILTER PLENUM	314	VESTIBULE	322	WOMEN'S TOILET	341	LIQUID WASTE LOADOUT	357	VESTIBULE
307	EXHAUST FAN ROOM	315	STORAGE ROOM	323	MEN'S TOILET	342	TRUCK LOCK		
308	HEPA FIRE SYSTEM EQUIPMENT	315A	AIR LOCK	324	SUMP PUMP	343	EMERGENCY EXIT		

HEDL 8408 185 6

Figure A-9. Fuels and Materials Examination Facility/427-Equipment Level Floor Plan.



17'-6" ELEVATION

201	ELEVATOR VESTIBULE	212	REACTOR ROOM	229	MP PRESSURE CONTROL TANKS
202	ELECTRICAL SWITCHGEAR	213	SUPPLY AIR EQUIPMENT	230	STORAGE
203	OBSERVATION AREA	214	REACTOR CONTROL	231	EQUIPMENT CORRIDOR
204	EMERGENCY AIR COMPRESSOR	215	WOMEN'S TOILET	233	ELECTRICAL SWITCHGEAR
205	MEN'S TOILET	216	MEN'S TOILET	234	INCINERATOR OFF-GAS
206	UNINTERRUPTABLE POWER SUPPLY #1	220	AIR LOCK	235	SUMP PUMP
207	WOMEN'S TOILET	221	SUMP PUMP	236	ANALTYICAL CHEMISTRY EXHAUST EQUIPMENT
208	ELECTRICAL EQUIPMENT ROOM	223	EQUIPMENT CORRIDOR	238	VACUUM EQUIPMENT
209	EQUIPMENT CORRIDOR	224	MECHANICAL EQUIPMENT	239	PASSAGE
210	SUPPLY AIR PLENUM	226	MP CELL SUPPORT	252	SUSPECT EQUIPMENT REPAIR
211	COMMUNICATIONS				

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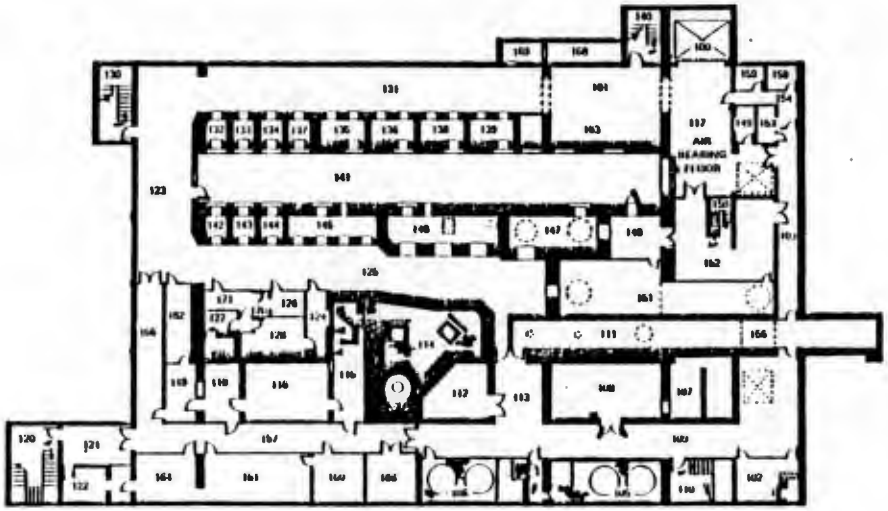
Figure A-10. Fuels and Materials Examination Facility/427-Process Support Level Floor Plan.



36'-0" ELEVATION

100	ELEVATOR
101	CORRIDOR
102	OHP LABORATORY
103	PASSAGE
105	RADIOACTIVE LIQUID WASTE
106	RETENTION LIQUID WASTE
107	Na REMOVAL TANK
108	Na REMOVAL EQUIPMENT
109	CORRIDOR
110	SE STAIRWELL
111	ENTRY TUNNEL
112	TRIGA WATER TREATMENT
113	EQUIPMENT CORRIDOR
114	TRIGA TARGET
115	CASSETTE LOADING
116	FILM EXPOSURE
117	ELEVATOR VESTIBULE
118	FILM PROCESS
119	PHOTO LABORATORY TRIGA
120	SW STAIRWELL
121	AIR LOCK
122	STORAGE
123	EQUIPMENT CORRIDOR
124	CHEMISTRY HOODROOM
125	OPERATING CORRIDOR
126	VERSAMAT PROCESS
127	AUTORADIOGRAPHY DARK ROOM
128	METALLOGRAPHY DARK ROOM
130	NW STAIRWELL
131	OPERATING CORRIDOR
132	PROCESS SUPPORT CELL
133	PROCESS SUPPORT CELL
134	PROCESS SUPPORT CELL
136	PROCESS SUPPORT CELL
138	PROCESS SUPPORT CELL
137	ORGANIC LIQUID WASTE INCINERATOR CELL
138	PROCESS SUPPORT CELL
139	PROCESS SUPPORT CELL (AIR ATMOSPHERE)
140	NE STAIRWELL
141	HORIZONTAL TRANSFER CORRIDOR
142	PROCESS SUPPORT CELL
143	PROCESS SUPPORT CELL
144	PROCESS SUPPORT CELL
145	PROCESS SUPPORT CELL
146	PROCESS SUPPORT CELL
147	TRANSFER TUNNEL
148	VESTIBULE
149	JANITOR
150	STAIR
151	HOT EQUIPMENT REPAIR
152	SUSPECT EQUIPMENT REPAIR
153	PERSONNEL DECONTAMINATION
154	VESTIBULE
155	PASSAGE
156	CASK ENTRY
157	PASSAGE
158	WOMEN'S CHANGE
159	MEN'S CHANGE
160	TRIGA STORAGE
161	MICROPROBE LABORATORY
162	PHOTOANALYSIS
163	EQUIPMENT STORAGE
164	SCANNING ELECTRON MICROSCOPE LABORATORY
166	ELECTRICAL EQUIPMENT ROOM
168	PIPE CHASE
169	PIPE CHASE
170	VERSAMAT DARK ROOM
171	VESTIBULE

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APPENDIX B

DEARBORN MATERIAL SAFETY DATA SHEET

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Material Safety Data Sheet

Emergency Phone
312-438-8241

Section 1 Product Identification

TRADE NAME: CODE 550
PRODUCT TYPE: Sodium Thiosulfate 0.1N
CODE IDENT.: 33-550

DOT SHIPPING NAME: Chemicals N.O.I., Water Testing Reagent

Section 2 Hazardous Ingredients

	CAS NUMBER	%	EXPOSURE CRITERIA
Sodium Thiosulfate	10102-17-2	<0.5	Not established
Sodium Borate	1330-43-4	<0.05	Not established
Water	7732-18-5	<100	Not applicable

HIMS 0-0-0 EPA REGISTRATION NO. Not applicable

Section 3 Physical Data

BOILING POINT, 760 mm Hg	212 F	MELTING POINT	NA
FREEZING POINT	ND	VAPOR PRESSURE	ND
SPECIFIC GRAVITY (H_2O=1)	1.0	SOLUBILITY IN H_2O	Miscible
VAPOR DENSITY (AIR=1)	ND	EVAPORATION RATE, (Bu Ac=1)	<1
% VOLATILES BY VOLUME	ND	pH	8 - 10

APPEARANCE & ODOR

Clear, colorless liquid.

Section 4 Fire & Explosion Hazard Data

FLASH POINT (& METHOD USED)	FLAMMABLE LIMITS IN AIR % BY VOLUME LOWER	UPPER	AUTO IGNITION TEMPERATURE
Not applicable	NA	NA	NA

EXTINGUISHING MEDIA: WATER FOG

SPECIAL FIRE FIGHTING PROCEDURES:

Firefighters should wear full protective gear.

UNUSUAL FIRE AND EXPLOSION HAZARD:

None known.

Section 5 Reactivity Data

STABILITY (NORMAL CONDITIONS): Stable
CONDITIONS TO AVOID: Not determined

INCOMPATABILITY (MATERIALS TO AVOID)

Acids, alkaloidal, metallic salts and silver halides

HAZARDOUS DECOMPOSITION PRODUCTS

None known

HAZARDOUS POLYMERIZATION: Will not occur
CONDITIONS TO AVOID: Not applicable

GRACE Dearborn

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Material Safety Data Sheet (continued)

CODE 550 CONTINUED

Section 6 Health Hazard Information

TOXICITY INFORMATION:

No TLV established for product. See Section 2 for component information.

EFFECTS OF OVEREXPOSURE:

INHALATION: Avoid breathing vapors or mist which may irritate respiratory passages.

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

EMERGENCY AND FIRST AID PROCEDURES

INHALATION: Remove affected persons to fresh air.

INGESTION: Call physician.

SKIN CONTACT: Flush skin with water, then wash with soap and watere. Wash contaminated clothing before reuse.

EYE CONTACT: Immediately flush eyes with water for 15 minutes. Call physician.

Section 7 Special Protection Information

VENTILATION REQUIREMENTS
Mechanical ventilation should be adequate

RESPIRATORY PROTECTION (SPECIFY TYPE)
None special

EYE PROTECTION
Safety glasses

GLOVES
Disposable plastic

OTHER PROTECTIVE CLOTHING AND EQUIPMENT

Lab coat or long sleeve work shirt.

Section 8 Spill or Leak Procedures

STEPS TO TAKE IF MATERIAL IS RELEASED OR SPILLED

Dilute with large amount of water. Wash down drain with excess water.

WASTE DISPOSAL METHOD

Dispose of in accordance with federal, state and local regulations.

Section 9 Special Precautions

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

Wash thoroughly after handling. Avoid contact with eyes, skin, clothing.

OTHER PRECAUTIONS

Protect containers from physical damage.

PREPARED BY: S. Morss DATE: 10/08/87

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Material Safety Data Sheet

Emergency Phone
312-438-8241

Section 1 Product Identification

TRADE NAME	PRODUCT TYPE	CODE IDENT.
CODE 562	Xylenol Orange Indicator	33-562

DOT SHIPPING NAME Chemicals N.O.I., Water Testing Reagents

Section 2 Hazardous Ingredients

	CAS NUMBER	%	EXPOSURE CRITERIA
Potassium Chloride	7447-40-7	>99	Not established
Xylenol Orange	3618-43-7	<0.1	Not established

HIMS 0-0-0 EPA REGISTRATION NO. Not applicable

Section 3 Physical Data

BOILING POINT, 760 mm Hg	NA	MELTING POINT	ND
FREEZING POINT	ND	VAPOR PRESSURE	ND
SPECIFIC GRAVITY (H_2O=1)	2.0	SOLUBILITY IN H_2O	complete
VAPOR DENSITY (AIR=1)	3.0	EVAPORATION RATE, (Bu Ac=1)	very low
% VOLATILES BY VOLUME	0	pH of 5% solution	7.0

APPEARANCE & ODOR

Purple, odorless powder

Section 4 Fire & Explosion Hazard Data

FLASH POINT (& METHOD USED)	FLAMMABLE LIMITS IN AIR % BY VOLUME LOWER	UPPER	AUTO IGNITION TEMPERATURE
Not applicable	NA	NA	NA

EXTINGUISHING MEDIA: WATER FOG

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	Moisture

INCOMPATABILITY (MATERIALS TO AVOID)

Silver solutions

HAZARDOUS DECOMPOSITION PRODUCTS

Not determined.

HAZARDOUS POLYMERIZATION	CONDITIONS TO AVOID
Will not occur	Not applicable

GRACE Dearborn

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Material Safety Data Sheet (continued)

CODE 562 CONTINUED

Section 6 Health Hazard Information

TOXICITY INFORMATION:

No TLV established for product. See Section 2 for component information.

EFFECTS OF OVEREXPOSURE:

INHALATION: Inhalation of powder may irritate respiratory tract.

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: Give large quantities of water or milk. Call physician.

SKIN CONTACT: Flush with water for 15 minutes. Wash with soap and water. Remove contaminated clothing and wash before reuse.

EYE CONTACT: Immediately flush with water for 15 minutes. Call physician.

Section 7 Special Protection Information

VENTILATION REQUIREMENTS
Mechanical ventilation should be adequate.

RESPIRATORY PROTECTION (SPECIFY TYPE)
Usually not needed

EYE PROTECTION
Safety glasses

GLOVES
Disposable plastic

OTHER PROTECTIVE CLOTHING AND EQUIPMENT

Lab coat or long sleeve shirt.

Section 8 Spill or Leak Procedures

STEPS TO TAKE IF MATERIAL IS RELEASED OR SPILLED

Flush to drain with excess water.

WASTE DISPOSAL METHOD

Dispose of in accordance with federal, state and local regulations.

Section 9 Special Precautions

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

Wash thoroughly after handling. Avoid contact with eyes, skin, clothing.

OTHER PRECAUTIONS

Protect containers from physical damage.

PREPARED BY: S. Morss DATE: 10/12/87

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Material Safety Data Sheet

Emergency Phone
312-438-8241

Section 1 Product Identification

TRADE NAME: CODE 595
PRODUCT TYPE: Hydrochloric Acid (1M)
CODE IDENT.: 33-595

DOT SHIPPING NAME: Hydrochloric acid, solution, corrosive liquid UN 1789

Section 2 Hazardous Ingredients

	CAS NUMBER	%	EXPOSURE CRITERIA
Hydrochloric acid	7647-01-0	<5	Ceiling limit: 7 mg/m3
Water	7732-18-5	<100	Not established

HIMS 3-0-0 EPA REGISTRATION NO. Not applicable

Section 3 Physical Data

BOILING POINT, 760 mm Hg	212 F	MELTING POINT	NA
FREEZING POINT	ND	VAPOR PRESSURE	ND
SPECIFIC GRAVITY (H_2O=1)	1.08	SOLUBILITY IN H_2O	complete
VAPOR DENSITY (AIR=1)	ND	EVAPORATION RATE, (Bu Ac=1)	NA
% VOLATILES BY VOLUME	ND	pH	<1

APPEARANCE & ODOR

Colorless to pale yellow liquid with pungent odor.

Section 4 Fire & Explosion Hazard Data

FLASH POINT (& METHOD USED)	FLAMMABLE LIMITS IN AIR % BY VOLUME LOWER	UPPER	AUTO IGNITION TEMPERATURE
Not applicable	NA	NA	NA

EXTINGUISHING MEDIA: WATER FOG

SPECIAL FIRE FIGHTING PROCEDURES:

Firefighters should wear full protective gear.

UNUSUAL FIRE AND EXPLOSION HAZARD:

None known.

Section 5 Reactivity Data

STABILITY (NORMAL CONDITIONS): Stable
CONDITIONS TO AVOID: Keep containers closed.

INCOMPATABILITY (MATERIALS TO AVOID)

Silver, lead, mercury salts, metals, strong alkali

HAZARDOUS DECOMPOSITION PRODUCTS

Chlorine gas, hydrogen gas if allowed to react with metal.

HAZARDOUS POLYMERIZATION: Will not occur
CONDITIONS TO AVOID: Not applicable

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Material Safety Data Sheet (continued)

CODE 595 CONTINUED

Section 6 Health Hazard Information

TOXICITY INFORMATION:

No TLV established for product. See Section 2 for component information.

EFFECTS OF OVEREXPOSURE:

INHALATION: Inhalation of vapors or mist may cause irritation to respiratory tract.

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: DO NOT induce vomiting. Give large quantities of water. Give at least one ounce of milk of magnesia in an equal amount of water, or three egg whites. Call physician.

SKIN CONTACT: Flush skin with water then wash with soap and water. Launder contaminated clothing before reuse.

EYE CONTACT: Flush eyes with water for 15 minutes. Call physician.

Section 7 Special Protection Information

VENTILATION REQUIREMENTS

Mechanical ventilation should be adequate.

RESPIRATORY PROTECTION (SPECIFY TYPE)

Hood recommended

EYE PROTECTION

Face shield or chemical goggles

GLOVES

Rubber

OTHER PROTECTIVE CLOTHING AND EQUIPMENT

Lab coat or long sleeve work shirt.

Section 8 Spill or Leak Procedure

STEPS TO TAKE IF MATERIAL IS RELEASED OR SPILLED

Neutralize spill with sodium bicarbonate or a soda ash-slaked lime mixture (50-50). Mix to form a slurry. Scoop and wash down the drain with excess water. Wash site of spill with soda and ash solution.

WASTE DISPOSAL METHOD

Dispose of in accordance with federal, state and local regulations.

Section 9 Special Precautions

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

Store in tightly closed containers. Use only with adequate ventilation.

OTHER PRECAUTIONS

Store in tightly covered containers

PREPARED BY: S. Horss DATE: 10/12/87

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Material Safety Data Sheet

Emergency Phone
312-438-8241

Section 1 Product Identification

TRADE NAME: DEARCIDE 702
PRODUCT TYPE: Biocide
CODE IDENT.: 14-120

DOT SHIPPING NAME: Corrosive Liquid, N.O.S. UN 1760

Section 2 Hazardous Ingredients

	CAS NUMBER	%	EXPOSURE CRITERIA
5-Chloro-2-methyl-4-isothiazolin-3-one	26172-55-4	1.15	Total isothiazolines
2-Methyl-4-isothiazolin-3-one	2682-20-4	0.35	TWA= 0.1 mg/m3 STEL=0.3 mg/m3
Magnesium chloride	7786-30-3	<2.0	Not established
Magnesium nitrate	10377-60-3	<3.0	Not established
Water	7732-18-5	<96.0	Not established

HIMS 3-0-0 EPA REGISTRATION NO. 4643-40

Section 3 Physical Data

BOILING POINT, 760 mm Hg	212 F	MELTING POINT	NA
FREEZING POINT	32 F	VAPOR PRESSURE	20mm Hg est.
SPECIFIC GRAVITY (H_2O = 1)	1.01	SOLUBILITY IN H_2O	complete
VAPOR DENSITY (AIR = 1)	0.6 est.	EVAPORATION RATE, (Bu Ac = 1)	<1
% VOLATILES BY VOLUME	ND	pH	3.5-4.5

APPEARANCE & ODOR

Pale amber to green liquid, mild aromatic 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:

Wear respirator (pressure-demand, self-contained breathing apparatus, MSHA/NIOSH approved or equivalent) and full protective gear. Use water spray to cool fire and exposed containers.

UNUSUAL FIRE AND EXPLOSION HAZARD:

Avoid exposure to fumes and vapors from a fire--can possibly include sulfur dioxide and hydrogen chloride and oxides of nitrogen.

Section 5 Reactivity Data

STABILITY (NORMAL CONDITIONS): Stable
CONDITIONS TO AVOID: Evaporation to dryness: Nitrates can explode

INCOMPATABILITY (MATERIALS TO AVOID)

None known

HAZARDOUS DECOMPOSITION PRODUCTS

HCl, oxides of sulfur and oxides of nitrogen.

HAZARDOUS POLYMERIZATION: Will not occur
CONDITIONS TO AVOID: Not applicable

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Material Safety Data Sheet (continued) DEARCIDE 702 CONTINUED

Section 6 Health Hazard Information

TOXICITY INFORMATION:
Oral LD50 rat: 457 mg/kg; Dermal LD50 rabbit: 660 mg/kg. Eye irritation rabbit: Corrosive. Corneal injury. Skin irritation rabbit: Corrosive under test conditions for DOT skin corrosivity. Severely irritating under conditions of OECD .

EFFECTS OF OVEREXPOSURE:

INHALATION: Harmful if inhaled.
INGESTION: Harmful if swallowed.
SKIN CONTACT: Corrosive to skin; causes burns. Harmful if absorbed through skin
EYE CONTACT: Corrosive to eyes; causes permanent, irreversible eye injury.

DELAYED EFFECTS: Substance can cause allergic skin reaction.

EMERGENCY AND FIRST AID PROCEDURES

INHALATION: Move subject to fresh air. Give artificial respiration if breathing has stopped.
INGESTION: If swallowed dilute by giving 2 glasses of water to drink. See a physician. Never give anything by mouth to unconscious person.
SKIN CONTACT: Wash thoroughly with soap and water. Remove and wash clothing before reuse.
EYE CONTACT: Flush eyes with a large amount of water for at least 15 minutes. Get prompt medical attention.
NOTE: Mucosal damage may contraindicate the use of gastric lavage. Measures against circulatory shock, respiratory depression & convulsions may be required.

Section 7 Special Protection Information

VENTILATION REQUIREMENTS
Mechanical local exhaust at point of contaminant (vapor or mist) release

RESPIRATORY PROTECTION (SPECIFY TYPE)
Wear MSHA/NIOSH-approved respirator suitable for concentrations encountered XX

EYE PROTECTION
Splashproof goggles & face shield

GLOVES
PVC or butyl rubber

OTHER PROTECTIVE CLOTHING AND EQUIPMENT
Impervious apron, eyewash facility, emergency shower, impervious overshoes.
XXwhere exposure limits are exceeded.

Section 8 Spill or Leak Procedures

STEPS TO TAKE IF MATERIAL IS RELEASED OR SPILLED

Wear protective clothing, splashproof goggles & impervious overshoes. Remove contaminated clothing promptly; launder thoroughly before reuse. Wash affected skin areas with soap and water. CAUTION: Keep spills out of municipal sewers and open bodies of water. Dike and absorb spill with inert material (dry earth, sand). Shovel all contaminated solids--diking material, absorbent and soil--into corrosion-proof drums for storage until disposal.

WASTE DISPOSAL METHOD

When discarded, this material is a hazardous waste. RCRA #D-002 (corrosive). Incinerate liquid and contaminated diking material, at a permitted facility, in accordance with local and state regulations.

Section 9 Special Precautions

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

Do not contaminate water, food or feed by storage or disposal.
Keep containers closed when not in use. Wash thoroughly after handling.

OTHER PRECAUTIONS

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

PREPARED BY: S. Morss DATE: 1/23/89

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

DEARCIDE® 702

Non-Oxidizing Microbicide for Control of Bacteria, Fungi and Algae

Micro-Biological Treatment

Application: DEARCIDE® 702 is formulated for the control of bacteria, fungi and algae in industrial recirculating water cooling towers. DEARCIDE 702 is also used to preserve metal working emulsions from bacterial and fungal degradation.

DEARCIDE 702, on discharge to the environment, is rapidly degraded to harmless by-products through chemical and microbiological action. This property makes this the product of choice for use in your systems.

Advantages:
- **Broad spectrum microbiological activity**
- **Convenient liquid**
- **Helps preserve tower wood**
- **Compatible with other cooling water treatments**

Directions For Use: NOTE: ADD DEARCIDE 702 SEPARATELY TO THE SYSTEM. WHILE NO INCOMPATIBILITIES EXIST AT USE CONCENTRATION, SOME INCOMPATIBILITY MAY OCCUR IN THE CONCENTRATED SOLUTIONS.

INDUSTRIAL RECIRCULATING WATER COOLING TOWERS: *Initial Dose:* When the system is noticeably fouled apply 2.46 to 7.46 lbs (37 to 113 fluid ounces) of DEARCIDE 702 per 1000 gallons of water in the system. Repeat until control is achieved. *Subsequent Dose:* When microbial control is evident, add 150 to 225 (19 to 28 fluid ounces) of DEARCIDE 702 per 1000 gal. of water in the system weekly or as needed to maintain control. Badly fouled systems must be cleaned before treatment is begun. DEARCIDE 702 weighs 8.4 lbs per gallon.

AIR WASH SYSTEMS: Add to the air washer sump or chill water sump to insure uniform mixing 35 to 883 ppm DEARCIDE 702 (0.3 to 7.46 lbs or 4.5 to 113 fluid ounces of DEARCIDE 702 per 1000 gallons of water in the system) depending upon the severity of contamination to control bacteria, fungi and algae which causes fouling in industrial air wash systems.

Intermittent Or Slug Method: *Initial Dose:* when the system is noticeably fouled, apply 148 to 883 ppm DEARCIDE 702 (1.26 to 7.46 pounds or 19 to 113 fluid ounces of DEARCIDE 702 per 1000 gallons of water in the system). Repeat until control is achieved. *Subsequent Dose:* When microbial control is evident, add 35 to 219 ppm DEARCIDE 702 (0.3 to 1.86 pounds or 4.5 to 28 fluid ounces of DEARCIDE 702 per 1000 gallons of water) weekly or as needed to maintain control.

Continuous Feed Method: *Initial Dose:* When the system is just noticeably fouled apply 148 to 883 ppm DEARCIDE 702 (1.26 to 7.46 pounds or 19 to 113 fluid ounces of DEARCIDE 702 per 1000 gallons of water in the system). *Subsequent Dose:* Maintain this treatment level by adding a continuous feed of 35 to 219 ppm DEARCIDE 702 (0.3 to 1.86 pounds of 4.5 to 28 fluid ounces of DEARCIDE 702 per 1000 gallons of makeup water). Badly fouled systems must be cleaned before initial treatment. NOTE: For use only in industrial air wash systems that maintain effective mist eliminating components.

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BREWERY PASTEURIZERS: Apply 9.3 to 15.5 fluid ounces DEARCIDE 702 per 1000 gallons (75 ppm to 125 ppm) of water in each preheat and/or precool compartment to be treated. Add one or more times daily to provide desired control of slime.

METAL WORKING FLUIDS: DEARCIDE 702 is recommended for the control of bacteria and fungi in soluble and emulsifiable type aqueous metal working fluids, such as emulsified petroleum oils, and formulations containing alcoholic fatty acid, sulfonated red oil or naphthalene sulfonate. These fluids are usually prepared by diluting the product concentrates 1:40 to 1:60 with water.

For the maintenance of nonfouled system, use DEARCIDE 702 at 32 fluid ounces per 1000 gallons of emulsion (2 lbs) every 4 weeks or 32-154 fluid ounces per 1000 gallons emulsion (2-10 lbs) every 8-12 weeks. For a noticeably fouled system use an initial dose of 64-154 fluid ounces per 1000 gallons emulsion. (4-10 lbs) to be followed by subsequent maintenance dosages depending upon the treatment interval noted above. A higher dosage range and/or increased frequency of treatment may be required depending upon rate of dilution of the preservative with makeup fluid, the nature and severity of contamination, level of control required, filtration effectiveness, system design, etc. The preservative should be dispensed into the use-dilution of the metal working fluid using a metering pump.

PHOTOPROCESSING SYSTEMS: Start with a clean system. Water Recycling: Use 2.1 to 4.2 lbs (32 to 64 fl. ozs.) DEARCIDE 702 per 1000 gals. capacity of water in the system. Add to final rinse or used water collection tank by slug dose once weekly or as needed. Once-Through: Use 26 lbs (3 gals) DEARCIDE 702 per 1000 gals capacity of water in the system, single application start-up dosage added to the wash tanks. Thereafter, add DEARCIDE 702 each operating day for one hour using a chemical proportioning pump at a dosage of 2 to 3 lbs. per hour (32 to 48 fl. ozs.) to wash tanks. Increase to two hours per day if needed. The user is advised that he must maintain a level of discharge into the publicly-owned treatment works which is in compliance with the recommended guidelines for the photographic processing industry. Contact your Regional E.P.A. Office for guidance.

OIL FIELD: For control of slime forming bacteria and sulfate reducing bacteria in oil and gas field water systems, including enhanced recovery injection fluids, drilling, fracturing and completion fluids, slug treat with 67-332 ppm DEARCIDE 702 depending on contamination. *Initial Dose:* Add 166-332 ppm DEARCIDE 702 (6.9-13.9 gal or 58.0-116.8 lbs/1000 bbls of water) at a point in the system where it will be uniformly mixed. Repeat treatment after three days or as needed until control is achieved. *Subsequent Dose:* Add 67-166 ppm DEARCIDE 702 (2.8-6.9 gal or 23.5-58.0 lbs/1000 bbls of water) every seven days or as needed to maintain control.

Product Data:
- **Form: Liquid**
- **Odor: None**
- **Density: 8.4 lbs/gal**
- **Color: Light Green**
- **Flash Point: None**
- **Freezing Point: 32°F (0°C)**

Limitations and Handling: DANGER - Keep out of Reach of Children. Hazardous to humans and domestic animals. Corrosive. Causes eye damage and skin burns. May cause allergic skin reaction. May be harmful if inhaled. May be fatal if swallowed. or absorbed through the skin. Do not get in eyes, on skin, on clothing. Wear goggles or face shield and rubber gloves when handling. Avoid breathing vapor or mist. Avoid contamination of food. Do not take internally. Wash thoroughly after handling.

FIRST AID: If swallowed, do not induce vomiting. Drink promptly a large quantity of milk, egg whites, gelatin solution or if these are not available, drink large quantities of water. Avoid alcohol. Call a physician immediately. If inhaled, remove immediately to fresh air. If victim is not breathing, apply artificial respiration. If breathing is difficult, give oxygen and call a physician immediately. If on skin, wash thoroughly with soap and water. Remove and wash contaminated clothing before reuse. If in eyes, flush with plenty of water for at least 15 minutes. Call a physician. NOTE TO.PHYSICIAN: Probable mucosal damage may contraindicate the use of gastric lavage. Measures against circulatory shock, respiratory depression and convulsions may be needed.

Available Packaging: 30 gallon drums - Approximately 248 lbs
55 gallon drums - Approximately 455 lbs

Material Safety Data Sheet

Emergency Phone
312-438-8241

Section 1 Product Identification

TRADE NAME: DEARCIDE 717
PRODUCT TYPE: Microbiocide
CODE IDENT.: 14-200

DOT SHIPPING NAME: Compound Industrial Process Water Treating, Liquid

Section 2 Hazardous Ingredients

	CAS NUMBER	%	EXPOSURE CRITERIA
Alkyl Dimethyl Benzyl Ammonium Chloride	1875-92-9	12.5%	not established
bis (Tri-n-Butyltin) Oxide	56-35-9	2.25%	not established
Inert ingredients		82.25	not established

HIMS 2-0-0 EPA REGISTRATION NO. 4643-02

Section 3 Physical Data

BOILING POINT, 760 mm Hg	ND a	MELTING POINT	NA
FREEZING POINT	24 F	VAPOR PRESSURE	21 mm Hg
SPECIFIC GRAVITY (H_2O=1)	1.0	SOLUBILITY IN H_2O	appreciable
VAPOR DENSITY (AIR=1)	ND	EVAPORATION RATE, (Bu Ac=1)	< 1
% VOLATILES BY VOLUME	ND	pH	9 - 10

APPEARANCE & ODOR

Colorless liquid with a slightly aromatic odor.

Section 4 Fire & Explosion Hazard Data

FLASH POINT (& METHOD USED)	FLAMMABLE LIMITS IN AIR % BY VOLUME LOWER	UPPER	AUTO IGNITION TEMPERATURE
None	NA	NA	NA

EXTINGUISHING MEDIA: FOAM CO2 DRY CHEMICAL

SPECIAL FIRE FIGHTING PROCEDURES:

Firefighters should wear full protective gear including self-contained breathing apparatus.

UNUSUAL FIRE AND EXPLOSION HAZARD:

none known

Section 5 Reactivity Data

STABILITY (NORMAL CONDITIONS): Stable
CONDITIONS TO AVOID: Not determined

INCOMPATABILITY (MATERIALS TO AVOID)

Strong oxidizing agents

HAZARDOUS DECOMPOSITION PRODUCTS

CO, CO2, NH3

HAZARDOUS POLYMERIZATION: Will not occur
CONDITIONS TO AVOID: Not applicable

GRACE Dearborn

Material Safety Data Sheet (continued) DEARCIDE 717 CONTINUED

Section 6 Health Hazard Information

TOXICITY INFORMATION:

no TLV established for product, see section 2 for component information.

EFFECTS OF OVEREXPOSURE:

INHALATION: Prolonged exposure to vapors may irritate nasal passages.

INGESTION: Harmful or fatal if swallowed. Avoid contamination of food. Oral toxicity; LD50 (rats) - 3,008 mg/kg.

SKIN OR EYE CONTACT: Causes eye damage and irritation.

EMERGENCY AND FIRST AID PROCEDURES

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

INGESTION: Contact physician and give promptly milk, egg whites, or gelatin solution. If these are not available, give large quantity of water. Induce vomiting by giving syrup of ipecac.

SKIN CONTACT: Wash off area of skin contact with soap and water.

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

Section 7 Special Protection Information

VENTILATION REQUIREMENTS
Mechanical exhaust should be adequate.

RESPIRATORY PROTECTION (SPECIFY TYPE)
None special - Do not breathe mist or vapors.

EYE PROTECTION
Goggles or face shield

GLOVES
Chemical gloves

OTHER PROTECTIVE CLOTHING AND EQUIPMENT

Wear protective clothing to minimize skin contact

Section 8 Spill or Leak Procedures

STEPS TO TAKE IF MATERIAL IS RELEASED OR SPILLED

Collect using absorbent, place in container for proper disposal. Use up to equal amounts of sodium oleate to detoxify.

WASTE DISPOSAL METHOD
Do not flush large quantities to drain that could upset waste treatment systems. Material should be disposed according to EPA Pesticide label instructions. Water treated with MICROBIOTREAT 321 should not be used for food processing, irrigation or in the manufacture of paper used for food packaging. Treated effluent should not be discharged where it will drain into lakes, streams, ponds or public water. Do not contaminate water by cleaning of equipment, or disposal of wastes. Apply this product only as specified on the label. Do not reuse empty drum. Rinse thoroughly with water and return to drum reconditioner, or destroy by preforating or crushing. Keep this product away from heat or open flames.

Section 9 Special Precautions

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

Keep container closed and protect from freezing.

OTHER PRECAUTIONS

For industrial use only. Keep away from children.

PREPARED BY: S. Morss DATE: 1/21/88

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

DEARCIDE® 717

Non-Oxidizing Microbicide for Control of Bacteria, Fungi and Algae

Micro-Biological Treatment

Application: DEARCIDE® 717 is formulated to control the growth of bacteria and algae in open recirculating cooling water systems; and to control bacteria and fungal slimes in pulp and paper mills.

Advantages:
- **Economical**
- **Non-corrosive to metals**
- **Convenient, easy to use liquid**
- **Will not damage tower wood**

Directions For Use: NOTE: ADD DEARCIDE 717 SEPARATELY TO THE SYSTEM. DO NOT MIX WITH OTHER TREATMENTS, IN ORDER TO AVOID POSSIBLE INCOMPATIBILITY.

RECIRCULATING COOLING WATER SYSTEMS: *Initial Dose:* When microbiological slimes are evident, apply 9.3 to 18.6 fluid ounces of DEARCIDE 717 per 1,000 gallons (75 ppm to 150 ppm) of water in the system. Repeat until control is achieved. Badly fouled systems should be cleaned before treatment.

Subsequent Dose: When microbiological control is evident, apply 6.2 to 12.4 fluid ounces of A-105 per 1,000 gallons (50 ppm to 100 ppm) of water in the system once per week, or as needed to maintain control. *Feeding:* DEARCIDE 717 should be fed at full strength in the cooling tower basin at a point of maximum water circulation. Tower bleedoff valves should be closed to permit a retention time of 4 hours.

PAPER MILLS: Dosage will vary from 4.8 to 9.6 fluid ounces of DEARCIDE 717 per ton of finished paper depending on the type of stock, complexity of the system, quality of raw water, and type or degree of contamination. *Feeding:* DEARCIDE 717 may be drip fed continuously from the drum or fed by suitable chemical pumps such as adjustable proportioning types; variable speed, positive displacement type; or by the reciprocating type. This product should be fed as early as possible in the system at such points as the hydropulper, machine chest or broke system.

Product Data:
- **Appearance: Colorless liquid**
- **Odor: Slightly aromatic**
- **Density: 8.3 lbs/gal (1.0 kg/L)**
- **Freezing Point: 24°F (-4°C)**

Limitations and Handling: DANGER. KEEP OUT OF REACH OF CHILDREN. FOR INDUSTRIAL USE ONLY. Corrosive. Causes eye damage and skin irritation. May be absorbed through the skin. Do not get in eyes, on skin or on clothing. Wear goggles or face shield and rubber gloves when handling. Harmful or fatal if swallowed. Avoid contamination of food. Water treated with DEARCIDE 717 should not be used for food processing, irrigation or in the manufacture of paper used for food packaging.

This product is toxic to fish. Treated effluent should not be discharged where it will drain into lakes, streams, ponds or public water. Do not contaminate water by cleaning of equipment, or disposal of wastes. Apply this product only as specified on the label. Do not reuse empty drum. Rinse thoroughly with water and return to drum reconditioner, or destroy by perforating or crushing. Keep this product away from heat or open flames.

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First Aid: In case of skin contact, wash with plenty of soap and water. For eyes, flush with water for 15 minutes and get prompt medical attention. Remove and wash contaminated clothing before reuse. If swallowed, drink promptly a large quantity of milk, egg whites, gelatin solution or if these are not available, drink large quantities of water. Avoid alcohol. Call a physician immediately.

Note to Physician: Probable mucosal damage may contraindicate the use of gastric lavage. Measures against circulatory shock, respiratory depression and convulsion may be needed.

Available Packaging: 30 gallon drums - Approximately 250 lbs net
55 gallon drums - Approximately 457 lbs net

9112047077 5

Material Safety Data Sheet

Emergency Phone
312-438-8241

Section 1 Product Identification

TRADE NAME: DEARBORN 727
PRODUCT TYPE: Cooling water treatment
CODE IDENT.: II-688

DOT SHIPPING NAME: Compound Industrial Process Water treating, Liquid

Section 2 Hazardous Ingredients

	CAS NUMBER	%	EXPOSURE CRITERIA
Potassium hydroxide	1310-58-3	< 10	not established

HMIS 2-0-0 EPA REGISTRATION NO. --

Section 3 Physical Data

BOILING POINT, 760 mm Hg	> 212 F	MELTING POINT	NA
FREEZING POINT	19 F	VAPOR PRESSURE	22 mm Hg
SPECIFIC GRAVITY (H_2O = 1)	1.05	SOLUBILITY IN H_2O	complete
VAPOR DENSITY (AIR = 1)	ND	EVAPORATION RATE, (Bu Ac = 1)	< 1
% VOLATILES BY VOLUME	ND	pH	11.0

APPEARANCE & ODOR

Brown liquid, mild 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): Stable
CONDITIONS TO AVOID: Not determined

INCOMPATIBILITY (MATERIALS TO AVOID)

Strong oxidizing agents

HAZARDOUS DECOMPOSITION PRODUCTS

CO, CO2

HAZARDOUS POLYMERIZATION: will not occur
CONDITIONS TO AVOID: Not applicable

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Material Safety Data Sheet (continued) DEARBORN 727 CONTINUED

Section 6 Health Hazard Information

TOXICITY INFORMATION:

See Section 2

EFFECTS OF OVEREXPOSURE:

INHALATION: Prolonged 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: Drink plenty of fluids and seek medical attention.

SKIN CONTACT: Wash off skin with water.

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

Section 7 Special Protection Information

VENTILATION REQUIREMENTS
Mechanical ventilation should be adequate

RESPIRATORY PROTECTION (SPECIFY TYPE)
None special

EYE PROTECTION
chemical goggles

GLOVES
PVC or rubber

OTHER PROTECTIVE CLOTHING AND EQUIPMENT

Protective clothing to minimize skin contact.

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 chemical scavenger service in authorized landfill. For additional disposal instructions, 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 when not in use and protect from physical damage.
Keep from freezing.

OTHER PRECAUTIONS

For industrial use only.

PREPARED BY: S. Morss DATE: 1/19/88

The data included herein are presented according to W. R. Grace & Co.'s practices current at the time of preparation hereof, are made available solely for the consideration, investigation and verification of the original recipients hereof and do not constitute a representation or warranty for which Grace assumes legal responsibility. It is the responsibility of a recipient of this data to remain currently informed on chemical hazard information, to design and update its own safety program and to comply with all national, federal, state, and local laws and regulations applicable to safety, occupational health, right to know and environmental protection.

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Material Safety Data Sheet

Emergency Phone
312-438-8241

Section 1 Product Identification

TRADE NAME	PRODUCT TYPE	CODE IDENT.
CODE 899 *	Beryllium Sulfate **	33-899

DOT SHIPPING NAME Chemical N.O.I. Water Testing Reagent

Section 2 Hazardous Ingredients

	CAS NUMBER	%	EXPOSURE CRITERIA
Beryllium Sulfate	13510-49-1	<5	TWA: 0.002 mg/m3 LD 50 I.V. mice 0.5 mg
Demineralized water to	7732-18-5	100	Not available

* Interference Suppressor

** Tetrahydrate

HIMS EPA REGISTRATION NO. Not applicable

Section 3 Physical Data

BOILING POINT, 760 mm Hg	212 F	MELTING POINT	NA
FREEZING POINT	ND	VAPOR PRESSURE	ND
SPECIFIC GRAVITY (H_2O = 1)	0.95	SOLUBILITY IN H_2O	miscible
VAPOR DENSITY (AIR = 1)	ND	EVAPORATION RATE, (Bu Ac = 1)	ND
% VOLATILES BY VOLUME	>95	pH	5 - 7

APPEARANCE & ODOR

Clear, colorless, odorless liquid.

Section 4 Fire & Explosion Hazard Data

FLASH POINT (& METHOD USED)	FLAMMABLE LIMITS IN AIR % BY VOLUME LOWER	UPPER	AUTO IGNITION TEMPERATURE
Not applicable	NA	NA	NA

EXTINGUISHING MEDIA: WATER FOG FOAM CO_2 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	Heat

INCOMPATABILITY (MATERIALS TO AVOID)

Caustic

HAZARDOUS DECOMPOSITION PRODUCTS

Sulfur oxides

HAZARDOUS POLYMERIZATION	CONDITIONS TO AVOID
Will not occur	Not determined

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Material Safety Data Sheet (continued)

CODE 899 * CONTINUED

Section 6 Health Hazard Information

TOXICITY INFORMATION:

No TLV established for product. See Section 2 for component information.

EFFECTS OF OVEREXPOSURE:

INGESTION: Suspect poisonous substance. May be fatal if swallowed.

SKIN CONTACT: Skin sensitization may occur.

EMERGENCY AND FIRST AID PROCEDURES

INHALATION: Remove affected persons to fresh air. Give artificial respiration if necessary.

INGESTION: Encourage vomiting using syrup of ipecas or tablespoon of milk of magnesia in strong tea. Contact physician and inform of known or suspected ingestion of poisonous substance.

SKIN CONTACT: Flush skin with water then wash with soap and water. Wash contaminated clothing before reuse. Call Dermatologist.

EYE CONTACT: Immediately flush eyes with water for 15 minutes. Call physician.

Section 7 Special Protection Information

VENTILATION REQUIREMENTS
Mechanical ventilation should be adequate.

RESPIRATORY PROTECTION (SPECIFY TYPE)
Hood

EYE PROTECTION
Face Shield, safety glasses

GLOVES
Butyl Rubber

OTHER PROTECTIVE CLOTHING AND EQUIPMENT

Lab coat or long sleeve work shirt.

Section 8 Spill or Leak Procedures

STEPS TO TAKE IF MATERIAL IS RELEASED OR SPILLED

Dilute with large amount of water. Wash down with excess water.

WASTE DISPOSAL METHOD

Dispose of in accordance with federal, state and local regulations.

Section 9 Special Precautions

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

Wash thoroughly after handling. Store away from oxidizers.
Keep away from alkalies.

OTHER PRECAUTIONS

Protect container from physical damage.

PREPARED BY: S. Morss DATE: 9/14/87

The data included herein are presented according to W. R. Grace & Co.'s practices current at the time of preparation hereof, are made available solely for the consideration, investigation and verification of the original recipients hereof and do not constitute a representation or warranty for which Grace assumes legal responsibility. It is the responsibility of a recipient of this data to remain currently informed on chemical hazard information, to design and update its own safety program and to comply with all national, federal, state, and local laws and regulations applicable to safety, occupational health, right to know and environmental protection.

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Material Safety Data Sheet

Emergency Phone
312-438-8241

Section 1 Product Identification

TRADE NAME: CODE 904
PRODUCT TYPE: Thorium Nitrate (0.001M)
CODE IDENT.: 33-904

DOT SHIPPING NAME: Chemicals, N.O.I., Water Testing Reagents

Section 2 Hazardous Ingredients

	CAS NUMBER	%	EXPOSURE CRITERIA
Thorium Nitrate	13822-29-5	<0.05	Not established
Water	7732-18-5	<100	Not established

The level of alpha radiation of Code 900 thorium nitrate is equivalent to 0.000025 microcuries per sq. gram, which is the lowest level considered to be radioactive under Dept. of Transportation Regulation 49 CFR 173.389 (e). alpha radiation does not penetrate the skin.

HIMS 1-0-0 EPA REGISTRATION NO. Not applicable

Section 3 Physical Data

BOILING POINT, 760 mm Hg	212 F	MELTING POINT	ND
FREEZING POINT	ND	VAPOR PRESSURE	ND
SPECIFIC GRAVITY (H_2O=1)	1.0	SOLUBILITY IN H_2O	miscible
VAPOR DENSITY (AIR=1)	ND	EVAPORATION RATE, (Bu Ac=1)	<1
% VOLATILES BY VOLUME	>99	pH	4-6

APPEARANCE & ODOR

Clear, colorless, odorless solution.

Section 4 Fire & Explosion Hazard Data

FLASH POINT (& METHOD USED)	FLAMMABLE LIMITS IN AIR % BY VOLUME LOWER	UPPER	AUTO IGNITION TEMPERATURE
Not applicable	NA	NA	NA

EXTINGUISHING MEDIA: WATER FOG

SPECIAL FIRE FIGHTING PROCEDURES:

Firefighters should wear full protective gear.

UNUSUAL FIRE AND EXPLOSION HAZARD:

None special

Section 5 Reactivity Data

STABILITY (NORMAL CONDITIONS): Stable
CONDITIONS TO AVOID: Not determined

INCOMPATABILITY (MATERIALS TO AVOID)

Soluble Fluorides

HAZARDOUS DECOMPOSITION PRODUCTS

Not determined

HAZARDOUS POLYMERIZATION: Will not occur
CONDITIONS TO AVOID: Not determined

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Material Safety Data Sheet (continued)

CODE 904 CONTINUED

Section 6 Health Hazard Information

TOXICITY INFORMATION:

No TLV established for product. See Section 2 for component information.

EFFECTS OF OVEREXPOSURE:

No chronic effects anticipated.

EMERGENCY AND FIRST AID PROCEDURES

INHALATION: Remove affected persons to fresh air.

INGESTION: Contact physician.

SKIN CONTACT: Flush skin with water then wash with soap and water. Wash contaminated clothing before reuse.

EYE CONTACT: Immediately flush eyes with water for 15 minutes. Call physician.

Section 7 Special Protection Information

VENTILATION REQUIREMENTS
Mechanical ventilation should be adequate

RESPIRATORY PROTECTION (SPECIFY TYPE)
None special

EYE PROTECTION
Safety glasses

GLOVES
Disposable plastic

OTHER PROTECTIVE CLOTHING AND EQUIPMENT

Lab Coat or long sleeve work shirt.

Section 8 Spill or Leak Procedures

STEPS TO TAKE IF MATERIAL IS RELEASED OR SPILLED

Dilute with large amount of water. Wash down drain with excess water.

WASTE DISPOSAL METHOD

Dispose of in accordance with federal, state and local regulations.

Section 9 Special Precautions

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

Wash thoroughly after handling. Avoid contact with eyes, skin, clothing.

OTHER PRECAUTIONS

Store container closed.

PREPARED BY: S. Horss DATE: 10/22/87

The data included herein are presented according to W. R. Grace & Co.'s practices current at the time of preparation hereof, are made available solely for the consideration, investigation and verification of the original recipients hereof and do not constitute a representation or warranty for which Grace assumes legal responsibility. It is the responsibility of a recipient of this data to remain currently informed on chemical hazard information, to design and update its own safety program and to comply with all national, federal, state, and local laws and regulations applicable to safety, occupational health, right to know and enviromental protection.

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Material Safety Data Sheet

Emergency Phone
312-438-8241

Section 1 Product Identification

TRADE NAME	PRODUCT TYPE	CODE IDENT.
DEARBORN 876	Cooling water treatment	11-876

DOT SHIPPING NAME
Compound industrial process water treating, liquid

Section 2 Hazardous Ingredients

	CAS NUMBER	%	EXPOSURE CRITERIA
Potassium hydroxide (45%)	1310-58-3	< 18	Ceiling limit: 2 mg/m3

HMIS 2-0-0

Section 3 Physical Data

BOILING POINT, 760 mm Hg	> 212 F	MELTING POINT	NA
FREEZING POINT	25 F	VAPOR PRESSURE	20 mm Hg
SPECIFIC GRAVITY (H_2O = 1)	1.11	SOLUBILITY IN H_2O	complete
VAPOR DENSITY (AIR = 1)	ND	EVAPORATION RATE, (Bu Ac = 1)	< 1
% VOLATILES BY VOLUME	ND	pH	10.5 - 11.5

APPEARANCE & ODOR

Clear liquid

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	Not determined

INCOMPATIBILITY (MATERIALS TO AVOID)

Strong oxidizing agents

HAZARDOUS DECOMPOSITION PRODUCTS

CO, CO2, oxides of nitrogen

HAZARDOUS POLYMERIZATION	CONDITIONS TO AVOID
Will not occur	Not applicable

GRACE Dearborn

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Material Safety Data Sheet (continued) DEARBORN 876 CONTINUED

Section 6 Health Hazard Information

TOXICITY INFORMATION:

See Section 2

EFFECTS OF OVEREXPOSURE:

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

INGESTION: Harmful if swallowed. Moderately alkaline liquid.

SKIN OR EYE CONTACT: Prolonged or frequent skin contact may irritate skin and eyes.

EMERGENCY AND FIRST AID PROCEDURES

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

INGESTION: If ingested, feed milk of magnesia in water and consult physician

SKIN CONTACT: Wash with soap and water.

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

Treat as alkaline liquid.

Section 7 Special Protection Information

VENTILATION REQUIREMENTS
Mechanical ventialation should be adequate

RESPIRATORY PROTECTION (SPECIFY TYPE)
None special

EYE PROTECTION
Goggles or face shield

GLOVES
Chemical gloves

OTHER PROTECTIVE CLOTHING AND EQUIPMENT

Alkali resistant clothing.

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 chemical scavenger service in authorized landfill. For additional disposal instructions, 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 when not in use. Keep from freezing.

OTHER PRECAUTIONS

For industrial use only.

PREPARED BY: S. Horss DATE: 1/19/88

The data included herein are presented according to W. R. Grace & Co.'s practices current at the time of preparation hereof, are made available solely for the consideration, investigation and verification of the original recipient hereof and do not constitute a representation or warranty for which Grace assumes legal responsibility. It is the responsibility of a recipient of this data to remain currently informed on chemical hazard information, to design and update its own safety program and to comply with all national, federal, state, and local laws and regulations dealing with safety, occupational health, right to know and environmental protection.

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

PRODUCT BULLETIN 22-876

DEARBORN® 876

Cooling Water Sequestrant and Dispersant

Cooling Water Treatment

Application: DEARBORN® 876 cooling water treatment combines DEARBORN's effective polymeric antifoulants with a highly stable complexing and dispersing agent. Regular use of DEARBORN 876 helps to prevent deposits due to such troublesome foulants as metallic oxides, silt, dead microbiological growths and organic debris. This product is also suggested for systems which have fouled beyond the capabilities of conventional dispersants to restore normal water flow and heat transfer. DEARBORN 876 is designed for once-through and open recirculating cooling water systems such as those used in oil refineries, chemical plants, power generating stations, metal mining and refining installations, and general industry.

Advantages:

- **On-stream desludging**
- **Chemically stable**
- **Restores heat transfer**
- **Non-corrosive**

Directions For Use: For once through systems, maintain 5 to 15 ppm DEARBORN 876 continuously, or apply intermittently at 10 to 50 ppm for ½ hour to 8 hours per day. For open recirculating systems, maintain 20 to 50 ppm DEARBORN 876 in the circulating water continuously; or for intermittent application to towers, obtain maximum retention time by closing the bleed-off and maintaining 20 to 50 ppm DEARBORN 876 for 24 hours. The severity and type of fouling will determine the optimum dosage to be used. There will be instances where higher dosages may be recommended for rapid removal of difficult deposits.

DEARBORN 876 may be pumped directly from the shipping container, or from chemical feed tanks, using equipment of standard construction. Apply to the cooling tower discharge or directly into the recirculating water lines on a continuous or proportional basis. Avoid mixing DEARBORN 876 in feed solution with other chemicals.

Product Data:

- **Appearance: Colorless liquid**
- **Density 9.24 lbs/gal (1.11 kg/L)**
- **Product pH: 11.0**
- **Freezing Point: 25°F (−4°C)**

Limitations and Handling: Harmful if swallowed. Do not use in potable water systems. Avoid contact with skin, eyes or clothing. Flush from skin with water. If eyes are affected, flush with water and get medical attention. Keep container closed when not in use.

Available Packaging: 30 Gallon Drums – Approximately 273 lbs. net
55 Gallon Drums – Approximately 501 lbs. net

GRACE Dearborn

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GRACE Dearborn

Dearborn Division

W. R. Grace & Co. - Conn.
300 Genesee Street
Lake Zurich, IL 60047

(312) 438-3241

October 26, 1989

Mr. Richard Bloom
Westinghouse Hanford Co.
P. O.Box 1970 - Mailstop L-557
Richland, WA 99352

Dear Mr. Bloom:

In response to your request, current Material Safety Data Sheets are enclosed for Super Filmeen 14, Dearcide 702, Dearcide 717, and Dearborn 727.

SUPER FILMEEN 14 has a 96 hr LC_{50} of 3.2 mg/l for bluegill sunfish.

DEARCIDE 702 has a 96 hr LC_{50} of 36 mg/l for bluegill sunfish, 8 mg/l for fathead minnow, 9.3 mg/l for rainbow trout, and a 48 hr LC_{50} of 10.3 mg/l for daphnia magna.

DEARCIDE 717 has a 96 hr LC_{50} of 0.28 ppm for rainbow trout and 0.63 ppm for bluegill sunfish.

DEARBORN 727 would have a 96 hr LC_{50} >1000 mg/l for both bluegill sunfish and rainbow trout.

Please contact me if you have additional questions on these or other Dearborn products.

Sincerely,

S. MORSS
Government Regulations Officer

Enclosures
a/s

CC: Pacific NW District

SM/llc

REF:LLC0327

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APPENDIX C

HANFORD SANITARY WATER QUALITY SURVEILLANCE

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HEHF-74

HANFORD SANITARY WATER QUALITY SURVEILLANCE

CY 1988

S. R. SOMERS

HANFORD ENVIRONMENTAL HEALTH FOUNDATION
ENVIRONMENTAL HEALTH SCIENCES

June 1989

TABLE OF CONTENTS

	Page
List of Tables	ii
Foreword	iii
Hanford Sanitary Water Systems	1
Summary of Data	2
Inorganic Chemicals	6
Organic Chemicals	6
Microbiological	7
Radiological	7
Chemical Monitoring	7
Primary Inorganic Chemical Contaminant Sampling	7
Secondary Chemical and Physical Contaminant Sampling	8
Organic Chemical Contaminant Sampling	10
Microbiological Monitoring	13
Radiological Monitoring	15
Appendix A	19
Acknowledgement	20
Distribution	21

TABLES

Page

TABLE I - Hanford Sanitary Water Systems 3

TABLE II - Primary Inorganic Chemicals in Hanford Sanitary Water Systems 9

TABLE III - Secondary Chemical and Physical Contaminants in Hanford Sanitary Water Systems 11

TABLE IV - Trihalomethanes in Hanford Sanitary Water Systems 12

TABLE V - Coliform Bacterial Densities in Untreated Hanford Sanitary Water Sources 15

TABLE VI - Radiological Contaminants in Hanford Sanitary Water Systems 17

FIGURES

FIGURE 1 - Hanford Sanitary Water Systems Map 5

FOREWORD

Sanitary water quality surveillance on the Hanford Site is conducted primarily as a joint effort by Hanford Environmental Health Foundation, Environmental Health Sciences Department (HEHF/EHS) and Pacific Northwest Laboratory, Earth Sciences Department (PNL/EARTH SCI). HEHF activities are concentrated in the areas of chemical and microbiological quality, while PNL efforts focus on radiological quality. Data from these two sources are reported herein.

The primary purpose of the surveillance program is the protection of the health of persons consuming water on the Hanford Site. This aim is met through the evaluation of compliance of Hanford sanitary water with applicable drinking water regulations. This report summarizes data collected for this purpose in CY 1988.

HANFORD SANITARY WATER QUALITY SURVEILLANCE

HANFORD SANITARY WATER SYSTEMS

During CY 1988, sanitary water was supplied on the Hanford Site by 17 individual drinking water systems, each generally consisting of a raw water supply, treatment facilities, and distribution piping. All of the systems are operated by Department of Energy contractors, with the exception of the City of Richland municipal system which provides water to the 700, 1100, and 3000 Areas. Twelve of the systems utilize Columbia River water as a raw water source, four systems utilize groundwater, and one system (Richland municipal) a combination of the two. The systems range in size from those providing plant-scale treatment and serving extensive areas to eleven systems which supply water to single or small complexes of facilities only.

A key regulatory/administrative development occurred with respect to the Hanford drinking water systems during CY 1988. The State of Washington has assigned system identification numbers and class designations to four major drinking water networks across the Site as part of their effort to assume direct regulatory oversight of those systems. The 100, 200, 300 and 400 Area systems have all been designated as Class 1, and future plans to incorporate many of the smaller systems are being developed. The impact on the existing Hanford drinking water monitoring program has not been significant in that the Hanford Site meets or exceeds all sampling requirements established by the State of Washington. Of more significance are the additional reporting requirements associated with regulation by the State.

The operational changes which have occurred during CY 1988 include the Gable Mountain drinking water facilities, both upper and lower, which discontinued service in September 1988 as part of the land reclamation project associated with prior BWIP programs. In addition, the 251-Trailer located adjacent to the 251 Electrical Switching Building, 600 Area, was uncoupled from the 100-B export line in July 1988. Future plans indicate that the 251 Building will supply treated water to the trailer. Lastly, the

small treatment system in the 105-B Building, 100-B Area, which received raw river water for filtration and chlorination on site, has been disconnected indefinitely due to the reduction in decommissioning activities. The 400 Area continues to utilize Well 499-S1-8J with two standby wells available, and PNL's Arid Land Ecology (ALE) complex continues to be supplied by bottled water due to previousy reported fluoride and lead problems in the system. It should be noted that before any deactivated or standby system returns to an active mode, complete chemical and microbiological testing will be conducted against State of Washington and Federal drinking water regulations.

The systems, along with their sources of supply, service areas, and additional pertinent information are listed in Table I. A Hanford Site map depicting location of the systems (with the exception of the Richland municipal system) is given in Figure 1.

SUMMARY OF DATA

Sanitary water quality data collected on the Hanford Site during CY 1988 were comparable to data collected and reported in previous years and demonstrated continued general compliance with applicable drinking water quality standards.[1,2] The only exceptions involved 1) a single sample in excess of the iron limit and at the color limit, 2) one sample at the manganese limit, and 3) infrequent positive bacteriological samples at various locations. Iron, manganese and color parameters, all aesthetic-based limits, are significantly impacted by localized piping corrosion and do not constitute a health concern at the levels noted. Positive microbiological samples resulted in purveyor notification for corrective action followed by additional monitoring to ensure potability.

---

[1] Rules and Regulations of the State Board of Health Regarding Public Water Systems, 1988, State of Washington Dept. of Social and Health Services.

[2] Environmental Protection Agency, National Interim Primary Drinking Water Regulations, 40 CFR 141.

TABLE I

HANFORD SANITARY WATER SYSTEMS

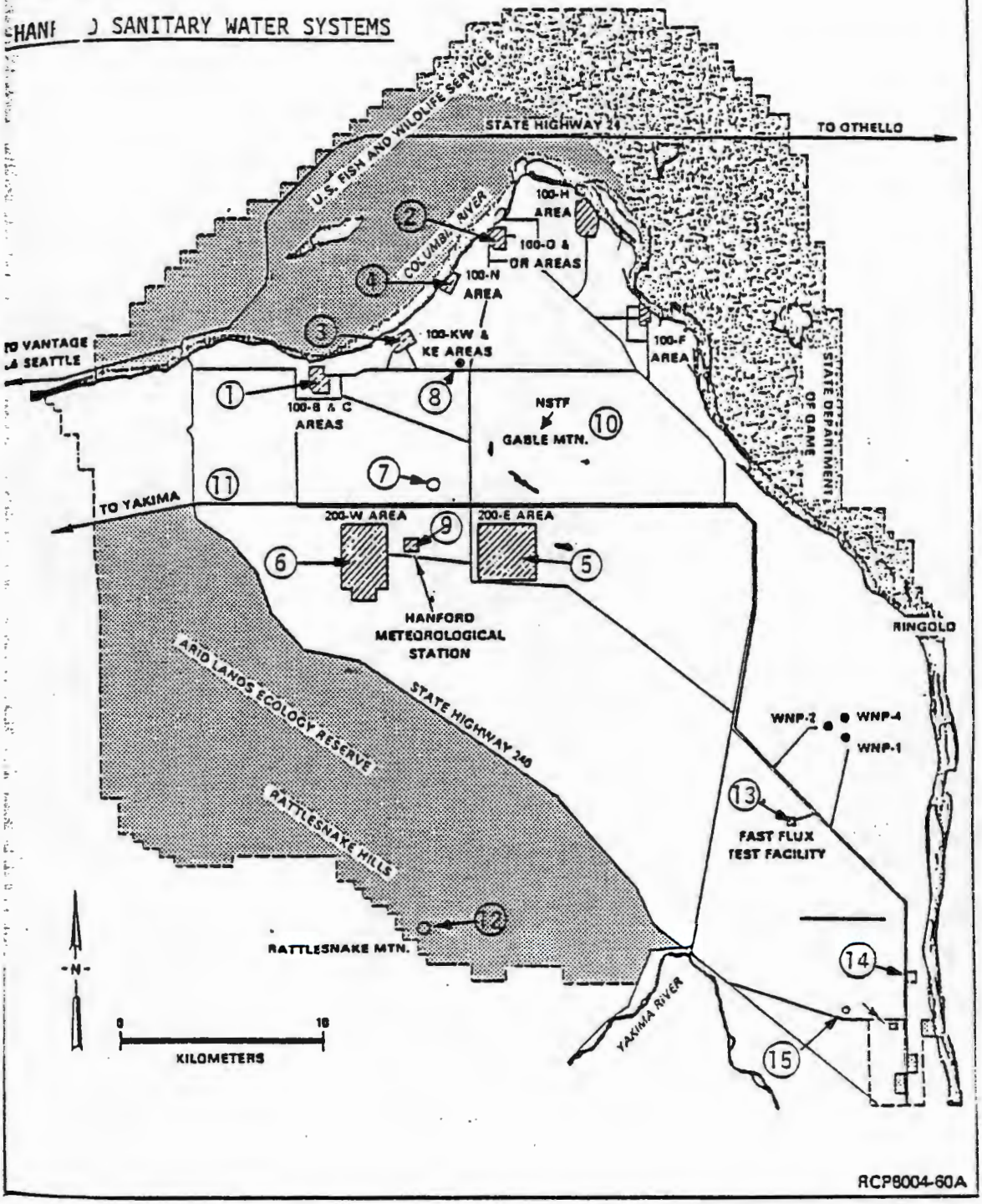
Sustem Name/ID Number	Source of Supply	Notes
182-B/418532	Columbia River via 181-B Pumphouse	Filtered and chlorinated. Sanitary water supplied to 182-B only. System is Westinghouse (WHC) operated.
100-D/418532	Columbia River via 181-D Pumphouse	Filtered and chlorinated at 183-D. Treated water also supplied to 100-F and 100-H Areas as needed. System is WHC operated.
100-K/418532	Columbia River via 181-K Pumphouse	Filtered and chlorinated. System is WHC operated.
100-N/418532	Columbia River via 181-N Pumphouse	Filtered and chlorinated. System is WHC operated.
200-E/41866V	Columbia River via 100-B raw water export	Filtered and chlorinated at 283-E. System is WHC operated.
200-W/41866V	Columbia River via 100-B raw water export	Filtered and chlorinated at 283-W. System is WHC operated.
251 Bldg. (Electrical Switching)	Columbia River via 100-B raw water export	Filtered and chlorinated at 251 Building. System is WHC operated.
609 Bldg. (100-Area Fire Station)	Columbia River via 100-B raw water export	Filtered and chlorinated at 609 Building. System is WHC operated.
622-R (Atmospheric Science Building)	Columbia River via 100-B raw water export	Filtered and chlorinated at 622-R Building. System is Pacific Northwest Laboratory (PNL) operated.

TABLE (Con't)

System Name/ID Number	Source of Supply	Notes
Gable Mt. Near Surface Test Facility (Upper & Lower Levels)	Columbia River via 100-B raw water export	Filtered and chlorinated. System is WHC operated.
Yakima Barricade	Well 699-49100-C	No treatment provided. System is WHC operated.
6652-C (PNL Observatory)	Developed spring on side of Rattlesnake Mountain (Elev. 3160')	Chlorination only. System is PNL operated.
Patrol Trng. Academy	Well 699-S28-EO	Chlorination only. System is WHC operated.
400 Area/419470	Wells 499-S1-8J and 499-SO-7	Supplies mixed: 93% from S1-8J, and 7% from SO-7 in CY 1988. Chlorination only. System is WHC operated.
300 Area/418408	Columbia River via 312 Pumphouse	Filtered and chlorinated at 315 Building. System is WHC operated.
Richland Municipal	Columbia River and groundwater	River water filtered and chlorinated. Well water chlorinated only. Operated by City of Richland.

FIGURE 1

HANF D SANITARY WATER SYSTEMS



1. 100-B Area
2. 100-D Area
3. 100-K Area
4. 100-N Area
5. 200-E Area
6. 200-W Area
7. 251 Building
8. 609 Building
9. 622-R Building
10. Gable Mountain (Near Surface Test Facility Upper and Lower)
11. Yakima Barricade
12. 6652-C Building
13. 400 Area
14. 300 Area
15. Patrol Trng. Academy

Inorganic Chemicals

Sanitary water from seventeen systems supplying water to Hanford facilities throughout CY 1988 was grab sampled for the eleven primary inorganic chemical contaminants listed in the State of Washington drinking water regulations. All samples indicated compliance with each of the maximum contaminant levels established for ten of these primary (health-related) contaminants. No maximum contaminant level has been established for sodium; however, a monitoring requirement has been included to assure that information on sodium levels is available to physicians treating persons on sodium-restricted diets. All but two of the systems were within an "optimum limit" for sodium proposed by the U. S. Environmental Protection Agency.

The same seventeen systems were also grab sampled for the secondary chemical and physical contaminants listed in the State of Washington regulations. All samples indicated total compliance with these secondary (aesthetic-based) limits, with the exception of one sample in excess of the maximum contaminant level for iron and at the limit for color, and a sample at the manganese limit. The noncompliant results are directly related to localized distribution piping corrosion and of aesthetic (taste, appearance, etc.) rather than health concern.

Organic Chemicals

All active Hanford drinking water systems were sampled and analyzed quarterly for a list of 63 volatile organic compounds. Of this list, twelve (i.e., four trihalomethanes and eight volatile organic chemicals (VOCs)), have established maximum contaminant levels. The remaining 51 compounds are subject to monitoring requirements, but have no established maximum contaminant levels, and act as indicator compounds to determine source vulnerability. All systems were within current total trihalomethane limits and the maximum contaminant levels (MCLs) for the eight volatile organics. The remaining 51 unregulated volatile organics were generally nondetectable in all sources, with the exception of one sample containing 38 ppb dichloromethane from the 622-R Building (PNL Atmospheric Science). Subsequent follow-up quarterly samples revealed no presence of dichloromethane.

Microbiological

Over the course of CY 1988, 1193 grab samples were collected from all drinking water systems serving Hanford facilities and analyzed for the presence of coliform bacteria. The samples were collected from representative locations within the distribution systems at regular time intervals and, in nearly all cases, were nondetectable for coliform bacteria.

Nine incidents occurred during CY 1988 where coliform bacteria were identified in Hanford drinking water systems. Eight of the incidents were classified as noncompliant, and a single incident was classified as unsatisfactory based on the State of Washington microbiological criteria. Regardless of classification, all locations were immediately put on increased surveillance and posted as nonpotable pending further microbiological testing. In all cases, corrective action and/or follow-up monitoring allowed the facilities to be returned to normal usage.

Radiological

All drinking water systems serving DOE contractors on the Hanford Site were monitored for radiological constituents in accordance with Federal Environmental Protection Agency and State of Washington drinking water regulations during CY 1988. No drinking water standards for radioactivity were exceeded in any of the potable water supply systems sampled during the year. Radionuclide concentrations observed throughout the year were similar to those observed during recent past years.

CHEMICAL MONITORING

Primary Inorganic Chemical Contaminant Sampling

Compliance of Hanford Site drinking water systems with standards for primary (health-related) inorganic chemicals listed in the State of Washington regulations was determined by grab sampling each system actively supplying water throughout CY 1988. The Richland municipal system was

sampled at two separate locations in the 3000 and 700 Areas. In all cases, this meets or exceeds the State of Washington required testing frequency for Class 1 and 2 systems of yearly analyses for surface water supplies and triennial analyses for groundwater supplies. Results of the analyses, along with applicable standards, are given in Table II. Sampling and analyses for the first six systems listed were performed in February and March 1988; the remaining eleven systems were sampled and analyzed in August and September 1988.

Data in Table II indicate overall compliance of Hanford drinking water systems with State of Washington standards for primary inorganic contaminants. The data are representative of typical historic levels of these parameters in Hanford drinking water.

No maximum contaminant level for sodium has been established under current drinking water regulations; however, State of Washington drinking ter regulations include a monitoring requirement for sodium to assure that information on sodium is available to physicians treating persons on sodium-restricted diets. The U. S. Environmental Protection Agency has proposed that levels of 20 mg/L or less in drinking water should be considered optimal in recognition of a small population segment with total dietary sodium restrictions of 500 mg/day or less. As indicated in Table II, only two Hanford Site systems--400 Area (primarily Well 499-S1-8J) and Yakima Barricade (Well 699-49100C)--revealed sodium levels exceeding this U. S. EPA "optimum limit." The data in Table II are typical of previous data on sodium in Hanford systems and reveal surface water systems well below and groundwater systems generally approaching or exceeding 20 mg/L.

Secondary Chemical and Physical Contaminant Sampling

Compliance of Hanford Site drinking water systems with secondary chemical and physical contaminant standards as listed in the State of Washington regulations was also determined by a grab sampling program. Once again, all drinking water systems active throughout CY 1988 were monitored. The required monitoring frequency (State of Washington) is the same as that for the primary inorganics for Class 1 and 2 systems; i.e., annually on

TABLE I

PRIMARY INORGANIC CHEMICALS IN HANFORD SANITARY WATER SYSTEMS

System	Concentration, Units of mg/L (ppm)										
	Arsenic	Barium	Cadmium	Chromium	Fluoride	Lead	Mercury	Nitrate (as N)	Selenium	Silver	Sodium
300 Area, 3720 Bldg.	*	0.16	*	*	*	0.014	*	0.18	*	*	2.5
Richland, RO Bldg.	*	0.12	*	*	*	*	*	0.17	*	*	2.6
Richland, 747 Bldg.	*	0.17	*	*	*	*	*	0.63	*	*	8.7
100-K Area, 1720 Bldg.	*	0.16	*	*	*	*	*	0.25	*	*	2.3
251 Substation	*	*	*	*	*	*	*	0.16	*	*	2.7
400 Area, 499-S1-8J	*	0.16	*	*	0.33	*	*	0.14	*	*	29.0
Gable Mountain, Upper	*	0.12	*	*	*	*	*	0.16	*	*	4.5
Gable Mounain, Lower	*	0.12	*	*	*	*	*	0.26	*	*	6.8
100-N Area, 1100 Bldg.	*	0.12	*	*	0.19	0.010	*	*	*	*	3.5
100-B Area, 182 Bldg.	*	0.11	0.0006	*	0.10	*	*	0.21[1]	*	*	2.2[1]
100-D Area, 1713 Bldg.	*	0.15	*	*	*	*	*	0.12	*	*	2.8
Well 699-49100-C, Yakima Barricade	*	0.43	0.003	*	*	*	*	2.9	*	*	29.0
622-R, PNL Atm. Sci.	*	0.12	*	*	*	*	*	0.18	*	*	5.1
200-E Area, 2750 Bldg.	*	0.12	*	*	*	*	*	1.18	*	*	2.4
200-W Area, 2704 Bldg.	*	0.14	*	*	*	*	*	*	*	*	2.3
Well S28-E0, Patrol Training Academy	0.008	0.20	*	*	0.24	*	*	2.07	*	*	11.5
609 Bldg., Central Fire Station	*	0.15	*	*	*	*	*	0.11	*	*	4.0
6652-C, PNL Observ.	*	0.14	*	*	0.19	*	*	1.4	*	*	8.6
Drinking Water Stnd	0.05	1.0	0.01	0.05	2.0	0.05	0.002	10.0	0.01	0.05	20.0**
Detection Limit	0.005	0.1	0.0005	0.005	0.1	0.005	0.0005	0.05	0.005	0.005	0.1

* Less than detection limit.
**EPA proposed optimum limit. (See text, "Chemical Monitoring, Primary Inorganic Chemical Contaminant Sampling.")
[1]Represents the average of data collected on 9-28, 11-9, and 11-16 necessitated by apparent contamination of initial sample.

surface water supplies and once every three years on groundwater supplies. Secondary contaminant standards can be distinguished from the primary (health-related) standards in that they are set to protect the aesthetic quality of water (taste, odor, color, appearance, etc.) and are set well below levels of health concern. Results of this sampling program are given in Table III.

The data indicate general compliance with applicable standards, except for a single sample in excess of the iron limit and at the color limit and a sample at the manganese limit. All of these parameters are regulated based on aesthetic-related concerns, such as taste and laundry staining, rather than on their toxic significance. These elements are generally associated with localized piping corrosion, especially in older Hanford facilities, and usually can be easily reduced via preflushing of fixtures and lines.

Organic Chemical Contaminant Sampling

All 17 Hanford drinking water systems were sampled and analyzed quarterly for a list of 63 organic chemicals. These chemicals generally fall into one of three regulatory groups; namely, four trihalomethane compounds regulated with a single combined maximum contaminant level (MCL), eight volatile organic compounds with individual MCLs, and lastly, a list of 51 volatile organics for which monitoring is required but for which no maximum contaminant levels have been established. A total list of all volatile organics monitored is provided in Appendix A.

Trihalomethanes in drinking water occur due to a chemical interaction of the chlorine added for disinfection with naturally occurring organic substances in the source water. State of Washington regulations limit total trihalomethanes; i.e., the sum of the compounds listed in Appendix A, Group 1, to 0.1 mg/L (100 ppb). Table IV represents the quarterly analysis of total trihalomethanes monitored within Hanford drinking water systems for CY 1988. As can be seen, all monitored Hanford systems were within the 100 ppb limit, with the highest measured concentration being 76% of the maximum contaminant level. This occurred at the Gable Mountain complex which terminated its drinking water system in September 1988. The monitoring

TABLE III

SECONDARY CHEMICAL AND PHYSICAL CONTAMINANTS IN HANFORD SANITARY WATER SYSTEMS

System	Concentration, Units of mg/L (ppm)							
	Color (Units)	Chloride	Copper	Iron	Manganese	Total Dissolved Solids	Sulfate	Zinc
300 Area, 3720 Building	*	2.9	0.10	*	*	100	16	1.6
Richland, RO Building	*	2.4	0.13	*	*	80	14	*
Richland, 747 Building	*	9.1	0.05	0.09	*	170	31	0.3
100-K Area, 1720 Building	*	2.0	*	0.05	*	79	33	0.1
251 Substation	*	1.6	*	*	*	85	12	0.1
400 Area, 499-S1-8J	*	11.9	0.11	*	*	209	34	*
Gable Mountain, Upper	*	3.9	0.12	*	*	89	12	0.2
Gable Mountain, Lower	*	6.9	*	0.05	*	64	10	1.4
100-N Area, 1100 Building	15	3.0	*	0.56**	0.01	110	25	1.0
100-B Area, 182 Building	*	1.9[1]	*	0.16	*	67[1]	14	0.9
100-D Area, 1713 Building	*	7.1	*	0.08	0.05	109	22	0.3
Well 699-49100-C, Yak. Barr.	*	3.8	*	*	*	382	73	1.3
622-R, PNL Atm. Sci.	*	4.8	*	*	*	73	11	0.3
200-E Area, 2750 Building	*	3.8	*	0.16	*	56	15	*
200-W Area, 2704 Building	*	2.4	*	*	*	67	15	*
Well S28-E0, Patrol Trng. Acad.	*	8.8	*	*	*	197	19	0.2
609 Bldg., Central Fire Station	*	3.7	*	0.05	0.01	82	11	*
6652-C, PNL Observatory	*	4.3	*	*	*	198	11	0.5
Drinking Water Standard	15	250	1.0	0.3	0.05	500	250	5.0
Detection Limit	5	0.2	0.05	0.03	0.01	5	0.5	0.1

*Less than detection limit.
**Noncompliance (see text, "Chemical Monitoring; Secondary Chemical and Physical Contaminant Sampling").
[1]Represents the average of data collected on 9-28, 11-9, and 11-16 necessitated by apparent contamination of initial sample.

TRIHALOMETHANES IN HANFORD SANITARY WATER SYSTEMS

System	Concentration, Units of ug/L (ppb)				
	February	June	August	December	Avg. Annual TTHM Conc.
400 Area, Well 499-S1-8J	5.7	7.4	*	*	6.6
Gable Mountain	19.0	76.0	--	--	47.5
100-K Area	12.0	26.2	27.1	20.7	21.5
100-B Area	3.4	2.3	18.0	21.1	11.2
251 Substation	6.4	18.6	34.9	13.9	18.5
Well 699-49100-C, Yakima Barricade	*	*	*	*	*
Richland, 700 Area	39.2	14.0	--	--	26.6
622-R, PNL Atmospheric Science	32.0	25.0	38.7	25.1	30.2
200-E Area	15.1	44.7	40.2	23.0	30.8
200-W Area	6.6	42.7	26.6	15.4	22.8
Richland, 3000 Area	29.7	11.4	26.8	8.8	19.2
6652-C, PNL Observatory	15.3	11.4	8.4	10.7	11.5
Well S28-E0, Patrol Trng. Academy	*	9.8	11.2	7.0	9.3
300 Area	10.4	50.0	61.7	32.9	38.8
100-D Area	2.8	28.8	16.6	8.7	14.2
100-N Area	14.0	26.5	24.5	24.6	22.4
609 Bldg., Central Fire Station	7.2	49.4	29.5	30.2	29.1

* = None Detected.
-- = Not sampled.

uirement for trihalomethanes for Class 1 and 2 systems utilizing orination as a treatment technique is quarterly for surface waters and ually for groundwater sources. In all cases, trihalomethane sampling ts or exceeds the State of Washington test frequencies.

Monitoring was conducted for the eight volatile organic chemicals for ich the Environmental Protection Agency and the State of Washington have tablished maximum contaminant levels (MCLs). (See Appendix A, Group 2, for emical constituents and established MCLs.) Grab samples were collected arterly from each ground and surface water system; subsequent results were eraged as a yearly average for each organic compound. For all systems, the gulated VOCs were nondetectable, less than 0.5 µg/L (ppb), which is far low regulated MCLs and indicates total compliance. Required sampling equencies for these eight VOCs range from quarterly to once every five ars based upon the detection of VOCs during initial sampling and/or lnerability of the system to contamination. Although the Hanford drinking ter network has historically been free of identified VOC contamination, rve ance for these compounds will continue.

The remaining 51 volatile organic compounds do not have established aximum contaminant levels, but are used as water quality indicators. Of all he organics analyzed (see Appendix A, Group 3), the only sample revealing a etectable VOC concentration was a first quarter sample from PNL's tmospheric Science Building (622-R) identified as having 38 µg/L (ppb) ichloromethane. Subsequent follow-up samples were all nondetectable for ichloromethane.

MICROBIOLOGICAL MONITORING

Microbiological quality of Hanford Site drinking water was monitored hrough a routine program of sample collection and analysis for coliform acteria, the traditionally used indicator organisms for bacterial contamination of drinking water. Representative grab samples were collected on an every-other-week basis from all systems supplying sanitary water on the

Hanford Site with the exception of the 300 Area which was sampled on a weekly basis. In addition, weekly samples were collected from the 1170 Building based on a past history of infrequent positive coliform results. These frequencies, in all cases, meet or exceed the minimum sampling frequencies specified in the State of Washington regulations.

Nine incidents occurred during CY 1988 where coliform bacteria were identified in Hanford drinking water systems. Eight of the incidents were classified as noncompliant and a single unsatisfactory based on the State of Washington microbiological criteria.

Positive coliform results occurred at the following buildings on the date(s) in parentheses: Patrol Training Academy (7-11); 182-B (7-26); 251 (8-22 and 10-3); 1170 (8-30, 9-27, 10-11, and 11-22); and 271-T (12-12). With all occurrences, maintenance crews or landlord personnel were notified to perform a system check and to verify proper chlorinator operations. The locations were posted until follow-up microbiological testing verified a return to satisfactory bacterial quality. With the exception of the 1170 Building, none of the buildings have a history of positive coliform results. The 1170 Building reportedly underwent several months of maintenance activities on the drinking water piping, followed by reoccurring positive results. Each incident was followed by notification, system review, and follow-up microbiological monitoring to confirm potability. The 1170 Building has a prior history of transient positive samples due to being located near the end of the city main. For this reason, the facility is on a weekly surveillance protocol.

As a general indicator of the bacteriological quality of Hanford source waters, coliform monitoring of raw water was begun in CY 1988. For both source types--surface and groundwater--the monitoring frequency is one sample per quarter. This surveillance sampling was initiated in the third quarter. It should be noted that bacterial concentrations in surface waters are highly variable with seasonal and climatic changes. In comparison, bacterial levels in groundwater sources are relatively stable and should reflect nondetectable coliform concentrations if the aquifer is a protected source and the well is properly sealed. The results are as summarized in Table V and include data

rom all ground and surface water sources or points of intake, with the xcep on of the 622-R Building (PNL Atmospheric Science) and 6652-C (PNL bservatory) which are currently being phased into this surveillance program.

TABLE V

COLIFORM BACTERIAL DENSITIES IN UNTREATED HANFORD SANITARY WATER SOURCES

System	Source	Bacterial Densities (Most Probable Number/100 mL) 3rd Quarter	4th Quarter
100 Area	Surface	170	17
200 Area (100-B export)	Surface	2	7
300 Area	Surface	110	22
400 Area (Well 499-S1-8J)	Ground	<2	<2
Yakima Barricade (Well 699-49100-C)	Ground	<2	<2
700/1100/3000 Areas (Richland Municipal)	Surface/Ground	240	79

RADIOLOGICAL MONITORING

All drinking water systems serving DOE contractor personnel on the Hanford Site were monitored for radiological constituents in accordance with applicable regulations throughout CY 1988. The raw water supply (untreated) was monitored in those cases where multiple treatment facilities or extensive distribution systems were served by a single raw water source. These included the 100-B Area, 100-N Area, 300 Area and Richland raw water supplies. In all other cases, finished or treated water was collected from the final distribution system. Samples were collected on a quarterly basis at a minimum. All routine radiochemical analyses of the drinking water samples were performed by U. S. Testing Company (UST).

The applicable standards for radiological constituents in drinking water are found in the National Interim Primary Drinking Water Regulations, Environmental Protection Agency, and Rules and Regulations of the State Board of Health Regarding Public Water Systems, State of Washington. These

standards are summarized as follows:

- The maximum allowable levels for gross alpha, Radium-226 and Radium-288 are:

Gross Alpha (excluding uranium)	15 pCi/L
Combined Radium-226 and Radium-228	5 pCi/L
Radium-226	3 pCi/L

- Gross alpha measurements may be substituted for the Radium-226 and Radium-228 analyses provided the gross alpha results do not exceed 5 pCi/L.

- The maximum allowable level for beta particle and gamma radioactivity from man-made radionuclides is the average annual concentration that produces an annual dose equivalent to the whole body or any internal organ greater than 4 millirem/year. If two or more radionuclides are present, the sum of their annual dose equivalents shall not exceed 4 millirem.

Compliance may be assumed without further analysis if the annual average concentrations of gross beta, tritium, and strontium-90 are less than 50 pCi/L, 20,000 pCi/L and 8 pCi/L, respectively.

The results of radiological analyses of drinking water samples collected during CY 1988 are summarized in Table VI. Radionuclide concentrations observed throughout 1988 were well below applicable drinking water limits in all cases. Monitoring for Iodine-131, which was not consistently identified at any location throughout the year, was performed at 100-N Area (first potential source of Iodine-131 entering the river) and at the 100-D and 300 Areas (the first two drinking water systems using river water downstream of 100-N) in order to demonstrate compliance and document the very low levels observed.

TABLE VI

RADIOLOGICAL CONTAMINANTS IN HANFORD SANITARY WATER SYSTEMS

System	No. of Samples	Annual Average Concentration[a], pCi/L				
		Alpha	Beta	^{3}H	^{131}I	^{90}Sr
100-B Area	4	0.39±0.26	0.9±0.6	100±20	*[b]	0.13±0.02
100-K Area	4	0.24±0.31	1.1±1.3	**[c]	*	**
100-N Area	12	0.45±0.08	1.8±0.3	120±80	0.21±0.26	0.21±0.04
100-D Area	4	0.25±0.29	2.0±0.8	130±40	0.06±0.35	0.52±0.14
300 Area	4	0.59±0.26	2.1±1.0	170±50	0.014±0.005	0.13±0.04
Richland[d]	12	0.53±0.21	1.1±0.5	130±10	*	0.13±0.02
Yakima Barricade	5	2.67±0.50	8.8±2.3	60±100	*	0.01±0.03
400 Area	4	0.05±0.12	7.2±2.2	4,100±2,400	*	0.01±0.02
Patrol Academy	4	1.73±0.44	6.1±1.4	-4±80	*	0.04±0.04
Observatory	4	0.52±0.43	1.8±1.1	-6±80	*	0.003±0.016
Standards[e]		15 (excluding U)	50	20,000	3	8

[a]Average reported ± two standard error of the calculated mean.
[b]* Signifies constituent was not detected.
[c]**Signifies samples not analyzed for this constituent during 1988.
[d]Columbia River component only.
[e]See text, "Radiological Monitoring" for further discussion.

In general, results observed throughout CY 1988 were similar to those observed during recent past years. The concentration of Iodine-129 in 400 Area drinking water continued to be of special interest during 1988 since itwas identified at elevated levels in the local ground water. Analysis of one sample of the 400 drinking water revealed an I-129 concentration of 0.0046 ± 0.0009 pCi/L, well below the 1.0 pCi/L level which would result in an annual dose equivalent of 4 millirem.

APPENDIX A

GROUP 1 - TRIHALOMETHANES

Chloroform
Bromoform
Dichlorobromoform
Dibromochloroform

GROUP 2 - REGULATED VOLATILE ORGANIC COMPOUNDS

Compound	Maximum Contaminant Level (ppb)
Vinyl chloride	2
Carbon tetrachloride	5
Benzene	5
1,2-dichloroethane	5
Trichloroethylene	5
1,1-dichloroethylene	7
p-dichlorobenzene	75
1,1,1-trichloroethane	200

GROUP 3 - UNREGULATED VOLATILE ORGANIC COMPOUNDS

Dichlorodifluoromethane
1,1-dichloropropene
Chloroethane
Chloroform
Trans-1,2-dichloroethylene
Bromoform
cis-1,2-dichloroethane
Dibromomethane
p-isopropyltoluene
1,1,2-trichloroethane
1,3-dichloropropane
1,2-dibromoethane
1,1,1,2-tetrachloroethane
1,2,3-trichloropropane
p-chlorotoluene
1,4-dichlorobenzene
1,2-dibromo-3-chloropropane
Hexachlorobutadiene
Ethyl benzene
o-Xylene
Isopropylbenzene
1,3,5-trimethylbenzene
1,2,4-trimethylbenzene
N-butyl benzene
1,1,2,2-tetrachloroethane
Dibromochloromethane
Chloromethane
Bromomethane
Trichlorofluoromethane
Methylene chloride
1,1-dichloroethane
2,2-dichloropropane
Chlorobromomethane
Dichlorobromomethane
1,3-dichloropropene
Tetrachloroethylene
1,2-dichloropropane
Chlorobenzene
Bromobenzene
o-chlorotoluene
m-dichlorobenzene
Toluene
1,2,4-trichlorobenzene
1,2,3-trichlorobenzene
p-Xylene
Styrene
N-propyl benzene
t-Butyl benzene
Sec-butyl benzene
Naphthalene
m-Xylene

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A. G. Law, R2-84
G. G. Meade, R3-54
T. E. Morris, S4-01
D. J. Sommers, H4-52

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APPENDIX D

OLD AND NEW DATA

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Table D-1. Old and New Data for the 400 Area Secondary Cooling Water. (sheet 1 of 10)

Constituent	Sample number[a]	Sampling date	Method[c]	Result (ppb)
Arsenic (EP Toxic)	50713E	10/20/89	ICP	<5.00 E+02
Arsenic (EP Toxic)	50784E	11/21/89	ICP	<5.00 E+02
Arsenic (EP Toxic)	50826E	12/06/89	ICP	<5.00 E+02
Arsenic (EP Toxic)	50876E	01/09/90	ICP	<5.00 E+02
Barium	50240	02/19/87	ICP	3.80 E+01
Barium	50293	05/05/87	ICP	4.40 E+01
Barium	50299	05/11/87	ICP	4.40 E+01
Barium	50332	08/07/87	ICP	3.40 E+01
Barium	50713	10/20/89	ICP	3.00 E+01
Barium	50784	11/21/89	ICP	4.00 E+01
Barium	50826	12/06/89	ICP	3.80 E+01
Barium	50876	01/09/90	ICP	3.00 E+01
Barium (EP Toxic)	50713E	10/20/89	ICP	<1.00 E+03
Barium (EP Toxic)	50784E	11/21/89	ICP	<1.00 E+03
Barium (EP Toxic)	50826E	12/06/89	ICP	<1.00 E+03
Barium (EP Toxic)	50876E	01/09/90	ICP	<1.00 E+03
Boron	50713	10/20/89	ICP	4.60 E+01
Boron	50784	11/21/89	ICP	5.50 E+01
Boron	50826	12/06/89	ICP	5.20 E+01
Boron	50876	01/09/90	ICP	4.10 E+01
Cadmium (EP Toxic)	50713E	10/20/89	ICP	<1.00 E+02
Cadmium (EP Toxic)	50784E	11/21/89	ICP	<1.00 E+02
Cadmium (EP Toxic)	50826E	12/06/89	ICP	<1.00 E+02
Cadmium (EP Toxic)	50876E	01/09/90	ICP	<1.00 E+02
Calcium	50240	02/19/87	ICP	7.16 E+04
Calcium	50293	05/05/87	ICP	7.93 E+04
Calcium	50299	05/11/87	ICP	7.89 E+04
Calcium	50332	08/07/87	ICP	4.16 E+04
Calcium	50713	10/20/89	ICP	4.89 E+04
Calcium	50784	11/21/89	ICP	6.79 E+04
Calcium	50826	12/06/89	ICP	5.47 E+04
Calcium	50876	01/09/90	ICP	4.89 E+04
Chloride	50240	02/19/87	IC	2.58 E+04
Chloride	50293	05/05/87	IC	2.19 E+04
Chloride	50299	05/11/87	IC	2.23 E+04
Chloride	50332	08/07/87	IC	1.79 E+04
Chloride	50713	10/20/89	IC	1.90 E+04
Chloride	50784	11/21/89	IC	1.51 E+04
Chloride	50826	12/06/89	IC	2.72 E+04
Chloride	50876	01/09/90	IC	2.10 E+04
Chromium (EP Toxic)	50713E	10/20/89	ICP	<5.00 E+02
Chromium (EP Toxic)	50784E	11/21/89	ICP	<5.00 E+02
Chromium (EP Toxic)	50826E	12/06/89	ICP	<5.00 E+02
Chromium (EP Toxic)	50876E	01/09/90	ICP	<5.00 E+02
Copper	50240	02/19/87	ICP	2.00 E+01

Table D-1. Old and New Data for the 400 Area Secondary Cooling Water. (sheet 2 of 10)

Constituent	Sample number[a]	Sampling date	Method[c]	Result (ppb)
Copper	50293	05/05/87	ICP	2.40 E+01
Copper	50299	05/11/87	ICP	2.00 E+01
Copper	50332	08/07/87	ICP	1.30 E+01
Copper	50713	10/20/89	ICP	<1.00 E+01
Copper	50784	11/21/89	ICP	<1.00 E+01
Copper	50826	12/06/89	ICP	<1.00 E+01
Copper	50876	01/09/90	ICP	1.10 E+01
Fluoride	50240	02/19/87	IC	5.37 E+02
Fluoride	50293	05/05/87	IC	1.10 E+03
Fluoride	50299	05/11/87	IC	1.15 E+03
Fluoride	50332	08/07/87	IC	6.15 E+02
Fluoride	50332	08/07/87	ISE	6.80 E+02
Fluoride	50713	10/20/89	IC	7.00 E+02
Fluoride	50713	10/20/89	ISE	6.22 E+02
Fluoride	50784	11/21/89	IC	5.35 E+02
Fluoride	50784	11/21/89	ISE	7.50 E+02
Fluoride	50826	12/06/89	IC	7.00 E+02
Fluoride	50826	12/06/89	ISE	6.88 E+02
Fluoride	50876	01/09/90	IC	7.00 E+02
Fluoride	50876	01/09/90	ISE	6.55 E+02
Iron	50240	02/19/87	ICP	<5.00 E+01
Iron	50293	05/05/87	ICP	<5.00 E+01
Iron	50299	05/11/87	ICP	5.60 E+01
Iron	50332	08/07/87	ICP	<5.00 E+01
Iron	50713	10/20/89	ICP	3.40 E+01
Iron	50784	11/21/89	ICP	<3.00 E+01
Iron	50826	12/06/89	ICP	7.90 E+01
Iron	50876	01/09/90	ICP	7.20 E+01
Lead (EP Toxic)	50713E	10/20/89	ICP	<5.00 E+02
Lead (EP Toxic)	50784E	11/21/89	ICP	<5.00 E+02
Lead (EP Toxic)	50826E	12/06/89	ICP	<5.00 E+02
Lead (EP Toxic)	50876E	01/09/90	ICP	<5.00 E+02
Lithium	50713	10/20/89	ICP	2.50 E+01
Lithium	50784	11/21/89	ICP	3.40 E+01
Lithium	50826	12/06/89	ICP	3.00 E+01
Lithium	50876	01/09/90	ICP	2.60 E+01
Magnesium	50240	02/19/87	ICP	1.98 E+04
Magnesium	50293	05/05/87	ICP	2.38 E+04
Magnesium	50299	05/11/87	ICP	2.42 E+04
Magnesium	50332	08/07/87	ICP	1.47 E+04
Magnesium	50713	10/20/89	ICP	1.45 E+04
Magnesium	50784	11/21/89	ICP	1.83 E+04
Magnesium	50826	12/06/89	ICP	1.64 E+04
Magnesium	50876	01/09/90	ICP	1.38 E+04
Manganese	50240	02/19/87	ICP	1.30 E+01

Table D-1. Old and New Data for the 400 Area Secondary Cooling Water. (sheet 3 of 10)

Constituent	Sample number[a]	Sampling date	Method[c]	Result (ppb)
Manganese	50293	05/05/87	ICP	2.90 E+01
Manganese	50299	05/11/87	ICP	4.00 E+01
Manganese	50332	08/07/87	ICP	2.20 E+01
Manganese	50713	10/20/89	ICP	1.80 E+01
Manganese	50784	11/21/89	ICP	8.00 E+00
Manganese	50826	12/06/89	ICP	1.50 E+01
Manganese	50876	01/09/90	ICP	1.20 E+01
Mercury (EP Toxic)	50713E	10/20/89	CVAA/M	<2.00 E+01
Mercury (EP Toxic)	50784E	11/21/89	CVAA/M	<2.00 E+01
Mercury (EP Toxic)	50826E	12/06/89	CVAA/M	<2.00 E+01
Mercury (EP Toxic)	50876E	01/09/90	CVAA/M	<2.00 E+01
Nitrate	50240	02/19/87	IC	2.23 E+03
Nitrate	50293	05/05/87	IC	1.51 E+03
Nitrate	50299	05/11/87	IC	1.07 E+03
Nitrate	50332	08/07/87	IC	5.87 E+02
Nitrate	50713	10/20/89	IC	1.10 E+03
Nitrate	50784	11/21/89	IC	9.37 E+02
Nitrate	50826	12/06/89	IC	1.40 E+03
Nitrate	50876	01/09/90	IC	1.00 E+03
Potassium	50240	02/19/87	ICP	2.31 E+04
Potassium	50293	05/05/87	ICP	2.57 E+04
Potassium	50299	05/11/87	ICP	2.51 E+04
Potassium	50332	08/07/87	ICP	1.44 E+04
Potassium	50713	10/20/89	ICP	1.43 E+04
Potassium	50784	11/21/89	ICP	1.95 E+04
Potassium	50826	12/06/89	ICP	1.71 E+04
Potassium	50876	01/09/90	ICP	1.41 E+04
Selenium (EP Toxic)	50713E	10/20/89	ICP	<5.00 E+02
Selenium (EP Toxic)	50784E	11/21/89	ICP	<5.00 E+02
Selenium (EP Toxic)	50826E	12/06/89	ICP	<5.00 E+02
Selenium (EP Toxic)	50876E	01/09/90	ICP	<5.00 E+02
Silicon	50713	10/20/89	ICP	3.46 E+04
Silicon	50784	11/21/89	ICP	4.41 E+04
Silicon	50826	12/06/89	ICP	3.87 E+04
Silicon	50876	01/09/90	ICP	3.21 E+04
Silver (EP Toxic)	50713E	10/20/89	ICP	<5.00 E+02
Silver (EP Toxic)	50784E	11/21/89	ICP	<5.00 E+02
Silver (EP Toxic)	50826E	12/06/89	ICP	<5.00 E+02
Silver (EP Toxic)	50876E	01/09/90	ICP	<5.00 E+02
Sodium	50240	02/19/87	ICP	8.38 E+04
Sodium	50293	05/05/87	ICP	9.59 E+04
Sodium	50299	05/11/87	ICP	9.62 E+04
Sodium	50332	08/07/87	ICP	5.81 E+04
Sodium	50713	10/20/89	ICP	5.91 E+04
Sodium	50784	11/21/89	ICP	7.61 E+04

Table D-1. Old and New Data for the 400 Area Secondary Cooling Water. (sheet 4 of 10)

Constituent	Sample number[a]	Sampling date	Method[c]	Result (ppb)
Sodium	50826	12/06/89	ICP	6.75 E+04
Sodium	50876	01/09/90	ICP	5.58 E+04
Strontium	50240	02/19/87	ICP	3.44 E+02
Strontium	50293	05/05/87	ICP	3.85 E+02
Strontium	50299	05/11/87	ICP	3.84 E+02
Strontium	50332	08/07/87	ICP	<3.00 E+02
Strontium	50713	10/20/89	ICP	2.57 E+02
Strontium	50784	11/21/89	ICP	3.42 E+02
Strontium	50826	12/06/89	ICP	2.94 E+02
Strontium	50876	01/09/90	ICP	2.49 E+02
Sulfate	50240	02/19/87	IC	7.94 E+04
Sulfate	50293	05/05/87	IC	8.15 E+04
Sulfate	50299	05/11/87	IC	8.35 E+04
Sulfate	50332	08/07/87	IC	5.49 E+04
Sulfate	50713	10/20/89	IC	6.40 E+04
Sulfate	50784	11/21/89	IC	5.12 E+04
Sulfate	50826	12/06/89	IC	6.88 E+04
Sulfate	50876	01/09/90	IC	7.19 E+04
Uranium	50240	02/19/87	FLUOR	1.72 E-01
Uranium	50293	05/05/87	FLUOR	1.67 E+00
Uranium	50299	05/11/87	FLUOR	2.07 E+00
Uranium	50332	08/07/87	FLUOR	4.78 E-01
Uranium	50713	10/20/89	FLUOR	1.85 E-01
Uranium	50784	11/21/89	FLUOR	2.14 E-01
Uranium	50826	12/06/89	FLUOR	5.68 E-01
Uranium	50876	01/09/90	FLUOR	3.08 E-01
Zinc	50240	02/19/87	ICP	7.30 E+01
Zinc	50293	05/05/87	ICP	5.40 E+01
Zinc	50299	05/11/87	ICP	3.90 E+01
Zinc	50332	08/07/87	ICP	1.07 E+02
Zinc	50713	10/20/89	ICP	4.20 E+01
Zinc	50784	11/21/89	ICP	2.00 E+01
Zinc	50826	12/06/89	ICP	2.60 E+01
Zinc	50876	01/09/90	ICP	4.80 E+01
Acetone	50713	10/20/89	VOA	2.70 E+01
Acetone	50713	10/20/89	ABN	<1.00 E+01
Acetone	50713B	10/20/89	VOA	<1.00 E+01
Acetone	50713T	10/20/89	VOA	<1.00 E+01
Acetone	50784	11/21/89	VOA	<1.00 E+01
Acetone	50784	11/21/89	ABN	<1.00 E+01
Acetone	50784B	11/21/89	VOA	<1.00 E+01
Acetone	50784T	11/21/89	VOA	<1.00 E+01
Acetone	50826	12/06/89	VOA	<1.00 E+01
Acetone	50826	12/06/89	ABN	<1.00 E+01
Acetone	50826B	12/06/89	VOA	<1.00 E+01

Table D-1. Old and New Data for the 400 Area Secondary Cooling Water. (sheet 5 of 10)

Constituent	Sample number[a]	Sampling date	Method[c]	Result (ppb)
Acetone	50826T	12/06/89	VOA	<1.00 E+01
Acetone	50876	01/09/90	VOA	<1.00 E+01
Acetone	50876	01/09/90	ABN	<1.00 E+01
Acetone	50876B	01/09/90	VOA	<6.00 E+00
Acetone	50876T	01/09/90	VOA	<1.00 E+01
Ammonia	50240	02/19/87	ISE	<5.00 E+01
Ammonia	50293	05/05/87	ISE	<5.00 E+01
Ammonia	50299	05/11/87	ISE	<5.00 E+01
Ammonia	50332	08/07/87	ISE	<5.00 E+01
Ammonia	50713	10/20/89	ISE	1.00 E+02
Ammonia	50784	11/21/89	ISE	<5.00 E+01
Ammonia	50826	12/06/89	ISE	<5.00 E+01
Ammonia	50876	01/09/90	ISE	1.20 E+02
Bromodichloromethane	50713	10/20/89	VOA	<5.00 E+00
Bromodichloromethane	50713B	10/20/89	VOA	<5.00 E+00
Bromodichloromethane	50713T	10/20/89	VOA	<5.00 E+00
Bromodichloromethane	50784	11/21/89	VOA	<5.00 E+00
Bromodichloromethane	50784B	11/21/89	VOA	<5.00 E+00
Bromodichloromethane	50784T	11/21/89	VOA	<5.00 E+00
Bromodichloromethane	50826	12/06/89	VOA	5.00 E+00
Bromodichloromethane	50826B	12/06/89	VOA	<5.00 E+00
Bromodichloromethane	50826T	12/06/89	VOA	<5.00 E+00
Bromodichloromethane	50876	01/09/90	VOA	<5.00 E+00
Bromodichloromethane	50876B	01/09/90	VOA	<5.00 E+00
Bromodichloromethane	50876T	01/09/90	VOA	<5.00 E+00
2-butanone	50240	02/19/87	VOA	<1.00 E+01
2-butanone	50240B	02/19/87	VOA	<1.00 E+01
2-butanone	50293	05/05/87	VOA	<1.00 E+01
2-butanone	50293B	05/05/87	VOA	<1.00 E+01
2-butanone	50332	08/07/87	VOA	<1.00 E+01
2-butanone	50332B	08/07/87	VOA	<1.00 E+01
2-butanone	50713	10/20/89	VOA	1.20 E+01
2-butanone	50713B	10/20/89	VOA	2.30 E+01
2-butanone	50713T	10/20/89	VOA	1.90 E+01
2-butanone	50784	11/21/89	VOA	<1.00 E+01
2-butanone	50784B	11/21/89	VOA	<1.00 E+01
2-butanone	50784T	11/21/89	VOA	<1.00 E+01
2-butanone	50826	12/06/89	VOA	<6.00 E+00
2-butanone	50826B	12/06/89	VOA	<7.00 E+00
2-butanone	50826T	12/06/89	VOA	<1.00 E+01
2-butanone	50876	01/09/90	VOA	<1.00 E+01
2-butanone	50876B	01/09/90	VOA	<1.00 E+01
2-butanone	50876T	01/09/90	VOA	<1.00 E+01
Dichloromethane	50240	02/19/87	VOA	<1.00 E+01
Dichloromethane	50240B	02/19/87	VOA	4.90 E+01

Table D-1. Old and New Data for the 400 Area Secondary Cooling Water. (sheet 6 of 10)

Constituent	Sample number[a]	Sampling date	Method[c]	Result (ppb)
Dichloromethane	50293	05/05/87	VOA	<1.00 E+01
Dichloromethane	50293B	05/05/87	VOA	3.60 E+01
Dichloromethane	50332	08/07/87	VOA	<1.00 E+01
Dichloromethane	50332B	08/07/87	VOA	<1.00 E+01
Dichloromethane	50713	10/20/89	VOA	<5.00 E+00
Dichloromethane	50713B	10/20/89	VOA	1.00 E+01
Dichloromethane	50713T	10/20/89	VOA	7.90 E+01
Dichloromethane	50784	11/21/89	VOA	<5.00 E+00
Dichloromethane	50784B	11/21/89	VOA	<3.00 E+00
Dichloromethane	50784T	11/21/89	VOA	<3.00 E+00
Dichloromethane	50826	12/06/89	VOA	<5.00 E+00
Dichloromethane	50826B	12/06/89	VOA	<5.00 E+00
Dichloromethane	50826T	12/06/89	VOA	<5.00 E+00
Dichloromethane	50876	01/09/90	VOA	<5.00 E+00
Dichloromethane	50876B	01/09/90	VOA	<5.00 E+00
Dichloromethane	50876T	01/09/90	VOA	<5.00 E+00
Diethoxytetrahydrofuran	50240	02/19/87	ABN	3.70 E+01
Tetrahydrofuran	50713	10/20/89	VOA	<1.00 E+01
Tetrahydrofuran	50713B	10/20/89	VOA	2.00 E+01
Tetrahydrofuran	50713T	10/20/89	VOA	<1.00 E+01
Tetrahydrofuran	50784	11/21/89	VOA	<1.00 E+01
Tetrahydrofuran	50784B	11/21/89	VOA	<1.00 E+01
Tetrahydrofuran	50784T	11/21/89	VOA	<1.00 E+01
Tetrahydrofuran	50826	12/06/89	VOA	<1.00 E+01
Tetrahydrofuran	50826B	12/06/89	VOA	<1.00 E+01
Tetrahydrofuran	50826T	12/06/89	VOA	<1.00 E+01
Tetrahydrofuran	50876	01/09/90	VOA	<1.00 E+01
Tetrahydrofuran	50876B	01/09/90	VOA	<1.00 E+01
Tetrahydrofuran	50876T	01/09/90	VOA	<6.00 E+00
Trichloromethane	50240	02/19/87	VOA	<1.00 E+01
Trichloromethane	50240B	02/19/87	VOA	<1.00 E+01
Trichloromethane	50293	05/05/87	VOA	<1.00 E+01
Trichloromethane	50293B	05/05/87	VOA	<1.00 E+01
Trichloromethane	50332	08/07/87	VOA	<1.00 E+01
Trichloromethane	50332B	08/07/87	VOA	<1.00 E+01
Trichloromethane	50713	10/20/89	VOA	<5.00 E+00
Trichloromethane	50713B	10/20/89	VOA	<5.00 E+00
Trichloromethane	50713T	10/20/89	VOA	<5.00 E+00
Trichloromethane	50784	11/21/89	VOA	<5.00 E+00
Trichloromethane	50784B	11/21/89	VOA	<4.00 E+00
Trichloromethane	50784T	11/21/89	VOA	1.10 E+01
Trichloromethane	50826	12/06/89	VOA	8.00 E+00
Trichloromethane	50826B	12/06/89	VOA	<4.00 E+00
Trichloromethane	50826T	12/06/89	VOA	<4.00 E+00
Trichloromethane	50876	01/09/90	VOA	<5.00 E+00

Table D-1. Old and New Data for the 400 Area Secondary Cooling Water. (sheet 7 of 10)

Constituent	Sample number[a]	Sampling date	Method[c]	Result (ppb)
Trichloromethane	50876B	01/09/90	VOA	<3.00 E+00
Trichloromethane	50876T	01/09/90	VOA	<3.00 E+00
Unknown	50240	02/19/87	ABN	5.60 E+01
Unknown	50293	05/05/87	ABN	5.70 E+01
Alkalinity (method B)	50713	10/20/89	TITRA	2.42 E+05
Alkalinity (method B)	50784	11/21/89	TITRA	3.09 E+05
Alkalinity (method B)	50826	12/06/89	TITRA	2.73 E+05
Alkalinity (method B)	50876	01/09/90	TITRA	2.86 E+05
Alpha activity (pCi/L)	50240	02/19/87	Alpha	5.20 E-01
Alpha activity (pCi/L)	50293	05/05/87	Alpha	9.22 E-01
Alpha activity (pCi/L)	50332	08/07/87	Alpha	3.20 E-01
Alpha activity (pCi/L)	50713	10/20/89	Alpha	<5.17 E-02
Alpha activity (pCi/L)	50784	11/21/89	Alpha	<1.27 E+00
Alpha activity (pCi/L)	50876	01/09/90	Alpha	<6.23 E-01
Beta activity (pCi/L)	50240	02/19/87	Beta	2.14 E+01
Beta activity (pCi/L)	50293	05/05/87	Beta	3.17 E+01
Beta activity (pCi/L)	50299	05/11/87	Beta	2.95 E+01
Beta activity (pCi/L)	50332	08/07/87	Beta	2.25 E+01
Beta activity (pCi/L)	50713	10/20/89	Beta	1.22 E+01
Beta activity (pCi/L)	50784	11/21/89	Beta	2.02 E+01
Beta activity (pCi/L)	50826	12/06/89	Beta	3.12 E+01
Beta activity (pCi/L)	50876	01/09/90	Beta	1.26 E+01
Conductivity (µS)	50240	02/19/87	COND-Fld	6.28 E+02
Conductivity (µS)	50293	05/05/87	COND-Fld	1.10 E+02
Conductivity (µS)	50299	05/11/87	COND-Fld	7.61 E+02
Conductivity (µS)	50332	08/07/87	COND-Fld	5.32 E+02
Conductivity (µS)	50713	10/20/89	COND-Fld	5.27 E+02
Conductivity (µS)	50784	11/21/89	COND-Fld	7.53 E+02
Conductivity (µS)	50826	12/06/89	COND-Fld	6.85 E+02
Conductivity (µS)	50876	01/09/90	COND-Fld	6.98 E+02
Ignitability (°F)[b]	50713E	10/20/89	IGNIT	2.12 E+02
Ignitability (°F)[b]	50784E	11/21/89	IGNIT	2.14 E+02
Ignitability (°F)[b]	50826E	12/06/89	IGNIT	2.10 E+02
Ignitability (°F)[b]	50876E	01/09/90	IGNIT	2.12 E+02
pH (dimensionless)	50240	02/19/87	PH-Fld	8.22 E+00
pH (dimensionless)	50293	05/05/87	PH-Fld	8.05 E+00
pH (dimensionless)	50299	05/11/87	PH-Fld	8.20 E+00
pH (dimensionless)	50332	08/07/87	PH-Fld	7.60 E+00
pH (dimensionless)	50713	10/20/89	PH-Fld	8.85 E+00
pH (dimensionless)	50784	11/21/89	PH-Fld	8.80 E+00
pH (dimensionless)	50826	12/06/89	PH-Fld	7.25 E+00
pH (dimensionless)	50876	01/09/90	PH-Fld	8.80 E+00
Reactivity cyanide (mg/kg)	50713E	10/20/89	DSPEC	<1.00 E+02
Reactivity cyanide (mg/kg)	50784E	11/21/89	DSPEC	<1.00 E+02
Reactivity cyanide (mg/kg)	50826E	12/06/89	DSPEC	<1.00 E+02

Table D-1. Old and New Data for the 400 Area Secondary Cooling Water. (sheet 8 of 10)

Constituent	Sample number[a]	Sampling date	Method[c]	Result (ppb)
Reactivity cyanide (mg/kg)	50876E	01/09/90	DSPEC	<1.00 E+02
Reactivity sulfide (mg/kg)	50713E	10/20/89	DTITRA	<1.00 E+02
Reactivity sulfide (mg/kg)	50784E	11/21/89	DTITRA	<1.00 E+02
Reactivity sulfide (mg/kg)	50826E	12/06/89	DTITRA	<1.00 E+02
Reactivity sulfide (mg/kg)	50876E	01/09/90	DTITRA	<1.00 E+02
TDS	50713	10/20/89	TDS	4.01 E+05
TDS	50784	11/21/89	TDS	5.53 E+05
TDS	50826	12/06/89	TDS	4.65 E+05
TDS	50876	01/09/90	TDS	4.11 E+05
Temperature (°C)	50240	02/19/87	TEMP-Fld	1.38 E+01
Temperature (°C)	50293	05/05/87	TEMP-Fld	1.97 E+01
Temperature (°C)	50299	05/11/87	TEMP-Fld	2.22 E+01
Temperature (°C)	50332	08/07/87	TEMP-Fld	2.44 E+01
Temperature (°C)	50713	10/20/89	TEMP-Fld	1.93 E+01
Temperature (°C)	50784	11/21/89	TEMP-Fld	1.86 E+01
Temperature (°C)	50826	12/06/89	TEMP-Fld	1.63 E+01
Temperature (°C)	50876	01/09/90	TEMP-Fld	1.77 E+01
TOC	50240	02/19/87	TOC	3.35 E+03
TOC	50293	05/05/87	TOC	3.74 E+03
TOC	50299	05/11/87	TOC	4.29 E+03
TOC	50332	08/07/87	TOC	1.98 E+03
TOC	50713	10/20/89	TOC	2.40 E+03
TOC	50784	11/21/89	TOC	<1.90 E+03
TOC	50826	12/06/89	TOC	2.30 E+03
TOC	50876	01/09/90	TOC	2.10 E+03
Total carbon	50713	10/20/89	TC	6.00 E+04
Total carbon	50784	11/21/89	TC	6.95 E+04
Total carbon	50826	12/06/89	TC	6.28 E+04
Total carbon	50876	01/09/90	TC	5.14 E+04
TOX (as Cl)	50240	02/19/87	LTOX	1.86 E+02
TOX (as Cl)	50293	05/05/87	LTOX	1.47 E+02
TOX (as Cl)	50299	05/11/87	LTOX	1.32 E+02
TOX (as Cl)	50332	08/07/87	LTOX	1.03 E+02
TOX (as Cl)	50713	10/20/89	LTOX	7.30 E+01
TOX (as Cl)	50784	11/21/89	LTOX	1.54 E+02
TOX (as Cl)	50826	12/06/89	LTOX	2.61 E+02
TOX (as Cl)	50876	01/09/90	LTOX	7.90 E+01
^{60}Co (pCi/L)	50713	10/20/89	GEA	<4.02 E-01
^{60}Co (pCi/L)	50784	11/21/89	GEA	9.16 E+01
^{60}Co (pCi/L)	50826	12/06/89	GEA	<2.36 E-01
^{60}Co (pCi/L)	50876	01/09/90	GEA	<5.94 E-01
^{137}Cs (pCi/L)	50713	10/20/89	GEA	<3.48 E-01
^{137}Cs (pCi/L)	50784	11/21/89	GEA	9.48 E+01
^{137}Cs (pCi/L)	50826	12/06/89	GEA	<6.67 E-01
^{3}H (pCi/L)	50713	10/20/89	LSC	6.65 E+03

Table D-1. Old and New Data for the 400 Area Secondary Cooling Water. (sheet 9 of 10)

Constituent	Sample number[a]	Sampling date	Method[c]	Result (ppb)
^{3}H (pCi/L)	50784	11/21/89	LSC	6.31 E+03
^{3}H (pCi/L)	50826	12/06/89	LSC	6.89 E+03
^{3}H (pCi/L)	50876	01/09/90	LSC	6.31 E+03
Radium total (pCi/L)	50713	10/20/89	Alpha-Ra	1.82 E-01
Radium total (pCi/L)	50784	11/21/89	Alpha-Ra	1.70 E-01
Radium total (pCi/L)	50826	12/06/89	Alpha-Ra	<1.32 E-01
Radium total (pCi/L)	50876	01/09/90	Alpha-Ra	<7.35 E-02

NOTE: Measurements are in ppb unless noted.
AA = atomic absorption spectroscopy
EP = Extraction Procedure Toxicity Test
GC = gas chromatography
ICP = inductively-coupled plasma spectroscopy
MS = mass spectrometry
TDS = total dissolved solids
TOC = total organic carbon
TOX = total organic halides

[a]See Table 3-1 for corresponding chain-of-custody number and explanations of sample number suffix.

[b]Ignitability is the maximum temperature of the test (no sample actually ignited).

[c]Methods code:

Code	Analytical Method	Reference[d]
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

Table D-1. Old and New Data for the 400 Area Secondary Cooling Water. (sheet 10 of 10)

Code	Analytical Method	Reference[d]
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
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

[d]Reference:

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*, 3rd ed., SW-846, U.S. Environmental Protection Agency, Washington, D.C.