DOE/RL-92-71
Rev. 1

100-D Ponds Closure Plan

United States
Department of Energy
Richland, Washington

DOE/RL-92-71
Rev. 1

100-D Ponds Closure Plan

Date Published
September 1997

United States
Department of Energy
P.O. Box 550
Richland, Washington 99352

EXECUTIVE SUMMARY

The Hanford Facility is owned by the U. S. Government and operated by the U. S. Department of Energy (DOE), Richland Operations Office (RL). Dangerous waste and mixed waste (containing both radioactive and dangerous components) are managed and produced on the Hanford Facility, a portion of the 1,450-square-kilometer (560-square-mile) Hanford Site. The 100-D Ponds is a Treatment Storage, and Disposal (TSD) unit on the Hanford Facility that received both dangerous and nonregulated waste. Dangerous waste is regulated in accordance with the *Resource Conservation and Recovery Act of 1976* (RCRA) and the *State of Washington Hazardous Waste Management Act of 1976* [as administered through the Washington State Department of Ecology (Ecology) Dangerous Waste Regulations, *Washington Administrative Code* (WAC), Chapter 173-303].

This Closure Plan (Rev. 1) for the 100-D Ponds TSD unit consists of a RCRA Part A Dangerous Waste Permit Application (Rev. 3), a RCRA Closure Plan, and supporting information contained in the appendices to the plan. The Part A Permit Application revisions are explained at the beginning of the Part A section. The closure plan consists of eight chapters containing facility description, process information, waste characteristics, and groundwater monitoring data. There are also chapters containing the closure strategy and performance standards. The strategy for the closure of the 100-D Ponds TSD unit is clean closure. Appendices A and B of the closure plan demonstrate that soil and groundwater beneath 100-D Ponds are below cleanup limits. All dangerous wastes or dangerous waste constituents or residues association with the operation of the ponds have been removed, therefore, human health and the environment are protected.

Discharges to the 100-D Ponds, which are located in the 100-DR-1 operable unit, were discontinued in June 1994. Contaminated sediment was removed from the ponds in August 1996. Subsequent sampling and analysis demonstrated that there is no contamination remaining in the ponds, therefore, this closure plan is a demonstration of clean closure as defined in the Hanford Facility RCRA Permit, Part II.K.1. Closure of the 100-D Ponds will be complete after approval and incorporation of this Closure Plan in the Hanford Facility RCRA Permit, Modification D. Since the 100-D Ponds are considered clean, there will be no requirements for a landfill cover or post-closure care.

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APPENDICES

ACRONYMS AND ABBREVIATIONS

CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	*Code of Federal Regulations*
COC	Contaminant of Concern
DOE	U.S. Department of Energy
DQO	Data Quality Objectives
Ecology	Washington State Department of Ecology
ERC	Environmental Restoration Contractor
EPA	U.S. Environmental Protection Agency
HEIS	Hanford Environmental Information System
MDL	mechanical development laboratory
MTCA	*Model Toxics Control Act*
QA	quality assurance
QC	quality control
PCB	Polychlorinated biphenyl
RCRA	*Resource Conservation and Recovery Act of 1976*
RPD	Relative Percent Difference
RL	U.S. Department of Energy, Richland Operations Office
SAP	Sampling and Analysis Plan
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
TSD	treatment, storage, and/or disposal
WAC	Washington Administrative Code
WTF	Water Treatment Facility

PART A FORMS

The owner or operator of a facility that transfers, treats, stores, disposes, or recycles dangerous waste must obtain a permit in accordance with *Washington Administrative Code* (WAC) 173-303-800 through 840 covering the active life, closure period, ground water protection compliance period, and/or post-closure care period, as applicable. The dangerous waste permit application, commonly referred to as the Part A, allows a treatment, storage, and disposal (TSD) unit to operate without endangering public health or the environment.

The 100-D Ponds historically received corrosive dangerous waste from the regeneration of three ion exchange columns, which required the operator to apply for a dangerous waste permit. The TSD is no longer receiving discharges of any kind and will be closed under interim status. Form 1 of the Part A, included in this closure plan, was submitted to the Washington State Department of Ecology (Ecology) in May 1988. The three-page Form 1 provides general information about the Hanford Facility such as contacts, location, and operator information.

Form 3 of the Part A is specific to 100-D Ponds. The original Part A, Form 3 was submitted in August 1986. Revision 1 was prepared to add Process Code D85 (Disposal-Other), the amount, and unit of measurement, respectively. Revision 1, submitted on August 15, 1987, also increased the Estimated Annual Quantity of Waste from 64,350,000 L (17,000,000 gal) to 567,800,000 L (150,000,000 gal). Revision 2 of the Part A, Form 3, submitted November 16, 1987, changed Process Code D85 to D84 (Disposal-Surface Impoundment). Revision 3 of the Part A, Form 3 was prepared to accompany Revision 0 of this closure plan, and revises discharge quantities and deletes reference to the 185-D Thermal Hydraulics Test Facility as a current effluent contributor. Revision 4 of the Part A, Form 3 was prepared after all discharges to the ponds were ceased in June 1994, and reflects the current status of this unit.

FORM 1

State of Washington Department of Ecology

WASHINGTON STATE

DANGEROUS WASTE PERMIT GENERAL INFORMATION

(Read "Form 1 Instructions" before starting)

I. EPA/STATE I.D. NUMBER
WA7890008967

II. NAME OF FACILITY
US DEPARTMENT OF ENERGY - HANFORD FACILITY

III. FACILITY CONTACT
A. NAME & TITLE (last, first, & title): WAGONER, JOHN D., MANAGER
B. PHONE (area code & no.): 509 376 7395

IV. FACILITY MAILING ADDRESS
A. STREET OR P.O. BOX: PO BOX 550
B. CITY OR TOWN: RICHLAND
C. STATE: WA
D. ZIP CODE: 99352

V. FACILITY LOCATION
A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER: HANFORD SITE
B. COUNTY NAME: BENTON
C. CITY OR TOWN: RICHLAND
D. STATE: WA
E. ZIP CODE: 99352
F. COUNTY CODE (if known): 005

IV. SIC CODES *(4-digit, in order of priority)*

A. FIRST		B. SECOND	
9999	(specify) NONCLASSIFIABLE	4953	(specify) REFUSE SYSTEMS
C. THIRD		D. FOURTH	
9511	(specify) AIR AND WATER RESOURCE AND SOLID WASTE MANAGEMENT	8733	(specify) RESEARCH, NONCOMMERCIAL

VII. OPERATOR INFORMATION
A. NAME:
DEPARTMENT OF ENERGY, RICHLAND OPERATIONS
FLUOR DANIEL HANFORD, INC. (FDH)
B. Is the name listed in Item VII-A also the owner? * ☒ YES ☐ NO **

C. STATUS OF OPERATOR (Enter the appropriate letter into the answer box; if "Other", specify.)
F = FEDERAL
S = STATE
P = PRIVATE
M = PUBLIC (other than federal or state)
O = OTHER (specify)
F (specify)

D. PHONE (area code & no.): * 509 376 7395
** 509 372 2886

E. STREET OR P.O. BOX: * PO BOX 550 (DOE-RL)
** P. O. BOX 1000 (FDH)

F. CITY OR TOWN: RICHLAND
G. STATE: WA
H. ZIP CODE: 99352

VIII. INDIAN LAND
Is the facility located on Indian lands? ☐ YES ☒ NO

* DOE-RL: OWNER/OPERATOR **FDH: CO-OPERATOR FOR CERTAIN UNITS ON THE HANFORD SITE.

COMPLETE BACK PAGE

IX. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids undergound. Include all springs, rivers and other surface water bodies in the map area. See instructions for precise requirements.

X. NATURE OF BUSINESS *(provide a brief description)*

- NONCLASSIFIABLE - GENERAL
- REFUSE SYSTEMS
- AIR AND WATER RESOURCE AND SOLID WASTE MANAGEMENT
- RESEARCH, NONCOMMERCIAL

XI. CERTIFICATION *(see instructions)*

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE (type or print) SEE ATTACHMENT	B. SIGNATURE	C. DATE SIGNED

FORM 1

DANGEROUS WASTE PERMIT GENERAL INFORMATION

XI. OPERATOR CERTIFICATION

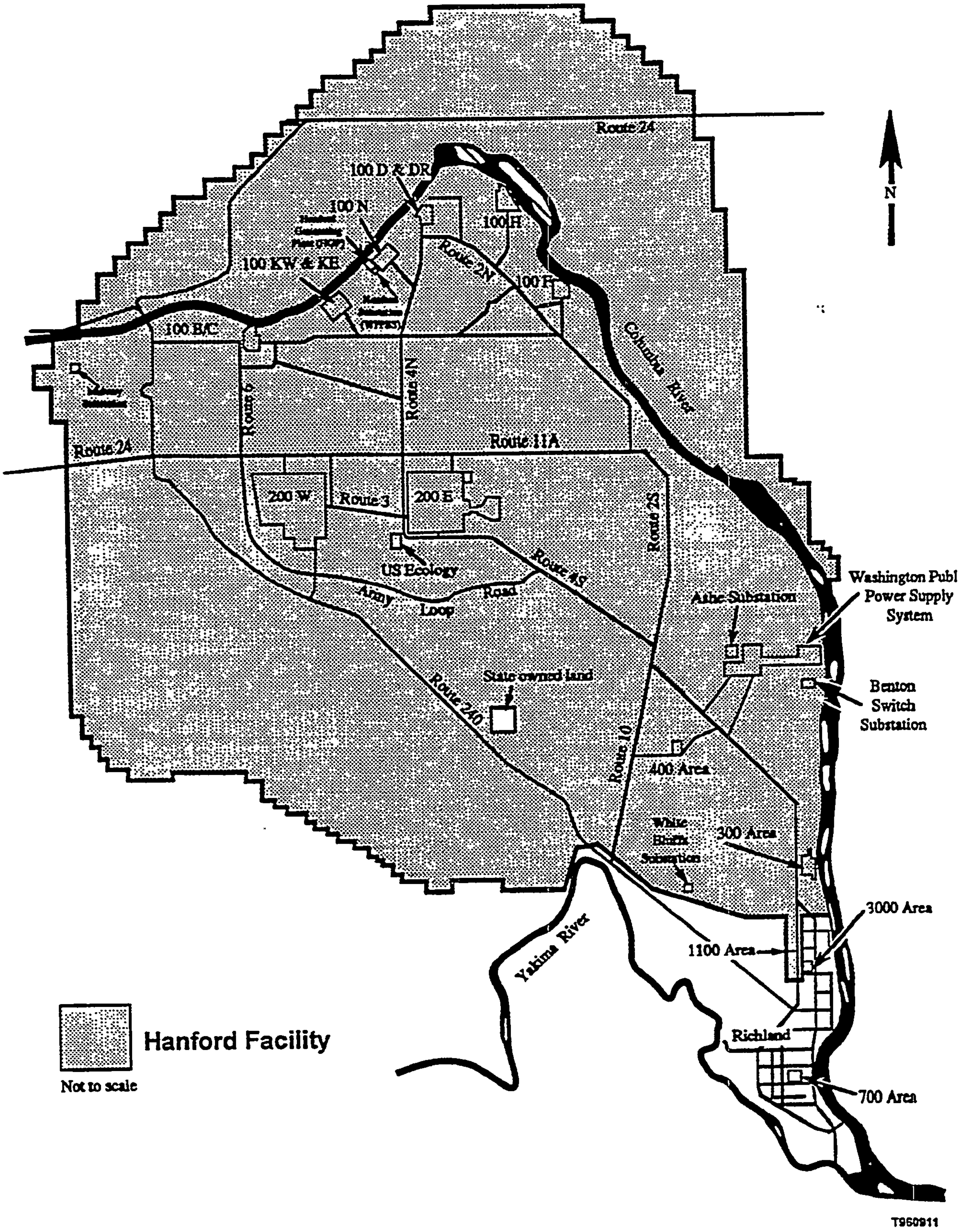
I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

John D. Wagoner
Owner/Operator
John D. Wagoner, Manager
U.S. Department of Energy
Richland Operations Office

9/26/96
Date

Co-operator
H. J. Hatch,
President and Chief Executive Officer
Fluor Daniel Hanford, Inc.

9/13/96
Date



T960911

Hanford Facility

Please print or type in the unshaded areas only
(fill-in areas are spaced for elite type, i.e., 12 character/inch).

FORM **3**

DANGEROUS WASTE PERMIT APPLICATION

1. EPA/STATE I.D. NUMBER

W	A	7	8	9	0	0	0	8	9

FOR OFFICIAL USE ONLY

APPLICATION APPROVED	DATE RECEIVED *(mo., day, & yr.)*	COMMENTS

II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below (mark one box only) to indicate whether this is the first application you are submitting for your facility or a revisec application. If this is your first application and you already know your facility's EPA/STATE I.D. Number, or if this is a revised application, enter your facility's EPA/ST I.D. Number in Section I above.

A. FIRST APPLICATION *(place an "X" below and provide the appropriate data)*

☐ 1. EXISTING FACILITY *(See instructions for definition of "existing" facility. Complete item below.)*

MO.	DAY	YR.
0 1	0 1	7 7

FOR EXISTING FACILITIES, PROVIDE THE DATE *(mo., day, & yr.)* OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED *(use the boxes to the left)*

☐ 2. NEW FACILITY *(Complete item below)*

MO.	DAY	YR.

FOR NEW FACILITIES, PROVIDE THE DATE, *(mo., day, & yr)* OPERATION BEGAN OR IS EXPECTED TO BEGIN

B. REVISED APPLICATION *(place an "X" below and complete Section I above)*

☒ 1. FACILITY HAS AN INTERIM STATUS PERMIT

☐ 2. FACILITY HAS A FINAL PERMIT

III. PROCESSES - CODES AND CAPACITIES

A. PROCESS CODE - Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for enter codes. If more lines are needed, enter the code(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe th process *(including its design capacity)* in the space provided on the *(Section III-C).*

B. PROCESS DESIGN CAPACITY - For each code entered in column A enter the capacity of the process.

1. AMOUNT - Enter the amount.

2. UNIT OF MEASURE - For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure usec Only the units of measure that are listed below should be used.

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
torage:		
CONTAINER (barrel, drum, etc)	S01	GALLONS OR LITERS
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
INJECTION WELL	D80	GALLONS OR LITERS
LANDFILL	D81	ACRE-FEET *(the volume that would cover one acre to a depth of one foot)* OR HECTARE-METER
LAND APPLICATION	D82	ACRES OR HECTARES
OCEAN DISPOSAL	D83	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D84	GALLONS OR LITERS

PROCESS	PROCESS CODE	APPROPRIATE UNITS O MEASURE FOR PROCES DESIGN CAPACITY
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
OTHER (Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Section III-C.)	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G
LITERS	L
CUBIC YARDS	Y
CUBIC METERS	C
GALLONS PER DAY	U

UNIT OF MEASURE	UNIT OF MEASURE CODE
LITERS PER DAY	V
TONS PER HOUR	D
METRIC TONS PER HOUR	W
GALLONS PER HOUR	E
LITERS PER HOUR	H

UNIT OF MEASURE	UNIT O MEASUF CODE
ACRE-FEET	
HECTARE-METER	
ACRES	
HECTARES	

EXAMPLE FOR COMPLETING SECTION III *(shown in line numbers X-1 and X-2 below)*: *A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons.* The facility also has an incinerator that can burn up to 20 gallons per hour.

LINE NUMBER	A. PROCESS CODE *(from list above)*	B. PROCESS DESIGN CAPACITY 1. AMOUNT *(specify)*	2. UNIT OF MEASURE *(enter code)*	FOR OFFICIAL USE ONLY	LINE NUMBER	A. PROCESS CODE *(from list above)*	B. PROCESS DESIGN CAPACITY 1. AMOUNT *(specify)*	2. UNIT OF MEASURE *(enter code)*	FOR OFFIC USE ONL
X-1	*S 0 2*	*600*	*G*		*5*				
X-2	*T 0 3*	*20*	*E*		*6*				
	T 0 4	45,000	U		*7*				
2	D 8 4	19,600,000	G		*8*				
3					*9*				
4					*10*				

Continued from the front.

III. PROCESSES (continued)

SPACE FOR ADDITIONAL PROCESS CODES OR FOR DESCRIBING OTHER PROCESS (code "T04"). FOR EACH PROCESS ENTERED HERE INCLUDE DESIGN CAPA

T04, D84

The 100-D Ponds historically received corrosive dangerous waste from the regeneration of three ion exchange columns located in the Thermal Hydraulics Test Facility and the Mechanical Development Laboratory of the combined 185-D/189-D Building, and nonregulated process water generated from the 183-D Filter Water Plant (183-D), a sanitary water treatment facility. Treatment of the waste occurred by the successive discharge to the ponds of acidic waste and caustic waste (T04). This treatment served to neutralize the waste in the ponds. Any acidic or caustic waste that reached the soil was likely buffered by the calcareous constituents of the soil. Approximately 45,000 gallons (170,000 liters) per day were treated in the 100-D Ponds; a fraction of this was the corrosive dangerous waste. This unit has not received dangerous waste since January 1986. The 100-D Ponds also received 720,000 gallons (2,730,000 liters) of nonregulated process water twice a year when the 183-D Settling Basins were washed down, and 140,000 gallons (530,000 liters) monthly when the 183-D sandfilters were backwashed. 100-D Ponds last received a discharge of nonregulated process water on May 27, 1994 and will be closed under interim status. The process design capacity for disposal reflects the maximum volume of waste/process water discharged to the 100-D Ponds annually before January 1986, rather than the physical capacity of the unit (D84).

IV. DESCRIPTION OF DANGEROUS WASTES

A. DANGEROUS WASTE NUMBER - Enter the four digit number from Chapter 173-303 WAC for each listed dangerous waste you will handle. If you handle dangerous wastes which are not listed in Chapter 173-303 WAC, enter the four digit number(s) that describes the characteristics and/or the toxic contaminants of those dangerous wastes.

B. ESTIMATED ANNUAL QUANTITY - For each listed waste entered in column A estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in column A estimate the total annual quantity of all the non-listed waste(s) that will be handled which possess that characteristic or contaminant.

C. UNIT OF MEASURE - For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account appropriate density or specific gravity of the waste.

D. PROCESSES

1. PROCESS CODES:

For listed dangerous waste: For each listed dangerous waste entered in column A select the code(s) from the list of process codes contained in Section III to indicate how the waste will be stored, treated, and/or disposed of at the facility.

For non-listed dangerous wastes: For each characteristic or toxic contaminant entered in Column A, select the code(s) from the list of process codes contained i Section III to indicate all the processes that will be used to store, treat, and/or dispose of all the non-listed dangerous wastes that possess that characteristic or toxic contaminant.

Note: Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in the extreme righ box of Item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code(s).

2. PROCESS DESCRIPTION: If a code is not listed for a process that will be used, describe the process in the space provided on the form.

NOTE: DANGEROUS WASTES DESCRIBED BY MORE THAN ONE DANGEROUS WASTE NUMBER - Dangerous wastes that can be described by more than one Wast Number shall be described on the form as follows:

1. Select one of the Dangerous Waste Numbers and enter it in column A. On the same line complete columns B, C, and D by estimating the total annual quantity the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
2. In column A of the next line enter the other Dangerous Waste Number that can be used to describe the waste. In column D(2) on that line enter "included witl above" and make no other entries on that line.
3. Repeat step 2 for each other Dangerous Waste Number that can be used to describe the dangerous waste.

EXAMPLE FOR COMPLETING SECTION IV *(shown in line numbers X-1, X-2, X-3, and X-4 below)* - A facility will treat and dispose of an estimated 900 pounds per y of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non-listed wastes. Two wastes are corrosiv only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per y of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

LINE NO.	A. DANGEROUS WASTE NO. *(enter code)*				B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE *(enter code)*	D. PROCESSES 1. PROCESS CODES *(enter)*				D. PROCESSES 2. PROCESS DESCRIPTION *(if a code is not entered in D(1))*
	K	0	5	4	900	P	T 0 3	D 8 0			
X-2	D	0	0	2	400	P	T 0 3	D 8 0			
X-3	D	0	0	1	100	P	T 0 3	D 8 0			
X-4	D	0	0	2			T 0 3	D 8 0			*Included with above*

Continued from page 2.

NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

I.D. NUMBER *(entered from page 1)*

A	7	8	9	0	0	0	8	9	6	7

IV. DESCRIPTION OF DANGEROUS WASTES (continued)

LINE NO.	A. DANGEROUS WASTE NO. *(enter code)*	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE *(enter code)*	D. PROCESSES 1. PROCESS CODES *(enter)*				D. PROCESSES 2. PROCESS DESCRIPTION *(if a code is not entered in D(1))*
1	D002	163,600,000	P	T04	D84			Neutralization/Percolation
2								
3								
4								
5								
6								
7								
8								
9								
10								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
25								
26								

Continued from the front.

IV. DESCRIPTION OF DANGEROUS WASTES (continued)

USE THIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM SECTION D(1) ON PAGE 3.

The 100-D Ponds historically received corrosive dangerous waste from the 185-D/189-D Building and nonregulated process water from the 183-D. The waste consisted of the acidic and caustic backwashes (D002) from the regeneration of ion exchange columns in the 185-D/189-D Building. The actual annual volume of corrosive waste discharged to the 100-D Ponds is not known, although approximately 19,600,000 gallons (74,200,000 liters) of waste/process water was discharged annually to the ponds before January 1986.

ACILITY DRAWING

xisting facilities must include in the space provided on page 5 a scale drawing of the facility *(see instructions for more detail).*

VI. PHOTOGRAPHS

All existing facilities must include photographs *(aerial or ground-level)* that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas *(see instructions for more detail).*

VII. FACILITY GEOGRAPHIC LOCATION

This information is provided on the attached drawings and photos.

LATITUDE *(degrees, minutes, & seconds)*	LONGITUDE *(degrees, minutes, & seconds)*

VIII. FACILITY OWNER

☒ A. If the facility owner is also the facility operator as listed in Section VII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VII on Form 1, complete the following items:

1. NAME OF FACILITY'S LEGAL OWNER	2. PHONE NO. *(area code & no.)*

3. STREET OR P.O. BOX	4. CITY OR TOWN	5. ST.	6. ZIP CODE

IX. OWNER CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

NAME *(print or type)*	SIGNATURE	DATE SIGNED
John D. Wagoner, Manager U.S. Department of Energy Richland Operations Office	John D. Wagoner	6/30/94

OPERATOR CERTIFICATION

ify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my y of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that are significant penalties for submitting false information, including the possibility of fine and imprisonment.

NAME *(print or type)*	SIGNATURE	DATE SIGNED
SEE ATTACHMENT		

X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

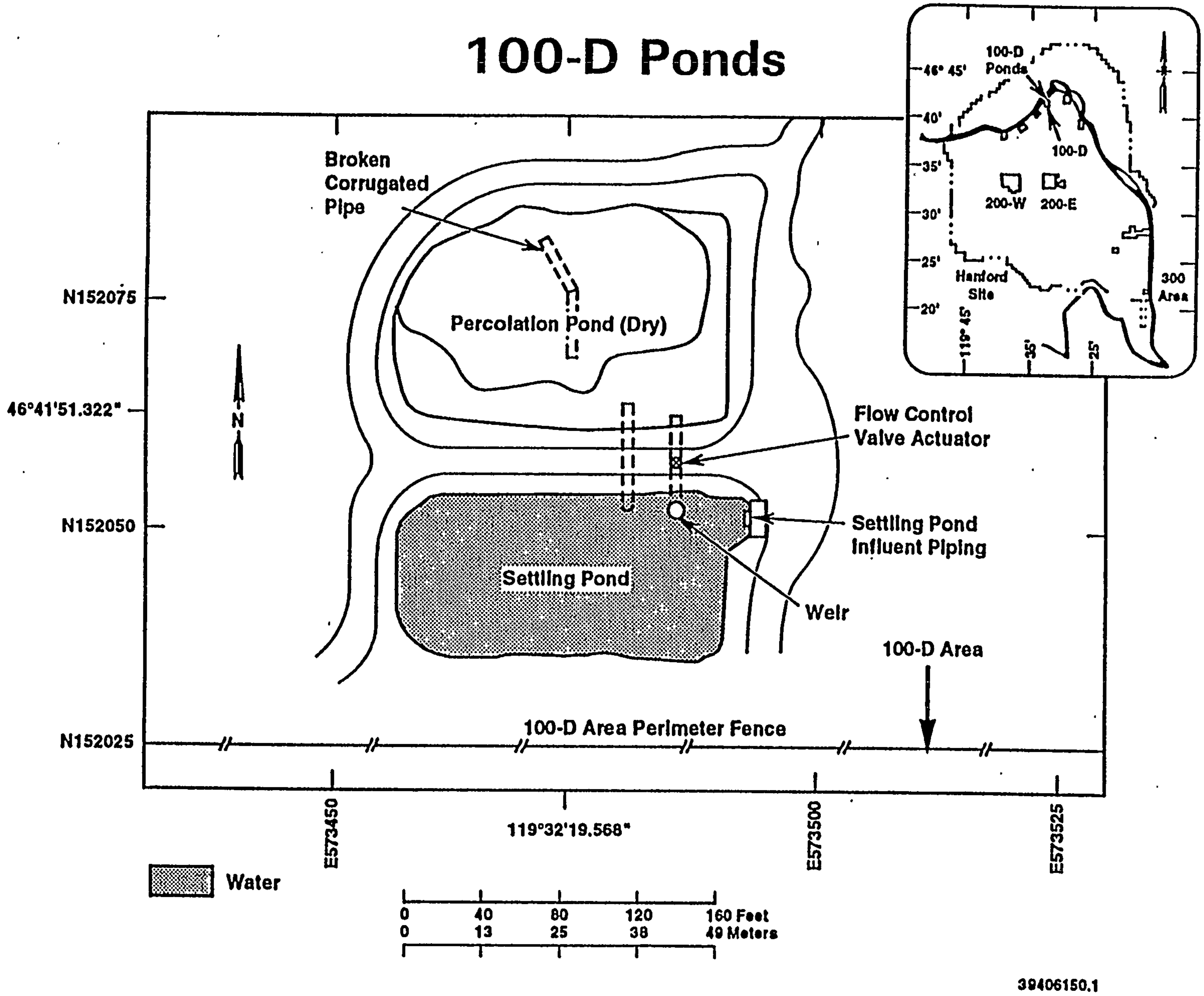
John D. Wagoner
Owner/Operator
John D. Wagoner, Manager
U.S. Department of Energy
Richland Operations Office

6/30/94
Date

Edward S. Keen
Co-operator
Edward S. Keen, President
Bechtel Hanford, Inc.

6/30/94
Date

100-D Ponds


Broken Corrugated Pipe
Percolation Pond (Dry)
Flow Control Valve Actuator
Settling Pond Influent Piping
Settling Pond
Weir
100-D Area
100-D Area Perimeter Fence
N152075
46°41'51.322"
N152050
N152025
N
E573450
119°32'19.568"
E573500
E573525
Water
0 40 80 120 160 Feet
0 13 25 38 49 Meters
100-D Ponds
100-D
200-W
200-E
Hanford Site
300 Area
46° 45'
40'
35'
30'
25'
20'
119° 45'
35'
25'
39406150.1

100-D PONDS

46°41'51.322"
119°32'19.568"

92102814-22CN
(PHOTO TAKEN 1992)

1.0 INTRODUCTION

This closure plan presents a description of the 100-D Ponds structures and boundaries, the history of the waste managed, and the approach that was followed to close the 100-D Ponds Treatment, Storage, and/or Disposal (TSD) unit. This chapter provides general information on the location and regulatory history of the 100-D Ponds and a brief overview of the contents of each subsequent chapter of this closure plan.

1.1 GENERAL INFORMATION

The 100-D Ponds were used as a land surface impoundment for the disposal of liquid effluent, located within the Hanford Site. This site has been classified as a *Resource Conservation and Recovery Act of 1976* (RCRA) TSD unit because of a potential for having received nonradioactive, regulated dangerous waste. These ponds no longer receive dangerous waste, and so are being closed as a RCRA-regulated TSD unit.

Only dangerous constituents derived from the 100-D Ponds operations will be addressed in this closure plan in accordance with *Washington Administrative Code* (WAC) 173-303-610(2)(b)(i). The dangerous waste directly leading to the classification of the site as a RCRA TSD unit did not contain radioactive constituents. Information provided on radionuclides is only for general knowledge where appropriate. The radioactive portion of mixed waste is interpreted by the U.S. Department of Energy (DOE) to be regulated under the *Atomic Energy Act of 1954*; the nonradioactive dangerous portion of mixed waste is interpreted to be regulated under RCRA and the State of Washington Department of Ecology (Ecology) *Dangerous Waste Regulations.*

The 100-D Ponds TSD unit is located within the 100-DR-1 operable unit boundary as designated in the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1996). The effluent pipeline (waste site 100-D-31), which fed the ponds, will be addressed in a primary *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) decision document. All discharges to 100-D Ponds were discontinued in June 1994. Closure of this TSD unit has been conducted pursuant to the requirements of Ecology's *Dangerous Waste Regulations,* WAC 173-303-610, WAC 173-303-650, and 40 *Code of Federal Regulations* (CFR) 265.

In August 1996 contaminated sediment was removed from 100-D Ponds as part of an RL voluntary cleanup action. Subsequent sampling and analysis demonstrated that there is no contamination remaining in the ponds, therefore this closure plan is a demonstration of clean closure as defined in the Hanford Facility RCRA Permit, Part II.K.1. Information supporting this position is presented in Appendices A and B.

1.2 100-D PONDS CLOSURE PLAN CONTENTS

The 100-D Ponds closure plan consists of the following nine chapters.

- Introduction (Chapter 1.0)
- Facility Description (Chapter 2.0), consisting of brief descriptions of the Hanford Site and the 100-D Ponds TSD unit structures and boundary. Information on Hanford Site security also is provided.
- Process Information (Chapter 3.0), describing how the 100-D Ponds processed the waste and explaining the overall waste treatment system.
- Waste Characteristics (Chapter 4.0), discussing the waste inventory and the characteristics of the waste that was treated and disposed of at the 100-D Ponds.
- Groundwater Monitoring (Chapter 5.0), describing the current groundwater monitoring program established to monitor and characterize groundwater composition in the vicinity of the 100-D Ponds.
- Closure Strategy and Performance Standards (Chapter 6.0), discussing the closure strategy of clean closure and performance standards for protection of health and the environment.
- Closure Activities (Chapter 7.0), discussing closure schedule and certification.
- References (Chapter 8.0).

2.0 FACILITY DESCRIPTION

This chapter briefly describes the general Hanford Site, the Hanford Facility, the 100-D Ponds TSD unit and location, and provides information on Hanford Site security.

2.1 HANFORD SITE AND RCRA FACILITY DESCRIPTION

The Hanford Site (Figure 2-1) covers approximately 1,450 km^2 (560 mi^2) of semiarid land that is owned by the U.S. Government and managed by the U. S. Department of Energy (DOE), Richland Operations Office (RL). The Hanford Site is located northwest of the city of Richland, Washington, which is the nearest population center. In early 1943, the U.S. Army Corps of Engineers selected the Hanford Site as the location for reactor, chemical separation, and related activities for the production and purification of plutonium. Since 1989, activities at the Hanford Site have focused on waste management and environmental remediation and restoration.

The Hanford Facility is a single RCRA facility, identified by U.S. Environmental Protection Agency (EPA)/State Identification Number WA7890008967, that consists of over 60 TSD units included in the *Hanford Site Dangerous Waste Part A Permit Application* (DOE-RL 1988). The Hanford Facility consists of the contiguous portion of the Hanford Site that contains these TSD units and, for the purposes of RCRA, is owned and operated by DOE, (excluding lands north and east of the Columbia River, river islands, lands owned by the Bonneville Power Administration, lands leased to the Washington Public Power Supply System, and lands owned by or leased to Washington State).

2.2 DESCRIPTION OF 100-D PONDS TREATMENT, STORAGE, AND/OR DISPOSAL UNIT

The 100-D Ponds TSD unit is located adjacent to and north of the north perimeter fence of the 100-D Area (Figure 2-2). This TSD unit was constructed as a surface impoundment for liquid effluent and operated between 1977 and 1994. It was constructed primarily for the impoundment and disposal of nonradioactive, nondangerous liquid effluent from the 183-D Water Treatment Facility (WTF). This unit consists of two surface ponds, which during operation were interconnected by pond effluent transfer piping.

Beginning in 1950, before the operation of this site as a TSD unit, this location served as the 188-D Ash Disposal Basin (waste site 126-D-1), which received coal ash from the 184-D Powerhouse. Until 1966, when the ash basin was retired, the location received ash/water effluent only. Between 1966 and 1977 the site received no discharges. All discharges to this location as either the ash basin or as the 100-D Ponds have arrived by way of the same influent pipe from the 100-D Area process sewer system (Figure 2-2). Before pond operations began, in 1977, the 100-D Area process sewer system discharged into the Columbia River through the 1904-D Outfall structure (waste site 116-D-5) and river pipeline, except when coal ash slurry was diverted into the Ash Disposal Basin. All discharges to the process sewer system were permanently diverted into 100-D Ponds after 1977.

The following predate the unit as a RCRA TSD and are not within the scope of this closure plan: (1) pond influent piping, (2) the surrounding ash piles, and (3) any dangerous waste constituents contained within the influent piping or the ash piles. These areas are being addressed through the CERCLA process. They are discussed in this and following chapters for historical information regarding previous site usage and the potential effect of this usage on the 100-D Ponds TSD unit.

The 100-D Ponds began operations in 1977 as a single uncovered and unlined pond of approximately 0.2 hectare (0.5 acre) in size. The original pond was constructed by excavating an area located within the eastern half of what was formerly the 188-D Ash Disposal Basin to a depth of 9 m (30 ft) below local grade. The ash was removed and piled around the perimeter of the ponds.

In 1979, the original pond was modified to eliminate a bottom sealing problem caused by the accumulation of flocculent. At that time, the pond was divided into two ponds by the construction of a dike with sloping walls (Figure 2-3). The ponds have a combined surface dimension of 50 by 67 m (160 by 220 ft) and the two ponds maintained the surface elevation of the original pond.

The south pond functioned as a settling pond and is approximately 29 m (95 ft) long, 50 m (160 ft) wide, and 3.7 m (12 ft) deep, with a capacity of approximately 3,500,000 L (925,000 gal). All discharges to the settling pond ceased in June 1994.

The north pond was originally designed to function as a percolation pond and is approximately 32 m (105 ft) long, 50 m (160 ft) wide, and 5.5 m (18 ft) deep at the center, which is the deepest point. The percolation pond has an effluent holding capacity of approximately 6,330,000 L (1,670,000 gal). The percolation pond received little flow from the settling pond. The pond is essentially void of vegetation, except for sparse grasses and brush, and an accumulation of tumbleweed.

During operation of the ponds, effluent entered the settling pond at the northeast corner through a 0.9 meter- (36 inch-) diameter influent pipe originating from the 100-D Area process sewer system. This process sewer system consists of a 2.06 meter- (6.5 ft-) square reinforced concrete box structure that travels a portion of the path identified in Figure 2-2.

Two horizontal effluent transfer pipes were installed at different elevations in the dike to allow flow of clarified effluent from the settling pond to the percolation pond (Figure 2-3). A carbon steel standpipe approximately 61.1 cm (24 in.) in diameter was located in the northeast portion of the settling pond. The standpipe was attached to the lower effluent transfer pipe. A valve actuator arm protruded from the top of the dike directly above the lower transfer pipe. During pond operations this valve controlled the flow of water between the ponds. These pipes were removed during remediation preparation activities conducted in June 1996.

The TSD unit is surrounded on the east, north, and west sides by piles of coal ash and soil excavated prior to and during the construction of the ponds. A road enters the northeast corner of the unit, allowing vehicular access to the ponds.

There are currently four RCRA groundwater monitoring wells near the ponds. A discussion of these wells is included in Chapter 5.0.

The 100-D Ponds were remediated in August 1996 by removing sediment from the settling pond and removing the piping associated with pond operations.

2.3 SECURITY INFORMATION

The entire Hanford Site is a controlled-access area. The Hanford Site currently maintains access control to operational areas and around-the-clock surveillance for the protection of government property, classified information, and special nuclear materials. The Hanford Patrol maintains a continuous presence of protective force personnel to provide Hanford Site security.

Guarded barricades are maintained around-the-clock at checkpoints on vehicular access roads leading to the operational areas of the Hanford Site. All personnel accessing these areas must have a DOE-issued security identification badge indicating the appropriate authorization. Personnel are also subject to search while on the Hanford Site.

At the 100-D Ponds, administrative controls are in place and enforced with an informational barrier indicating that only authorized entry inside the roped-off area is allowed. The 100-D Ponds TSD unit is currently encircled by a light chain. A placard stating "RCRA Waste Site--Do Not Disturb" is attached to the rope blocking the vehicular access road entering the site at the northeast corner (Figure 2-3).

Figure 2-1. Hanford Site and Regional Map

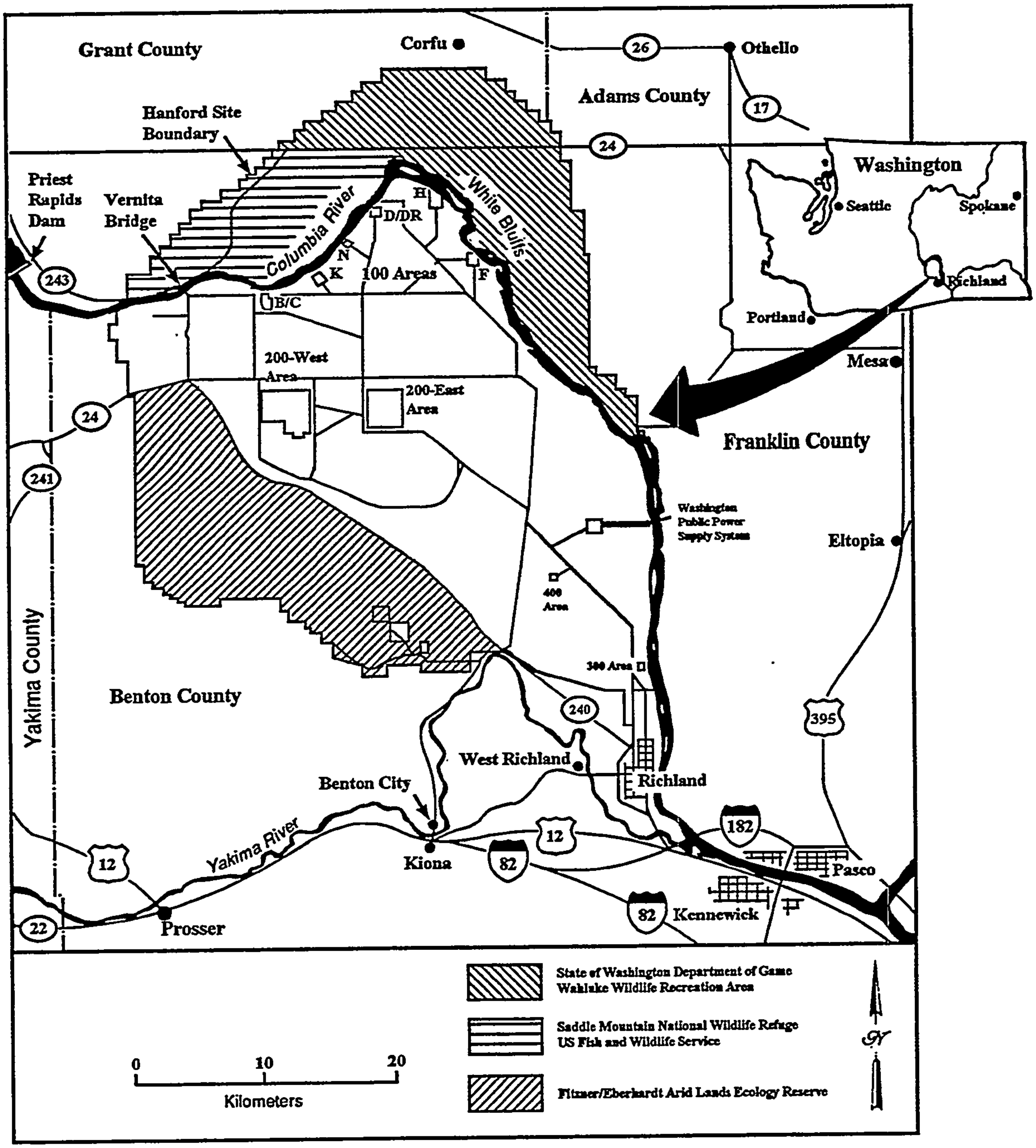


Figure 2-2. The 100-D Area at the Hanford Site

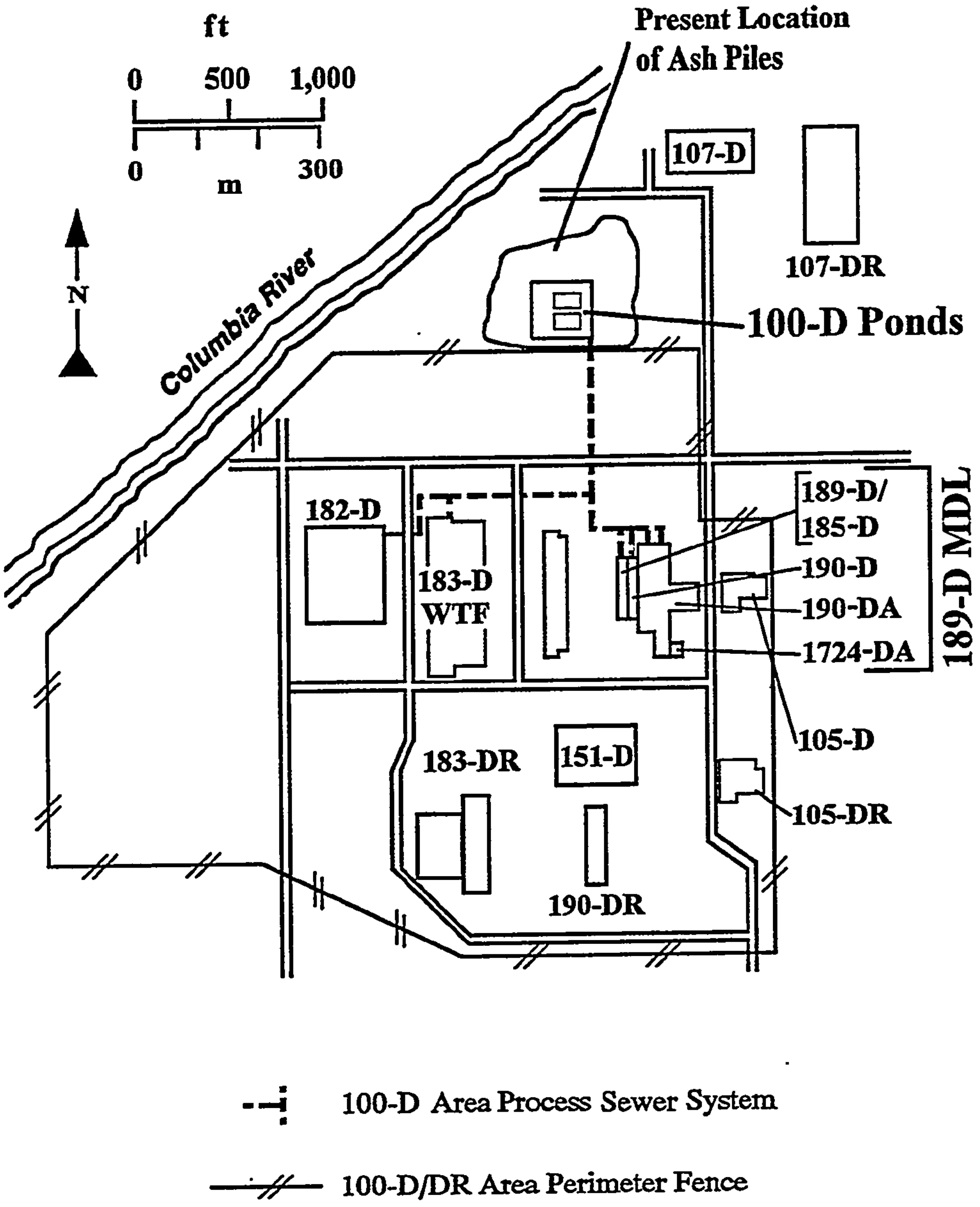
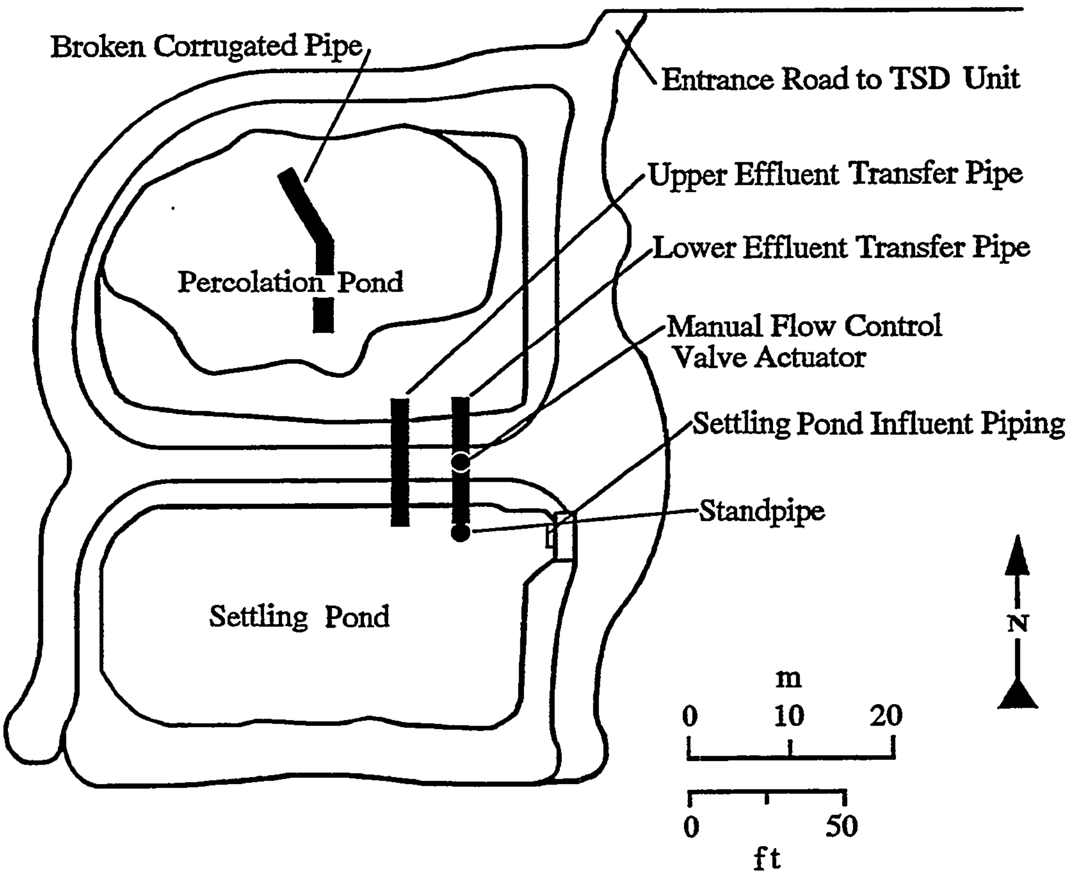


Figure 2-3. Plan View of 100-D Ponds
(Features shown in solid black were removed in 1996)



3.0 PROCESS INFORMATION

This chapter describes how the 100-D Ponds TSD unit received, processed, and disposed of waste. This chapter identifies all of the known waste streams that this location received since its first pre-RCRA use as a coal ash disposal site beginning in 1950, until discharges to the unit ceased in 1994. The discussion of discharges to the site in its pre-RCRA time frame is presented for information to assist in explaining a historical potential for the presence of non-RCRA constituents at the Site.

The 100-D Ponds unit was constructed primarily for the disposal of 183-D WTF nondangerous waste water, which will be described in this chapter. Characterization data also indicates that some dangerous waste was discharged to the unit (BHI 1995). This waste probably originated from the 189-D Mechanical Development Laboratory (MDL) complex and arrived by way of the process sewer system (Figure 2-2). The facilities and processes that generated these waste streams will be described in this chapter. The previous operation of this site as the 188-D Ash Disposal Basin is described in this chapter because of the pervasiveness of coal ash at the site and the potential impact of coal ash to groundwater quality. Also described in this chapter is the process by which residual contaminants within the process sewer system, such as mercury, could have combined with the heavy coal ash slurry and been deposited in the ash basin.

3.1 DESCRIPTION OF 100-D PONDS OPERATIONS

The 100-D Ponds TSD unit was constructed in 1977 primarily to dispose of nondangerous waste water from the 183-D WTF. Columbia River water containing filter and settling basin residues from the 183-D WTF entered the 100-D Ponds TSD at the northeast corner of the settling (south) pond. The effluent originally was intended to be retained in the settling pond for at least three days so suspended solids could settle out of solution before being transferred to the percolation pond. During this settling period, effluent would also be evaporating and infiltrating the settling pond soil column. The effluent would be allowed to rise in the settling pond until it overflowed into a standpipe which was attached to the lower transfer pipe buried in the dike. There was also an upper transfer pipe which, although never used, was intended to channel effluent to the percolation pond during periods of high settling pond water levels. The lower transfer pipe had an in-line flow control valve that was opened by manually operating a valve actuator arm, allowing clarified settling pond effluent to flow from the standpipe to the percolation pond. Once in the percolation pond, the effluent evaporated or infiltrated into the percolation pond soil column.

3.2 188-D ASH DISPOSAL BASIN DESCRIPTION AND PROCESS INFORMATION

The 100-D Ponds were constructed within the boundaries of what was formerly the 188-D Ash Disposal Basin. Before construction of the ponds in 1977, coal ash in unknown quantities was flushed from the boilers of the 184-D Powerhouse through the process sewer system to the basin using raw Columbia River water. During ash disposal activities, process sewer effluent that normally flowed to the 1904-D (Columbia River) Outfall was temporarily diverted to the 188-D

Ash Disposal Basin. These temporary diversion activities continued until 1966 when 188-D Ash Basin usage was discontinued. There were no reported process sewer diversions to the location between 1966 and 1977 when the ash basin reentered service as the 100-D Ponds. Coal ash can be enriched with various trace elements such as heavy metals (Smith 1981), raising the possibility that these or other ash constituents in chemical combination with effluent may be present at the ponds. However, studies have shown coal ash from power plants at the Hanford Site to be nonradioactive and nonhazardous according to WAC 173-303 (Rasmussen and Carlson 1987). Chapter 4.0 contains a more complete discussion of coal ash contamination and Table 4-2 summarizes the results of previous analyses of Hanford Site coal ash. Any contamination from coal ash would be a past practice activity and not associated with this TSD unit.

A potential also exists that the coal ash slurry may have picked up residual mercury from the process sewer system and carried it into the ash basin. Further discussion of potential mercury deposition in the ash basin and its status as a past practice constituent is contained in Section 3.3.3.4.

3.3 EFFLUENT RECEIVED BY 100-D PONDS

The effluent streams which were discharged to 100-D Ponds originated from the 183-D WTF, the 182-D Reservoir, the 189-D MDL, and several other facilities. Available information regarding the volume and composition of these effluent streams is presented and discussed in this section and summarized in Table 3-1. All discharges to the ponds ceased in 1994.

3.3.1 183-D Water Treatment Facility

Prior to June 1994, the 100-D Ponds received four intermittent nonradioactive, nondangerous waste streams from the 183-D WTF, which provides fire protection system water to several areas on the Hanford Site. Discharges from this unit to the settling pond occurred at an average daily rate of 18.9 L (5 gal) per minute, except during filter backwash when the average daily rate increased to 265 L (70 gal) per minute. Necessary discharges from the 183-D WTF are now deposited in a concrete basin in the 100-D Area.

The primary stream to the 100-D Ponds was the monthly backwash of two gravity multimedia filters located in the 183-D WTF. The filter media consists of: (1) a gravel layer, (2) a layer of sand, and (3) a top layer of anthracite. Filter backwash effluent was composed of water from the 183-D Clearwell (a potable water reservoir), raw water solids previously trapped within the filters, and aluminum precipitate originating from the addition of alum (aluminum sulfate) as the flocculating agent. Until 1990, Separan[*], a filtration aid, was added in liquid form after filter backwashing to promote initial filtration. Separan contained: (1) sodium carbonate, (2) polyacrylamide, (3) sodium sulfite, (4) sodium sulfate, and (5) water. Each filter backwash lasted 30 minutes and generated approximately 265,300 L (70,000 gal) of waste water for a monthly discharge to the ponds for both filters of approximately 530,600 L (140,000 gal) of

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[*] Separan is a trademark of Dow Chemical U.S.A.

waste water. Chemical analysis of samples of 183-D discharge effluent taken on four occasions between December 1989 and March 1990 indicate that filter backwash effluent is not a dangerous waste by WAC-173-303-070 criteria (WHC 1992).

The ponds also received waste water from the washdown of the two 183-D Settling Basins. Basin washdown was normally performed twice a year and the effluent was composed of: (1) clean water from the fire system, (2) raw water sediment, and (3) alum precipitate. The washdown of each basin generated approximately 1,364,400 L (360,000 gal) of effluent for a biannual discharge to the ponds of 2,728,800 L (720,000 gal) for both basins.

The two remaining waste streams are considered miscellaneous clean discharges, which were received by the ponds only on a contingency basis. One of these effluent streams was sanitary (potable) water from the possible overflow of the 183-D Clearwell. The other effluent stream was general building waste water from the 183-D WTF floor and trench drains. Engineered and administrative controls were implemented at the 183-D WTF to minimize the potential of lubricants or other materials entering the ponds through open building drains. Administrative procedures included: (1) spill control, (2) lock and tag procedures, (3) training on spill cleanup, and (4) reporting. Engineering controls included: (1) plugging of pump bedplate drains, (2) reduced use of lead valve packing, and (3) storage of lubricants in cabinets surrounded with spill absorbent material. Other hazardous chemicals are not routinely used or stored in the 183-D WTF.

3.3.2 182-D Reservoir

The 182-D Reservoir stores raw Columbia River water for eventual transfer to the 183-D WTF for processing. The reservoir water level is maintained by manual adjustment of an inlet valve. In the unlikely event that the 182-D Reservoir should overflow, the 100-D Ponds would have received raw Columbia River water. Reservoir overflow would have flowed to drains connected to the process sewer system which in turn discharged to the ponds. The overflow would contain no sludge or sediment concentrations and is considered to be a nondangerous effluent stream (WHC 1992).

3.3.3 189-D Mechanical Development Laboratory

The 189-D MDL operated from 1944 until 1988. Its operations consisted of the collective activities occurring in the combined 185-D/189-D Building, along with those activities in the attached 190-D, 190-DA, and 1724-DA Buildings. Activities within this complex that contributed effluent to the 100-D Ponds were a mechanical development laboratory, the Thermal Hydraulics Test Facility that included two High-Temperature/High-Pressure Test Loops, a craft shop and storage area, and the Fuel Discharge Trampoline Test Facility. Some of these effluent streams may have contained corrosive chemicals, dangerous volatile organic shop chemicals, and/or radiological contamination. The only pre-1977 effluent from the 189-D MDL discussed here is shop floor and sink drain discharge to the process sewer system before 1974, which present a historical potential to have deposited liquid mercury in process sewer piping that was later shared by the 100-D Ponds.

3.3.3.1 Demineralizer Recharge Effluent. From 1977 until 1986, the 100-D Ponds received intermittent discharges of effluent containing corrosive chemicals originating from the recharge of three demineralizers located in the 189-D MDL. Two demineralizers located in the Thermal Hydraulics Test Facility supported two High-Pressure and High-Temperature Loops containing demineralized water. The recharge effluent from these two demineralizers was discharged approximately every five to six years. Effluent from a third demineralizer that served a mechanical development laboratory in the 189-D Building was discharged about every two to three years from 1977 until 1983, when this demineralizer was removed from service.

Demineralizer recharge entailed the injection of acidic and caustic chemicals (hydrochloric or sulfuric acid and sodium hydroxide, respectively) into the demineralizer columns along with 25 to 30 L (7 to 8 gal) per minute of water. The chemical/water effluent was then removed from the center of the column using an aspirator. Water was added again to further dilute the effluent, which was then discharged as waste water to the process sewer system. In 1986, operating procedures were implemented at the complex requiring effluent retention for pH testing and neutralization before release to the ponds. Even before implementation of mandatory neutralization procedures, operations has reported that demineralizer regeneration chemicals (acids and bases) were either used in rapid succession or used simultaneously to neutralize the effluent before discharge.

3.3.3.2 High-Pressure and High-Temperature Loop Drainage. The largest of the two High-Pressure and High-Temperature Loops supported by the demineralizers provided an intermittent stream of filtered/chlorinated water to the 100-D Ponds. Although the loop was mechanically sealed, resulting in no discharges during operation, it was occasionally drained to the process sewer system resulting in a 757- to 1,135-L (200- to 300-gal) discharge of chlorinated, demineralized water to the ponds. There are no records regarding the frequency of loop drainage. The second and smaller loop contained water contaminated with low-level radioactivity that was drained to waste tanks in the Thermal Hydraulics Test Facility and then transferred out for appropriate management.

3.3.3.3 Fuel Discharge Trampoline Test Facility Basin Drainage. The Fuel Discharge Trampoline Test Facility located in 1724-DA Building of the 189-D MDL provided an intermittent stream of filtered/chlorinated water to the ponds. This facility was used for the testing of 100-N Reactor fuel discharge trampoline components. Unirradiated fuel elements were used in this testing and were sometimes purposely ruptured during testing (DOE-RL 1989).

This facility contained a small concrete-lined basin at the base of a mockup of the 100-N Reactor face. Testing of the discharge trampoline components could have led to radiological contamination of this basin. There are no records available concerning the frequency or volume of basin discharges to the process sewer, but they may have occurred and would subsequently have been deposited in 100-D Ponds.

3.3.3.4 Floor and Sink Drain Discharges. A mechanical development laboratory located in the 189-D Building contained mercury switches and manometers. Liquid metallic mercury could have been deposited in the floor and sink drains of this laboratory, which ultimately drained into 100-D Ponds. Until the late 1960s, when the toxic properties of mercury became known, mercury spills from such instrumentation were not recorded and were generally swept into building floor drains. Residual mercury in the process sewer system that was not washed to the river outfall could have been carried to the 188D-Ash Disposal Basin with coal-ash slurry from 1950 until 1966, when diversions to the ash disposal basin ceased. In 1974, traps were installed at mercury switches and manometers to preclude the possibility of mercury spills to drains. After 1977, residual mercury, most likely by then remaining in the ponds' influent piping, could have been carried into the 100-D Ponds by otherwise clean effluent from the 183-D WTF. The chronology of mercury deposition compared with the operational time frames of the ash basin and the 100-D Ponds TSD unit indicate that the only surfaces potentially contaminated with mercury were the diversion leg of pond influent piping and possibly the immediate piping outfall point in the settling pond. Section 4.1.2.2 contains further discussion of mercury as a potential source of pond contamination.

Typical organic shop chemicals, such as thinners and solvents, were normally used in the craft shop and the mechanical development laboratory located in the 189-D Building. These chemicals could have been released through accidental spills to the floor or sink drains to the 100-D Ponds. However, this building is not reported to have been a storage area for bulk quantities of such chemicals, and spillage or disposal of any significant quantities to drains is considered unlikely. Section 4.1.2.3 contains further discussion of this potential source of pond contamination.

Table 3-1. Active and Inactive Nondangerous Waste Streams to the 100-D Ponds TSD Unit

Stream Origin	Release period	Effluent	Frequency	Quantity, L(gal)		
				Per event	Annual	Total
183-D Water Treatment Facility:						
- Multimedia filter backwash (totals for both filters)	1977-1994	Sanitary water+alum and filter solids	Monthly	530,000 (140,000)	6,360,000 (1,680,000)	108,111,000 (28,560,000)
- 183-D Settling Basin washdown (totals for both basins)	1977-1994	Raw water, raw water solids, and residual sludge	Biannually	2,725,000 (720,000)	5,450,000 (1,440,000)	92,667,000 (24,480,000)
- Floor and trench drains	1977-1994	Sanitary water	Weekly	75(20) [4,100 lb]	3,940 (1,040)	66,925 (17,680)
- Alum spill to drains	5/91	Liquid alum	N/A	1,136,000 (300,000)	N/A	[4,100 lb]
- Inadvertent discharge	Jan. 1993	Sanitary water	N/A		N/A	1,136,000 (300,000)
- Clearwell overflow	1977-1994	Sanitary water	Contingency			
182-D Reservoir overflow	1977-1994	Raw water	Contingency			
189-D Mechanical Development Laboratory:						
- High-temperature(high-pressure loop drainage	1977-1986	Demineralized water	Undocumented	1,135 (300)	Undocumented	19,300 (5,100)
- Fuel Discharge Trampoline Test Facility	1977-1986	Filtered,chlorinated water	Undocumented	Undocumented	Undocumented	
					Total	202,000,000 (53,358,000)

4.0 WASTE CHARACTERISTICS

This chapter discusses the actual and potential waste inventories and the characteristics of the waste treated at the 100-D Ponds TSD unit.

4.1 ESTIMATE OF MAXIMUM INVENTORY OF WASTE

This section identifies the inventory of nondangerous waste and the potential inventory of dangerous waste received by the 100-D Ponds TSD unit.

4.1.1 Inventory of Nondangerous Waste

The major effluent contributor to the 100-D Ponds has always been the 183-D WTF and its four waste water streams collectively identified as nondangerous clean streams (WHC 1992). In 1991, there was a nondangerous 1,860 kg (4,100) lb spill of an aqueous solution of aluminum sulfate (alum) to the 183-D WTF floor drains and subsequently to the 100-D Ponds. This spill requires no sampling or analysis above that already completed because alum is already present in the ponds as a normal constituent of the 183-D WTF nondangerous effluent. Clean streams also originated from the 189-D MDL complex until it closed permanently in 1988. Nondangerous liquid effluent discharges from all contributors to the 100-D Ponds TSD unit since 1977 are summarized in Table 3-1.

4.1.2 Inventory of Dangerous Waste

This section will discuss and evaluate the potential for this unit to have received or to contain dangerous wastes, as identified through process knowledge and historical information. An estimated maximum inventory of dangerous wastes received by the 100-D Ponds TSD unit is summarized in Table 4-1.

4.1.2.1 Corrosive Chemicals. Until 1986, the 189-D MDL occasionally discharged potentially corrosive effluents from the regeneration of three demineralizers to the process sewer system which in turn emptied into the 100-D Ponds. These effluents may have exhibited pH levels below 2.0 or above 12.5 upon arrival at the ponds, although their actual corrosivity level was never established. The potential for this site to have received this potentially corrosive characteristic dangerous effluent led to the classification of the 100-D Ponds as a TSD unit.

Based on the frequency of demineralizer regeneration, it is estimated that no more than eight regeneration events occurred during operation of the ponds. The chemical usage per regeneration is reported as 43 kg (95 lb) sodium hydroxide and 32 kg (70 lb) hydrochloric or sulfuric acid. The maximum potential waste inventory, therefore, is estimated at 344 kg (760 lb) caustic and 253 kg (560 lb) acid. The total estimated quantity of potentially corrosive chemicals discharged to the ponds is listed in Table 4-1.

To expedite neutralization, acidic and caustic chemicals used in demineralizer regeneration were generally injected into the demineralizers either in sequence or were cogenerated, which was procedurally required in the latter part of the operation of the 189-D MDL. The effluent was then diluted with water twice during the regeneration process to prevent pH excursions, and was then checked with litmus paper before discharge and found to be neutral (noncorrosive) and therefore, nondangerous. Effluent at pH of below 2.0 (acidic) or above 12.5 (caustic) that may actually have reached the 100-D Ponds can reasonably be expected to have been neutralized by the calcareous coal ash in the unlined ponds. RCRA sampling performed by the operable unit for this closure measured a pH of 6.9 for standing water in the settling pond (DOE-RL 1993).

4.1.2.2 Mercury. In 1989, the presence of liquid metallic mercury was visibly confirmed in the floor drain of the 189-D Building mechanical development laboratory (Price 1989). This drain is a branch of the main process sewer system that discharged to the ponds. An investigation determined that accidents involving laboratory instruments such as manometers and mercury switches could have contributed up to 2.6 kg (5 lb) of mercury to the process sewer system (Gano and Lauterbach 1990). It is unlikely that a significant portion of this mercury could have been deposited in the ponds, as mercury traps were installed three years before the ponds began receiving effluent in 1977, and considerable flushing of the drains and process sewer system would have occurred before that time.

4.1.2.3 Dangerous Shop Chemicals. Until 1988, when the 189-D MDL permanently closed, standard volatile organic shop chemicals such as thinners and solvents could have been released to the 100-D Ponds from open floor and sink drains of the craft shop or the mechanical development laboratory of the 189-D MDL complex. However, such chemicals were not normally stored in bulk quantities nor were they procedurally discharged to the drain system when spent. Consequently, the potential spillage is reasonably limited to accidents involving small quantities of these chemicals. Any releases that did occur would have been diluted by large volumes of process sewer system water and the high volatility of such organics would likely minimize their persistence and detectability over time.

4.1.2.4 Coal Ash Contaminants. Because of the previous operation of the 100-D Ponds location as the 188-D Ash Disposal Basin (waste site 126-D-1), coal ash is pervasive at the site. Some coal ash can be relatively enriched in assorted heavy metals, which have the potential to contribute to groundwater contamination (Beaver et al. 1987). Analyses of coal ash samples from 100-D Ponds and other ash piles at the Hanford Site show low levels of most metals when compared to typical soils. Table 4-2 contains the results of analyses of three coal ash samples obtained approximately 80 m (260 ft) directly west of the center of the percolation pond. These samples were collected to represent a background composition of ash unaffected by disposal activities at 100-D Ponds. The only analytes which exceed the average Hanford Site background values (DOE-RL 1995) are aluminum, barium, and calcium. Table 4-2 also presents the results of leachate analyses for coal ash from the 200 Areas. Leachate concentrations are well below EPA guidelines for toxicity. Studies have concluded that ash from Hanford Site power plants is nonradioactive and nondangerous per WAC 173-303 (Rasmussen and Carlson 1987).

The pH of coal ash is typically elevated, owing to the presence of calcium and magnesium oxides and hydroxides (Huffman and Huggins 1986). Groundwater in contact with coal ash often shows elevated pH, in the range of 8 to 9 (Beaver et al. 1987). This topic is discussed further in Appendix B.

4.2 WASTE FORMS TREATED AT THE 100-D PONDS

All waste that entered the TSD unit entered as liquid effluent from the process sewer system. The only dangerous wastes documented as being released into the ponds are the potential acid and caustic demineralizer regenerative solutions designated within the Part A Permit as D002 corrosive characteristic dangerous waste. This would have been in addition to the effluent containing nondangerous suspended solids from the 183-D WTF for which the ponds were primarily constructed. Undocumented wastes were also discharged to the ponds, judging from analyses of the sediments at the bottom of the settling pond (BHI 1995).

Dangerous effluent would have been treated, stored, and/or disposed of in the following manner. Effluent would have been received by and stored in the settling pond; treatment would have been by neutralization of acids and caustics by chemical interaction with each other or with the calcareous materials of the unlined settling pond. Disposal would have consisted of evaporation or infiltration into the settling and percolation pond soil columns.

Table 4-1. Maximum Potential Inventory of Dangerous Waste to 100-D Ponds TSD Unit (all from the 189-D MDL)

Stream origin	Stream constituents	Total quantity, kg/lbs
- Demineralizer recharge	hydrochloric and/or sulfuric acid	253/560
	sodium hydroxide	344/760
- Floor and sink drains	mercury	2.3/5

Table 4-2. Chemical Analyses of Hanford Coal Ash

Contaminant	100-D Ponds Background Ash, mg/kg			EP toxicity analysis, mg/L[b]	EPA limit, mg/L[c]
	B07259	B07260	B07261[a]		
Aluminum	13600	14900	13900		
Antimony	<13	<13.3	<12.8		
Arsenic	<2.0	2.2	<1.8	<0.2	5
Barium	629	687	633	2.9	100
Cadmium	<1.52	<1.55	<1.50	<0.05	1
Calcium	19400	19300	17100		
Chromium	6.9	7.3	6.7	<0.05	5
Cobalt	<4.4	<5.9	<5.2		
Copper	9.1	11	9.4		
Iron	3970	4110	4270		
Lead	1.9	2.5	2.1	<0.1	5
Magnesium	3880	4320	3850		
Manganese	269	217	214		
Mercury	<0.08	<0.06	<0.06	<0.001	0.2
Nickel	<5.2	<8.5	<6.2		
Potassium	<290	<297	<287		
Selenium	<0.46	1.2	<0.51	<0.1	1
Silver	7.7	<2.22	<2.14	0.01	5
Sodium	<226	<254	<229		
Thallium	<0.44	<0.44	<0.45		
Vanadium	17.3	18.6	17.4		
Zinc	15.1	28.7	25.7		

a Duplicate of B107260
b DOE-RL 1989
c 40CFR 141

5.0 GROUNDWATER MONITORING

This section describes the hydrology of the 100-D Area and the groundwater well network which monitors groundwater composition in the vicinity of 100-D Ponds. A summary of results from over four years of monitoring is also discussed. This section does not include a description of postclosure care, as all dangerous wastes have been removed from this unit and clean closure is planned.

5.1 VADOSE ZONE AND AQUIFER IDENTIFICATION

The 100-D Area is underlain by the Hanford and Ringold formations with localized accumulations of backfill material and Holocene surficial deposits. The water table currently lies approximately 14.4 m (47 ft) beneath the bottom of 100-D Ponds, within Ringold Formation gravel. Figure 5-1 shows the water table in the 100-D Area in February 1995 and June 1996.

The vadose zone in the 100-D Area is composed of backfill, Holocene surficial deposits, and Hanford formation sediments. In the vicinity of 100-D Ponds, the entire Hanford formation has been removed by excavation and backfilled by power plant coal ash (Figure 5-2). The coal ash generally can be characterized as angular to subangular grains, ranging in size from medium sand to small pebbles. This material is not significantly cemented, and is commonly loose and friable. The composition of the coal ash is discussed in Appendix B.

The uppermost, unconfined aquifer in the 100-D Area is 3 to 7.6 m (10 to 25 ft) thick and is bounded on top by the water table and on the bottom by the shallowest confining unit of the Ringold Formation (Figure 5-3). The aquifer is comprised of partially-cemented pebble to cobble gravel with a sand matrix. Slug tests in the uppermost aquifer yielded values of horizontal hydraulic conductivity ranging from 1.2 to 40 m/d (3.9 to 130 ft/d) (Hartman 1992).

The confining unit immediately beneath the unconfined aquifer is a clay-rich unit of overbank/paleosol mud. It appears to be continuous throughout the 100-D Area, and is approximately 15 m (50 ft) thick. This is underlain by a unit composed of thin aquifers and aquitards approximately 60 m (200 ft) thick that extends down to the Ringold lower mud unit. No estimates of aquifer properties are available for this unit.

5.1.1 Direction and Rate of Groundwater Movement

Groundwater flow in the 100-D Area was strongly influenced by liquid waste discharge in the past. Extensive leakage occurred from the reactor coolant retention basins that created large mounds on the normal water table (Brown 1963). An infiltration test was conducted near the end of the operating periods for reactors in the 100-D area to determine the capacity of the natural soil column for direct input of coolant (Eliason and Hajek 1967). Data from that test have been used to reconstruct the configuration of the water table when mounding was present (Figure 5-4). While the reconstruction in Figure 5-4 may represent "worst-case" conditions, it nevertheless provides evidence for historical pathways that contamination may have followed to its current locations (Connelly 1997). Water levels had returned to near natural levels by the mid-1970s.

The water table currently lies approximately 14.4 m (47 ft) beneath 100-D Ponds, within Ringold Formation gravel. Groundwater flow is interpreted to be toward the northwest beneath 100-D Ponds for most of the year. During the Spring, the groundwater in this area is typically influenced by higher water levels in the Columbia River, which has the effect of making the groundwater table shallower toward the river and changing the groundwater flow direction towards the east. This seasonal variation is illustrated in Figure 5-1.

An estimate of the current average linear velocity (v) of groundwater beneath the 100-D Ponds can be calculated from Darcy's Law according to the following equation:

$$v = \frac{Ki}{n_e}$$

where:

K = Horizontal hydraulic conductivity of uppermost aquifer: 0.3 to 40 m (1.0 to 130 ft) per day (Hartman 1992)

i = Horizontal hydraulic gradient (measured in July 1992): 1.8×10^{-3}

n_e = Effective porosity of uppermost aquifer: 0.2 (Fetter 1980, p. 64)

The resulting range of velocity is 2.7×10^{-3} to 0.36 m (8.9×10^{-3} to 1.2 ft) per day. These calculated velocities are consistent with those used to reconstruct the water table configuration that might have been present during the reactor operating years (Connelly 1997). The accuracy of these estimates is a function of uncertainties associated with the input parameters (i.e., the hydraulic properties for the aquifer and the water table gradient). Because these parameters are limited by the number and locations of monitoring wells, estimates in some areas are more accurate than in others. The actual rate of contaminant migration also is affected by retardation and by changes in gradient as a result of changing river stage.

5.2 INTERIM STATUS PERIOD GROUNDWATER MONITORING

Groundwater monitoring at the 100-D Ponds site is conducted in accordance with WAC 173-303-400 and 40 CFR 265, Subpart F. These regulations govern "interim status" TSD units, which are those that do not currently have final permits to treat, store, or dispose of dangerous waste.

Collection of 100-D Ponds groundwater monitoring samples began in 1992. As required by 40 CFR 265.92, groundwater is analyzed for groundwater quality parameters, drinking water parameters, and contamination indicator parameters. Statistical comparisons of contamination indicator parameters upgradient and downgradient of the site are made on a quarterly basis. This phase of groundwater monitoring is commonly called "indicator evaluation" or "detection" monitoring.

5.2.1 Well Location and Design

The groundwater monitoring network for the 100-D Ponds is comprised of one upgradient and three downgradient wells (Figure 5-5). The wells are completed at the top of the unconfined aquifer. As-built diagrams of the wells, including geologic and geophysical logs and other information, are summarized in *Borehole Completion Data Package for the 100-D Ponds* (Hartman 1992).

5.2.2 Groundwater Sampling and Analysis

The groundwater monitoring plan for the 100-D Ponds (Hartman 1991) describes sample collection, field chemistry measurements, analytical methods, chain-of-custody control, and quality control. The four wells in the 100-D Ponds monitoring network were sampled quarterly for the first year and semiannually thereafter, as required by 40 CFR 265.92. A list of sampling dates and associated analyses is contained in the attachment to Appendix B.

5.3 RESULTS OF GROUNDWATER MONITORING

This section summarizes and evaluates the groundwater information collected throughout the course of monitoring at 100-D Ponds.

5.3.1 Potentiometric Levels

Water levels have been measured monthly during the monitoring period. These data are recorded in the annual report for RCRA groundwater monitoring projects at Hanford Site facilities (e.g., DOE-RL 1996a). A plot of water level versus time (Figure 5-6) shows significant fluctuation in all four monitoring wells, which mainly results from fluctuation of the Columbia River level. Water levels can change by over 2 m (6.6 ft) over the course of a year. High river levels in the Spring of 1996 influenced all wells in the 100-D Ponds monitoring network, resulting in the highest water table recorded in this area during the last five years. Water level in well 199-D8-5 during this time rose by 214 cm (7 ft) over the course of eight months.

Water levels in two of the downgradient wells, 199-D8-4 and 199-D8-6, can be slightly higher than the water level in the upgradient well (199-D5-13) when the river stage is high. Groundwater flow under 100-D Ponds is generally to the north and northwest. There are no observable effects of groundwater mounding beneath 100-D Ponds seen in the water level data, although the effects of discharge to the ponds can be seen in the hydrochemistry data discussed in the next section.

5.3.2 Groundwater Quality

Groundwater near 100-D Ponds has been collected and analyzed for various constituents since 1992. Four quarters of data were collected in 1992 and 1993 and analyzed for a complete suite of organic and inorganic constituents and radionuclides. These constituents are listed in the attachment to Appendix B, and compared to the groundwater monitoring analytes listed in 40 CFR Part 264, Appendix IX. Complete chemical analyses of the groundwater are available from the Hanford Environmental Information System (HEIS) database, and summarized in the annual report for RCRA groundwater monitoring projects at Hanford Site facilities (e.g., Hartman and Dresel 1997).

Table 5-1 contains a statistical summary for contaminants of potential concern from the three downgradient wells, and shows that groundwater levels are below *Model Toxic Control Act* (MTCA) B groundwater cleanup standards. Of special concern are the few chemicals that were found to be above MTCA B soil cleanup standards for groundwater protection in the sediments of the settling pond, which have been removed. These chemicals included polychlorinated biphenyls (PCB), arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, vanadium, and zinc. None of these constituents were found in the downgradient wells at levels that would indicate contribution from 100-D Ponds. These results indicate that disposal activities at 100-D Ponds did not have any adverse effects on groundwater.

Although discharges to 100-D Ponds did not create a groundwater mound detectable by water levels in the monitoring wells, the effect of the discharges can be seen in the water chemistry data. The greatest volume of effluent routed to the Ponds was raw or treated river water released from the 183-D WTF, which diluted the groundwater beneath the Ponds. The groundwater upgradient of 100-D Ponds is contaminated with chromium, tritium, and nitrate. The discharges into 100-D Ponds effectively diluted this groundwater to values typical of or below background concentrations for the Hanford Site, as shown by analyses from downgradient monitoring well samples (DOE-RL 1996a).

Figure 5-7 shows chromium concentrations and conductivity measurements over time for the upgradient and downgradient monitoring wells. These plots show that water quality in the upgradient well has degraded since the decrease of discharges to the ponds and final cessation in May 1994, while concentrations in the downgradient wells have changed little since that time. This is interpreted to be the result of the lack of "clean" water from past discharges to dilute the contaminated water entering the area from upgradient sources. For a more complete discussion of groundwater contamination in the 100-D Area, see Peterson et al. (1996).

The RCRA groundwater monitoring program for interim status units (40 CFR 265, Subpart F) requires a comparison of concentrations of various indicator parameters from downgradient wells with critical mean values calculated from an upgradient well. Over the course of groundwater monitoring at 100-D Ponds, pH is the only parameter which has exceeded the critical value. This exceedence occurred in February 1996 in the two downgradient wells 199-D8-4 and 199-D8-6. Ecology was notified of this exceedence and an assessment report was submitted (Hartman 1996). The coal ash underlying the ponds is the source of the elevated pH in the groundwater, as discussed in Section 4.1.2.4.

Figure 5-1. Contour Map of the Water Table Around the 100-D Area in February 1995 and June 1996.

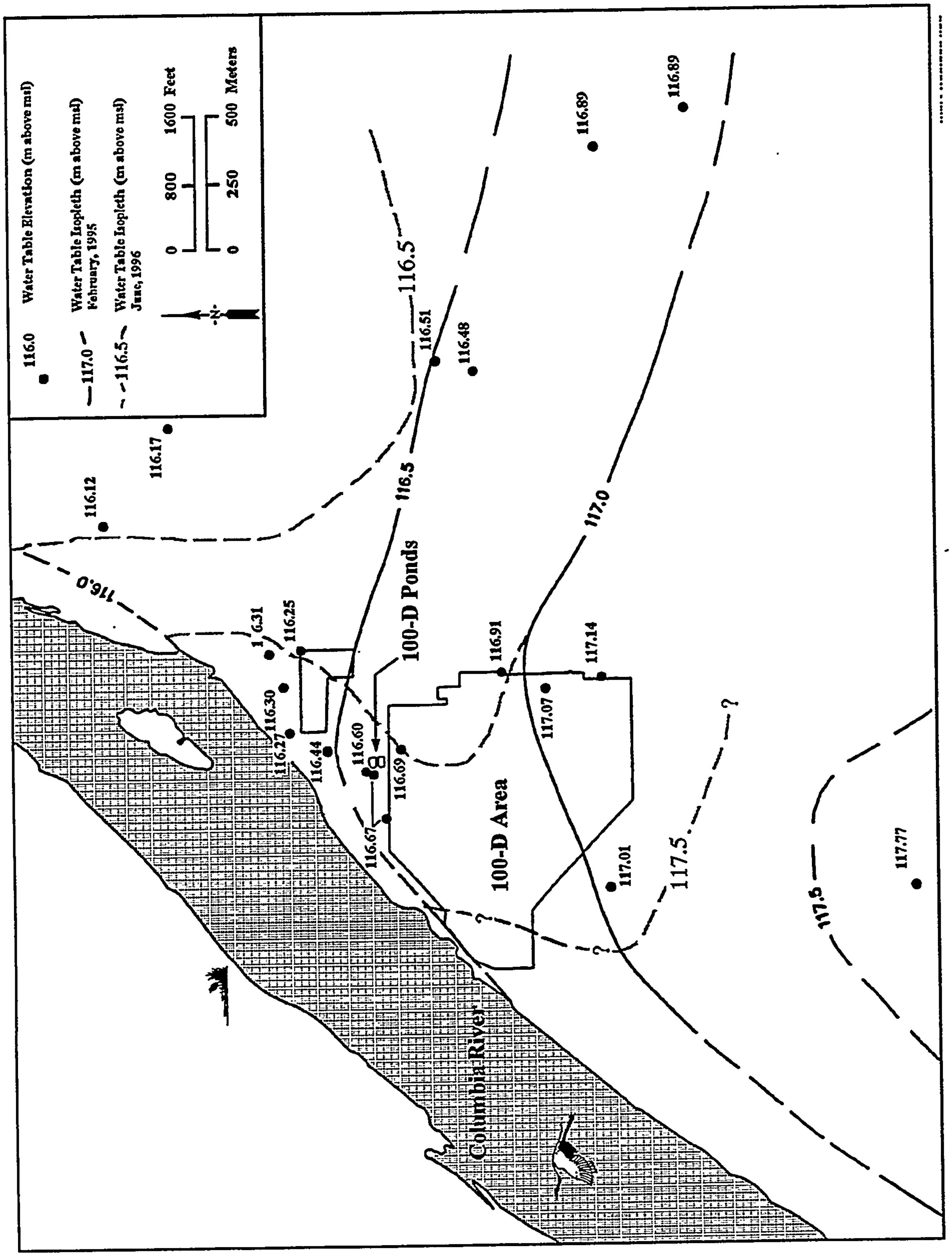

Figure 5-2. Approximate Thickness of Coal Ash in the Vicinity of 100-D Ponds

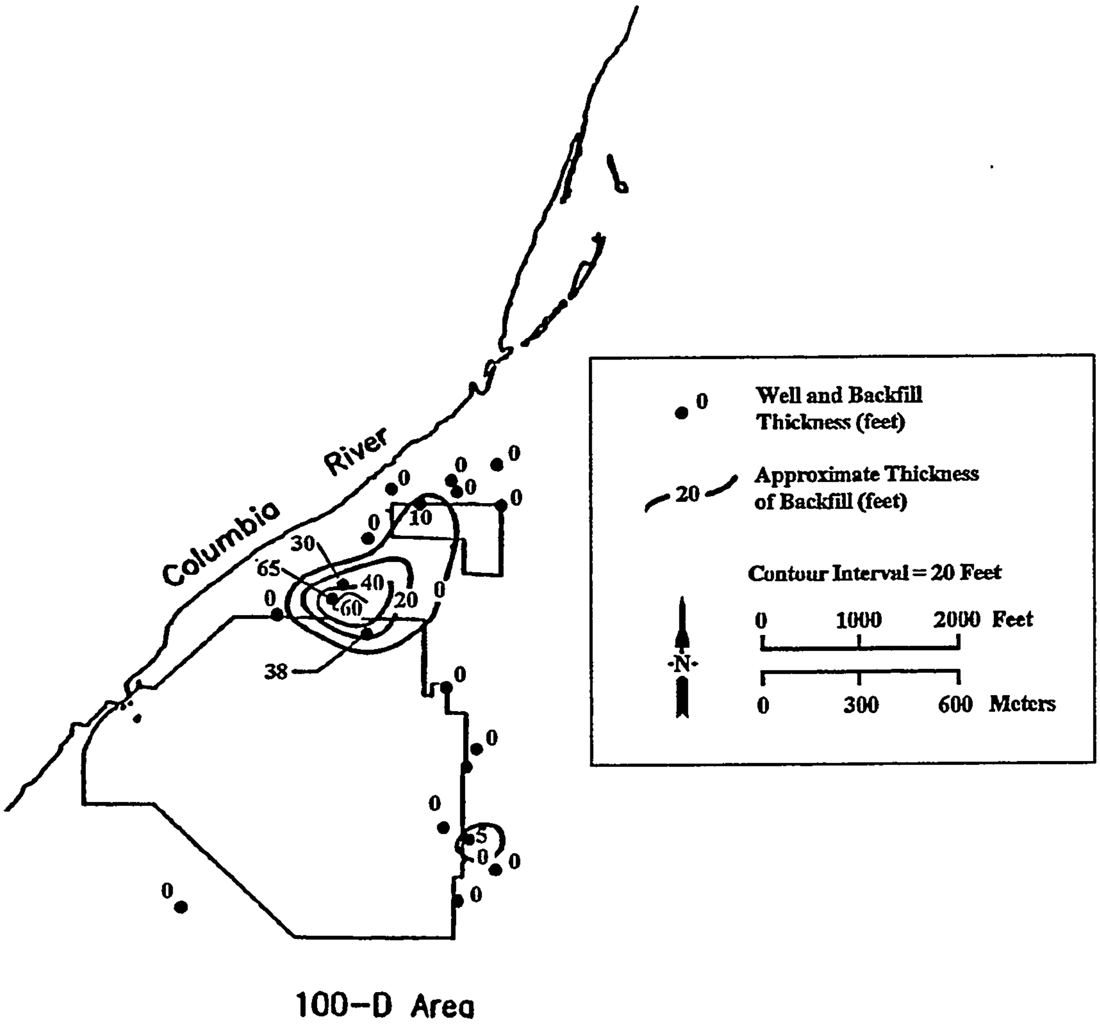

Figure 5-3. General Stratigraphy and Hydrostratigraphy of the 100-D Area

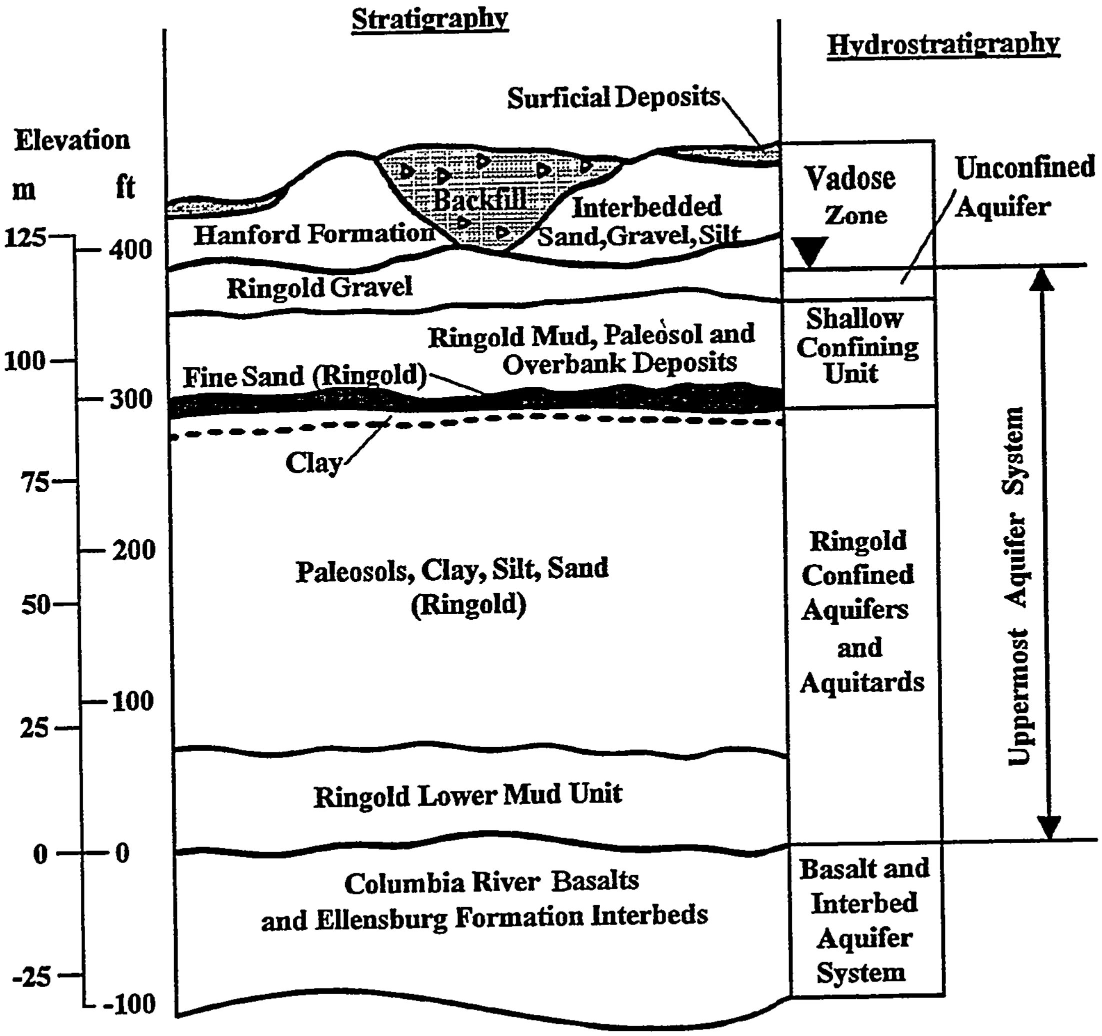

Figure 5-4. Contour Map of the Water Table Around the D and H Areas in 1967

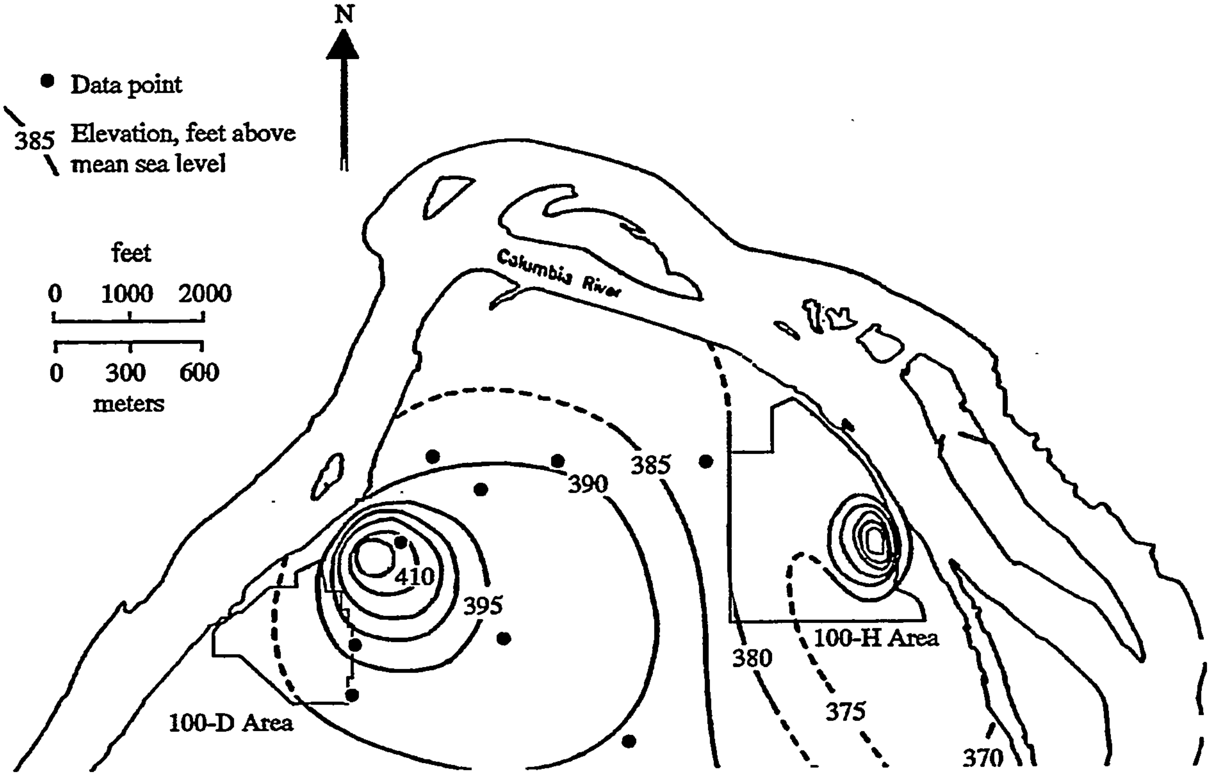

Figure 5-5. Groundwater Monitoring Wells at 100-D Ponds

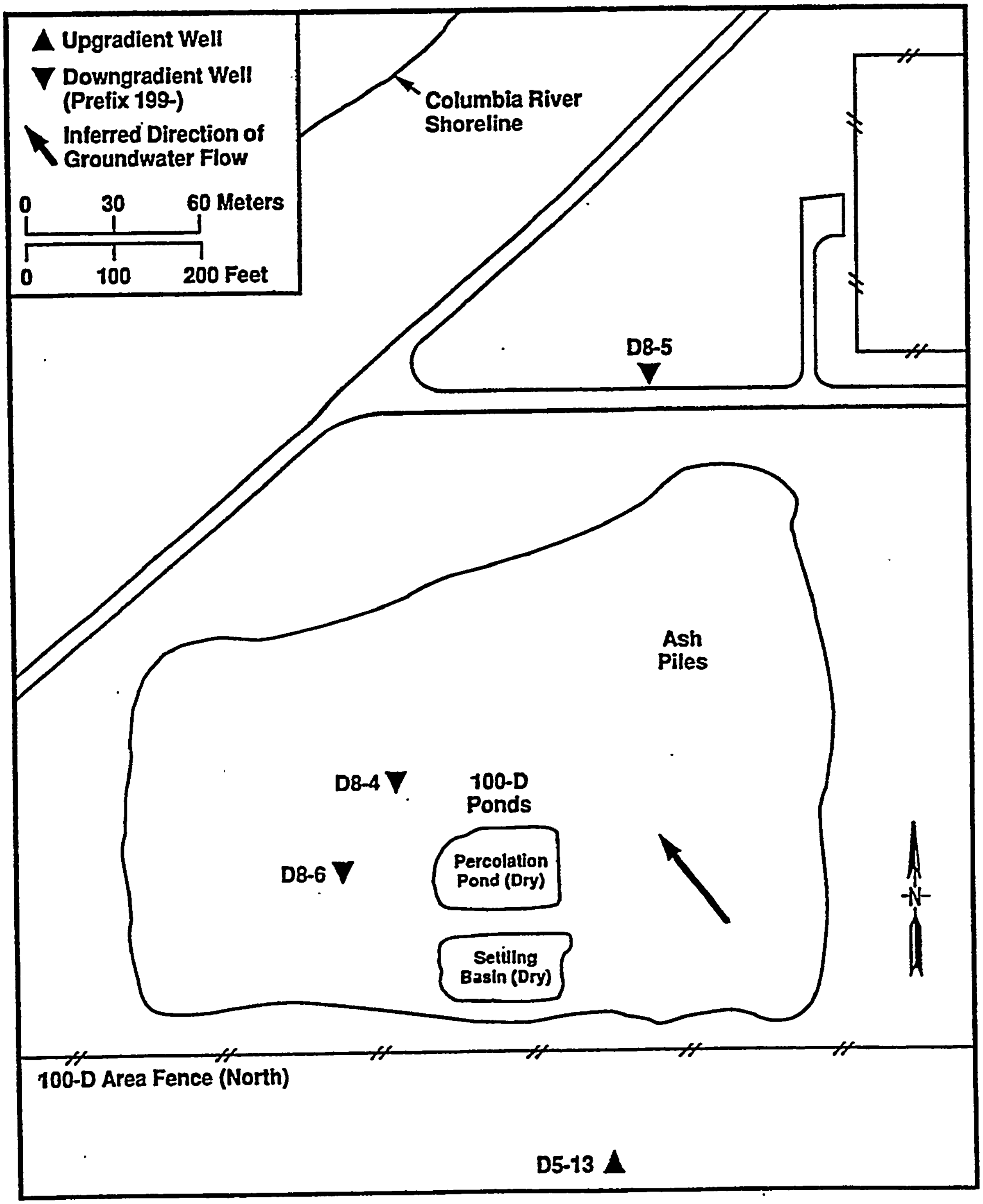

Figure 5-6. Groundwater Levels in 100-D Ponds Monitoring Wells

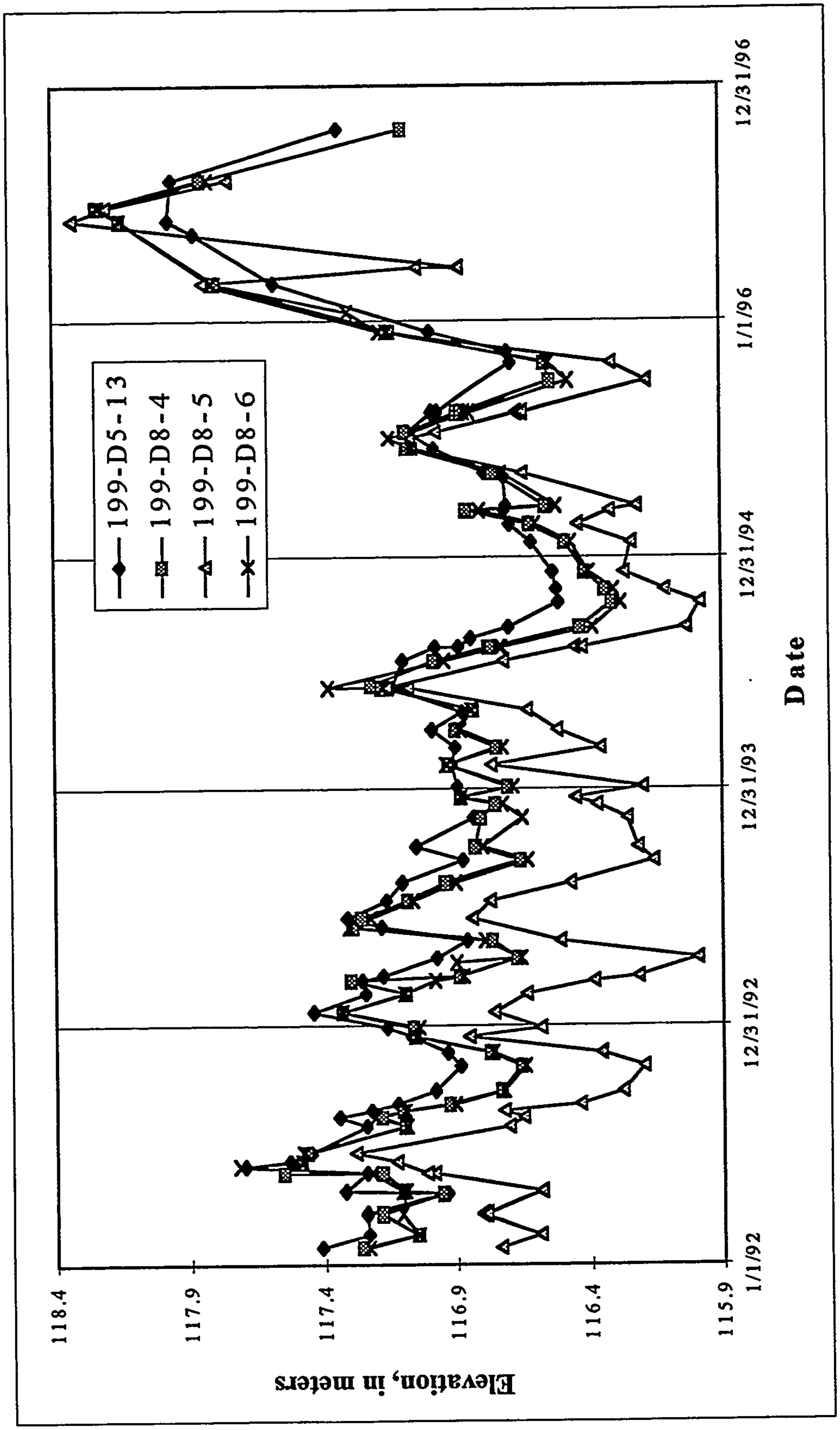

Figure 5-7. Conductivity and Chromium Values from 100-D Ponds Monitoring Wells.
Vertical line represents end of discharges to the ponds.

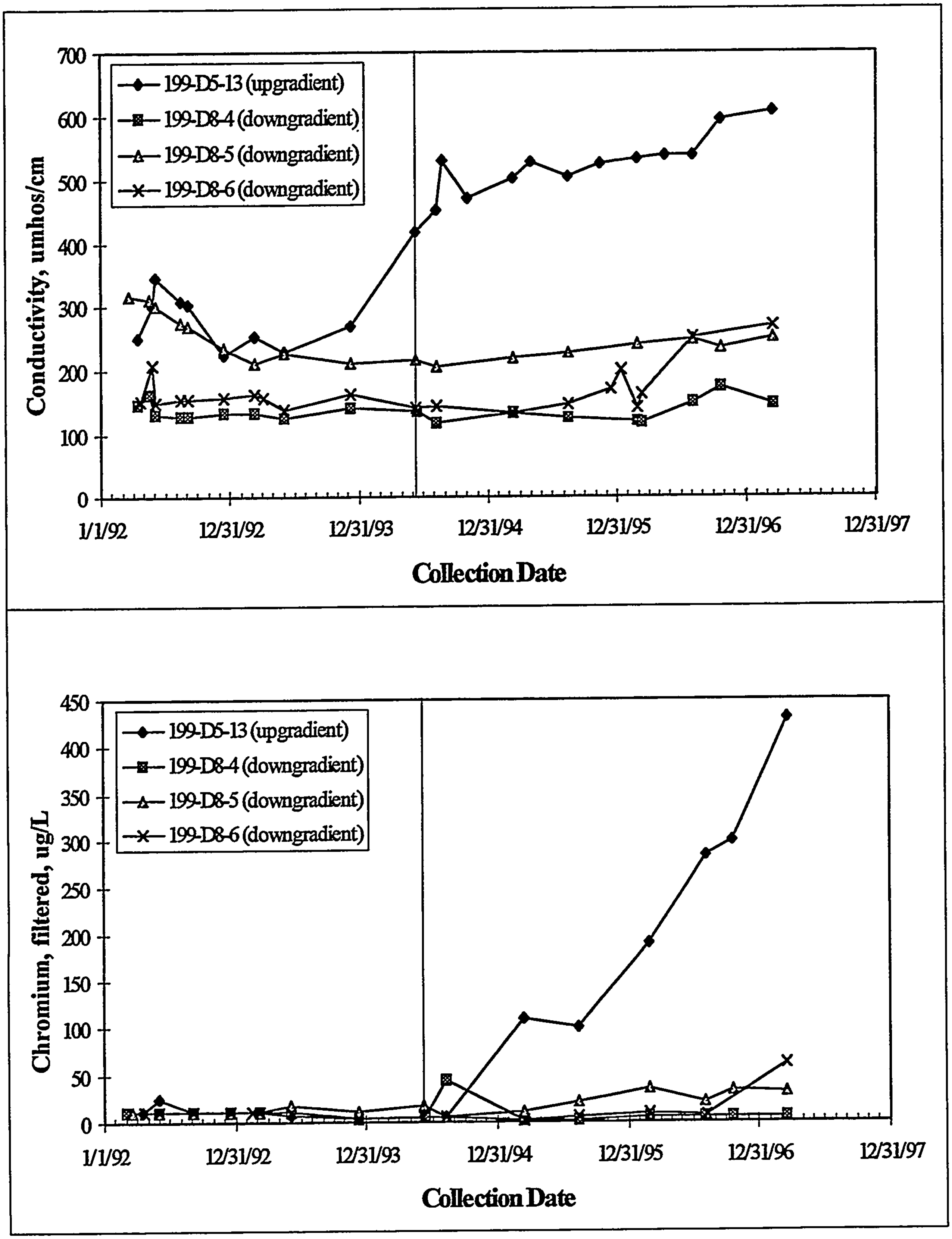

Table 5-1. Statistical Summary of Groundwater Samples from Monitoring Wells Downgradient of 100-D Ponds.

Compound	Filtered/ Unfiltered	Average µg/L	Std. Dev. µg/L	Min µg/L	Max µg/L	# Samples	# Samples <DL	% > DL	MTCA B GW, µg/L	Max value > MTCA B?
Antimony	Filtered	60.73	41.47	12	100	37	37	0		NA
Aroclor-1016	Unfiltered	0.50	0.00	0.5	0.5	12	12	0	1.12	NO
Aroclor-1221	Unfiltered	0.63	0.23	0.5	1	12	12	0		NA
Aroclor-1232	Unfiltered	0.50	0.00	0.5	0.5	12	12	0		NA
Aroclor-1242	Unfiltered	0.50	0.00	0.5	0.5	12	12	0		NA
Aroclor-1248	Unfiltered	0.50	0.00	0.5	0.5	12	12	0		NA
Aroclor-1254	Unfiltered	0.50	0.00	0.5	0.5	12	12	0	0.32	NO*
Aroclor-1260	Unfiltered	0.50	0.00	0.5	0.5	12	12	0	0.011	NO*
Arsenic	Filtered	2.42	0.19	2	2.5	19	16	16	4.8	NO
Barium	Filtered	25.28	15.42	10	70	37	7	81	1120	NO
Beryllium	Filtered	1.04	0.53	0.085	1.5	37	34	8	80	NO
Cadmium	Filtered	3.38	1.75	0.49	5	37	33	11	8	NO
Chromium	Filtered	10.54	8.24	1.85	44	37	27	27	80	NO
Copper	Filtered	6.16	4.21	1.05	10	37	34	8	592	NO
Lead	Filtered	2.58	0.34	2.5	4	19	18	5	5	NO
Manganese	Filtered	5.26	10.43	0.275	63	37	22	41		NA
Mercury	Filtered	0.07	0.03	0.0095	0.1	37	34	8	4.8	NO
Nickel	Filtered	12.06	6.50	5.5	42	37	36	3	320	NO
Silver	Filtered	6.12	4.06	1.435	10	37	37	0	80	NO
Vanadium	Filtered	10.45	5.21	1.92	15	37	26	30	112	NO
Zinc	Filtered	4.97	2.60	1.3	13	37	24	35	4800	NO

NA = not applicable * = Detection limit for analyte above regulatory limit.

6.0 CLOSURE STRATEGY AND PERFORMANCE STANDARDS

This chapter describes the closure strategy, closure performance standards, and closure activities for the 100-D Ponds TSD unit.

6.1 CLOSURE STRATEGY

The strategy for the closure of this TSD unit is clean closure. Data presented in Appendices A and B demonstrate that soil and groundwater beneath 100-D Ponds are below cleanup limits in accordance with WAC 173-610(2)(b), as outlined in Section 6.2.

6.2 GENERAL PERFORMANCE STANDARDS

The closure performance standards in WAC 173-303-610(2) require the owner or operator to close the TSD unit in a manner that:

> "(a)(i) Minimizes the need for further maintenance;
>
> (ii) Controls, minimizes or eliminates to the extent necessary to protect human health and the environment, postclosure escape of dangerous waste, dangerous constituents, leachate, contaminated run-off, or dangerous waste decomposition products to the ground, surface water, ground water, or the atmosphere; and
>
> (iii) Returns the land to the appearance and use of surrounding land areas to the degree possible given the nature of the previous dangerous waste activity."

All dangerous wastes or dangerous waste constituents or residues associated with the operations of the ponds have been removed, so no maintenance is or will be required and human and environmental health is protected. The ponds were established in a preexisting excavation in the coal ash basin and, as such, are not required to be backfilled.

6.3 CLOSURE ACTIVITIES

Activities leading to clean closure of the 100-D Ponds TSD included sampling to characterize the composition of near-surface sediments (BHI 1995) and removal and disposal of sediment from the settling pond, as described in Appendix A. Subsequent collection of verification samples from beneath the surface of the ponds was conducted according to the Sampling and Analysis Plan (SAP) for the 100-D Ponds Voluntary Remediation Project (DOE-RL 1996b). The sampling and analysis strategy was determined through the Data Quality Objectives (DQO) process, which is summarized in Appendix C. Cleanup limits and detection limits were agreed to in the DQO and modified slightly during approval of the SAP. Final cleanup limits are contained in Table A-3 of

Appendix A. Samples were analyzed in accordance with State-approved methods and procedures, according to EPA Analytical Level III standards. Analytical results were evaluated according to procedures in MTCA and Ecology guidance (Ecology 1992). These results are detailed in Appendix A, which concludes that 100-D Ponds is in compliance with WAC-173-303-610(2)(b)

7.0 CLOSURE ACTIVITIES

This chapter discusses the activities that will be conducted to finalize closure of the 100-D Ponds TSD unit.

7.1 SCHEDULE OF CLOSURE

Closure of the 100-D Ponds will be complete after approval and incorporation of this Closure Plan in Permit Modification D. Certification will be submitted within 60 days of closure plan approval, as required by WAC 173-303-610(6). The 100-D Ponds is considered clean closed and therefore will not be subject to closure with a landfill cover and postclosure care requirements.

7.2 CERTIFICATION OF CLOSURE

The certification of closure for 100-D Ponds, signed by both the RL and a registered independent professional engineer, will be submitted to Ecology and the Benton County Auditor within 60 days after this closure plan is approved. An example of the certification is presented in Figure 7-1. Documentation supporting the independent registered professional engineer's certification will be supplied upon request.

Figure 7-1. Closure Certification for 100-D Ponds

CLOSURE CERTIFICATION
FOR 100-D PONDS

Hanford Facility
U.S. Department of Energy, DOE Richland Operations Office

We, the undersigned, hereby certify that all 100-D Ponds closure activities were performed in accordance with the specifications in the approved closure plan.

____________________________________ __________
Owner/Operator Signature RL Representative Date
(Typed Name)

________________________ P.E.# ______ State ___ __________
Signature Independent Registered Professional Engineer Date
(Typed Name, Professional Engineer license number, state of issuance, and date of signature)

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APPENDIX A

SUMMARY OF REMEDIATION AND VALIDATION SAMPLING AND ANALYSIS AT 100-D PONDS

FIGURES

TABLES

A1.0 INTRODUCTION

Characterization data collected from 100-D Ponds in 1992 and 1995 (BHI 1995) showed that surface sediment in the settling pond was contaminated with various metals and polychlorinated biphenyls (PCB), up to a depth of 60 cm (24 in.). Subsurface data collected from trenches in 1995 indicated that the substrate below this surface layer was free of contaminants. Based on this information, it was determined that this treatment, storage, and/or disposal unit (TSD) could be completely remediated and demonstrated to be clean if this contaminated sediment was removed. The decision was made to excavate and dispose of the contaminated sediment and collect samples to verify that no contamination remained at the ponds.

This appendix describes the remediation of 100-D Ponds and subsequent sampling and analysis of surface soils at the facility.

A2.0 VOLUNTARY REMEDIATION

The scope of work for the remediation of the 100-D Ponds involved the removal of piping and contaminated sediments associated with past waste disposal practices at this TSD. The major assumptions that were made during the planning phase of the project are the following:

1. Only the upper sediment layer in the settling pond needed to be excavated because contaminant concentrations in the material beneath this layer were below cleanup goals (BHI 1995). Characterization sampling of the percolation pond showed that this area was not contaminated.

2. The contaminated sediment in the settling pond varied in thickness between approximately 0.6 to 1.5 m (2 to 5 ft) (BHI 1995) and had areal dimensions of approximately 41 by 27 m (135 by 90 ft). An average contaminated sediment thickness of 1 m (3 ft) was assumed, so the calculated volume of contaminated sediment was approximately 1,030 m^3 (1,350 yd^3).

3. Regardless of the variability of the contaminated sediment thickness, the sediment would be excavated down to the top of the coal ash (as indicated by the distinctive black color).

4. Radiological surveys indicated that radioactive contamination was present only in the upper 15 cm (6 in.) of contaminated sediment. The radioactively contaminated sediment would be skimmed off and disposed of as radioactive nondangerous waste while the remainder of the contaminated sediment would be disposed of as nondangerous waste.

5. The excavated sediment would be disposed of in the low level burial grounds. Characterization data from the ponds showed that the sediment did not designate as dangerous waste. This fact, coupled with the presence of low levels of radioactive contamination, made it appropriate to dispose of this sediment in the low level burial grounds.

6. Verification sampling would be conducted after removal of the contaminated sediment layer (DOE-RL 1996). If the analytical laboratory results indicated contaminant concentrations above cleanup goals, excavation equipment would be re-mobilized (if necessary), and additional material would be excavated until cleanup goals were achieved.

7. The carbon steel piping embedded in the earthen dike that separated the settling pond from the percolation pond and a corrugated steel pipe laying in the bottom of the percolation pond would be removed and disposed of.

The labor needed to excavate and haul the contaminated material was performed by plant forces as determined in "Hanford Site Plant Forces Work Reviews 8850-032-96 and 8850-033-96" (Broom 1996a and 1996b). The plant forces were directed by the Bechtel Hanford, Inc. (BHI) Field Support Organization. The work plan (BHI 1996a) outlined the general approach for performing the work. The final hazard classification for the project classified the work as "radiological" (BHI 1996b). The field work was performed under Demand Work Request number 19960607004 which provided the specific task instructions for performing the work. The site specific health and safety plan (BHI 1996c) classified the work as "low hazard" both from an industrial safety and radiological perspective. The hazards were expected to be those commonly found in small-scale excavation projects and the radiological hazards were expected to be very low levels. Level D personal protective equipment (the lowest level of protection) was prescribed for the work.

Mobilization for field activities began on June 18 (all dates are calendar year 1996) when the office trailer was delivered and set up. A ramp to access the settling pond was cut into the dike separating the two ponds, and the overflow pipe was removed on June 19. The influent pipe and weir were removed on June 20. All piping that was removed was surveyed for radioactive contamination, and none was detected with field instruments. The piping was released by the Radiological Control Technicians (RCT) and staged to the northwest of the ponds for later disposal to the 183-F Clearwell. Surface gravel was spread on the access roads and ramp to improve traction in the coal ash that is the predominate soil type in the area. Water spray was used to control dust emissions throughout the project. Because the low level waste burial ground was not yet able to receive waste from this TSD (due to an administrative requirement within DOE), the project was placed on hold on June 21.

Excavation of the contaminated sediment in the settling pond began on August 12. A front-end loader was used to excavate the sediments. The original plan called for skimming the upper 15 cm (6 in.) of contaminated sediment to remove the radioactive contamination and minimize waste. The loader operator found it difficult to guide the bucket and maintain this depth, however, and the actual skimming depth was about 30 cm (12 in.). Excavation of the sediments was also difficult because of loose material on the surface that provided poor traction for the loader. On August 13, the loader became mired in the sediment due to the presence of moisture in an underlying layer which would not support the weight of the loader. A tractor was used to pull the loader out. Because of the difficulty of skimming the surface layer, the plan was changed on August 14 to remove all of the contaminated sediment layer down to the ash layer and handle all of the material as radioactively contaminated. Excavated sediment was staged on the south side of the settling pond and covered with plastic sheeting at the end of each shift to prevent dust emissions.

Ten-yard dump trucks were used to haul the excavated sediment to the 218-W-4C burial ground in the 200 West Area, and placed in Trench #48. The truck beds were lined with plastic sheeting before loading. Once loaded, the sheeting was folded over the pile and taped shut to prevent release during transport.

On two occasions, winds were too high at the burial grounds to allow dumping. On both occasions, winds subsided to safe levels within about two hours. Winds at the excavation site were never a problem.

Owing to several logistical concerns, overtime was approved for completing sediment removal in order to maintain the original schedule. Twelve-hour shifts were worked August 15 and 16, and an eight-hour shift was worked on August 17 (Saturday) when sediment removal was completed. A total of 69 truckloads [approximately 7.7 m^3 (10 yd^3) each load] was hauled to the low level waste burial ground. Two truckloads of scrap steel piping (non-radioactive) were hauled to the 183-F clear well for disposal on August 19. Photographs of the ponds before and after the remediation activities are shown in Figure A-1.

A3.0 VERIFICATION SAMPLING AND ANALYSIS

A3.1 SAMPLING

Verification samples were collected from 100-D Ponds on August 21, 1996. Sampling was guided by the 100-D Ponds Sampling and Analysis Plan (SAP) (DOE-RL 1996), which was reviewed and approved by the Washington State Department of Ecology (Ecology). Figure A-2 is a map of the ponds showing the sampling sites.

A3.1.1 Sampling Locations

The sampling locations were measured using a Brunton* compass and 100-ft tape measure, following the coordinates in Table 2-1 of the SAP. The surveyed sites were marked with "pin flags," with the site sample number and HEIS number marked on the flag.

Sample site P-5 was not an appropriate location to collect a sample as material from the dike between the two ponds had been pushed into the percolation pond during remediation activities, covering the sampling site with approximately 2 m (6 ft) of fill material. The site was moved to an area which had not been covered and was renamed sampling site P-5A. This site is 5.5 m (18 ft) north and 2.5 m (8.2 ft) east of the original location of P-5.

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* Brunton is a trademark of The Brunton Company

The SAP required samples to be collected from the banks of the ponds based on the total area of the lower third of the banks, at a rate of one sample for every 100 m^2 of bank area. The circumference of the settling pond was measured at 118.1 m (387.5 ft), and the percolation pond at 68.9 m (226 ft). The total bank height was estimated at 3 m (10 ft) for both ponds. The area of the lower third of the bank of the settling pond was calculated to be 120 m^2 (1,291 ft^2) and 70 m^2 (753 ft^2) for the percolation pond. For the settling pond, sampling site S-1 represents one bank sample, and the other was chosen randomly and designated SB-2. The bank sample for the percolation pond was also chosen randomly, and designated PB-1.

The sample locations were surveyed on August 28, 1996, using global positioning satellite techniques. Coordinates of the surveyed locations are presented in Table A-1.

A3.1.2 Sample Collection

All sampling activities were performed according to procedures cited in the SAP. The sampling log is reproduced in Attachment A-1. Sampling activities were monitored by Environmental Restoration Contractor (ERC) Quality Assurance personnel for compliance with the SAP. The self assessment (SA# D-Pond-001-96, contained in the Project file) found that the sampling was performed according to the SAP and all applicable ERC procedures.

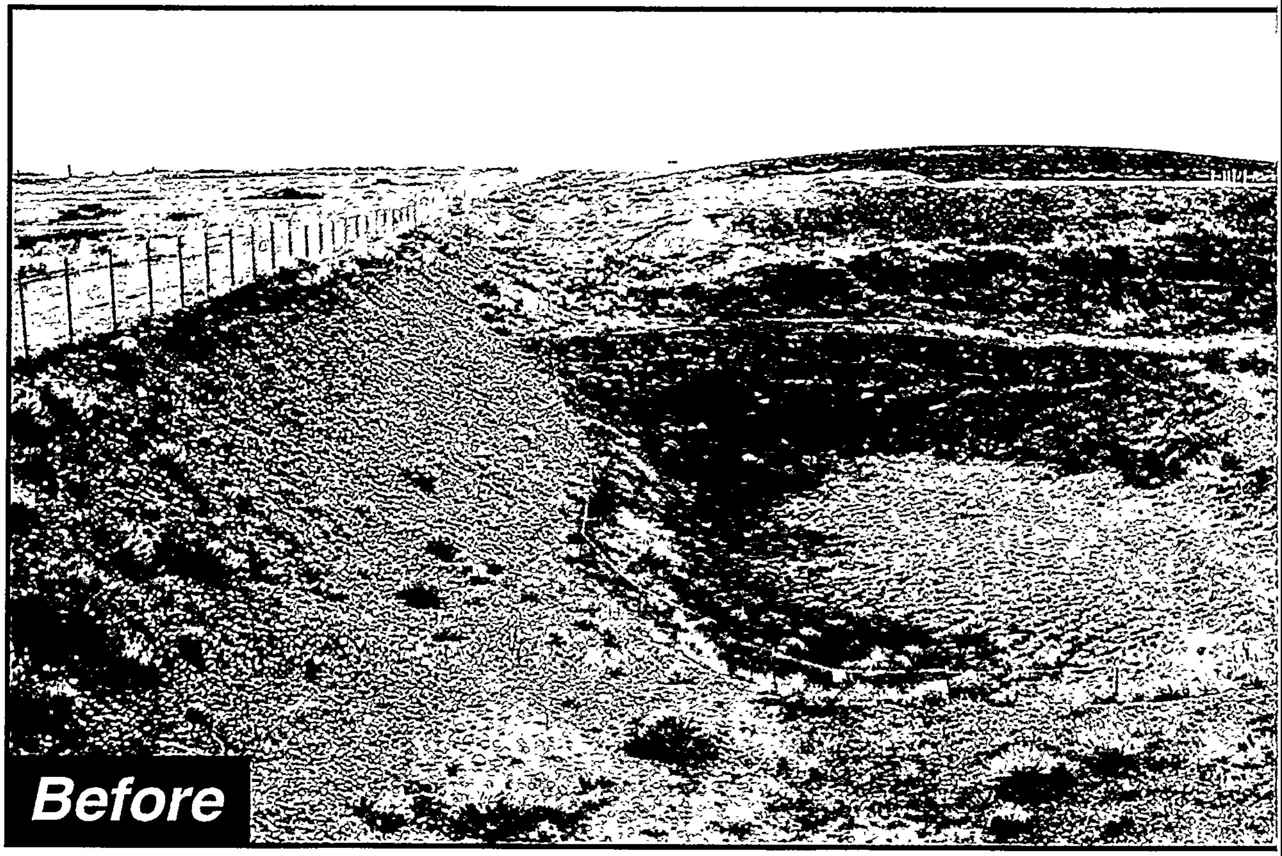
Sampling was conducted by digging approximately 30 cm (12 in.) below the surface with a steel shovel, then scraping away the material which contacted the shovel and collecting the sample with stainless steel and/or plastic tools. A total of 19 samples were collected, which included one field blank of silica sand and two duplicate samples. The samples were placed in the appropriate containers, labeled, and packed in coolers. At the end of the sampling event the coolers were shipped to the laboratory for analysis. No radiological prescreening of samples was necessary before shipment offsite, as determined by health physics personnel and based on previously-collected data.

A3.2 LABORATORY ANALYSIS

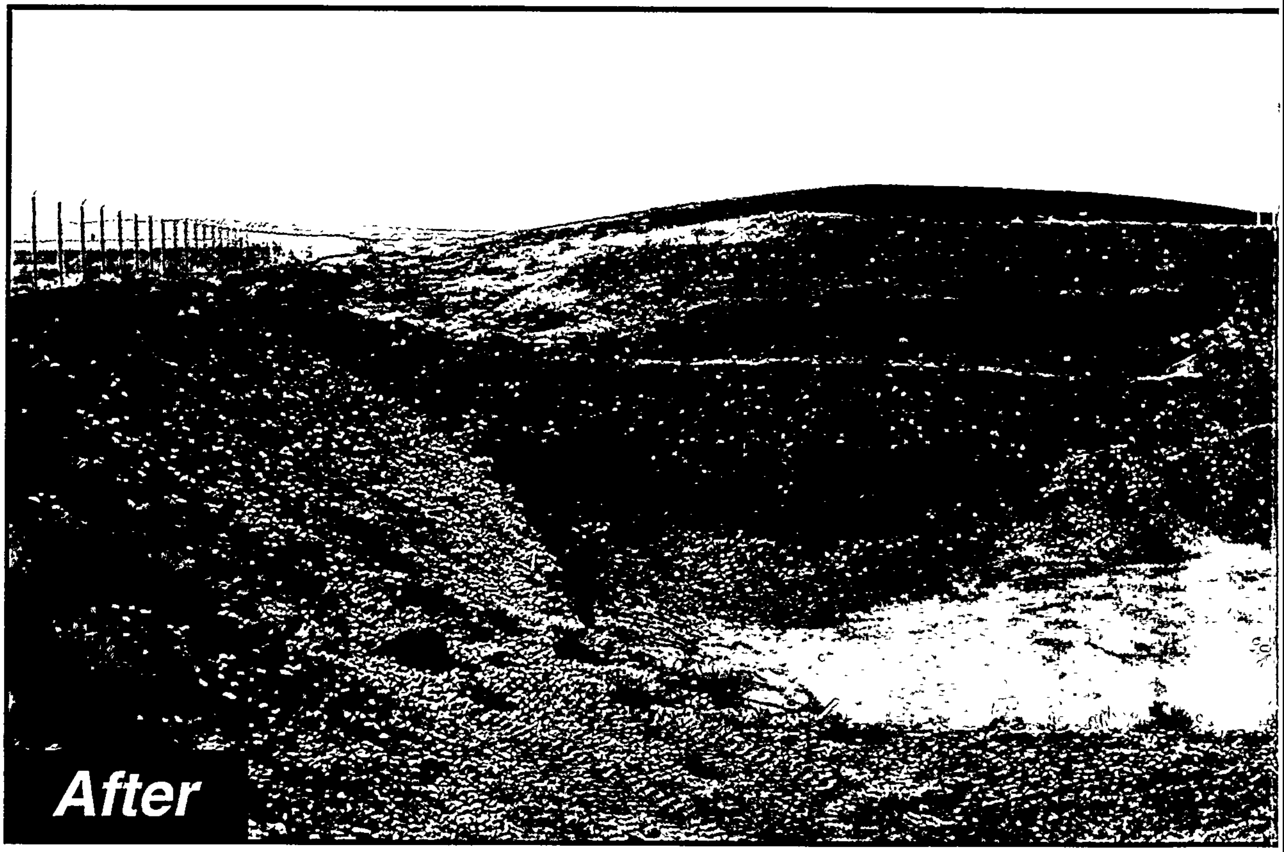
The samples were submitted to Quanterra Environmental Services (QES) for analysis of the contaminants of concern (COC), under Sample Authorization Form B96-139. The COCs were identified and agreed to in the DQO, and are presented in Appendix C, Table 2. Most metals were analyzed by EPA SW-846 method 6010A. Exceptions were arsenic (method 7060), lead (method 7421), thallium (method 7841), mercury (method 7471), and hexavalent chromium (preparation method 3060A, analysis method 7196). Analysis of PCBs was by method 8080A.

A3.2.1 Validation of Analyses

A validation report for the QES laboratory data was prepared by A.T. Kearney, Inc., and transmitted to the ERC in November 1996. This report evaluated all 19 verification samples in accordance with Hanford Site procedures (WHC 1993).



Before



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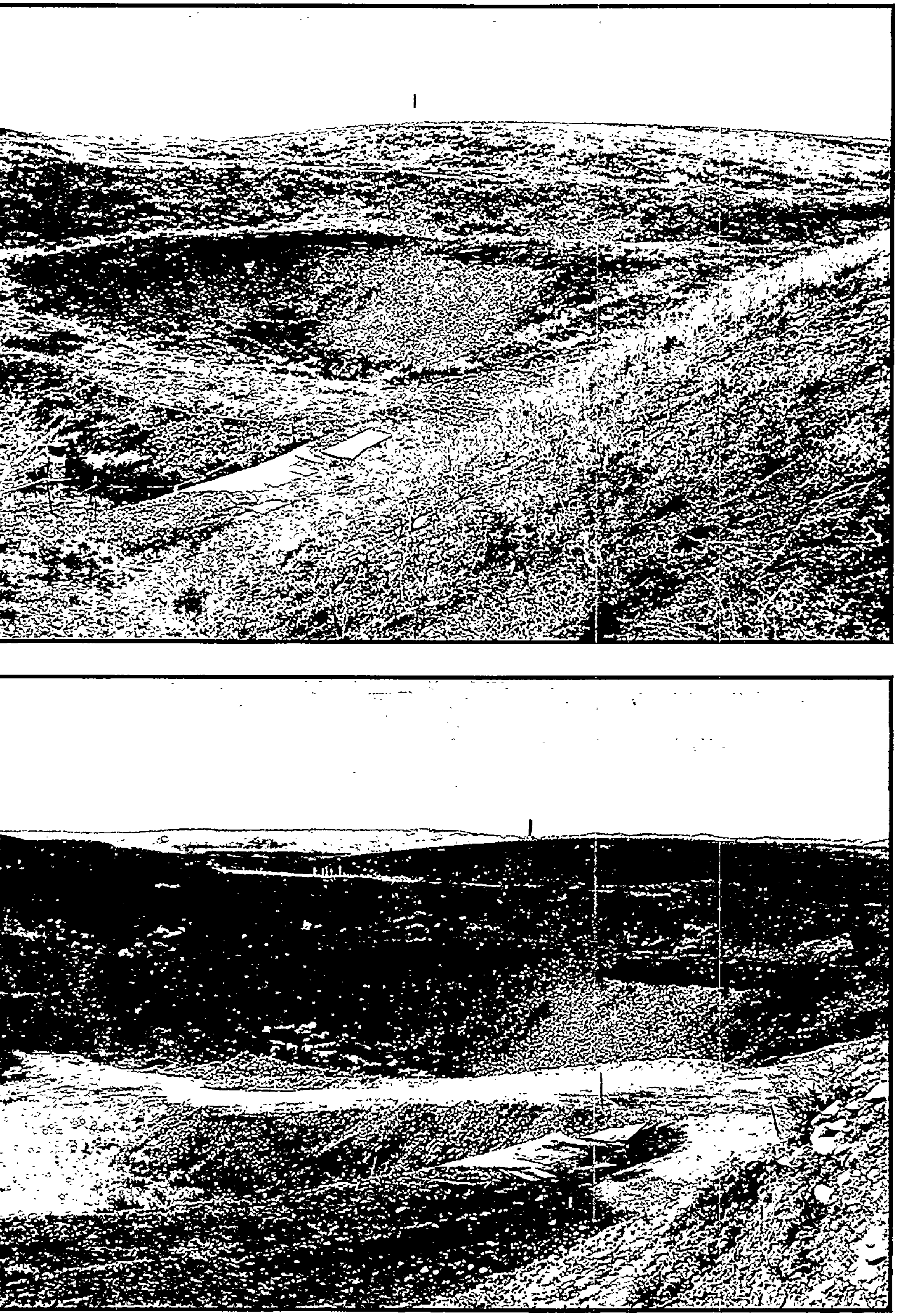

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Figure A-1. Photographs of 100-D Ponds Before and After Removal of Contaminated Sediment. View is to the West.

Figure A-2. Topographic Map of 100-D Ponds, Showing Verification Sampling Localities.

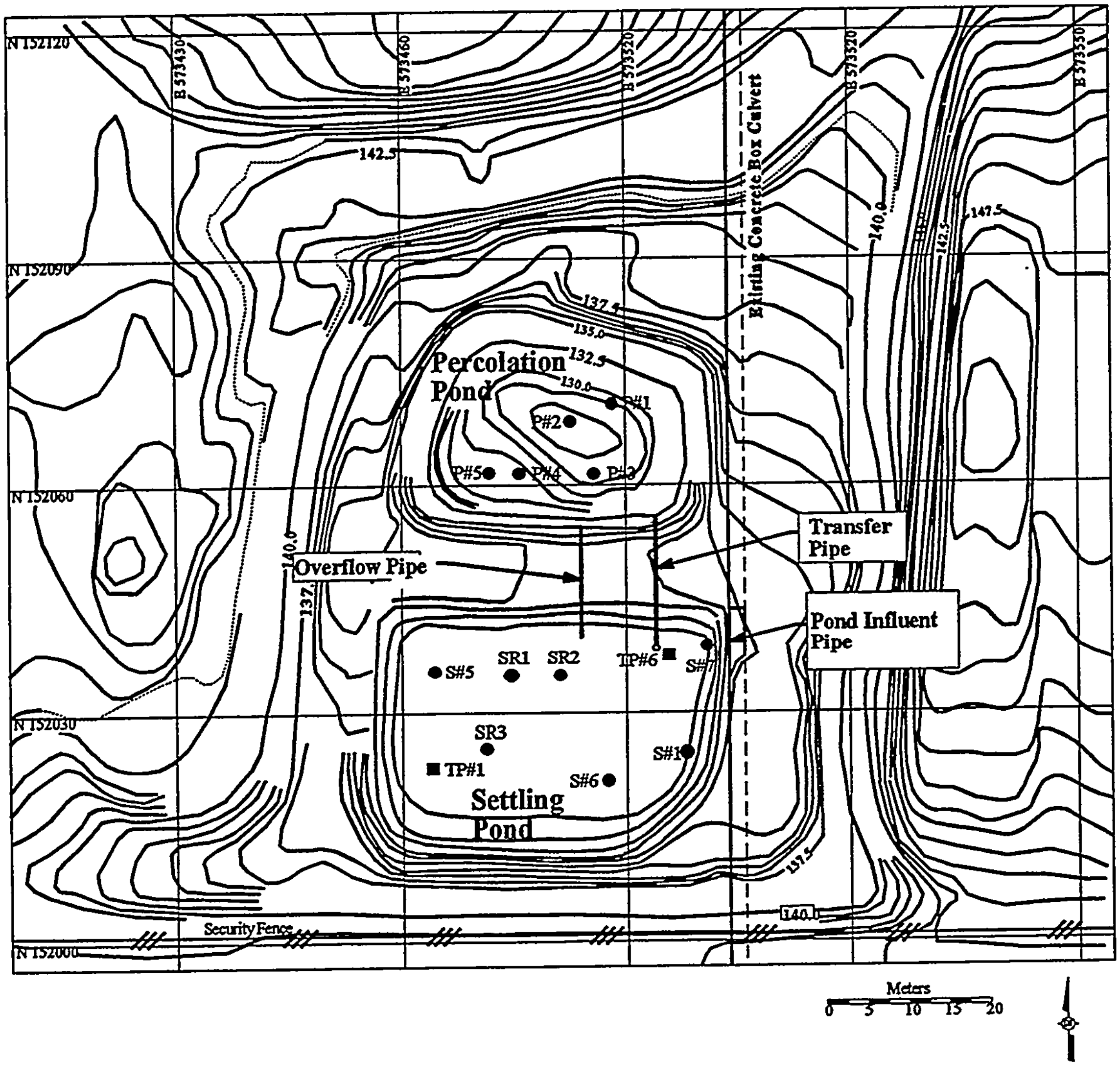

Table A-1. Sampling Site Locations, in Washington State Coordinate System.

Sample Number	Northing	Easting	Elevation
P-1	152067.94	573486.85	129.48
P-2	152065.22	573481.57	129.35
P-3	152058.94	573484.65	130.27
P-4	152058.85	573475.59	131.65
P-5A	152063.92	573474.04	131.25
PB-1	152064.99	573468.58	131.09
S-1	152025.28	573497.55	132.49
S-5	152034.86	573466.46	131.25
S-6	152021.47	573487.93	131.38
S-7	152038.33	573500.04	131.36
SB-1	152016.44	573465.23	131.72
SR-1	152034.50	573475.97	131.32
SR-2	152034.48	573481.99	131.34
TP-1	152023.46	573466.09	130.63
TP-2	152037.24	573495.58	131.22
SR-3	152025.88	573473.05	0.00

The validation report evaluated the laboratory data on the basis of holding times, accuracy, precision, detection levels, completeness, and other measurements of data quality. No major deficiencies were found with the data. Minor deficiencies are as follows:

- Holding time was exceeded for mercury by one day for one sample (B0HYS5). The initial analysis for this sample was out of the calibration range of the instrument, and was not immediately diluted and rerun. ERC personnel authorized reanalysis of this sample, and the resulting value was qualified with a "J."

- Matrix spike/matrix spike duplicate recoveries were outside quality control (QC) limits for aluminum, manganese, thallium, barium, and calcium. These analytes were assigned "J" qualifiers, indicating estimated values. Under the validation guidelines, these data are usable for decision-making purposes.

A3.2.2 Quality Assurance/Quality Control Samples

Two duplicate samples were collected from the settling pond and submitted for analysis. These duplicates are meant to give an indication of spatial variability resulting from sample heterogeneity. One field blank sample consisting of silica sand was poured into sample containers near the discharge pipe in the settling pond. The blank is used to assess environmental and sampling equipment contamination.

Analyses for the COCs present above detection limits in the duplicate and blank samples is presented in Table A-2. The relative percent difference (RPD) between duplicates is also presented. The RPDs are below 20% for most of the analytes, with exceptions for arsenic, cadmium, hexavalent chromium, and nickel. These results may indicate a small amount of heterogeneity in the 100-D Ponds samples. The largest RPD is for hexavalent chromium, which reflects a difference between the detection limit value of 0.57 mg/kg and 0.84 mg/kg for the duplicate at sampling site SR-2. This difference is not large and would be undetectable if a higher reported detection limit were used, such as the limit of quantitation [as recommended by the American Chemical Society; (ACS 1983)].

Detectable amounts of iron, lead, manganese, and zinc were found in the field blank, although at very low levels.

A3.3 STATISTICAL EVALUATION OF VERIFICATION DATA

Laboratory analytical data are presented in Attachment A-2. The sample set was statistically compared to the cleanup limits used for this TSD unit. These cleanup limits conform to MTCA B levels (WAC173-340-740), as discussed in Appendix C (see Tables 2 and 4).

For the purposes of evaluating the data with respect to the cleanup limits, the duplicate analyses were averaged with their co-located samples. The data represent ten samples from the settling pond and six samples from the percolation pond. All of the samples will be considered as one data set, because 100-D Ponds is a single RCRA unit. Only the COCs determined for 100-D Ponds are discussed below, although a full suite of metals and pesticides were analyzed.

A3.3.1 Methodology

This section presents a statistical summary of the 100-D Ponds data and compares the results to the cleanup limits. The method used for this comparison will be the three-part test described in the Washington State Department of Ecology *Model Toxics Control Act* (MTCA; Washington Administrative Code-173-340), as modified by the *Statistical Guidance for Ecology Site Managers* (Ecology 1992). These tests consist of the following steps:

1. Determine the distribution of the data
2. If data are normally or lognormally distributed, calculate the upper 95% one-sided confidence limit on the mean, using the appropriate distribution, and compare to the cleanup limit.
3. Determine if the largest value from the sample set is greater than two times the cleanup limit.
4. Determine if more than 10% of the samples exceed the cleanup limit.

If the data fail any of the tests in steps 3 through 5, the verification data fail the Ecology test. Other statistical tests may be applied to the data to further test if the site is contaminated, as discussed in *Hanford Site Background Data Application Guide: Part 1, Soil* (DOE-RL 1994).

Table A-2. Data for Duplicate Samples, in mg/kg, and Relative Percent Differences (RPD).

HEIS	Sample #	Description	Ag	As	Be	Cd	Cr-tot	Cr6+
BOHYS	S7	near discharge pipe	0.65	0.55	0.52	1.1	5.4	0.57
BOHYS	S7	dupe to BOHYS7, Ecology split	0.7	0.49	0.49	1.4	6.2	0.57
		RPD	**7.41**	**11.54**	**5.94**	**24.00**	**13.79**	**0.00**
BOHYT	SR2	Northern settling pond	0.68	0.62	0.55	1	4.3	0.57
BOHYT	SR2	dupe to BOHYT1, Ecology split	0.58	0.81	0.61	1.2	5	0.84
		RPD	**15.87**	**26.57**	**10.34**	**18.18**	**15.05**	**38.30**
			Cu	Ni	Pb	V	Zn	
BOHYS	S7	near discharge pipe	11.3	9.3	1.3	75.4	54.5	
BOHYS	S7	dupe to BOHYS7, Ecology split	10.4	13.3	1.2	70.9	54.2	
		RPD	**8.29**	**35.40**	**8**	**6.15**	**0.55**	
BOHYT	SR2	Northern settling pond	11.1	6.5	1.6	67.2	46.9	
BOHYT	SR2	dupe to BOHYT1, Ecology split	13.3	8	1.7	71.1	49.2	
		RPD	**18.03**	**20.69**	**6.06**	**5.64**	**4.79**	

A3.3.2 Detection Limit Data

The majority of values for the following COCs were below the contract required detection limit (CRDL) or contract required quantitation limit (CRQL): the polychlorinated biphenyls (PCB) Aroclor 1254 and Aroclor 1260, hexavalent chromium, mercury, antimony, and thallium. These analytes were evaluated according to the Ecology guidance (Ecology 1992, Supplement S-6).

For analytes that have greater than 50% of their values below detection (also called censored values), Ecology recommends that the maximum value in the data set be used to compare to the cleanup limit, instead of the 95% upper confidence limit on the mean.

A special case for detection limit data may occur with duplicate samples when one of the samples is above and one below the detection limit. Ecology recommends averaging the detected value with half of the detection limit value, and treat this average as a detected value. Both duplicates for antimony and hexavalent chromium for sampling site SR-2 fit this case and were treated in the recommended manner.

A3.3.3 Distribution of Data

The distributions of the various analytes were determined by using the W test, as recommended by Ecology (Ecology 1992). The analytes silver, barium, cadmium, copper, and manganese were found to follow the lognormal distribution as determined by the W test. The analytes which were found not to follow either a normal or lognormal distribution, according to the W test, were arsenic, beryllium, total chromium, nickel, lead, vanadium, and zinc.

A3.3.4 Application of Ecology Tests

Results of the Ecology tests applied to the 100-D Ponds COC verification data are listed in Table A-3, along with a statistical summary of the data. The cleanup limits in Table A-3 differ from those in Appendix C for several analytes. The values in Table A-3 reflect cleanup limits used throughout the 100 Areas, and agreed to by all involved parties. The compliance values used to compare with the cleanup limit were from three sources:

1. For those analytes which passed the W test for lognormality, the lognormal one-sided upper 95% confidence limit on the mean was computed and used as the compliance value.
2. Analytes which did not pass the W test generally used the maximum result from the data as the compliance value.
3. For total chromium, a nonparametric estimate of the upper 95% confidence limit on the mean was used following the method described by Gilbert (1987, p. 139).

Ecology guidance suggests that a set of data which does not conform to either a normal or lognormal distribution be represented by the maximum value, regardless of the number of undetected values. This approach leads to an exceedance by total chromium, which has a maximum value of 22.5 mg/kg compared to the cleanup limit of 18.5 mg/kg. All other total chromium values are below 11 mg/kg. Because of the initial exceedance produced by using the Ecology method (#2, above), alternative methods for evaluating a compliance limit for total chromium were pursued. The use of other approaches is allowed in the MTCA regulation and guidance.

The distribution of total chromium values for 100-D Ponds verification samples is shown on a lognormal probability plot in Figure A-3, along with background values from the Hanford site (DOE-RL 1995). This figure shows that the 100-D Ponds data deviate from a lognormal distribution, but are within the range of sitewide background. The maximum value of 22.5 mg/kg is also within the range of background values, so instead of using this as the compliance value the nonparametric upper 95% confidence limit on the mean was computed, resulting in a value of 7.98 mg/kg. As allowed by Ecology, this was used as the compliance value and compared to the cleanup limit of 18.5 mg/kg total chromium.

A3.3.5 Evaluation of Ecology Data

Samples analyzed by Ecology consisted of four splits from the verification samples and four samples collected by Ecology personnel on August 28, 1996. The Ecology samples were analyzed for metals and selected radionuclides. These samples were not analyzed for PCBs.

Statistical analysis of the Ecology samples is presented in Table A-4, following the same procedures employed for the verification samples (Section A3.3.4). The Ecology samples substantiate that surface samples in the ponds are below cleanup limits.

Table A-3. Summary Statistics and Compliance with Cleanup Limits for 100-D Ponds Verification Data of Near Surface Soils. All units in mg/kg.

Ecology Test	Aroclor-1254	Aroclor-1260	Ag	As	Ba
Distribution	Below detection	Below detection	Lognormal	Nonparametric	Lognormal
Value used for compliance	maximum	maximum	lognormal 95% UCL	maximum	lognormal 95% UCL
Compliance value	0.07	0.04	0.76	4.20	127.80
Cleanup Limit	0.13	0.13	5	6.47	5600
Is compliance value > CL?	NO	NO	NO	NO	NO
Datum > 2X CL?	NO	NO	NO	NO	NO
> 10% of data > CL?	NO	NO	NO	NO	NO
Summary Statistics					
% data below DL	93.75	100	0	0	0
95% UCL on mean	NA	NA	0.76	1.44	127.80
Minimum	0.033	0.033	0.47	0.41	74.1
Maximum	0.072	0.036	0.96	4.2	166

	Be	Cd	total Cr	Cr^{6+}	Cu
Distribution	Nonparametric	Lognormal	Nonparametric	Below detection	Lognormal
Value used for compliance	maximum	lognormal 95% UCL	onparametric 95% UC	maximum	lognormal 95% UCL
Compliance value	0.63	1.30	7.98	0.62	13.20
Cleanup Limit	1.51	80	18.5	8	59.2
Is compliance value > CL?	NO	NO	NO	NO	NO
Datum > 2X CL?	NO	NO	NO	NO	NO
> 10% of data > CL?	NO	NO	NO	NO	NO
Summary Statistics					
% data below DL	0	0	0	87.5	0
95% UCL on mean	0.58	1.30	7.98	NA	13.20
Minimum	0.39	0.95	3	0.56	10.85
Maximum	0.63	1.5	22.5	0.62	16

	Hg	Mn	Ni	Pb	Sb
Distribution	Below detection	Lognormal	Nonparametric	Nonparametric	Below detection
Value used for compliance	maximum	lognormal 95% UCL	maximum	maximum	maximum
Compliance value	5.30	326.34	19.30	6.40	5.40
Cleanup Limit	24	11200	32	250	10
Is compliance value > CL?	NO	NO	NO	NO	NO
Datum > 2X CL?	NO	NO	NO	NO	NO
> 10% of data > CL?	NO	NO	NO	NO	NO
Summary Statistics					
% data below DL	68.75	0	0	0	81.25
95% UCL on mean	NA	326.34	10.07	2.96	NA
Minimum	0.02	266	6.6	1.25	3.5
Maximum	5.3	362	19.3	6.4	5.4

	Tl	V	Zn
Distribution	Below detection	Nonparametric	Nonparametric
Value used for compliance	maximum	maximum	maximum
Compliance value	0.19	73.15	93.60
Cleanup Limit	2	85.1	24000
Is compliance value > CL?	NO	NO	NO
Datum > 2X CL?	NO	NO	NO
> 10% of data > CL?	NO	NO	NO
Summary Statistics			
% data below DL	0	0	0
95% UCL on mean	NA	69.08	57.35
Minimum	0.11	39.1	37.4
Maximum	0.19	73.2	93.6

Figure A-3. Distribution of Total Chromium from the Sitewide Background Data Set and the 100-D Ponds Verification Data.

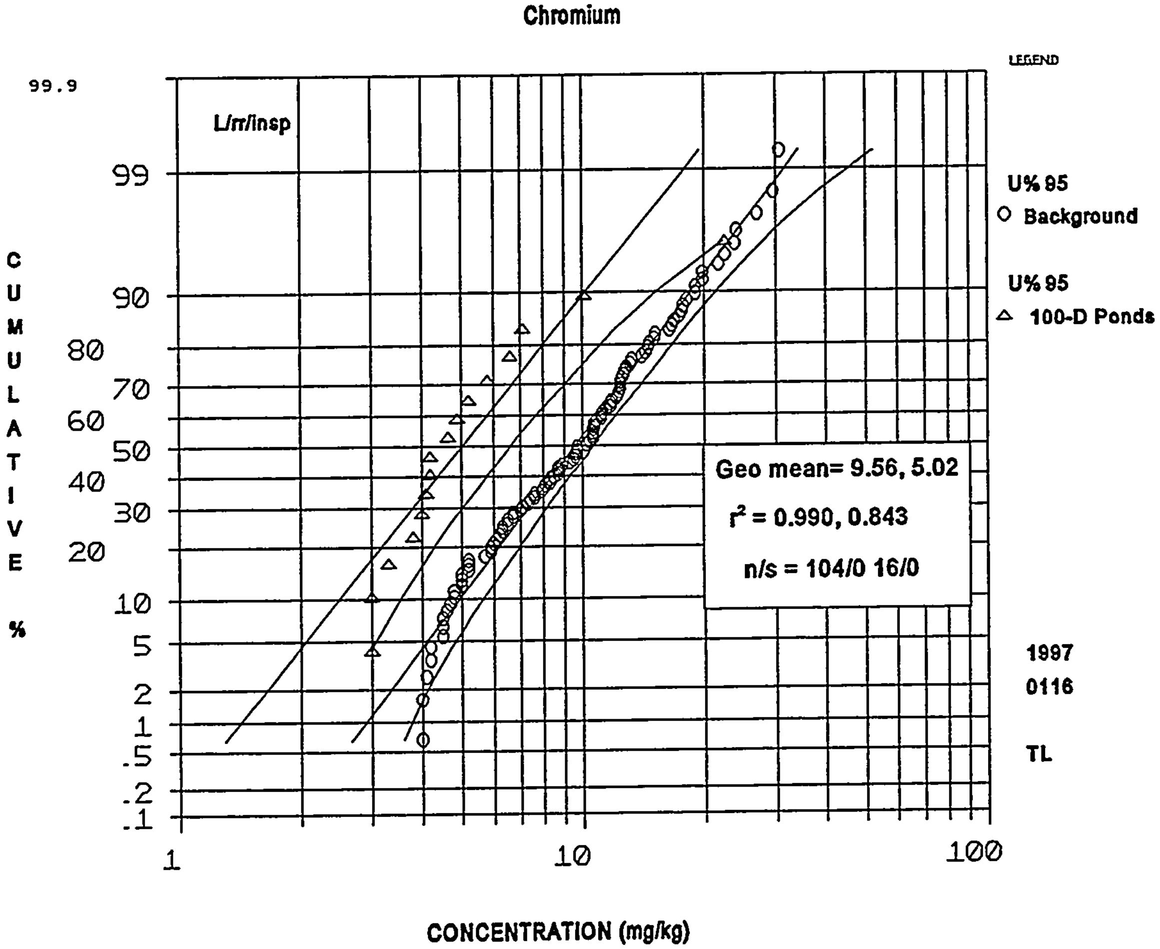

Table A-4. Summary Statistics and Compliance with Cleanup Limits for Ecology Near-Surface Soil Samples.

Parameter	Ag	As	Ba	Cd
Distribution	Below detection	Nonparametric	Lognormal	Below detection
Value used for compliance	maximum	maximum	lognormal 95% UCL	maximum
Compliance value	1.2	2.5	129.6380863	1.2
Cleanup Limit	5	6.47	5600	80
Is compliance value > CL?	NO	NO	NO	NO
Datum > 2X CL?	NO	NO	NO	NO
> 10% of data > CL?	NO	NO	NO	NO
Summary Statistics				
% data below DL	100	37.5	0	100
95% UCL on mean	NA	1.607794454	129.6380863	NA
Minimum	1	1.1	69.2	1
Maximum	1.2	2.5	158	1.2

Parameter	Cr	Cr6+	Hg	Pb
Distribution	Below detection	Below detection	Below detection	Below detection
Value used for compliance	maximum	maximum	maximum	maximum
Compliance value	8.1	0.5	1.9	6.4
Cleanup Limit	18.5	8	24	250
Is compliance value > CL?	NO	NO	NO	NO
Datum > 2X CL?	NO	NO	NO	NO
> 10% of data > CL?	NO	NO	NO	NO
Summary Statistics				
% data below DL	0	100	75	0
95% UCL on mean	NA	NA	NA	NA
Minimum	2.9	0.5	0.03	0.7
Maximum	8.1	0.5	1.9	6.4

3.3.6 Summary of Verification Data

Nineteen samples were collected from the settling and percolation ponds at depths of 25 to 30 cm (10 to 12 in.). One of the samples was a field blank and two were duplicate samples. The sampling methods, sampling sites, and types of analyses were approved by Ecology prior to sampling and analysis. The analytical data were validated by an independent contractor and found to satisfy the QA/QC requirements with minor deficiencies.

Statistical guidance from Ecology was used to evaluate the data. The verification sample values were found to be below cleanup limits. Samples collected by Ecology and analyzed in an independent laboratory were also below cleanup limits. These data show that the voluntary cleanup in the settling pond was successful in removing the contamination associated with this TSD.

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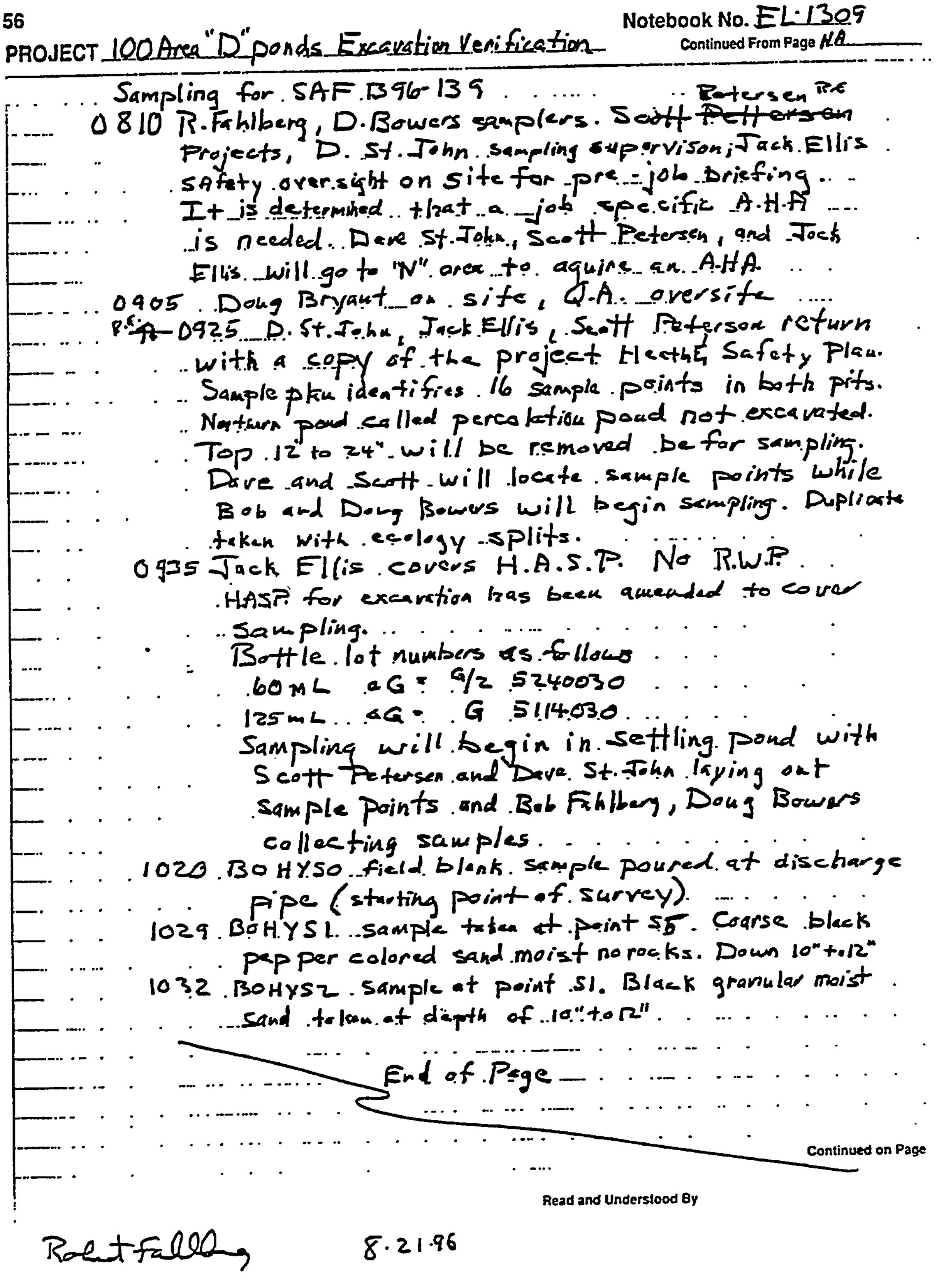
ATTACHMENT A-1

REPRODUCTION OF VERIFICATION SAMPLING LOG

Figure A1-1. Sampling Log for Verification Sampling (Page 1 of 5).



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PROJECT 100 Area "D" ponds Excavation Verification Continued From Page NA

Sampling for SAF B96-139

0810 R. Fahlberg, D. Bowers samplers. Scott ~~Pettersen~~ Petersen RE Projects, D. St. John sampling supervison; Jack Ellis safety oversight on site for pre-job briefing. It is determined that a job specific A.H.A is needed. Dave St. John, Scott Petersen, and Jack Ellis will go to "N" area to aquire an A.H.A.

0905 Doug Bryant on site, Q.A. oversite

RE ~~A~~ 0925 D. St. John, Jack Ellis, Scott Peterson return with a copy of the project Health Safety Plan. Sample plan identifies 16 sample points in both pits. Northern pond called percolation pond not excavated. Top 12" to 24" will be removed befor sampling. Dave and Scott will locate sample points while Bob and Doug Bowers will begin sampling. Duplicate taken with ecology splits.

0935 Jack Ellis covers H.A.S.P. No R.W.P. HASP for excavation has been amended to cover sampling.

Bottle lot numbers as follows

60 mL aG = G/2 5240030

125 mL aG = G 5114030

Sampling will begin in settling pond with Scott Petersen and Dave St. John laying out sample points and Bob Fahlberg, Doug Bowers collecting samples.

1020 B0HYS0 field blank sample poured at discharge pipe (starting point of survey).

1029 B0HYS1 sample taken at point S5. Coarse black pepper colored sand moist no rocks. Down 10" to 12"

1032 B0HYS2 sample at point S1. Black granular moist sand taken at depth of 10" to 12".

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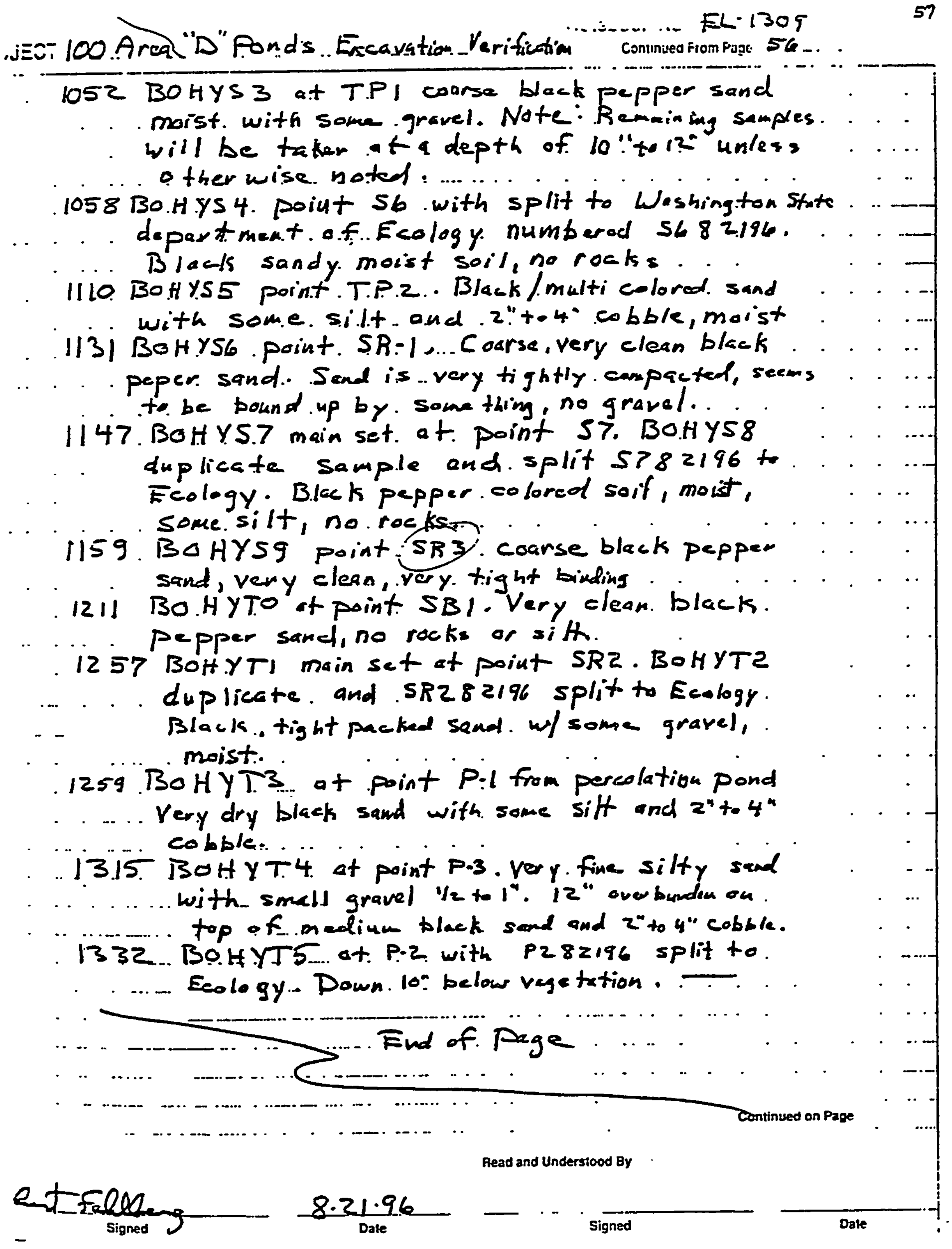
Read and Understood By

Robert Fahlberg 8.21.96

Figure A1-1. Sampling Log for Verification Sampling (Page 2 of 5).



EL-1309 57

JECT 100 Area "D" Ponds Excavation Verification Continued From Page 56

1052 BOHYS3 at T.P1 coarse black pepper sand moist with some gravel. Note: Remaining samples will be taken at a depth of 10" to 12" unless otherwise noted.

1058 BOHYS4 point S6 with split to Washington State department of Ecology numbered S682196. Black sandy moist soil, no rocks

1110 BOHYS5 point T.P.2. Black/multi colored sand with some silt and 2" to 4" cobble, moist

1131 BOHYS6 point SR-1, Coarse, very clean black peper sand. Sand is very tightly compacted, seems to be bound up by something, no gravel.

1147 BOHYS7 main set at point S7. BOHYS8 duplicate sample and split S782196 to Ecology. Black pepper colored soil, moist, some silt, no rocks.

1159 BOHYS9 point SR3. coarse black pepper sand, very clean, very tight binding

1211 BOHYT0 at point SB1. Very clean black pepper sand, no rocks or silt.

1257 BOHYT1 main set at point SR2. BOHYT2 duplicate and SR282196 split to Ecology. Black, tight packed sand w/ some gravel, moist.

1259 BOHYT3 at point P-1 from percolation pond Very dry black sand with some silt and 2" to 4" cobble.

1315 BOHYT4 at point P-3. Very fine silty sand with small gravel 1/2 to 1". 12" overburden on top of medium black sand and 2" to 4" cobble.

1332 BOHYT5 at P-2 with P282196 split to Ecology. Down 10" below vegetation.

End of Page

Continued on Page

Read and Understood By

8-21-96

Signed Date Signed Date

Figure A1-1. Sampling Log for Verification Sampling (Page 3 of 5).

58

PROJECT 100 "D" Ponds Excavation Verification

Notebook No. EL-1309
Continued From Page 57

1332 continued. Dry powder and sandy soil. Some gravel and cobble

1337 BOHYT6 at P-4. Coarse black silty sand with 1" to 3" cobble, and pea gravel. 18" over burden

1350 BOHYT7 at point PB-1. Point add by Scott Petersen. Coordinates = 105'3" North and P.F. 88.3' ~~98.4'~~ west of discharge pipe. Very tightly compacted clay. No gravel or sand.

1403 BOHYT8 Point P5A replaces original P5 location. New coordinates are 87.3 west and P.F. ~~86~~ 85.6 North of discharge pipe. Loose powdery soil and granular sand, very dry. Mixed with gravel and 5" to 8" cobble. Down 10" in sluffing hole

Note: the following are additional dimensions per Scott Petersen.

circumference of settling pond = 387.5'
" " percolation pond = 226'
average bank hieght used to calculate slope area of both ponds is 10'.
slope area of settling pond = 120 sq. meters
slope area of percolation pond = 70 sq. meters

End of Day

Continued on Page

Read and Understood By

8-21-96

Figure A1-1. Sampling Log for Verification Sampling (Page 4 of 5).

SAF B96-139

HEIS #	TIME/ DATE	SAMPLE LOCATION	RESIN MEDIA	LAB	COMMENTS
B0HYS0	1020 8.21.96	Near Discharge Pipe	NA	Q	Field Blank Taken from Settling Pond
B0HYS1	1029 8.21.96	S5			
B0HYS2	1032 8.21.96	S1			
B0HYS3	1052 8.21.96	TP1			
B0HYS4	1058 8.21.96	S6			Split to Washington State Dept. of Ecology numbered S682196
B0HYS5	1110 8.21.96	TP2			
B0HYS6	1131 8.21.96	SR-1			
B0HYS7	1147 8.21.96	S-7			Ecology Split # S782196
B0HYS8	1147 8.21.96	S-7			Duplicate to B0HYS7
B0HYS9	1159 8.21.96	SR-3			
B0HYT0	1211 8.21.96	SB-1			Point Added by Scott Peterson coordinates = 123' west and 73'6" south of discharge pipe
B0HYT1	1257 8.21.96	SR-2			Ecology split # SR282196
B0HYT2	1257 8.21.96	SR-2			Duplicate to B0HYT1
B0HYT3	1259 8.21.96	P-1			Taken from Percolation Pond
B0HYT4	1315 8.21.96	P-3			
B0HYT5	1332 8.21.96	P-2	↓	↓	Ecology split # P282196

Figure A1-1. Sampling Log for Verification Sampling (Page 5 of 5).

SAF B96- 139

HEIS #	TIME/ DATE	SAMPLE LOCATION	RESIN MEDIA	LAB	COMMENTS
B0HYT6	1337 8/21/96	P-4	NA	Q	
B0HYT7	1350 8·21·96	PB-1	"	"	Point Added by Scott Petersen coordinates = 105'3" North and 88'3" West of discharge Pipe
B0HYT8	1403 8·21·96	P5A	"	"	Point replaces P-5 new co-ordinates are 87.3 west and 85.6 north of Discharge pipe.

ATTACHMENT A-2

LABORATORY DATA SHEETS FOR VERIFICATION SAMPLES

Figure A2-1. Inorganic Analysis Data Sheet (Page 1 of 19).

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1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
B0HYS0

Lab Name: QUANTERRA MO
Contract: 550.168
Lab Code: ITMO
Case No.:
SAS No.:
SDG No.: W01139
Matrix (soil/water): SOIL
Lab Sample ID: 11923-001
Level (low/med): LOW
Date Received: 08/22/96
% Solids: 100.0

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	290		N	P	J
7440-36-0	Antimony	4.4	U		P	
7440-38-2	Arsenic	0.11	B		F	
7440-39-3	Barium	5.3	~~B~~	N	P	J
7440-41-7	Beryllium	0.23	B		P	
7440-43-9	Cadmium	0.33	U		P	
7440-70-2	Calcium	88.9	B	E	P	
7440-47-3	Chromium	0.29	U		P	
7440-48-4	Cobalt	0.29	U		P	
7440-50-8	Copper	0.72	U		P	
7439-89-6	Iron	2360			P	
7439-92-1	Lead	0.88			F	
7439-95-4	Magnesium	29.6	B		P	
7439-96-5	Manganese	41.0		N	P	J
7439-97-6	Mercury	0.02	U		CV	
7440-02-0	Nickel	1.0	U		P	
7440-09-7	Potassium	330	U		P	
7440-22-4	Silver	0.59	B		P	
7440-23-5	Sodium	20.4	B		P	
7440-28-0	Thallium	0.11	~~U~~	N	F	UJ
7440-62-2	Vanadium	0.31	U		P	
7440-66-6	Zinc	7.3			P	

Color Before:
Color After:
Clarity Before:
Clarity After:
Texture:
Artifacts:

Comments:

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Figure A2-1. Inorganic Analysis Data Sheet (Page 2 of 19).

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
B0HYS1

Lab Name: QUANTERRA_MO
Contract: 550.168
Lab Code: ITMO
Case No.:
SAS No.:
SDG No.: W01139
Matrix (soil/water): SOIL
Lab Sample ID: 11923-002
Level (low/med): LOW
Date Received: 08/22/96
% Solids: 93.8

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	5040		N	P	J
7440-36-0	Antimony	4.7	U		P	
7440-38-2	Arsenic	0.52	B		F	
7440-39-3	Barium	113		N	P	J
7440-41-7	Beryllium	0.60			P	
7440-43-9	Cadmium	1.2			P	
7440-70-2	Calcium	12700		E	P	J
7440-47-3	Chromium	4.0			P	
7440-48-4	Cobalt	13.6			P	
7440-50-8	Copper	13.1			P	
7439-89-6	Iron	27500			P	
7439-92-1	Lead	1.7			F	
7439-95-4	Magnesium	4820			P	
7439-96-5	Manganese	335		N	P	J
7439-97-6	Mercury	0.02	U		CV	
7440-02-0	Nickel	8.6			P	
7440-09-7	Potassium	405	B		P	
7440-22-4	Silver	0.54	B		P	
7440-23-5	Sodium	284			P	
7440-28-0	Thallium	0.12	U	N	F	UJ
7440-62-2	Vanadium	72.2			P	
7440-66-6	Zinc	51.1			P	

Color Before:
Color After:
Clarity Before:
Clarity After:
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Comments:

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Figure A2-1. Inorganic Analysis Data Sheet (Page 3 of 19).

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1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

B0HYS2

Lab Name: QUANTERRA_MO
Contract: 550.168
Lab Code: ITMO Case No.:
SAS No.:
SDG No.: W01139
Matrix (soil/water): SOIL
Lab Sample ID: 11923-003
Level (low/med): LOW
Date Received: 08/22/96
% Solids: 95.9

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	3720		N	P	J
7440-36-0	Antimony	4.6	U		P	
7440-38-2	Arsenic	0.58	B		F	
7440-39-3	Barium	86.2		N	P	J
7440-41-7	Beryllium	0.54			P	
7440-43-9	Cadmium	1.3			P	
7440-70-2	Calcium	4410		E	P	J
7440-47-3	Chromium	4.2			P	
7440-48-4	Cobalt	13.2			P	
7440-50-8	Copper	12.0			P	
7439-89-6	Iron	25700			P	
7439-92-1	Lead	1.4			F	
7439-95-4	Magnesium	4150			P	
7439-96-5	Manganese	321		N	P	
7439-97-6	Mercury	0.02	U		CV	
7440-02-0	Nickel	8.1			P	
7440-09-7	Potassium	345	U		P	
7440-22-4	Silver	0.55	B		P	
7440-23-5	Sodium	245			P	
7440-28-0	Thallium	0.13	~~B~~	N	F	J
7440-62-2	Vanadium	71.3			P	
7440-66-6	Zinc	45.8			P	

Color Before:
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Clarity Before:
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Figure A2-1. Inorganic Analysis Data Sheet (Page 4 of 19).

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1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
B0HYS3

Lab Name: QUANTERRA_MO
Contract: 550.168
Lab Code: ITMO Case No.:
SAS No.:
SDG No.: W01139
Matrix (soil/water): SOIL
Lab Sample ID: 11923-004
Level (low/med): LOW
Date Received: 08/22/96
% Solids: 92.9

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	4330		N	P	J
7440-36-0	Antimony	4.7	U		P	
7440-38-2	Arsenic	0.41	B		F	
7440-39-3	Barium	87.0		N	P	J
7440-41-7	Beryllium	0.54			P	
7440-43-9	Cadmium	1.2			P	
7440-70-2	Calcium	10300		E	P	J
7440-47-3	Chromium	3.0			P	
7440-48-4	Cobalt	12.1			P	
7440-50-8	Copper	13.1			P	
7439-89-6	Iron	23400			P	
7439-92-1	Lead	1.4			F	
7439-95-4	Magnesium	4570			P	
7439-96-5	Manganese	288		N	P	
7439-97-6	Mercury	0.02	U		CV	
7440-02-0	Nickel	8.0			P	
7440-09-7	Potassium	443	B		P	
7440-22-4	Silver	0.66	B		P	
7440-23-5	Sodium	241			P	
7440-28-0	Thallium	0.12	~~B~~	N	F	J
7440-62-2	Vanadium	56.7			P	
7440-66-6	Zinc	44.9			P	

Color Before:
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Clarity Before:
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Figure A2-1. Inorganic Analysis Data Sheet (Page 5 of 19).

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1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

B0HYS4

Lab Name: QUANTERRA_MO
Contract: 550.168
Lab Code: ITMO Case No.:
SAS No.:
SDG No.: W01139
Matrix (soil/water): SOIL
Lab Sample ID: 11923-005
Level (low/med): LOW
Date Received: 08/22/96
% Solids: 96.0

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	3900		N	P	J
7440-36-0	Antimony	4.6	U		P	
7440-38-2	Arsenic	0.58	B		F	
7440-39-3	Barium	77.2		N	P	J
7440-41-7	Beryllium	0.53			P	
7440-43-9	Cadmium	1.2			P	
7440-70-2	Calcium	6260		E	P	J
7440-47-3	Chromium	4.2			P	
7440-48-4	Cobalt	13.5			P	
7440-50-8	Copper	11.5			P	
7439-89-6	Iron	27200			P	
7439-92-1	Lead	1.3			F	
7439-95-4	Magnesium	4580			P	
7439-96-5	Manganese	345		N	P	
7439-97-6	Mercury	0.02	U		CV	
7440-02-0	Nickel	9.1			P	
7440-09-7	Potassium	488	B		P	
7440-22-4	Silver	0.74	B		P	
7440-23-5	Sodium	213			P	
7440-28-0	Thallium	0.11	U	N	F	UJ
7440-62-2	Vanadium	71.4			P	
7440-66-6	Zinc	46.7			P	

Color Before:
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Clarity Before:
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Figure A2-1. Inorganic Analysis Data Sheet (Page 6 of 19).

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1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
B0HYS5

Lab Name: QUANTERRA_MO
Contract: 550.168
Lab Code: ITMO
Case No.:
SAS No.:
SDG No.: W01139
Matrix (soil/water): SOIL
Lab Sample ID: 11923-006
Level (low/med): LOW
Date Received: 08/22/96
% Solids: 90.0

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	9560		N	P	J
7440-36-0	Antimony	4.9	U		P	
7440-38-2	Arsenic	2.5			F	
7440-39-3	Barium	90.1		N	P	J
7440-41-7	Beryllium	0.51	B		P	
7440-43-9	Cadmium	1.4			P	
7440-70-2	Calcium	4110		E	P	J
7440-47-3	Chromium	10.1			P	
7440-48-4	Cobalt	12.6			P	
7440-50-8	Copper	16.0			P	
7439-89-6	Iron	26900			P	
7439-92-1	Lead	6.4			F	
7439-95-4	Magnesium	3990			P	
7439-96-5	Manganese	327		N	P	
7439-97-6	Mercury	5.3			CV	J
7440-02-0	Nickel	7.6			P	
7440-09-7	Potassium	514	B		P	
7440-22-4	Silver	0.65	B		P	
7440-23-5	Sodium	247			P	
7440-28-0	Thallium	0.12	U	N	F	UJ
7440-62-2	Vanadium	70.3			P	
7440-66-6	Zinc	93.6			P	

Color Before:
Color After:
Clarity Before:
Clarity After:
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Comments:

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Figure A2-1. Inorganic Analysis Data Sheet (Page 7 of 19).

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1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
B0HYS6

Lab Name: QUANTERRA_MO
Contract: 550.168
Lab Code: ITMO Case No.:
SAS No.:
SDG No.: W01139
Matrix (soil/water): SOIL
Lab Sample ID: 11923-007
Level (low/med): LOW
Date Received: 08/22/96
% Solids: 93.0

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	5000		N	P	J
7440-36-0	Antimony	4.7	U		P	
7440-38-2	Arsenic	0.50	B		F	
7440-39-3	Barium	166		N	P	J
7440-41-7	Beryllium	0.58			P	
7440-43-9	Cadmium	1.1			P	
7440-70-2	Calcium	12600		E	P	J
7440-47-3	Chromium	3.8			P	
7440-48-4	Cobalt	13.1			P	
7440-50-8	Copper	11.8			P	
7439-89-6	Iron	26200			P	
7439-92-1	Lead	1.6			F	
7439-95-4	Magnesium	4770			P	
7439-96-5	Manganese	298		N	P	
7439-97-6	Mercury	0.02	U		CV	
7440-02-0	Nickel	6.6			P	
7440-09-7	Potassium	467	B		P	
7440-22-4	Silver	0.47	B		P	
7440-23-5	Sodium	253			P	
7440-28-0	Thallium	0.12	U	N	F	UJ
7440-62-2	Vanadium	70.4			P	
7440-66-6	Zinc	47.6			P	

Color Before:
Color After:
Clarity Before:
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Comments:

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Figure A2-1. Inorganic Analysis Data Sheet (Page 8 of 19).

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1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

B0HYS7

Lab Name: QUANTERRA_MO
Contract: 550.168
Lab Code: ITMO
Case No.:
SAS No.:
SDG No.: W01139
Matrix (soil/water): SOIL
Lab Sample ID: 11923-008
Level (low/med): LOW
Date Received: 08/22/96
% Solids: 95.7

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	4430		N	P	J
7440-36-0	Antimony	4.6	U		P	
7440-38-2	Arsenic	0.55	B		F	
7440-39-3	Barium	79.6		N	P	J
7440-41-7	Beryllium	0.52	B		P	
7440-43-9	Cadmium	1.1			P	
7440-70-2	Calcium	4070		E	P	J
7440-47-3	Chromium	5.4			P	
7440-48-4	Cobalt	13.8			P	
7440-50-8	Copper	11.3			P	
7439-89-6	Iron	28000			P	
7439-92-1	Lead	1.3			F	
7439-95-4	Magnesium	4350			P	
7439-96-5	Manganese	340		N	P	
7439-97-6	Mercury	0.02	U		CV	
7440-02-0	Nickel	9.3			P	
7440-09-7	Potassium	345	U		P	
7440-22-4	Silver	0.65	B		P	
7440-23-5	Sodium	230			P	
7440-28-0	Thallium	0.11	U	N	F	UJ
7440-62-2	Vanadium	75.4			P	
7440-66-6	Zinc	54.5			P	

Color Before:
Color After:
Clarity Before:
Clarity After:
Texture:
Artifacts:

Comments:

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Figure A2-1. Inorganic Analysis Data Sheet (Page 9 of 19).

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1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
B0HYS8

Lab Name: QUANTERRA_MO
Contract: 550.168
Lab Code: ITMO
Case No.:
SAS No.:
SDG No.: W01139
Matrix (soil/water): SOIL
Lab Sample ID: 11923-009
Level (low/med): LOW
Date Received: 08/22/96
% Solids: 95.2

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	4420		N	P	J
7440-36-0	Antimony	5.3	B		P	
7440-38-2	Arsenic	0.49	B		F	
7440-39-3	Barium	68.6		N	P	J
7440-41-7	Beryllium	0.49	B		P	
7440-43-9	Cadmium	1.4			P	
7440-70-2	Calcium	3980		E	P	J
7440-47-3	Chromium	6.2			P	
7440-48-4	Cobalt	13.6			P	
7440-50-8	Copper	10.4			P	
7439-89-6	Iron	26900			P	
7439-92-1	Lead	1.2			F	
7439-95-4	Magnesium	4660			P	
7439-96-5	Manganese	322		N	P	
7439-97-6	Mercury	0.02	U		CV	
7440-02-0	Nickel	13.3			P	
7440-09-7	Potassium	435	B		P	
7440-22-4	Silver	0.70	B		P	
7440-23-5	Sodium	223			P	
7440-28-0	Thallium	0.12	U	N	F	UJ
7440-62-2	Vanadium	70.9			P	
7440-66-6	Zinc	54.2			P	

Color Before:
Color After:
Clarity Before:
Clarity After:
Texture:
Artifacts:

Comments:

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Figure A2-1. Inorganic Analysis Data Sheet (Page 10 of 19).

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1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

B0HYS9

Lab Name: QUANTERRA_MO
Contract: 550.168
Lab Code: ITMO
Case No.:
SAS No.:
SDG No.: W01139
Matrix (soil/water): SOIL
Lab Sample ID: 11923-010
Level (low/med): LOW
Date Received: 08/22/96
% Solids: 92.4

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	3990		N	P	J
7440-36-0	Antimony	4.7	U		P	
7440-38-2	Arsenic	0.49	B		F	
7440-39-3	Barium	108		N	P	J
7440-41-7	Beryllium	0.54			P	
7440-43-9	Cadmium	0.95			P	
7440-70-2	Calcium	13200		E	P	J
7440-47-3	Chromium	3.3			P	
7440-48-4	Cobalt	12.2			P	
7440-50-8	Copper	11.8			P	
7439-89-6	Iron	24600			P	
7439-92-1	Lead	1.4			F	
7439-95-4	Magnesium	4390			P	
7439-96-5	Manganese	282		N	P	
7439-97-6	Mercury	0.02	U		CV	
7440-02-0	Nickel	8.0			P	
7440-09-7	Potassium	421	B		P	
7440-22-4	Silver	0.80	B		P	
7440-23-5	Sodium	227			P	
7440-28-0	Thallium	0.12	U	N	F	UJ
7440-62-2	Vanadium	65.8			P	
7440-66-6	Zinc	43.8			P	

Color Before:
Color After:
Clarity Before:
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Comments:

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Figure A2-1. Inorganic Analysis Data Sheet (Page 11 of 19).

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1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

B0HYT0

Lab Name: QUANTERRA_MO
Contract: 550.168
Lab Code: ITMO Case No.:
SAS No.:
SDG No.: W01139
Matrix (soil/water): SOIL
Lab Sample ID: 11923-011
Level (low/med): LOW
Date Received: 08/22/96
% Solids: 96.4

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	3630		N	P	J
7440-36-0	Antimony	4.5	U		P	
7440-38-2	Arsenic	0.52	B		F	
7440-39-3	Barium	76.6		N	P	J
7440-41-7	Beryllium	0.39	B		P	
7440-43-9	Cadmium	0.99			P	
7440-70-2	Calcium	4310		E	P	J
7440-47-3	Chromium	3.0			P	
7440-48-4	Cobalt	9.9			P	
7440-50-8	Copper	11.1			P	
7439-89-6	Iron	19500			P	
7439-92-1	Lead	1.6			F	
7439-95-4	Magnesium	4050			P	
7439-96-5	Manganese	266		N	P	
7439-97-6	Mercury	0.02	U		CV	
7440-02-0	Nickel	7.2			P	
7440-09-7	Potassium	343	U		P	
7440-22-4	Silver	0.85	B		P	
7440-23-5	Sodium	207			P	
7440-28-0	Thallium	0.11	U	N	F	UJ
7440-62-2	Vanadium	39.1			P	
7440-66-6	Zinc	37.4			P	

Color Before:
Color After:
Clarity Before:
Clarity After:
Texture:
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Comments:

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Figure A2-1. Inorganic Analysis Data Sheet (Page 12 of 19).

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

B0HYT1

Lab Name: QUANTERRA_MO
Contract: 550.168
Lab Code: ITMO Case No.:
SAS No.:
SDG No.: W01139
Matrix (soil/water): SOIL
Lab Sample ID: 11923-012
Level (low/med): LOW
Date Received: 08/22/96
% Solids: 95.1

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	4920		N	P	J
7440-36-0	Antimony	4.7	B		P	
7440-38-2	Arsenic	0.62	B		F	
7440-39-3	Barium	96.5		N	P	J
7440-41-7	Beryllium	0.55			P	
7440-43-9	Cadmium	1.0			P	
7440-70-2	Calcium	9000		E	P	J
7440-47-3	Chromium	4.3			P	
7440-48-4	Cobalt	12.4			P	
7440-50-8	Copper	11.1			P	
7439-89-6	Iron	25400			P	
7439-92-1	Lead	1.6			F	
7439-95-4	Magnesium	4540			P	
7439-96-5	Manganese	295		N	P	
7439-97-6	Mercury	0.02	U		CV	
7440-02-0	Nickel	6.5			P	
7440-09-7	Potassium	378	B		P	
7440-22-4	Silver	0.68	B		P	
7440-23-5	Sodium	219			P	
7440-28-0	Thallium	0.12	U	N	F	UJ
7440-62-2	Vanadium	67.2			P	
7440-66-6	Zinc	46.9			P	

Color Before:
Color After:
Clarity Before:
Clarity After:
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Comments:

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Figure A2-1. Inorganic Analysis Data Sheet (Page 13 of 19).

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1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
B0HYT2

Lab Name: QUANTERRA_MO
Contract: 550.168
Lab Code: ITMO
Case No.:
SAS No.:
SDG No.: W01139
Matrix (soil/water): SOIL
Lab Sample ID: 11923-013
Level (low/med): LOW
Date Received: 08/22/96
% Solids: 94.2

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	5370		N	P	J
7440-36-0	Antimony	4.6	U		P	
7440-38-2	Arsenic	0.81	B		F	
7440-39-3	Barium	105		N	P	J
7440-41-7	Beryllium	0.61			P	
7440-43-9	Cadmium	1.2			P	
7440-70-2	Calcium	10200		E	P	J
7440-47-3	Chromium	5.0			P	
7440-48-4	Cobalt	12.7			P	
7440-50-8	Copper	13.3			P	
7439-89-6	Iron	27400			P	
7439-92-1	Lead	1.7			F	
7439-95-4	Magnesium	4900			P	
7439-96-5	Manganese	305		N	P	
7439-97-6	Mercury	0.02	U		CV	
7440-02-0	Nickel	8.0			P	
7440-09-7	Potassium	519	B		P	
7440-22-4	Silver	0.58	B		P	
7440-23-5	Sodium	248			P	
7440-28-0	Thallium	0.13	~~B~~	N	F	J
7440-62-2	Vanadium	71.1			P	
7440-66-6	Zinc	49.2			P	

Color Before:
Color After:
Clarity Before:
Clarity After:
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Comments:

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Figure A2-1. Inorganic Analysis Data Sheet (Page 14 of 19).

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1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

B0HYT3

Lab Name: QUANTERRA_MO
Contract: 550.168
Lab Code: ITMO
Case No.:
SAS No.:
SDG No.: W01139
Matrix (soil/water): SOIL
Lab Sample ID: 11923-014
Level (low/med): LOW
Date Received: 08/22/96
% Solids: 99.0

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	5090		N	P	J
7440-36-0	Antimony	4.4	U		P	
7440-38-2	Arsenic	0.72	B		F	
7440-39-3	Barium	158		N	P	J
7440-41-7	Beryllium	0.59			P	
7440-43-9	Cadmium	1.4			P	
7440-70-2	Calcium	7270		E	P	J
7440-47-3	Chromium	4.1			P	
7440-48-4	Cobalt	11.9			P	
7440-50-8	Copper	11.7			P	
7439-89-6	Iron	25300			P	
7439-92-1	Lead	2.0			F	
7439-95-4	Magnesium	4450			P	
7439-96-5	Manganese	292		N	P	
7439-97-6	Mercury	0.05			CV	
7440-02-0	Nickel	8.1			P	
7440-09-7	Potassium	376	B		P	
7440-22-4	Silver	0.73	B		P	
7440-23-5	Sodium	377			P	
7440-28-0	Thallium	0.16	~~B~~	N	F	J
7440-62-2	Vanadium	66.5			P	
7440-66-6	Zinc	48.4			P	

Color Before:
Color After:
Clarity Before:
Clarity After:
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Figure A2-1. Inorganic Analysis Data Sheet (Page 15 of 19).

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1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

B0HYT4

Lab Name: QUANTERRA_MO
Contract: 550.168
Lab Code: ITMO Case No.:
SAS No.:
SDG No.: W01139
Matrix (soil/water): SOIL
Lab Sample ID: 11923-015
Level (low/med): LOW
Date Received: 08/22/96
% Solids: 97.0

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	6120		N	P	J
7440-36-0	Antimony	4.5	U		P	
7440-38-2	Arsenic	1.4			F	
7440-39-3	Barium	159		N	P	J
7440-41-7	Beryllium	0.61			P	
7440-43-9	Cadmium	1.2			P	
7440-70-2	Calcium	7230		E	P	J
7440-47-3	Chromium	7.1			P	
7440-48-4	Cobalt	11.9			P	
7440-50-8	Copper	14.6			P	
7439-89-6	Iron	25000			P	
7439-92-1	Lead	3.5			F	
7439-95-4	Magnesium	4690			P	
7439-96-5	Manganese	338		N	P	
7439-97-6	Mercury	0.12			CV	
7440-02-0	Nickel	8.4			P	
7440-09-7	Potassium	606			P	
7440-22-4	Silver	0.49	B		P	
7440-23-5	Sodium	281			P	
7440-28-0	Thallium	0.18	~~B~~	N	F	J
7440-62-2	Vanadium	64.8			P	
7440-66-6	Zinc	59.5			P	

Color Before:
Color After:
Clarity Before:
Clarity After:
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Figure A2-1. Inorganic Analysis Data Sheet (Page 16 of 19).

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1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
B0HYT5

Lab Name: QUANTERRA_MO
Contract: 550.168
Lab Code: ITMO Case No.:
SAS No.:
SDG No.: W01139
Matrix (soil/water): SOIL
Lab Sample ID: 11923-016
Level (low/med): LOW
Date Received: 08/22/96
% Solids: 99.0

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	4900		N	P	J
7440-36-0	Antimony	5.4	B		P	
7440-38-2	Arsenic	0.89	B		F	
7440-39-3	Barium	121		N	P	J
7440-41-7	Beryllium	0.56			P	
7440-43-9	Cadmium	1.4			P	
7440-70-2	Calcium	6890		E	P	J
7440-47-3	Chromium	4.9			P	
7440-48-4	Cobalt	12.5			P	
7440-50-8	Copper	11.8			P	
7439-89-6	Iron	26200			P	
7439-92-1	Lead	2.2			F	
7439-95-4	Magnesium	4580			P	
7439-96-5	Manganese	300		N	P	
7439-97-6	Mercury	0.04			CV	
7440-02-0	Nickel	7.9			P	
7440-09-7	Potassium	483	B		P	
7440-22-4	Silver	0.72	B		P	
7440-23-5	Sodium	283			P	
7440-28-0	Thallium	0.15	~~B~~	N	F	J
7440-62-2	Vanadium	67.9			P	
7440-66-6	Zinc	49.8			P	

Color Before:
Color After:
Clarity Before:
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Comments:

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Figure A2-1. Inorganic Analysis Data Sheet (Page 17 of 19).

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1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

B0HYT6

Lab Name: QUANTERRA_MO
Contract: 550.168
Lab Code: ITMO
Case No.:
SAS No.:
SDG No.: W01139
Matrix (soil/water): SOIL
Lab Sample ID: 11923-017
Level (low/med): LOW
Date Received: 08/22/96
% Solids: 98.9

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	4840		N	P	J
7440-36-0	Antimony	4.4	U		P	
7440-38-2	Arsenic	0.89	B		F	
7440-39-3	Barium	120		N	P	J
7440-41-7	Beryllium	0.57			P	
7440-43-9	Cadmium	1.5			P	
7440-70-2	Calcium	6770		E	P	J
7440-47-3	Chromium	5.2			P	
7440-48-4	Cobalt	12.7			P	
7440-50-8	Copper	12.4			P	
7439-89-6	Iron	27200			P	
7439-92-1	Lead	2.1			F	
7439-95-4	Magnesium	4540			P	
7439-96-5	Manganese	328		N	P	
7439-97-6	Mercury	0.02	B		CV	
7440-02-0	Nickel	7.7			P	
7440-09-7	Potassium	647			P	
7440-22-4	Silver	0.87	B		P	
7440-23-5	Sodium	279			P	
7440-28-0	Thallium	0.11	U	N	F	UJ
7440-62-2	Vanadium	68.4			P	
7440-66-6	Zinc	53.9			P	

Color Before:
Color After:
Clarity Before:
Clarity After:
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Comments:

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Figure A2-1. Inorganic Analysis Data Sheet (Page 18 of 19).

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1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
B0HYT7

Lab Name: QUANTERRA_MO
Contract: 550.168
Lab Code: ITMO Case No.:
SAS No.:
SDG No.: W01139
Matrix (soil/water): SOIL
Lab Sample ID: 11923-018
Level (low/med): LOW
Date Received: 08/22/96
% Solids: 97.3

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	10500		N	P	J
7440-36-0	Antimony	4.5	U		P	
7440-38-2	Arsenic	4.2			F	
7440-39-3	Barium	115		N	P	J
7440-41-7	Beryllium	0.63			P	
7440-43-9	Cadmium	1.1			P	
7440-70-2	Calcium	7480		E	P	J
7440-47-3	Chromium	22.5			P	
7440-48-4	Cobalt	9.6			P	
7440-50-8	Copper	14.0			P	
7439-89-6	Iron	22000			P	
7439-92-1	Lead	5.5			F	
7439-95-4	Magnesium	6350			P	
7439-96-5	Manganese	362		N	P	
7439-97-6	Mercury	0.02	U		CV	
7440-02-0	Nickel	19.3			P	
7440-09-7	Potassium	1460			P	
7440-22-4	Silver	0.96	B		P	
7440-23-5	Sodium	219			P	
7440-28-0	Thallium	0.19	~~B~~	N	F	J
7440-62-2	Vanadium	45.6			P	
7440-66-6	Zinc	55.8			P	

Color Before:
Color After:
Clarity Before:
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Comments:

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Figure A2-1. Inorganic Analysis Data Sheet (Page 19 of 19).

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1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
B0HYT8

Lab Name: QUANTERRA_MO
Contract: 550.168
Lab Code: ITMO Case No.:
SAS No.:
SDG No.: W01139
Matrix (soil/water): SOIL
Lab Sample ID: 11923-019
Level (low/med): LOW
Date Received: 08/22/96
% Solids: 99.5

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	5860		N	P	J
7440-36-0	Antimony	4.4	U		P	
7440-38-2	Arsenic	1.1			F	
7440-39-3	Barium	142		N	P	J
7440-41-7	Beryllium	0.61			P	
7440-43-9	Cadmium	1.3			P	
7440-70-2	Calcium	7550		E	P	J
7440-47-3	Chromium	6.6			P	
7440-48-4	Cobalt	12.2			P	
7440-50-8	Copper	13.6			P	
7439-89-6	Iron	26600			P	
7439-92-1	Lead	2.4			F	
7439-95-4	Magnesium	4910			P	
7439-96-5	Manganese	316		N	P	
7439-97-6	Mercury	0.02	U		CV	
7440-02-0	Nickel	8.4			P	
7440-09-7	Potassium	668			P	
7440-22-4	Silver	0.75	B		P	
7440-23-5	Sodium	293			P	
7440-28-0	Thallium	0.11	U	N	F	UJ
7440-62-2	Vanadium	68.4			P	
7440-66-6	Zinc	55.8			P	

Color Before:
Color After:
Clarity Before:
Clarity After:
Texture:
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Comments:

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Figure A2-2. Hexavalent Chromium Analysis Data Sheet.

HEXAVALENT CHROMIUM DATA SUMMARY

SDG. W01139

ANALYSIS DATE. 8/23/96

MATRIX: SOIL

METHOD RICHWC5005

MDL: 0.57 mg/kg

SAMPLE LAB. ID	CLIENT ID	SAMPLE RESULT	UNITS	SPIKE ADDED	UNITS	SPIKE RECOVERED	UNITS	PERCENT RECOVERY
Prep Blank #1		0.002	mg/L					
LCS #1		0.425	mg/L	0.500	mg/L	0.425	mg/L	85
Prep Blank #2		0.001	mg/L					
LCS #2		0.503	mg/L	0.500	mg/L	0.503	mg/L	100.6
60830801	B0HYS0	< 0.57	mg/Kg					
60830801 Dup	B0HYS0	< 0.57	mg/Kg					
60830801 MS	B0HYS0	33.67	mg/Kg	39.98	mg/Kg	33.67	mg/Kg	84.2
60830801 MSD	B0HYS0	34.43	mg/Kg	39.98	mg/Kg	34.43	mg/Kg	86.1
60830801 $PbCrO_4$	B0HYS0	605.6	mg/Kg	669.2	mg/Kg	605.6	mg/Kg	90.5
60830802	B0HYS1	< 0.57	mg/Kg					
60830803	B0HYS2	0.623	mg/Kg					
60830804	B0HYS3	< 0.57	mg/Kg					
60830805	B0HYS4	< 0.57	mg/Kg					
60830806	B0HYS5	< 0.57	mg/Kg					
60830807	B0HYS6	< 0.57	mg/Kg					
60830808	B0HYS7	< 0.57	mg/Kg					
60830809	B0HYS8	< 0.57	mg/Kg					
60830810	B0HYS9	< 0.57	mg/Kg					
60830811	B0HYT0	< 0.57	mg/Kg					
60830812	B0HYT1	< 0.57	mg/Kg					
60830813	B0HYT2	0.840	mg/Kg					
60830814	B0HYT3	< 0.57	mg/Kg					
* 60830815	B0HYT4	< 0.57	mg/Kg					
* 60830815 Dup	B0HYT4	< 0.57	mg/Kg					
* 60830815 MS	B0HYT4	36.26	mg/Kg	39.98	mg/Kg	36.26	mg/Kg	90.7
* 60830815 MSD	B0HYT4	36.42	mg/Kg	39.97	mg/Kg	36.42	mg/Kg	91.1
* 60830815 $PbCrO_4$	B0HYT4	1074	mg/Kg	1047	mg/Kg	1074	mg/Kg	102.6
60830816	B0HYT5	< 0.57	mg/Kg					
60830817	B0HYT6	< 0.57	mg/Kg					
* 60830818	B0HYT7	< 0.57	mg/Kg					
60830819	B0HYT8	< 0.57	mg/Kg					

COMMENTS: * Results for samples #15 and 18. are reanalysis data. First run yielded low MS/MSD recoveries.

8/28/96

To convert preparation blank in mg/L to mg/kg: mg/kg = (mg/L * 0.1 L) / 0.0025kg

Form No.: CG-196, 8/95, Rev. 0

RPC 10/31/96

Figure A2-3. Pesticide Organics Analysis Data Sheet (Page 1 of 19).

1D
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
B0HYS0

Lab Name: QUANTERRA,MO Contract: SSC-188

Lab Code: ITMC Case No.: ______ SAS No.: ______ SDG No.: W01139

Matrix: (soil/water) SOIL Lab Sample ID: 11923-001

Sample wt/vol: 30.2 (g/ml) G Lab File ID: ______

Level: (low/med) LOW Date Sampled : 08-21-96

% Moisture: not dec. 0 dec. ______ Date Extracted: 09-04-96

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 09-19-96

GPC Cleanup: (Y/N) N pH: ______ Dilution Factor: 1

CAS NO.	Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
319-84-6	alpha-BHC	1.7	U
319-85-7	beta-BHC	1.7	U
319-86-8	delta-BHC	1.7	U
58-89-9	gamma-BHC (Lindane)	1.7	U
76-44-8	Heptachlor	1.7	U J
309-00-2	Aldrin	1.7	U J
1024-57-3	Heptachlor epoxide	1.7	U
959-98-8	Endosulfan I	1.7	U
60-57-1	Dieldrin	1.7	U J
72-55-9	4,4'-DDE	1.7	U
72-20-8	Endrin	1.7	U J
33213-65-9	Endosulfan II	1.7	U
72-54-8	4,4'-DDD	1.7	U
1031-07-8	Endosulfan sulfate	1.7	U
50-29-3	4,4'-DDT	1.7	U
53494-70-5	Endrin Aldehyde	1.7	U
72-43-5	Methoychlor	3.3	U
8001-35-2	Toxaphene	67	U
57-74-9	Chlordane (technical)	17	U
11104-28-2	Aroclor-1221	33	U
11141-28-2	Aroclor-1232	33	U
53469-21-9	Aroclor-1242	33	U
12674-11-2	Aroclor-1016	33	U
12672-29-6	Aroclor-1248	33	U
11097-57-4	Aroclor-1254	33	U
11096-82-5	Aroclor-1260	33	U

U: Concentration of analyte is less than the value given.

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Figure A2-3. Pesticide Organics Analysis Data Sheet (Page 2 of 19).

1D
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
B0HYS1

Lab Name: QUANTERRA,MO Contract: 550-168
Lab Code: ITMO Case No.: ______ SAS No.: ______ SDG No.: W01139
Matrix: (soil/water) SOIL Lab Sample ID: 11923-002
Sample wt/vol: 30.1 (g/ml) G Lab File ID: ______
Level: (low/med) LOW Date Sampled : 08-21-96
% Moisture: not dec. 6 dec. ______ Date Extracted: 09-04-96
Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 09-19-96
GPC Cleanup: (Y/N) N pH: ______ Dilution Factor: 1

CAS NO.	Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
319-84-6	alpha-BHC	1.8	U
319-85-7	beta-BHC	1.8	U
319-86-8	delta-BHC	1.8	U
58-89-9	gamma-BHC (Lindane)	1.8	U
76-44-8	Heptachlor	1.8	U J
309-00-2	Aldrin	1.8	U J
1024-57-3	Heptachlor epoxide	1.8	U
959-98-8	Endosulfan I	1.8	U
60-57-1	Dieldrin	1.8	U J
72-55-9	4,4'-DDE	1.8	U
72-20-8	Endrin	1.8	U J
33213-65-9	Endosulfan II	1.8	U
72-54-8	4,4'-DDD	1.8	U
1031-07-8	Endosulfan sulfate	1.8	U
50-29-3	4,4'-DDT	1.8	U
53494-70-5	Endrin Aldehyde	1.8	U
72-43-5	Methoychlor	3.5	U
8001-35-2	Toxaphene	71	U
57-74-9	Chlordane (technical)	18	U
11104-28-2	Aroclor-1221	35	U
11141-28-2	Aroclor-1232	35	U
53469-21-9	Aroclor-1242	35	U
12674-11-2	Aroclor-1016	35	U
12672-29-6	Aroclor-1248	35	U
11097-69-1	Aroclor-1254	35	U
11096-82-5	Aroclor-1260	35	U

U: Concentration of analyte is less than the value given.

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Figure A2-3. Pesticide Organics Analysis Data Sheet (Page 3 of 19).

1D
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
BOHYS2

Lab Name: QUANTERRA,MO Contract: 550-168

Lab Code: ITMO Case No.: ______ SAS No.: ______ SDG No.: W01139

Matrix: (soil/water) SOIL Lab Sample ID: 11923-003

Sample wt/vol: 30.2 (g/ml) G Lab File ID: ______

Level: (low/med) LOW Date Sampled : 08-21-96

% Moisture: not dec. 4 dec. ______ Date Extracted: 09-04-96

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 09-19-96

GPC Cleanup: (Y/N) N pH: ______ Dilution Factor: 1

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

CAS NO.	Compound	(ug/L or ug/Kg) UG/KG	Q
319-84-6	alpha-BHC	1.7	U
319-85-7	beta-BHC	1.7	U
319-86-8	delta-BHC	1.7	U
58-89-9	gamma-BHC (Lindane)	1.7	U
76-44-8	Heptachlor	1.7	U J
309-00-2	Aldrin	1.7	U J
1024-57-3	Heptachlor epoxide	1.7	U
959-98-8	Endosulfan I	1.7	U
60-57-1	Dieldrin	1.7	U J
72-55-9	4,4'-DDE	1.7	U
72-20-8	Endrin	1.7	U J
33213-65-9	Endosulfan II	1.7	U
72-54-8	4,4'-DDD	1.7	U
1031-07-8	Endosulfan sulfate	1.7	U
50-29-3	4,4'-DDT	1.7	U
53494-70-5	Endrin Aldehyde	1.7	U
72-43-5	Methoychlor	3.4	U
8001-35-2	Toxaphene	69	U
57-74-9	Chlordane (technical)	17	U
11104-28-2	Aroclor-1221	34	U
11141-28-2	Aroclor-1232	34	U
53469-21-9	Aroclor-1242	34	U
12674-11-2	Aroclor-1016	34	U
12672-29-6	Aroclor-1248	34	U
11097-57-4	Aroclor-1254	34	U
11096-82-5	Aroclor-1260	34	U

U: Concentration of analyte is less than the value given.

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Figure A2-3. Pesticide Organics Analysis Data Sheet (Page 4 of 19).

1D
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
B0HYS3

Lab Name: QUANTERRA,MO Contract: 550-168

Lab Code: ITMO Case No.: ______ SAS No.: ______ SDG No.: W01139

Matrix: (soil/water) SOIL Lab Sample ID: 11923-004

Sample wt/vol: 30.3 (g/ml) G Lab File ID: ______

Level: (low/med) LOW Date Sampled : 08-21-96

% Moisture: not dec. 7 dec. ______ Date Extracted: 09-04-96

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 09-19-96

GPC Cleanup: (Y/N) N pH: ______ Dilution Factor: 1

CAS NO.	Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
319-84-6	alpha-BHC	1.8	U
319-85-7	beta-BHC	1.8	U
319-86-8	delta-BHC	1.8	U
58-89-9	gamma-BHC (Lindane)	1.8	U
76-44-8	Heptachlor	1.8 J	U J
309-00-2	Aldrin	1.8 J	U J
1024-57-3	Heptachlor epoxide	1.8	U
959-98-8	Endosulfan I	1.8	U
60-57-1	Dieldrin	1.8 J	U J
72-55-9	4,4'-DDE	1.8	U
72-20-8	Endrin	1.8 J	U J
33213-65-9	Endosulfan II	1.8	U
72-54-8	4,4'-DDD	1.8	U
1031-07-8	Endosulfan sulfate	1.8	U
50-29-3	4,4'-DDT	1.8	U
53494-70-5	Endrin Aldehyde	1.8	U
72-43-5	Methoychlor	3.5	U
8001-35-2	Toxaphene	71	U
57-74-9	Chlordane (technical)	18	U
11104-28-2	Aroclor-1221	36	U
11141-28-2	Aroclor-1232	36	U
53469-21-9	Aroclor-1242	36	U
12674-11-2	Aroclor-1016	36	U
12672-29-6	Aroclor-1248	36	U
11097-57-4	Aroclor-1254	36	U
11096-82-5	Aroclor-1260	36	U

U: Concentration of analyte is less than the value given.

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Figure A2-3. Pesticide Organics Analysis Data Sheet (Page 5 of 19).

1D
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
B0HYS4

Lab Name: QUANTERRA,MO Contract: 550-168

Lab Code: ITMO Case No.: ______ SAS No.: ______ SDG No.: W01139

Matrix: (soil/water) SOIL Lab Sample ID: 11923-005

Sample wt/vol: 30.1 (g/ml) G Lab File ID: ______

Level: (low/med) LOW Date Sampled : 08-21-96

% Moisture: not dec. 4 dec. ______ Date Extracted: 09-04-96

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 09-19-96

GPC Cleanup: (Y/N) N pH: ______ Dilution Factor: 1

CAS NO.	Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
319-84-6	alpha-BHC	1.7	U
319-85-7	beta-BHC	1.7	U
319-86-8	delta-BHC	1.7	U
58-89-9	gamma-BHC (Lindane)	1.7	U
76-44-8	Heptachlor	1.7 a	U J
309-00-2	Aldrin	1.7 a	U J
1024-57-3	Heptachlor epoxide	1.7	U
959-98-8	Endosulfan I	1.7	U
60-57-1	Dieldrin	1.7 a	U J
72-55-9	4,4'-DDE	1.7	U
72-20-8	Endrin	1.7 a	U J
33213-65-9	Endosulfan II	1.7	U
72-54-8	4,4'-DDD	1.7	U
1031-07-8	Endosulfan sulfate	1.7	U
50-29-3	4,4'-DDT	1.7	U
53494-70-5	Endrin Aldehyde	1.7	U
72-43-5	Methoychlor	3.5	U
8001-35-2	Toxaphene	69	U
57-74-9	Chlordane (technical)	17	U
11104-28-2	Aroclor-1221	35	U
11141-28-2	Aroclor-1232	35	U
53469-21-9	Aroclor-1242	35	U
12674-11-2	Aroclor-1016	35	U
12672-29-6	Aroclor-1248	35	U
11097-57-4	Aroclor-1254	35	U
11096-82-5	Aroclor-1260	35	U

U: Concentration of analyte is less than the value given.

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Figure A2-3. Pesticide Organics Analysis Data Sheet (Page 6 of 19).

1D
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
BOHYS5

Lab Name: QUANTERRA,MO Contract: 550-168

Lab Code: ITMO Case No.: ____ SAS No.: ____ SDG No.: W01139

Matrix: (soil/water) SOIL Lab Sample ID: 11923-006

Sample wt/vol: 30.5 (g/ml) G Lab File ID: ____

Level: (low/med) LOW Date Sampled : 08-21-96

% Moisture: not dec. 10 dec. ____ Date Extracted: 09-04-96

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 09-19-96

GPC Cleanup: (Y/N) N pH: ____ Dilution Factor: 1

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

CAS NO.	Compound	Concentration	Q
319-84-6	alpha-BHC	1.8	U
319-85-7	beta-BHC	1.8	U
319-86-8	delta-BHC	1.8	U
58-89-9	gamma-BHC (Lindane)	1.8	U
76-44-8	Heptachlor	1.8	U J
309-00-2	Aldrin	1.8	U J
1024-57-3	Heptachlor epoxide	1.8	U
959-98-8	Endosulfan I	1.8	U
60-57-1	Dieldrin	1.8	U J
72-55-9	4,4'-DDE	1.8	U
72-20-8	Endrin	1.8	U J
33213-65-9	Endosulfan II	1.8	U
72-54-8	4,4'-DDD	1.8	U
1031-07-8	Endosulfan sulfate	1.8	U
50-29-3	4,4'-DDT	1.8	U
53494-70-5	Endrin Aldehyde	1.8	U
72-43-5	Methoychlor	3.6	U
8001-35-2	Toxaphene	73	U
57-74-9	Chlordane (technical)	18	U
11104-28-2	Aroclor-1221	36	U
11141-28-2	Aroclor-1232	36	U
53469-21-9	Aroclor-1242	36	U
12674-11-2	Aroclor-1016	36	U
12672-29-6	Aroclor-1248	36	
11097-57-4	Aroclor-1254	72	
11096-82-5	Aroclor-1260	36	U

U: Concentration of analyte is less than the value given.

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Figure A2-3. Pesticide Organics Analysis Data Sheet (Page 7 of 19).

1D
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
B0HYS6

Lab Name: QUANTERRA,MO Contract: 550-168
Lab Code: ITMO Case No.: ______ SAS No.: ______ SDG No.: W01139
Matrix: (soil/water) SOIL Lab Sample ID: 11923-007
Sample wt/vol: 30.1 (g/ml) G Lab File ID: ______
Level: (low/med) LOW Date Sampled : 08-21-96
% Moisture: not dec. 7 dec. ______ Date Extracted: 09-04-96
Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 09-19-96
GPC Cleanup: (Y/N) N pH: ______ Dilution Factor: 1

CAS NO.	Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
319-84-6	alpha-BHC	1.8	U
319-85-7	beta-BHC	1.8	U
319-86-8	delta-BHC	1.8	U
58-89-9	gamma-BHC (Lindane)	1.8	U
76-44-8	Heptachlor	1.8 ~~J~~	U J
309-00-2	Aldrin	1.8 ~~J~~	U J
1024-57-3	Heptachlor epoxide	1.8	U
959-98-8	Endosulfan I	1.8	U
60-57-1	Dieldrin	1.8 ~~J~~	U J
72-55-9	4,4'-DDE	1.8	U
72-20-8	Endrin	1.8 ~~J~~	U J
33213-65-9	Endosulfan II	1.8	U
72-54-8	4,4'-DDD	1.8	U
1031-07-8	Endosulfan sulfate	1.8	U
50-29-3	4,4'-DDT	1.8	U
53494-70-5	Endrin Aldehyde	1.8	U
72-43-5	Methoychlor	3.6	U
8001-35-2	Toxaphene	72	U
57-74-9	Chlordane (technical)	18	U
11104-28-2	Aroclor-1221	36	U
11141-28-2	Aroclor-1232	36	U
53469-21-9	Aroclor-1242	36	U
12674-11-2	Aroclor-1016	36	U
12672-29-6	Aroclor-1248	36	U
11097-57-4	Aroclor-1254	36	U
11096-82-5	Aroclor-1260	36	U

U: Concentration of analyte is less than the value given.

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Figure A2-3. Pesticide Organics Analysis Data Sheet (Page 8 of 19).

1D
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
B0HYS7

Lab Name: QUANTERRA,MO Contract: 550-168
Lab Code: ITMO Case No.: ______ SAS No.: ______ SDG No.: W01139
Matrix: (soil/water) SOIL Lab Sample ID: 11923-008
Sample wt/vol: 30.2 (g/ml) G Lab File ID: ______
Level: (low/med) LOW Date Sampled : 08-21-96
% Moisture: not dec. 4 dec. ______ Date Extracted: 09-04-96
Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 09-19-96
GPC Cleanup: (Y/N) N pH: ______ Dilution Factor: 1

CAS NO.	Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
319-84-6	alpha-BHC	1.7	U
319-85-7	beta-BHC	1.7	U
319-86-8	delta-BHC	1.7	U
58-89-9	gamma-BHC (Lindane)	1.7	U
76-44-8	Heptachlor	1.7	U J
309-00-2	Aldrin	1.7	U J
1024-57-3	Heptachlor epoxide	1.7	U
959-98-8	Endosulfan I	1.7	U
60-57-1	Dieldrin	1.7	U J
72-55-9	4,4'-DDE	1.7	U
72-20-8	Endrin	1.7	U J
33213-65-9	Endosulfan II	1.7	U
72-54-8	4,4'-DDD	1.7	U
1031-07-8	Endosulfan sulfate	1.7	U
50-29-3	4,4'-DDT	1.7	U
53494-70-5	Endrin Aldehyde	1.7	U
72-43-5	Methoychlor	3.5	U
8001-35-2	Toxaphene	69	U
57-74-9	Chlordane (technical)	17	U
11104-28-2	Aroclor-1221	35	U
11141-28-2	Aroclor-1232	35	U
53469-21-9	Aroclor-1242	35	U
12674-11-2	Aroclor-1016	35	U
12672-29-6	Aroclor-1248	35	U
11097-57-4	Aroclor-1254	35	U
11096-82-5	Aroclor-1260	35	U

U: Concentration of analyte is less than the value given.

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Figure A2-3. Pesticide Organics Analysis Data Sheet (Page 9 of 19).

1D
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
B0HYS8

Lab Name: QUANTERRA,MO Contract: 550-168

Lab Code: ITMO Case No.: ____ SAS No.: ____ SDG No.: W01139

Matrix: (soil/water) SOIL Lab Sample ID: 11923-009

Sample wt/vol: 30.5 (g/ml) G Lab File ID: ____

Level: (low/med) LOW Date Sampled : 08-21-96

% Moisture: not dec. 5 dec. ____ Date Extracted: 09-04-96

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 09-19-96

GPC Cleanup: (Y/N) N pH: ____ Dilution Factor: 1

CAS NO.	Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
319-84-6	alpha-BHC	1.7	U
319-85-7	beta-BHC	1.7	U
319-86-8	delta-BHC	1.7	U
58-89-9	gamma-BHC (Lindane)	1.7	U
76-44-8	Heptachlor	1.7	U J
309-00-2	Aldrin	1.7	U J
1024-57-3	Heptachlor epoxide	1.7	U
959-98-8	Endosulfan I	1.7	U
60-57-1	Dieldrin	1.7	U J
72-55-9	4,4'-DDE	1.7	U
72-20-8	Endrin	1.7	U J
33213-65-9	Endosulfan II	1.7	U
72-54-8	4,4'-DDD	1.7	U
1031-07-8	Endosulfan sulfate	1.7	U
50-29-3	4,4'-DDT	1.7	U
53494-70-5	Endrin Aldehyde	1.7	U
72-43-5	Methoychlor	3.4	U
8001-35-2	Toxaphene	69	U
57-74-9	Chlordane (technical)	17	U
11104-28-2	Aroclor-1221	34	U
11141-28-2	Aroclor-1232	34	U
53469-21-9	Aroclor-1242	34	U
12674-11-2	Aroclor-1016	34	U
12672-29-6	Aroclor-1248	34	U
11097-57-4	Aroclor-1254	34	U
11096-82-5	Aroclor-1260	34	U

U: Concentration of analyte is less than the value given.

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Figure A2-3. Pesticide Organics Analysis Data Sheet (Page 10 of 19).

1D
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
BOHYS9

Lab Name: QUANTERRA,MO Contract: 550-168

Lab Code: ITMO Case No.: ______ SAS No.: ______ SDG No.: W01139

Matrix: (soil/water) SOIL Lab Sample ID: 11923-010

Sample wt/vol: 30.5 (g/ml) G Lab File ID: ______

Level: (low/med) LOW Date Sampled : 08-21-96

% Moisture: not dec. 8 dec. ______ Date Extracted: 09-04-96

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 09-19-96

GPC Cleanup: (Y/N) N pH: ______ Dilution Factor: 1

CAS NO.	Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
319-84-6	alpha-BHC	1.8	U
319-85-7	beta-BHC	1.8	U
319-86-8	delta-BHC	1.8	U
58-89-9	gamma-BHC (Lindane)	1.8	U
76-44-8	Heptachlor	1.8	U J
309-00-2	Aldrin	1.8	U J
1024-57-3	Heptachlor epoxide	1.8	U
959-98-8	Endosulfan I	1.8	U
60-57-1	Dieldrin	1.8	U J
72-55-9	4,4'-DDE	1.8	U
72-20-8	Endrin	1.8	U J
33213-65-9	Endosulfan II	1.8	U
72-54-8	4,4'-DDD	1.8	U
1031-07-8	Endosulfan sulfate	1.8	U
50-29-3	4,4'-DDT	1.8	U
53494-70-5	Endrin Aldehyde	1.8	U
72-43-5	Methoxychlor	3.6	U
8001-35-2	Toxaphene	71	U
57-74-9	Chlordane (technical)	18	U
11104-28-2	Aroclor-1221	36	U
11141-28-2	Aroclor-1232	36	U
53469-21-9	Aroclor-1242	36	U
12674-11-2	Aroclor-1016	36	U
12672-29-6	Aroclor-1248	36	U
11097-57-4	Aroclor-1254	36	U
11096-82-5	Aroclor-1260	36	U

U: Concentration of analyte is less than the value given.

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Figure A2-3. Pesticide Organics Analysis Data Sheet (Page 11 of 19).

1D
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
BOHYT0

Lab Name: QUANTERRA,MO Contract: 550-168

Lab Code: ITMO Case No.: ______ SAS No.: ______ SDG No.: W01139

Matrix: (soil/water) SOIL Lab Sample ID: 11923-011

Sample wt/vol: 30.3 (g/ml) G Lab File ID: ______

Level: (low/med) LOW Date Sampled : 08-21-96

% Moisture: not dec. 4 dec. ______ Date Extracted: 09-04-96

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 09-19-96

GPC Cleanup: (Y/N) N pH: ______ Dilution Factor: 1

CAS NO.	Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
319-84-6	alpha-BHC	1.7	U
319-85-7	beta-BHC	1.7	U
319-86-8	delta-BHC	1.7	U
58-89-9	gamma-BHC (Lindane)	1.7	U
76-44-8	Heptachlor	1.7	U J
309-00-2	Aldrin	1.7	U J
1024-57-3	Heptachlor epoxide	1.7	U
959-98-8	Endosulfan I	1.7	U
60-57-1	Dieldrin	1.7	U J
72-55-9	4,4'-DDE	1.7	U
72-20-8	Endrin	1.7	U J
33213-65-9	Endosulfan II	1.7	U
72-54-8	4,4'-DDD	1.7	U
1031-07-8	Endosulfan sulfate	1.7	U
50-29-3	4,4'-DDT	1.7	U
53494-70-5	Endrin Aldehyde	1.7	U
72-43-5	Methoychlor	3.4	U
8001-35-2	Toxaphene	69	U
57-74-9	Chlordane (technical)	17	U
11104-28-2	Aroclor-1221	34	U
11141-28-2	Aroclor-1232	34	U
53469-21-9	Aroclor-1242	34	U
12674-11-2	Aroclor-1016	34	U
12672-29-6	Aroclor-1248	34	U
11097-57-4	Aroclor-1254	34	U
11096-82-5	Aroclor-1260	34	U

U: Concentration of analyte is less than the value given.

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Figure A2-3. Pesticide Organics Analysis Data Sheet (Page 12 of 19).

1D
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
B0HYT1

Lab Name: QUANTERRA,MO Contract: 550-168
Lab Code: ITMO Case No.: ______ SAS No.: ______ SDG No.: W01139
Matrix: (soil/water) SOIL Lab Sample ID: 11923-012
Sample wt/vol: 30.8 (g/ml) G Lab File ID: ______
Level: (low/med) LOW Date Sampled : 08-21-96
% Moisture: not dec. 5 dec. ______ Date Extracted: 09-04-96
Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 09-19-96
GPC Cleanup: (Y/N) N pH: ______ Dilution Factor: 1

CAS NO.	Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
319-84-6	alpha-BHC	1.7	U
319-85-7	beta-BHC	1.7	U
319-86-8	delta-BHC	1.7	U
58-89-9	gamma-BHC (Lindane)	1.7	U
76-44-8	Heptachlor	1.7	U J
309-00-2	Aldrin	1.7	U J
1024-57-3	Heptachlor epoxide	1.7	U
959-98-8	Endosulfan I	1.7	U
60-57-1	Dieldrin	1.7	U J
72-55-9	4,4'-DDE	1.7	U
72-20-8	Endrin	1.7	U J
33213-65-9	Endosulfan II	1.7	U
72-54-8	4,4'-DDD	1.7	U
1031-07-8	Endosulfan sulfate	1.7	U
50-29-3	4,4'-DDT	1.7	U
53494-70-5	Endrin Aldehyde	1.7	U
72-43-5	Methoychlor	3.4	U
8001-35-2	Toxaphene	68	U
57-74-9	Chlordane (technical)	17	U
11104-28-2	Aroclor-1221	34	U
11141-28-2	Aroclor-1232	34	U
53469-21-9	Aroclor-1242	34	U
12674-11-2	Aroclor-1016	34	U
12672-29-6	Aroclor-1248	34	U
11097-57-4	Aroclor-1254	34	U
11096-82-5	Aroclor-1260	34	U

U: Concentration of analyte is less than the value given.

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Figure A2-3. Pesticide Organics Analysis Data Sheet (Page 13 of 19).

1D
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
BOHYT2

Lab Name: QUANTERRA,MO Contract: 550-168

Lab Code: ITMO Case No.: ______ SAS No.: ______ SDG No.: W01139

Matrix: (soil/water) SOIL Lab Sample ID: 11923-013

Sample wt/vol: 30.6 (g/ml) G Lab File ID: ______

Level: (low/med) LOW Date Sampled : 08-21-96

% Moisture: not dec. 6 dec. ______ Date Extracted: 09-04-96

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 09-19-96

GPC Cleanup: (Y/N) N pH: ______ Dilution Factor: 1

CAS NO.	Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
319-84-6	alpha-BHC	1.7	U
319-85-7	beta-BHC	1.7	U
319-86-8	delta-BHC	1.7	U
58-89-9	gamma-BHC (Lindane)	1.7	U
76-44-8	Heptachlor	1.7	U J
309-00-2	Aldrin	1.7	U J
1024-57-3	Heptachlor epoxide	1.7	U
959-98-8	Endosulfan I	1.7	U
60-57-1	Dieldrin	1.7	U J
72-55-9	4,4'-DDE	1.7	U
72-20-8	Endrin	1.7	U J
33213-65-9	Endosulfan II	1.7	U
72-54-8	4,4'-DDD	1.7	U
1031-07-8	Endosulfan sulfate	1.7	U
50-29-3	4,4'-DDT	1.7	U
53494-70-5	Endrin Aldehyde	1.7	U
72-43-5	Methoychlor	3.5	U
8001-35-2	Toxaphene	69	U
57-74-9	Chlordane (technical)	17	U
11104-28-2	Aroclor-1221	35	U
11141-28-2	Aroclor-1232	35	U
53469-21-9	Aroclor-1242	35	U
12674-11-2	Aroclor-1016	35	U
12672-29-6	Aroclor-1248	35	U
11097-57-4	Aroclor-1254	35	U
11096-82-5	Aroclor-1260	35	U

U: Concentration of analyte is less than the value given.

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Figure A2-3. Pesticide Organics Analysis Data Sheet (Page 14 of 19).

1D
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
B0HYT3

Lab Name: QUANTERRA,MO Contract: 550-168
Lab Code: ITMO Case No.: ______ SAS No.: ______ SDG No.: W01139
Matrix: (soil/water) SOIL Lab Sample ID: 11923-014
Sample wt/vol: 30.2 (g/ml) G Lab File ID: ______
Level: (low/med) LOW Date Sampled : 08-21-96
% Moisture: not dec. 1 dec. ______ Date Extracted: 09-04-96
Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 09-19-96
GPC Cleanup: (Y/N) N pH: ______ Dilution Factor: 1

CAS NO.	Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
319-84-6	alpha-BHC	1.7	U
319-85-7	beta-BHC	1.7	U
319-86-8	delta-BHC	1.7	U
58-89-9	gamma-BHC (Lindane)	1.7	U
76-44-8	Heptachlor	1.7	U J
309-00-2	Aldrin	1.7	U J
1024-57-3	Heptachlor epoxide	1.7	U
959-95-8	Endosulfan I	1.7	U
60-57-1	Dieldrin	1.7	U J
72-55-9	4,4'-DDE	1.7	U
72-20-8	Endrin	1.7	U J
33213-65-9	Endosulfan II	1.7	U
72-54-8	4,4'-DDD	1.7	U
1031-07-8	Endosulfan sulfate	1.7	U
50-29-3	4,4'-DDT	1.7	U
53494-70-5	Endrin Aldehyde	1.7	U
72-43-5	Methoychlor	3.3	U
8001-35-2	Toxaphene	67	U
57-74-9	Chlordane (technical)	17	U
11104-28-2	Aroclor-1221	33	U
11141-28-2	Aroclor-1232	33	U
53469-21-9	Aroclor-1242	33	U
12674-11-2	Aroclor-1016	33	U
12672-29-6	Aroclor-1248	33	U
11097-57-4	Aroclor-1254	33	U
11096-82-5	Aroclor-1260	33	U

U: Concentration of analyte is less than the value given.

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Figure A2-3. Pesticide Organics Analysis Data Sheet (Page 15 of 19).

1D
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
B0HYT4

Lab Name: QUANTERRA,MO Contract: 550-168

Lab Code: ITMO Case No.: ______ SAS No.: ______ SDG No.: W01139

Matrix: (soil/water) SOIL

Lab Sample ID: 11923-015

Sample wt/vol: 30.5 (g/ml) G

Lab File ID: ______

Level: (low/med) LOW

Date Sampled : 08-21-96

% Moisture: not dec. 3 dec. ______

Date Extracted: 09-04-96

Extraction: (SepF/Cont/Sonc) SONC

Date Analyzed: 09-19-96

GPC Cleanup: (Y/N) N pH: ______

Dilution Factor: 1

CAS NO.	Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
319-84-6	alpha-BHC	1.7	U
319-85-7	beta-BHC	1.7	U
319-86-8	delta-BHC	1.7	U
58-89-9	gamma-BHC (Lindane)	1.7	U
76-44-8	Heptachlor	1.7	U J
309-00-2	Aldrin	1.7	U J
1024-57-3	Heptachlor epoxide	1.7	U
959-98-8	Endosulfan I	1.7	U
60-57-1	Dieldrin	1.7	U J
72-55-9	4,4'-DDE	1.7	U
72-20-8	Endrin	1.7	U J
33213-65-9	Endosulfan II	1.7	U
72-54-8	4,4'-DDD	1.7	U
1031-07-8	Endosulfan sulfate	1.7	U
50-29-3	4,4'-DDT	1.7	U
53494-70-5	Endrin Aldehyde	1.7	U
72-43-5	Methoychlor	3.4	U
8001-35-2	Toxaphene	68	U
57-74-9	Chlordane (technical)	17	U
11104-28-2	Aroclor-1221	34	U
11141-28-2	Aroclor-1232	34	U
53469-21-9	Aroclor-1242	34	U
12674-11-2	Aroclor-1016	34	U
12672-29-6	Aroclor-1248	34	U
11097-57-4	Aroclor-1254	34	U
11096-82-5	Aroclor-1260	34	U

U: Concentration of analyte is less than the value given.

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Figure A2-3. Pesticide Organics Analysis Data Sheet (Page 16 of 19).

1D
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
BOHYT5

Lab Name: QUANTERRA,MO Contract: 550-168

Lab Code: ITMO Case No.: ______ SAS No.: ______ SDG No.: W01139

Matrix: (soil/water) SOIL Lab Sample ID: 11923-016

Sample wt/vol: 30.4 (g/ml) G Lab File ID: ______

Level: (low/med) LOW Date Sampled : 08-21-96

% Moisture: not dec. 1 dec. ______ Date Extracted: 09-04-96

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 09-19-96

GPC Cleanup: (Y/N) N pH: ______ Dilution Factor: 1

CAS NO.	Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
319-84-6	alpha-BHC	1.7	U
319-85-7	beta-BHC	1.7	U
319-86-8	delta-BHC	1.7	U
58-89-9	gamma-BHC (Lindane)	1.7	U
76-44-8	Heptachlor	1.7	UJ
309-00-2	Aldrin	1.7	UJ
1024-57-3	Heptachlor epoxide	1.7	U
959-98-8	Endosulfan I	1.7	U
60-57-1	Dieldrin	1.7	UJ
72-55-9	4,4'-DDE	1.7	U
72-20-8	Endrin	1.7	UJ
33213-65-9	Endosulfan II	1.7	U
72-54-8	4,4'-DDD	1.7	U
1031-07-8	Endosulfan sulfate	1.7	U
50-29-3	4,4'-DDT	1.7	U
53494-70-5	Endrin Aldehyde	1.7	U
72-43-5	Methoychlor	3.3	U
8001-35-2	Toxaphene	66	U
57-74-9	Chlordane (technical)	17	U
11104-28-2	Aroclor-1221	33	U
11141-28-2	Aroclor-1232	33	U
53469-21-9	Aroclor-1242	33	U
12674-11-2	Aroclor-1016	33	U
12672-29-6	Aroclor-1248	33	U
11097-57-4	Aroclor-1254	33	U
11096-82-5	Aroclor-1260	33	U

U: Concentration of analyte is less than the value given.

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Figure A2-3. Pesticide Organics Analysis Data Sheet (Page 17 of 19).

1D
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
BOHYT6

Lab Name: QUANTERRA,MO Contract: 550-168

Lab Code: ITMO Case No.: ______ SAS No.: ______ SDG No.: W01139

Matrix: (soil/water) SOIL

Lab Sample ID: 11923-017

Sample wt/vol: 30.6 (g/ml) G

Lab File ID: ______

Level: (low/med) LOW

Date Sampled : 08-21-96

% Moisture: not dec. 1 dec. ______

Date Extracted: 09-04-96

Extraction: (SepF/Cont/Sonc) SONC

Date Analyzed: 09-19-96

GPC Cleanup: (Y/N) N pH: ______

Dilution Factor: 1

CAS NO.	Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
319-84-6	alpha-BHC	1.6	U
319-85-7	beta-BHC	1.6	U
319-86-8	delta-BHC	1.6	U
58-89-9	gamma-BHC (Lindane)	1.6	U
76-44-8	Heptachlor	1.6	U J
309-00-2	Aldrin	1.6	U J
1024-57-3	Heptachlor epoxide	1.6	U
959-98-8	Endosulfan I	1.6	U
60-57-1	Dieldrin	1.6	U J
72-55-9	4,4'-DDE	1.6	U
72-20-8	Endrin	1.6	U J
33213-65-9	Endosulfan II	1.6	U
72-54-8	4,4'-DDD	1.6	U
1031-07-8	Endosulfan sulfate	1.6	U
50-29-3	4,4'-DDT	1.6	U
53494-70-5	Endrin Aldehyde	1.6	U
72-43-5	Methoychlor	3.3	U
8001-35-2	Toxaphene	66	U
57-74-9	Chlordane (technical)	16	U
11104-28-2	Aroclor-1221	33	U
11141-28-2	Aroclor-1232	33	U
53469-21-9	Aroclor-1242	33	U
12674-11-2	Aroclor-1016	33	U
12672-29-6	Aroclor-1248	33	U
11097-57-4	Aroclor-1254	33	U
11096-82-5	Aroclor-1260	33	U

U: Concentration of analyte is less than the value given.

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Figure A2-3. Pesticide Organics Analysis Data Sheet (Page 18 of 19).

1D
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
B0HYT7

Lab Name: QUANTERRA,MO Contract: 550-168
Lab Code: ITMO Case No.: ______ SAS No.: ______ SDG No.: W01139
Matrix: (soil/water) SOIL Lab Sample ID: 11923-018
Sample wt/vol: 30.4 (g/ml) G Lab File ID: ______
Level: (low/med) LOW Date Sampled : 08-21-96
% Moisture: not dec. 3 dec. ______ Date Extracted: 09-04-96
Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 09-19-96
GPC Cleanup: (Y/N) N pH: ______ Dilution Factor: 1

CAS NO.	Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
319-84-6	alpha-BHC	1.7	U
319-85-7	beta-BHC	1.7	U
319-86-8	delta-BHC	1.7	U
58-89-9	gamma-BHC (Lindane)	1.7	U
76-44-8	Heptachlor	1.7	U J
309-00-2	Aldrin	1.7	U J
1024-57-3	Heptachlor epoxide	1.7	U
959-98-8	Endosulfan I	1.7	U
60-57-1	Dieldrin	1.7	U J
72-55-9	4,4'-DDE	1.7	U
72-20-8	Endrin	1.7	U J
33213-65-9	Endosulfan II	1.7	U
72-54-8	4,4'-DDD	1.7	U
1031-07-8	Endosulfan sulfate	1.7	U
50-29-3	4,4'-DDT	1.7	U
53494-70-5	Endrin Aldehyde	1.7	U
72-43-5	Methoychlor	3.4	U
8001-35-2	Toxaphene	68	U
57-74-9	Chlordane (technical)	17	U
11104-28-2	Aroclor-1221	34	U
11141-28-2	Aroclor-1232	34	U
53469-21-9	Aroclor-1242	34	U
12674-11-2	Aroclor-1016	34	U
12672-29-6	Aroclor-1248	34	U
11097-57-4	Aroclor-1254	34	U
11096-82-5	Aroclor-1260	34	U

U: Concentration of analyte is less than the value given.

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Figure A2-3. Pesticide Organics Analysis Data Sheet (Page 19 of 19).

1D
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
B0HYT8

Lab Name: QUANTERRA,MO Contract: 550-168

Lab Code: ITMO Case No.: ______ SAS No.: ______ SDG No.: W01139

Matrix: (soil/water) SOIL Lab Sample ID: 11923-019

Sample wt/vol: 30.7 (g/ml) G Lab File ID: ______

Level: (low/med) LOW Date Sampled : 08-21-96

% Moisture: not dec. 0 dec. ______ Date Extracted: 09-04-96

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 09-19-96

GPC Cleanup: (Y/N) N pH: ______ Dilution Factor: 1

CAS NO.	Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
319-84-6	alpha-BHC	1.6	U
319-85-7	beta-BHC	1.6	U
319-86-8	delta-BHC	1.6	U
58-89-9	gamma-BHC (Lindane)	1.6	U
76-44-8	Heptachlor	1.6	UJ
309-00-2	Aldrin	1.6	UJ
1024-57-3	Heptachlor epoxide	1.6	U
959-98-8	Endosulfan I	1.6	U
60-57-1	Dieldrin	1.6	UJ
72-55-9	4,4'-DDE	1.6	U
72-20-8	Endrin	1.6	UJ
33213-65-9	Endosulfan II	1.6	U
72-54-8	4,4'-DDD	1.6	U
1031-07-8	Endosulfan sulfate	1.6	U
50-29-3	4,4'-DDT	1.6	U
53494-70-5	Endrin Aldehyde	1.6	U
72-43-5	Methoychlor	3.3	U
8001-35-2	Toxaphene	65	U
57-74-9	Chlordane (technical)	16	U
11104-28-2	Aroclor-1221	33	U
11141-28-2	Aroclor-1232	33	U
53469-21-9	Aroclor-1242	33	U
12674-11-2	Aroclor-1016	33	U
12672-29-6	Aroclor-1248	33	U
11097-57-4	Aroclor-1254	33	U
11096-82-5	Aroclor-1260	33	U

U: Concentration of analyte is less than the value given.

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APPENDIX B

DEMONSTRATION OF COMPLIANCE WITH CLEAN CLOSURE STANDARDS FOR 100-D PONDS

CONTENTS

FIGURES

TABLES

B1.0 INTRODUCTION

The purpose of this demonstration of compliance with clean closure standards is to evaluate the possibility that discharges into the 100-D Ponds treatment, storage, and/or disposal (TSD) unit affected the subsurface soils and groundwater in the area. This will be accomplished by evaluating the groundwater data collected to date during monitoring of this unit, and by the simulation of reactions between the effluent and materials beneath the unit by the application of a geochemical model.

It is anticipated that this appendix may be copied and reviewed without the attached Closure Plan. For that reason, some of the material contained in this appendix is duplicated from the 100-D Ponds Closure Plan, particularly Sections B3.0, B3.1, B5.1, and Appendix A.

B2.0 REGULATORY BACKGROUND

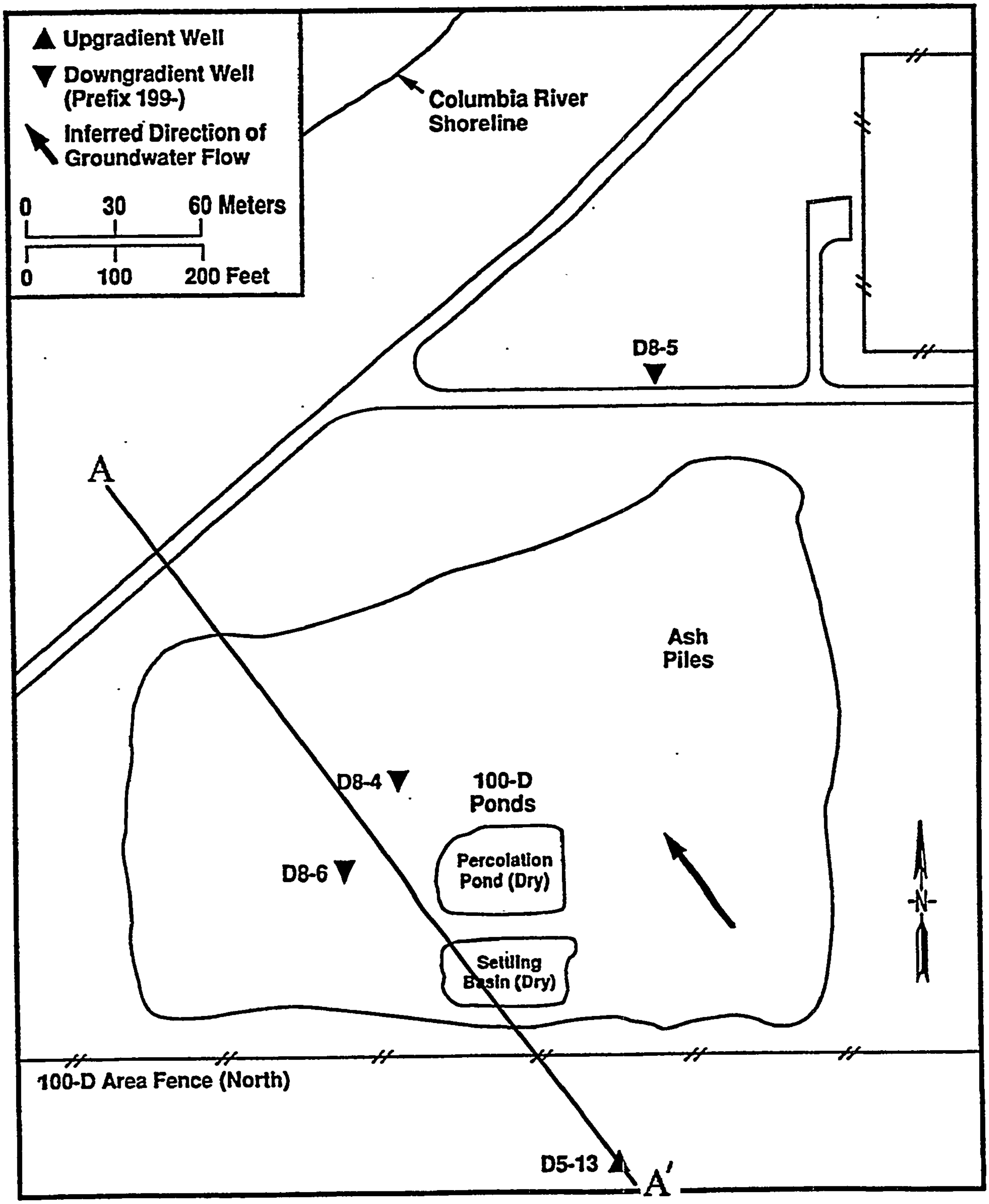
The *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) requires that demonstration of clean closure of a TSD unit must "include documentation that groundwater and soils have not been adversely impacted by the TSD group/unit, as described in 173-303-645 WAC" (Ecology et al. 1996, Section 6.3.1). Because these ponds are surface impoundments, compliance with final status groundwater monitoring (WAC 173-303-645) and a determination of no impact to the groundwater from the unit must be demonstrated to achieve clean closure, in accordance with WAC 173-303-610(2)(b) and Section II.K.1 of the Hanford Facility *Resource Conservation and Recovery Act* (RCRA) Permit. These regulations require cleanup to *Model Toxics Control Act* (MTCA; Washington Administrative Code-173-340) B levels. It is the intent of this document to demonstrate compliance with these requirements.

In addition to demonstrating that groundwater has not been adversely affected by waste disposal activities at 100-D Ponds, this document will provide evidence that subsurface soils were not contaminated by discharges to the ponds. Demonstration of this will rely on near-surface data and geochemical modeling of the vadose zone and saturated zone. Although clean subsoil is a prerequisite for clean closure of a TSD unit, there is no Washington State Department of Ecology (Ecology) regulation or guidance that requires testing of subsurface soils. The recent clean closure of 2101-M Pond, a RCRA TSD unit, was accepted by Ecology without RCRA-compliant deep vadose zone data (DOE-RL 1995).

B3.0 DESCRIPTION OF UNIT AND WASTE CHARACTERISTICS

The 100-D Ponds TSD unit is located adjacent to and north of the north perimeter fence of the 100-D Area (Figure B-1). Beginning in 1950, before the operation of this site as a TSD unit, this location served as the 188-D Ash Disposal Basin (waste site 126-D-1), which received coal ash from the 184-D Powerhouse. Until 1966, when the ash basin was retired, the location received

Figure B-1. Location of 100-D Ponds and Monitoring Wells. Line marked A-A' is transect for cross section in Figure B-2.



ash/water effluent only. Between 1966 and 1977 the site received no discharges. Figure B-2 is a cross section through 100-D Ponds showing the topographic profile along a northwest-southeast transect and subsurface features, including approximate boundaries of the coal ash and position of the water table.

The 100-D Ponds TSD unit was constructed as a surface impoundment for liquid effluent and operated between 1977 and 1994. It was constructed primarily for the impoundment and disposal of nonradioactive, nondangerous liquid effluent from the 183-D Water Treatment Facility (WTF). Constituents that may have been discharged to 100-D Ponds include the following:

1. Corrosive chemicals. Until 1986, the 189-D Method Development Laboratory (MDL) occasionally discharged potentially corrosive effluents from the regeneration of three demineralizers to the process sewer system, which in turn emptied into the 100-D Ponds. These effluents may have exhibited pH levels below 2.0 or above 12.5 upon arrival at the ponds, although their actual corrosivity level was never established. It is the potential for this site to have received these corrosive chemicals that led to the classification of the 100-D Ponds as a TSD unit.

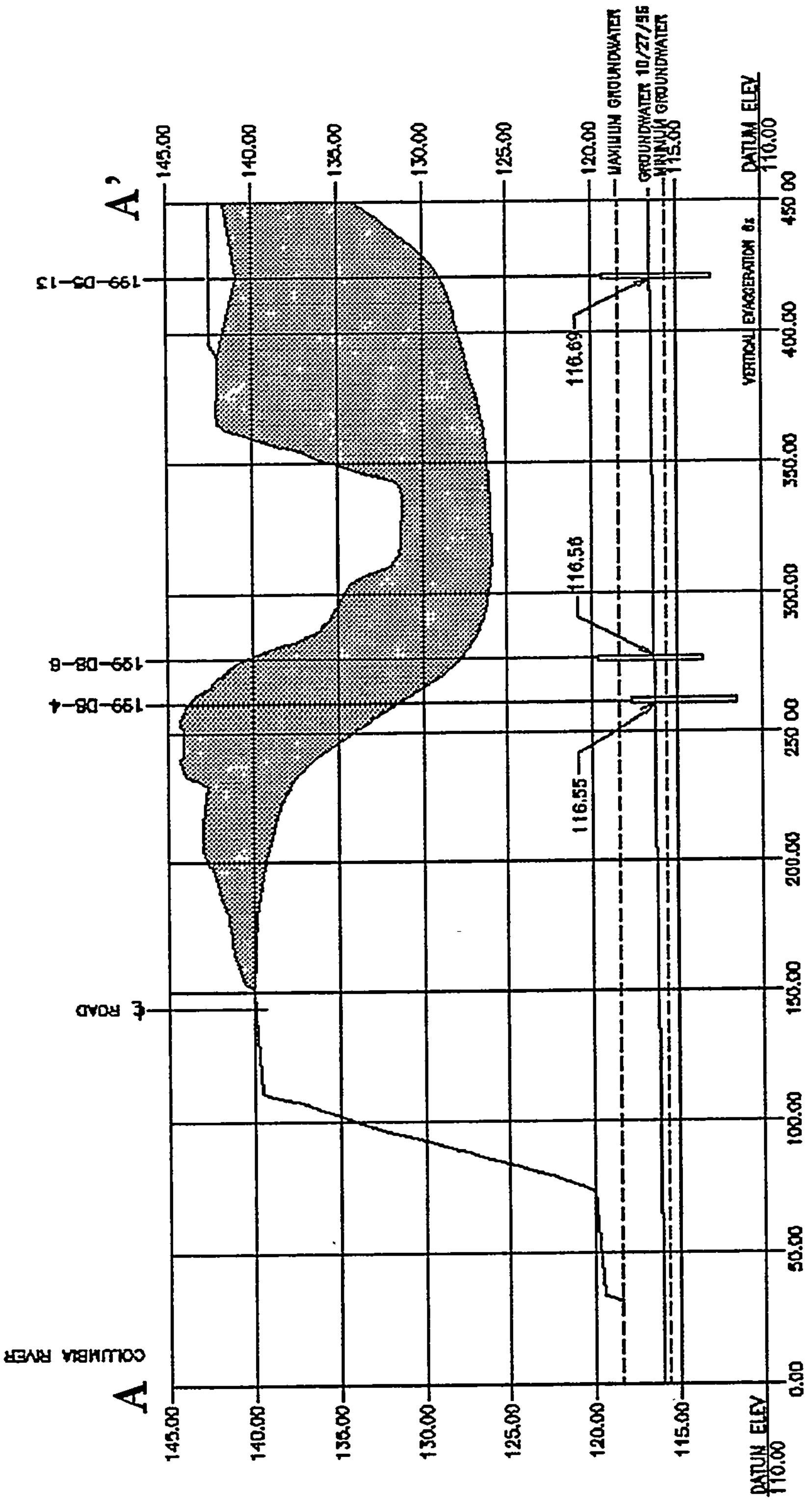
2. Mercury. No records exist that identify disposal of mercury into 100-D Ponds; however, the presence of liquid metallic mercury was visibly confirmed in the floor drain of the 189-D Building mechanical development laboratory in 1989 (Price 1989). Gano and Lauterbach (1990) documented that accidents involving laboratory instruments such as manometers and mercury switches could have contributed up to 2.6 kilograms (5 pounds) of mercury to the process sewer system (Gano and Lauterbach 1990). It is unlikely that a significant portion of this mercury could have been deposited in the ponds, as mercury traps were installed three years before the ponds began receiving effluent in 1977 and considerable flushing of the system would have occurred before that time.

3. Dangerous shop chemicals. Until 1988, when the 189-D MDL was permanently closed, standard volatile organic shop chemicals such as thinners and solvents could have been released to the 100-D Ponds from open floor and sink drains of the craft shop or the mechanical development laboratory of the 189-D MDL complex. However, such chemicals were not normally stored in bulk quantities nor were they procedurally discharged to the drain system when spent.

4. Radioactive constituents. Unirradiated uranium fuel elements used during testing at the Fuel Discharge Trampoline Test Facility may have contributed radiological contamination to 100-D Ponds. A discussion of radionuclides at the ponds is presented here for information only, because these constituents are outside the scope of WAC 173-303.

5. Concentration of naturally occurring metals from Columbia River water and sediment. The filters used at the 183-D WTF removed suspended and colloidal minerals from the river water, which would have been discharged into the 100-D Ponds during periodic backflushing of the filters. Semi-annual washdowns of the 183-D water storage basins also discharged river sediment and flocculent into the 100-D Ponds along with Columbia River water.

Figure B-2. Cross Section Through 100-D Ponds. See Figure B-1 for transect location. Patterned area is inferred extent of coal ash. All measurements in meters.



B3.1 CONTAMINANTS DEPOSITED IN 100-D PONDS

Two different sampling and analysis efforts have been conducted to characterize the ponds, one in August 1992 and the other in January 1995 (BHI 1995). Samples were analyzed for metals and organic analytes using both total (SW-846) and toxic characteristic leaching procedure (TCLP) analytical preparation and analysis techniques. Samples of the coal ash surrounding the ponds were also collected in September, 1992.

Characterization data indicated that some contaminants were present in the sediment on the bottom of the settling pond. These constituents probably originated from the 189-D MDL complex and arrived by way of the process sewer system. Constituents that were present above Ecology's MTCA B levels include polychlorinated biphenyls (PCBs), arsenic, barium, total chromium, lead, nickel, and zinc. The coal ash underlying the sediment has no significant contamination; all levels for contaminants of concern (COCs) are below MTCA B limits.

The contaminated sediments, which consisted of naturally occurring fine-grained material and alum (discussed in Section B4.1), were removed and disposed of in August, 1996. The floors of the settling and percolation ponds were sampled shortly after this remediation. Data from these samples are presented and discussed in Section B6.0.

B4.0 PHYSICAL AND CHEMICAL FACTORS AFFECTING CONTAMINANT MIGRATION

The effluent discharged to 100-D Ponds was predominantly water from the 183-D WTF. As discussed in Section B3.0, some corrosive liquids and miscellaneous chemicals were also discharged through the process sewer system into the ponds, along with river sediment and flocculent used in the water treatment process. These latter solids are important to consider when evaluating the mobility of metals and PCBs, as fine-grained sediment and flocculent have the ability to adsorb many chemicals and effectively immobilize them in an aqueous environment. It is thus possible that chemicals discharged into the ponds were fixed in the upper layer of sediment composed of flocculent and solids filtered from Columbia River water. A discussion of the use of flocculents for binding contaminants in water follows.

B4.1 FLOCCULENTS IN WATER TREATMENT

Coagulants and flocculents are used in liquid/solids separation applications to neutralize the ionic charges that surround solid particles dispersed in water, and cluster them together to promote settling. Most naturally occurring particles have a negatively charged surface in water due to the release of cations such as Na^+ and Ca^{2+} from the surface of the particle into the surrounding water. When microscopic particles of like charge approach one another, they repel and cannot coalesce to form larger particles. This leads to very stable systems of particles in water that will not settle. Cationic coagulants adsorb onto the negatively charged particle surfaces and neutralize the negative charges that are causing repulsion. Optimum coagulation occurs when the particle surface charge is reduced to near zero.

The agent used at the 183-D WTF as a coagulant and flocculent was aluminum sulfate (alum). This compound, and others like it (e.g., ferric chloride), have trivalent metal ions (Al^{+3} and Fe^{+3}) that are strongly attracted to any negatively charged surface. Trivalent cations are desirable coagulants when compared to divalent and monovalent cations, which have very weak coagulating abilities. The use of alum usually produces a fairly clean supernatant water since the metal hydroxides produced assist in the capture of very fine particles. Use of alum also tends to lower the pH of the system as anions are adsorbed.

The flocculent released into the ponds would carry with it the contaminants (natural or anthropogenic) adsorbed at the WTF, but would also probably have excess adsorption capacity when it was deposited on the surface of the settling pond. It is, therefore, likely that this alum would bind much of the contamination entering with the liquid effluent and prevent contaminants from migrating through the vadose zone. Data supporting this postulate are presented in Section 6.0.

B5.0 EVALUATION OF GROUNDWATER DATA

Groundwater monitoring at 100-D Ponds began in 1992. As required by 40 CFR 265.92, groundwater is analyzed for groundwater quality parameters, drinking water parameters, and contamination indicator parameters. Statistical comparisons of contamination indicator parameters upgradient and downgradient of the site are made on a quarterly basis. This phase of groundwater monitoring is commonly called "indicator evaluation" or "detection" monitoring.

The groundwater monitoring network for the 100-D Ponds is composed of one upgradient and three downgradient wells (Figure B-1). The wells are completed at the top of the unconfined aquifer.

B5.1 GROUNDWATER QUALITY

Four quarters of data were collected in 1992 and 1993 and analyzed for a complete suite of organic and inorganic constituents and radionuclides. These constituents are listed in Attachment B-1 and are compared to the groundwater monitoring analytes listed in 40 CFR 264, Appendix IX. Quarterly samples collected since 1993 have been analyzed for a suite of metals, anions, field measurements, and radiological components. A summary of the types of analyses performed for each sampling event is presented in Attachment B-1.

Table B-1 contains a statistical summary for contaminants of potential concern from the three downgradient wells and shows that groundwater concentrations are below MTCA B groundwater cleanup standards. Of special concern are the chemicals that were found to be above MTCA B soil cleanup standards for groundwater protection in the sediments of the settling pond, namely

Table B-1. Statistical Summary of Groundwater Samples from Monitoring Wells Downgradient of 100-D Ponds. All values in µg/L.

Compound	Filtered/ Unfiltered	Average µg/L	Std. Dev. µg/L	Min µg/L	Max µg/L	# Samples	# Samples <DL	% > DL	MTCA B GW, µg/L	Max value > MTCA B?
Antimony	Filtered	60.73	41.47	12	100	37	37	0		NA
Aroclor-1016	Unfiltered	0.50	0.00	0.5	0.5	12	12	0	1.12	NO
Aroclor-1221	Unfiltered	0.63	0.23	0.5	1	12	12	0		NA
Aroclor-1232	Unfiltered	0.50	0.00	0.5	0.5	12	12	0		NA
Aroclor-1242	Unfiltered	0.50	0.00	0.5	0.5	12	12	0		NA
Aroclor-1248	Unfiltered	0.50	0.00	0.5	0.5	12	12	0		NA
Aroclor-1254	Unfiltered	0.50	0.00	0.5	0.5	12	12	0	0.32	NO*
Aroclor-1260	Unfiltered	0.50	0.00	0.5	0.5	12	12	0	0.011	NO*
Arsenic	Filtered	2.42	0.19	2	2.5	19	16	16	4.8	NO
Barium	Filtered	25.28	15.42	10	70	37	7	81	1120	NO
Beryllium	Filtered	1.04	0.53	0.085	1.5	37	34	8	80	NO
Cadmium	Filtered	3.38	1.75	0.49	5	37	33	11	8	NO
Chromium	Filtered	10.54	8.24	1.85	44	37	27	27	80	NO
Copper	Filtered	6.16	4.21	1.05	10	37	34	8	592	NO
Lead	Filtered	2.58	0.34	2.5	4	19	18	5	5	NO
Manganese	Filtered	5.26	10.43	0.275	63	37	22	41		NA
Mercury	Filtered	0.07	0.03	0.0095	0.1	37	34	8	4.8	NO
Nickel	Filtered	12.06	6.50	5.5	42	37	36	3	320	NO
Silver	Filtered	6.12	4.06	1.435	10	37	37	0	80	NO
Vanadium	Filtered	10.45	5.21	1.92	15	37	26	30	112	NO
Zinc	Filtered	4.97	2.60	1.3	13	37	24	35	4800	NO

NA = not applicable * = Detection limit for analyte above regulatory limit.

PCBs, arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, vanadium, and zinc. None of these constituents was found in the downgradient wells at levels that would indicate contribution from 100-D Ponds. These results, which are supported by data from RCRA groundwater monitoring (e.g., DOE-RL 1996a), indicate that effluent disposal activities at 100-D Ponds did not have any adverse effects on groundwater.

Although discharges to 100-D Ponds did not create a groundwater mound detectable by water levels in the monitoring wells, the effect of the discharges can be seen in the water chemistry data. The greatest volume of effluent routed to the Ponds was raw or treated river water released from the 183-D WTF, which diluted the groundwater beneath the Ponds. The groundwater upgradient of 100-D Ponds is contaminated with chromium, tritium, and nitrate. The discharges into 100-D Ponds effectively diluted this groundwater to values typical of or below background concentrations for the Hanford Site, as shown by analyses from downgradient monitoring well samples (DOE-RL 1996a).

Figure B-3 shows chromium concentrations and conductivity measurements over time for the upgradient and downgradient monitoring wells. These plots show that water quality in the upgradient well has degraded since the decrease of discharges to 100-D Ponds and final cessation in May, 1994, while concentrations in the downgradient wells have changed little since that time. This is interpreted to be the result of the lack of "clean" water from past discharges to dilute the contaminated water entering the area from upgradient sources.

The RCRA groundwater monitoring program for interim status units (40 CFR 265, Subpart F) requires a comparison of concentrations of various indicator parameters from downgradient wells with critical mean values calculated from an upgradient well. Over the course of groundwater monitoring at 100-D Ponds, pH is the only parameter that has exceeded the critical value. This exceedence occurred in February 1996 in the two downgradient wells, 199-D8-4 and 199-D8-6. Ecology was notified of this exceedence and an assessment report was submitted (Hartman 1996). It was concluded that the coal ash underlying the Ponds is the source of the elevated pH in the groundwater.

B6.0 EVALUATION OF SUBSURFACE SOILS

In order to clean close a TSD unit, it must be demonstrated that "... levels of dangerous waste or dangerous waste constituents or residues do not exceed ... MTCA B ..." [WAC 173-303-610(2)(b)]. Data from near-surface soil samples (discussed in Section B6.1) and from groundwater analyses (Section B5.1) show no evidence that contaminants found in the surface sediments of 100-D Ponds migrated into the vadose zone and groundwater system. This premise is investigated in this section by evaluating near-surface soil samples and applying a geochemical model to investigate subsurface reactions between infiltrating solutions from 100-D Ponds and vadose and saturated zone materials.

B6.1 DATA FROM NEAR-SURFACE SAMPLES

Data collected in the 1995 characterization effort (Phase II; BHI 1995) were from surface samples and various depths collected from four different test pits with a maximum depth of 2.4 m (8.0 ft). These data and analyses of the 1992 samples (Phase I; BHI 1995) were used in the decision to remediate this TSD unit by removing the sediment from the settling pond. The Phase II data show that the ash beneath the fine grained settling pond sediment is not contaminated. The contaminants are restricted to the fine-grained sediment in the settling pond. These contaminants include PCBs, arsenic, total chromium, and lead (DOE-RL 1996b). The Phase II data also show that the concentrations of these contaminants drop sharply in the ash underlying the sediment. Figure B-4 shows this relationship for several contaminants.

Several samples intended to characterize the background composition of the coal ash surrounding and underlying 100-D Ponds were also collected in 1992. Average compositions for these samples are included in Figure B-4, and show that the materials underlying the sediment in Phase II samples are similar in composition to the background coal ash samples. The coal ash

Figure B-3. Conductivity and Chromium Values from 100-D Ponds Monitoring Wells from December 1991 to March 1997. Vertical line represents end of discharges to the ponds.

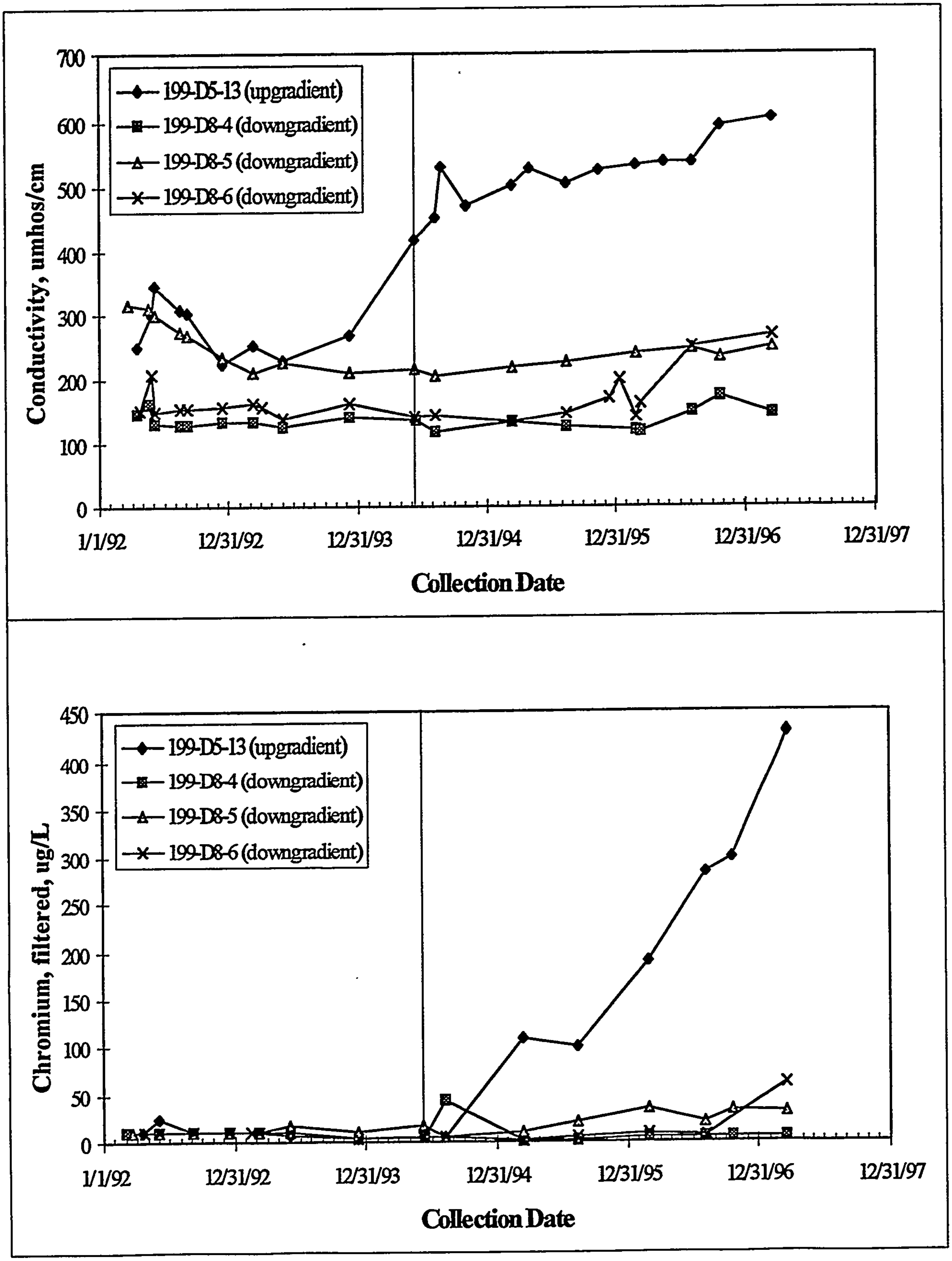
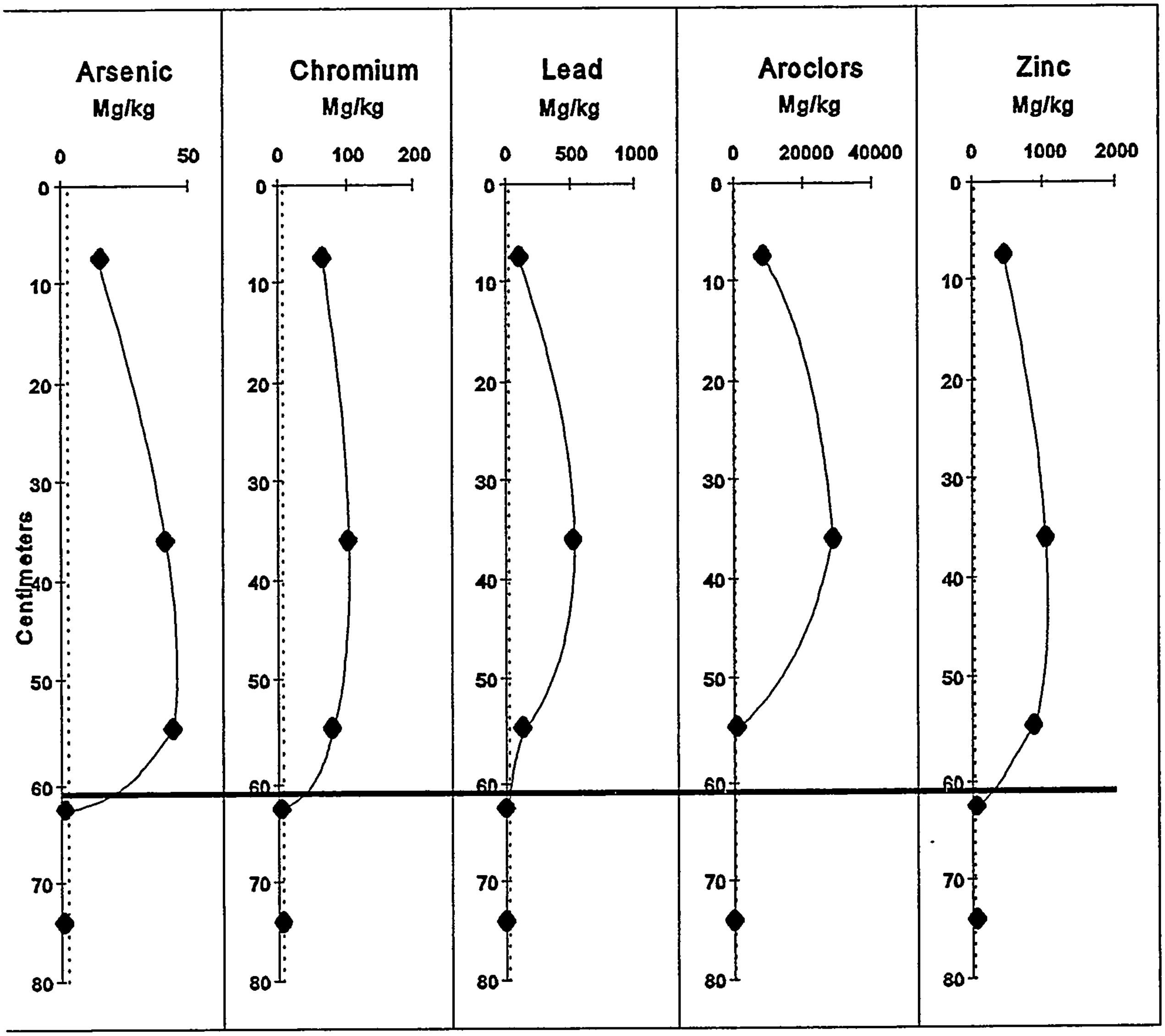


Figure B-4. Concentration Profile of Several Constituents in 100-D Ponds Sediment and Underlying Ash (below dark horizontal line). Dashed line is average of "background" coal ash samples surrounding and underlying 100-D Ponds. The lines connecting the data points are for illustration purposes, and may not reflect true concentrations at depth.



underlying the ponds is associated with a past practice activity and not with this RCRA TSD unit. Impacts to the environment attributable only to the coal ash, such as the pH excursions discussed in Section B5.1, will be addressed in the CERCLA process.

Additional samples were collected from the bottom of the ponds after removal of the contaminated sediments in August 1996. Data from these samples, summarized in Appendix A (Table A-3), are below Ecology MTCA B cleanup standards, indicating that contamination was fixed in the fine-grained sediments and did not migrate into the vadose zone.

B6.2 MODELING OF SUBSURFACE SOIL

In order to evaluate the possibility that dangerous wastes or dangerous waste constituents have migrated and been deposited into the vadose zone, geochemical modeling was performed to simulate reactions between infiltrating water and the various sediment types that occur beneath 100-D Ponds. The computer code PHREEQC was used for this simulation to identify the composition of solutions reacting with subsurface mineral assemblages and identify any phases that may precipitate. PHREEQC is distributed and maintained by the U.S. Geological Survey.

B6.2.1 The Computer Program PHREEQC

The computer code PHREEQC is based on an ion-association aqueous model with capabilities for speciation and saturation-index calculations, and other calculations involving mixing of solutions, mineral and gas equilibria, and ion-exchange reactions. The model uses thermodynamic data to simulate equilibrium conditions between different phases. A manual detailing the theory and operation of this program is available (Parkhurst 1995). This program and its precursor, PHREEQE, have been used for over 15 years for modeling surface and subsurface aqueous geochemical reactions.

B6.2.2 Application of PHREEQC to 100-D Ponds

The computer model PHREEQC calculates geochemical conditions at *equilibrium*, which necessitates the assumption that water-rock contact time is adequate to achieve equilibrium conditions. This was probably not the case during much of the time the ponds were active as an effluent disposal facility, because large amounts of water were discharged in a short time period and quickly reached the groundwater table. Evidence of this can be seen from a January 1993 incident where 1,136,000 L (300,000 gal) of water from the settling basins were inadvertently emptied into 100-D Ponds (Alexander 1993). A rise of several centimeters was measured in most of the monitoring wells within several days of this discharge, indicating fast infiltration rates and thus little time for equilibration to occur.

After discharges to the ponds ceased in June 1994, recharge to the vadose zone beneath the ponds effectively ceased and travel time for residual vadose zone waters increased. This residual water had longer to react with the ash and Ringold Formation and was more likely to be at equilibrium with the solid phases. The assumption of equilibrium should yield the most dissolution and precipitation and thus represents a "worst case" situation.

PHREEQC invokes a separate database file for the requisite thermodynamic data on the components, species, and phases necessary to perform the calculations. The database used for this modeling effort was adopted from the program MINTEQ, which has a comprehensive list over 1,100 species and more than 500 phases.

B6.2.2.1 Methodology. The modeling parameters were formulated to mimic the reactions that would be expected to occur beneath 100-D Ponds. PHREEQC allows several steps to be performed in one run; the output gives the results of each step and the final result of the run. For 100-D Ponds, the various steps were as follows:

1. React infiltrating water with coal ash underlying the ponds,

2. React the solution derived in step 1 with minerals typical of the Ringold Formation,

3. Mix this solution with groundwater, maintaining equilibrium with the Ringold Formation.

The initial solution composition and coal ash composition were selected without precise knowledge of their properties. Ideally, the infiltrating water would be defined by some average or upper statistical bound of the effluent composition released into 100-D Ponds. This information is not available, so the actual composition used was a combination of average Columbia River water for the major elements (PNL 1994) and the average of TCLP analyses performed on the sediments at the bottom of the settling pond for the metals (BHI 1995). The Columbia River is a likely primary water source, as approximately 25 million gallons of Columbia River water were received from the WTF during operation of the ponds. The rationale for using TCLP analyses for metals is that the maximum concentration of metals in infiltrating water would be the leachate from the contaminated sediments; TCLP analyses represent the "worst case" leachate likely to be produced from a sample.

Reaction of a solution with a solid requires the mineral phases of the solid to be known. Lacking mineral analyses of the coal ash, appropriate phases were chosen from published tables of mineral constituents in ash from various coals (Falcone and Schobert 1986). The minerals anhydrite ($CaSO_4$), quartz (SiO_2), and hematite (Fe_2O_3) were used to represent the coal ash in the PHREEQC program. In addition, calcium hydroxide in the form of portlandite ($Ca(OH)_2$) was included as a mineral phase in the ash because high calcium contents are typical of subbituminous coal (Huffman and Huggins 1986), which was the type used at Hanford.

The solution resulting from reaction of the infiltrating water with coal ash was then reacted with minerals typical of the Ringold Formation. These include quartz, plagioclase feldspar, calcite, and montmorillonite.

The third step was performed to determine if precipitation of any mineral phases was likely to occur when the reacted water was mixed with groundwater. The groundwater chosen was an average of pre-1994 analyses from the upgradient monitoring well, 199-D5-13. The restriction on the date was necessary because this well started to become contaminated with chromium and other constituents (Figure B-3) from upgradient sources in 1995, due to dissipation of the groundwater mound beneath the ponds as discharges diminished and finally ceased in June 1994.

B6.2.2.2 Results of Modeling. The model PHREEQC was run with the above inputs. The output produced by the program contains the composition of the modeled solution after each step, the distribution of the various aqueous species, and the saturation index of all minerals in the thermodynamic database that contain the components considered in the aqueous and solid phases. Phases that are in equilibrium with the solution have a saturation index equal to 0. Phases with a saturation index greater than 0 indicate that they are thermodynamically oversaturated and may precipitate from solution. After each reaction step, those phases with a saturation index greater than 0 were evaluated and allowed to precipitate if they were geologically feasible.

The first step in the modeling procedure was speciating the initial solution, which is Columbia River water with metals from TCLP analysis of the sediments added to it. This solution was then reacted with the vadose zone in two steps, as described in Section B6.2.2.1. Reaction with ash materials resulted in precipitation of a small amount of barium arsenate, Ca-nontronite (a member of the smectite group of clay minerals), hematite, and sepiolite (a member of the palygorskite group of clay minerals). The minerals anhydrite, portlandite, and quartz reacted with the solution to form the precipitates. The composition of the solution and mass of precipitates and reactants are listed in Table B-2.

The calculated pH of the vadose zone solution in equilibrium with coal ash phases is 12.3. The portlandite, a hydrous lime mineral, is responsible for the high pH. The model inputs were varied to determine the influence of small amounts of portlandite in the system, simulating a situation where preferred pathways through the coal ash were used for transport from the surface to the water table and reactive surfaces of portlandite are neutralized. The qualitative result is that only a small amount of portlandite in the system is necessary to increase pH above 12.

The water-ash solution was then equilibrated with minerals typical of the Ringold Formation. This resulted in albite, calcite, and montmorillonite reacting to precipitate anorthite and quartz, with no change in pH of the solution.

The solution produced by reaction with vadose zone minerals was then mixed with groundwater at a ratio of 10% meteoric water to 90% groundwater. This mixing and precipitation of plagioclase, calcite, and montmorillonite reduced the pH to 9.7. Barium arsenate and lead hydroxide are also identified as supersaturated phases in PHREEQC, although the amounts of precipitate are very small (Table B-2). Small amounts of hematite, quartz, and boehmite were consumed in this reaction.

B7.0 CONCLUSIONS

The 100-D Ponds received effluent from several different sources in the 100-D Area. The WTF was the source of the greatest volume of effluent, which contained flocculent and sediment entrained in Columbia River water. The MDL contributed a much smaller volume of contaminants but was the likely source of contaminants such as PCBs, although discharge of these and other chemicals has not been documented.

Data from over 5 years of groundwater monitoring clearly demonstrate that operation of 100-D Ponds has not had an adverse effect on groundwater. None of the COCs associated with sediment in the ponds are elevated in groundwater, and most analyses of COCs from the downgradient wells are below detection limit. Table B-1 shows that levels for all COCs are below MTCA B groundwater standards.

Elevated pH values have been recently recorded in two of the three downgradient wells (Hartman 1996). These two wells have historically had higher pH values than the upgradient wells, which is ascribed to the alkaline characteristics of the coal ash underlying and surrounding the ponds. The

Table B-2. Results from Geochemical Modeling of 100-D Ponds, Using PHREEQC. Solution compositions in mg/L.

Analyte	Beginning Solution, Col. R. water + TCLP*	Solution after Reaction w/ ash	Solution after Reaction w/ Ringold	Ave. Upgradient, Well D5-13	Mix 10% Ringold 90 % Upgradient	Solution, Mixed water w/ Ringold	Average Comp. of Downgradient Wells
Al	1.28E-03	0.0000	9.90E-02	8.10E-02	8.28E-02	2.51E-01	2.60E-01
As	1.00E-01	8.92E-02	8.92E-02	4.30E-03	1.28E-02	1.29E-08	2.61E-03
Ba	3.00E-02	6.46E-07	6.46E-07	8.00E-02	7.20E-02	3.69E-02	2.96E-02
Ca	21.25	5599.2	5567.1	43.73	596.0	218.04	25.46
Cd	5.00E-03	5.00E-03	5.00E-03	6.70E-03	6.53E-03	6.53E-03	0.00E+00
Cl	1	1.000399	1.000399	11.801305	10.72	10.720080	3.31
Cr	1.50E-02	1.50E-02	1.50E-02	7.50E-02	6.91E-02	6.90E-02	6.43E-02
F	1.00E-01	1.00E-01	1.00E-01	2.93E-01	2.74E-01	2.74E-01	1.92E-01
Fe	3.50E-02	7.84E-07	1.19E-03	2.52E-01	2.27E-01	1.49E-09	6.01E-01
Hg	2.00E-04	2.00E-04	2.00E-04	2.00E-04	2.00E-04	2.00E-04	8.60E-05
K	1.1	1.10	1.10	3.56	3.32	3.31	3.00
Mg	5.1	7.20E-06	1.14E-03	111.024	99.94	5.64E-09	3.50
N	2.00E-01	2.00E-01	2.00E-01	23.41	21.10	21.09	2.03
Na	2.15	2.15	38.37	5.66	8.932	8.856	4.29
Pb	1.00E-01	1.00E-01	1.00E-01	5.00E-03	1.45E-02	7.83E-04	2.61E-03
S	11	281.2	281.2	17.59	43.94	43.935900	22.86
Sb	3.20E-02	3.20E-02	3.20E-02	0.00E+00	3.20E-03	3.20E-03	6.01E-02
Si	17.8	3455.1	3457.9	5.21	350.3	2.876416	
V	2.00E-03	2.00E-03	2.00E-03	0.00E+00	2.00E-04	2.00E-03	1.07E-02
Zn	1.00E-03	1.00E-03	1.00E-03	1.56E-02	1.42E-02	1.41E-02	7.80E-03
pH	8.6	12.328	12.328	7.98	11.861	9.659	8.46
		mg/kg				**mg/kg**	
Precipitate:	Ca-nontronite	0.061			Ba3(AsO4)2	0.059	
	Ba3(AsO4)2	0.05			Anorthite	2316	
	Hematite	0.027			Albite	0.53	
	Sepiolite	32.2			Calcite	110.2	
	Anorthite		218.6		Montmorillonite	3147	
	Quartz		187.0		Pb(OH)2	0.016	
Reactant:	Anhydrite	624.5 Albite	413.1		Hematite	148.6	
	Portlandite	9670 Calcite	0.448		Quartz	2198	
	Quartz	7398 Mont.	0.0358		Boehmite	1869	

* Average TCLP analyses of sediments for Ba, Cd, Cr, Hg, Pb, Sb, V, and Zn.

recent increase in pH in the downgradient wells is probably related to cessation of discharge to the ponds, allowing more time for infiltrating water to be in contact with the ash and more completely approach equilibrium.

Data collected from different depths show that soil contamination in 100-D Ponds was restricted to the upper layer of sediment (Figure B-4), as COCs are not elevated in the ash immediately underlying the sediment. A geochemical model was employed to evaluate the possibility that contaminants were transported through the upper portions of the vadose zone and deposited in sedimentary deposits beneath 100-D Ponds. This process was postulated by Alexander (1993) in a hydrochemical conceptual model that suggested that the abrupt changes in mineralogy between the coal ash-Ringold interface would create a "geochemical trap" for cationic heavy metals. This argument was purely qualitative and based on some questionable assumptions. For instance, coal ash was invoked as the source for the heavy metals, but analyses of the ash have shown very low values for leachable heavy metals (DOE-RL 1992; Wilson 1990). Leachate compositions of samples from surface sediment in the settling pond also show very low levels of leachable heavy metals (e.g., <0.1 ppm lead, <0.02 ppm total chromium; BHI 1995).

The geochemical model PHREEQC was employed to simulate subsurface reactions between water infiltrating from 100-D Ponds and minerals in the vadose zone and saturated zone. The input parameters were chosen to represent an upper bound of values for heavy metals (using results of TCLP analyses from contaminated surface sediments) and caustic conditions (using portlandite as the calcium oxide phase) in the ash beneath the ponds. Results from this quantitative geochemical analysis show only a trace amount of precipitation of heavy metal-containing minerals at the water table. Most COC-containing minerals are strongly undersaturated, and would not be expected to precipitate.

Results from the PHREEQC model do not perfectly match conditions measured beneath the ponds. For example, the modeled solution has a final pH of 9.7 after mixing with groundwater and precipitation of minerals in the saturated zone. Recent measurements from monitoring wells downgradient of 100-D Ponds had average pH values of 9.3, although some measurements were as high as 9.9 (Hartman 1996). Calcium is markedly higher in the modeled solution than in prevailing groundwater conditions, and iron is lower. With the exception of these deviations, results from the modeled solution correspond closely to those in the groundwater and do not indicate that large amounts of minerals containing heavy metals are present in the subsurface beneath the ponds.

The chemical and modeling data support the argument that most or all of the COCs discharged to 100-D Ponds were immobilized in the flocculent and sediment deposited on the surface of the settling pond. This sediment was removed in August 1996, and samples collected from the bottom of the ponds after this removal show no evidence of contamination in the coal ash. The cleanup action, empirical data, and modeling results indicate that the contamination at 100-D Ponds has been successfully remediated and requires no further action.

B8.0 REFERENCES

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ATTACHMENT B-1

GROUNDWATER CONSTITUENTS ANALYZED IN 100-D PONDS MONITORING

Table Att B-1. Comparison of 40CFR Part 264 App. IX List with 100-D Ponds Groundwater Analyte List (Page 1 of 8).

100-D Pond Analytes	CAS	40CFR Part 264 App. IX List
1,1,1,2-Tetrachloroethane	630-20-6	1,1,1,2-Tetrachloroethane
1,1,1-Trichloroethane	71-55-6	1,1,1-Trichloroethane; Methylchloroform
1,1,2,2-Tetrachloroethane	79-34-5	1,1,2,2-Tetrachloroethane
1,1,2-Trichloroethane	79-00-5	1,1,2-Trichloroethane
1,1-Dichloroethane	75-34-3	1,1-Dichloroethane
1,1-Dichloroethene	75-35-4	1,1-Dichloroethylene; Vinylidene chloride
1,2,3-Trichloropropane	96-18-4	1,2,3-Trichloropropane
1,2,4,5-Tetrachlorobenzene	95-94-3	1,2,4,5-Tetrachlorobenzene
1,2,4-Trichlorobenzene	120-82-1	1,2,4-Trichlorobenzene
1,2-Dibromo-3-chloropropane	96-12-8	1,2-Dibromo-3-chloropropane; DBCP
1,2-Dibromoethane	106-93-4	1,2-Dibromoethane; Ethylene dibromide
1,2-Dichlorobenzene		
1,2-Dichloroethane	107-06-2	1,2-Dichloroethane; Ethylene dichloride
1,2-Dichloroethene		
1,2-Dichloropropane	78-87-5	1,2-Dichloropropane
1,3-Dichlorobenzene		
1,4-Dichlorobenzene		
1,4-Dioxane	123-91-1	1,4-Dioxane
1,4-Naphtoquinone	130-15-4	1,4-Naphthoquinone
1-Butanol		
1-Naphthylamine	134-32-7	1-Naphthylamine
2,3,4,6-Tetrachlorophenol	58-90-2	2,3,4,6-Tetrachlorophenol
	1746-01-6	2,3,7,8-TCDD; 2,3,7,8-Tetrachlorodibenzo-p-dioxin
	93-76-5	2,4,5-T; 2,4,5-Trichlorophenoxyacetic acid
2,4,5-Trichlorophenol	95-95-4	2,4,5-Trichlorophenol
2,4,6-Trichlorophenol	88-06-2	2,4,6-Trichlorophenol
	94-75-7	2,4-D; 2,4-Dichlorophenoxyacetic acid
2,4-Dichlorophenol	120-83-2	2,4-Dichlorophenol
2,4-Dimethylphenol	105-67-9	2,4-Dimethylphenol
2,4-Dinitrophenol	51-28-5	2,4-Dinitrophenol
2,4-Dinitrotoluene	121-14-2	2,4-Dinitrotoluene
2,6-Dichlorophenol	87-65-0	2,6-Dichlorophenol
2,6-Dinitrotoluene	606-20-2	2,6-Dinitrotoluene
2-Acetylaminofluorene	53-96-3	2-Acetylaminofluorene; 2-AAF
2-Chloronaphthalene	91-58-7	2-Chloronaphthalene
2-Chlorophenol	95-57-8	2-Chlorophenol
2-Hexanone	591-78-6	2-Hexanone
2-Methylnaphthalene	91-57-6	2-Methylnaphthalene
2-Methylphenol		
2-Naphthylamine	91-59-8	2-Naphthylamine
2-Nitroaniline		

Table Att B-1. Comparison of 40CFR Part 264 App. IX List with 100-D Ponds Groundwater Analyte List (Page 2 of 8).

100-D Pond Analytes	CAS	40CFR Part 264 App. IX List
2-Nitrophenol		
2-Picoline	109-06-8	2-Picoline
2-sec-Butyl-4,6-dinitrophenol(DNBP)		
3,3'-Dichlorobenzidine	91-94-1	3,3'-Dichlorobenzidine
3,3'-Dimethylbenzidine	119-93-7	3,3'-Dimethylbenzidine
3-Methylcholanthrene	56-49-5	3-Methylcholanthrene
3-Nitroaniline		
4,4'-DDD	72-54-8	4,4'-DDD
4,4'-DDE	72-55-9	4,4'-DDE
4,4'-DDT	50-29-3	4,4'-DDT
4,6-Dinitro-2-methylphenol	534-52-1	4,6-Dinitro-o-cresol
4-Aminobiphenyl	92-67-1	4-Aminobiphenyl
4-Bromophenylphenyl	101-55-3	4-Bromophenyl phenyl ether
4-Chloro-3-methylphenol		
4-Chloroaniline		
4-Chlorophenylphenyl	7005-72-3	4-Chlorophenyl phenyl ether
4-Methyl-2-pentanone	108-10-1	4-Methyl-2-pentanone; Methyl isobutyl ketone
4-Methylphenol		
4-Nitroaniline		
4-Nitrophenol		
4-Nitroquinoline-1-oxide	56-57-5	4-Nitroquinoline 1-oxide
5-Nitro-o-toluidine	99-55-8	5-Nitro-o-toluidine
7,12-Dimethylbenz[a]anthracene	57-97-6	7,12-Dimethylbenz[a]anthracene
9H-carbazole		
Acenaphthene	83-32-9	Acenaphthene
Acenaphthylene	208-96-8	Acenaphthylene
Acetone	67-64-1	Acetone
	75-05-8	Acetonitrile; Methyl cyanide
Acetophenone	98-86-2	Acetophenone
Acrolein	107-02-8	Acrolein
Acrylonitrile	107-13-1	Acrylonitrile
Aldrin	309-00-2	Aldrin
Alkalinity		
allylchloride	107-05-1	Allyl chloride
alpha,alpha-Dimethylphenethylamine	122-09-8	alpha, alpha-Dimethylphenethylamine
Alpha-BHC	319-84-6	alpha-BHC
alpha-Chlordane		
Aluminum		
Americium-241		
Aniline	62-53-3	Aniline
Anthracene	120-12-7	Anthracene
Antimony (Total)		Antimony

Table Att B-1. Comparison of 40CFR Part 264 App. IX List with 100-D Ponds Groundwater Analyte List (Page 3 of 8).

100-D Pond Analytes	**CAS**	**40CFR Part 264 App. IX List**
Antimony-125		
Aramite	140-57-8	Aramite
Aroclor-1016		
Aroclor-1221		
Aroclor-1232		
Aroclor-1242		
Aroclor-1248		
Aroclor-1254		
Aroclor-1260		
Arsenic (Total)		Arsenic
Barium (Total)		Barium
Benzene	71-43-2	Benzene
Benzo(a)anthracene	56-55-3	Benzo[a]anthracene; Benzanthracene
Benzo(a)pyrene	50-32-8	Benzo[a]pyrene
Benzo(b)fluoranthene	205-99-2	Benzo[b]fluoranthene
Benzo(ghi)perylene	191-24-2	Benzo[ghi]perylene
Benzo(k)fluoranthene	207-08-9	Benzo[k]fluoranthene
Benzyl	100-51-6	Benzyl alcohol
Beryllium (Total)		Beryllium
Beta-BHC	319-85-7	beta-BHC
Bis(2-chloroethyl)	108-60-1	Bis(2-chloro-1-methylethyl) ether; 2,2'-Di-
Bis(2-chloroisopropyl)	111-91-1	Bis(2-chloroethoxy)methane
Bis(2-Choroethoxy)methane	111-44-4	Bis(2-chloroethyl)ether
Bis(2-ethylhexyl)	117-81-7	Bis(2-ethylhexyl) phthalate
Bromide		
Bromodichloromethane	75-27-4	Bromodichloromethane
Bromoform	75-25-2	Bromoform; Tribromomethane
Butylbenzylphthalate	85-68-7	Butyl benzyl phthalate; Benzyl butyl phthalate
Cadmium (Total)		Cadmium
Calcium		
Carbon disulfide	75-15-0	Carbon disulfide
Carbon tetrachloride	56-23-5	Carbon tetrachloride
Carbon-14		
Cesium-134		
Cesium-137		
Chlordane	57-74-9	Chlordane
Chloride		
Chlorobenzene	108-90-7	Chlorobenzene
Chlorobenzilate	510-15-6	Chlorobenzilate chlorodiisopropyl ether
Chloroethane	75-00-3	Chloroethane; Ethyl chloride
Chloroform	67-66-3	Chloroform
Chloroprene	126-99-8	Chloroprene

Table Att B-1. Comparison of 40CFR Part 264 App. IX List with 100-D Ponds Groundwater Analyte List (Page 4 of 8).

100-D Pond Analytes	CAS	40CFR Part 264 App. IX List
Chromium (Total)		Chromium
Chromium-51		
Chrysene	218-01-9	Chrysene
cis-1,2-Dichloroethylene		
cis-1,3-Dichloropropene	10061-01-5	cis-1,3-Dichloropropene
Cobalt (Total)		Cobalt
Cobalt-60		
Coliforms		
Copper (Total)		Copper
Cresols		
Cyanide	57-12-5	Cyanide
Delta-BHC	319-86-8	delta-BHC
Di-n-butylphthalate	84-74-2	Di-n-butyl phthalate
Di-n-octylphthalate	117-84-0	Di-n-octyl phthalate
Diallate	2303-16-4	Diallate
Dibenz[a,h]anthracene	53-70-3	Dibenz[a,h]anthracene
Dibenzofuran	132-64-9	Dibenzofuran
Dibromochloromethane	124-48-1	Dibromochloromethane; Chlorodibromomethane
Dichlorodifluoromethane	75-71-8	Dichlorodifluoromethane
Dieldrin	60-57-1	Dieldrin
Diethylphthalate	84-66-2	Diethyl phthalate
Dimethoate	60-51-5	Dimethoate
Dimethyl	131-11-3	Dimethyl phthalate
2-secButyl-4,6-dinitrophenol(DNBP)	88-85-7	Dinoseb; DNBP; 2-sec-Butyl-4,6-dinitrophenol
Diphenylamine	122-39-4	Diphenylamine
	298-04-4	Disulfoton
Endosulfan I	959-98-8	Endosulfan I
Endosulfan II	33213-65-9	Endosulfan II
Endosulfan sulfate	1031-07-8	Endosulfan sulfate
Endrin	72-20-8	Endrin
Endrin aldehyde	7421-93-4	Endrin aldehyde
Endrin ketone		
Ethyl methacrylate	97-63-2	Ethyl methacrylate
Ethyl methanesulfonate	62-50-0	Ethyl methanesulfonate
Ethylbenzene	100-41-4	Ethylbenzene
Famphur	52-85-7	Famphur
Fluoranthene	206-44-0	Fluoranthene
Fluorene	86-73-7	Fluorene
Fluoride		
Gamma-BHC (Lindane)	58-89-9	gamma-BHC; Lindane
gamma-Chlordane		
Gross alpha		

Table Att B-1. Comparison of 40CFR Part 264 App. IX List with 100-D Ponds Groundwater Analyte List (Page 5 of 8).

100-D Pond Analytes	CAS	40CFR Part 264 App. IX List
Gross beta		
Heptachlor	76-44-8	Heptachlor
Heptachlor epoxide	1024-57-3	Heptachlor epoxide
Hexachlorobenzene	118-74-1	Hexachlorobenzene
Hexachlorobutadiene	87-68-3	Hexachlorobutadiene
Hexachlorocyclopentadiene	77-47-4	Hexachlorocyclopentadiene
Hexachloroethane	67-72-1	Hexachloroethane
Hexachlorophene	70-30-4	Hexachlorophene
Hexachloropropene	1888-71-7	Hexachloropropene
Hydrazine		
Indeno(1,2,3-cd)pyrene	193-39-5	Indeno(1,2,3-cd)pyrene
Iron		
Isobutyl alcohol	78-83-1	Isobutyl alcohol
Isodrin	465-73-6	Isodrin
Isophorone	78-59-1	Isophorone
Isosafrole	120-58-1	Isosafrole
Kepone	143-50-0	Kepone
Kerosene		
Lead (Total)		Lead
m-Cresol	108-39-4	m-Cresol
	541-73-1	m-Dichlorobenzene
m-dinitrobenzene	99-65-0	m-Dinitrobenzene
	99-09-2	m-Nitroaniline
Magnesium		
Manganese		
Mercury (Total)		Mercury
Methacrylonitrile	126-98-7	Methacrylonitrile
Methapyrilene	91-80-5	Methapyrilene
Methoxychlor	72-43-5	Methoxychlor
Bromomethane	74-83-9	Methyl bromide; Bromomethane
Chloromethane	74-87-3	Methyl chloride; Chloromethane
	78-93-3	Methyl ethyl ketone; MEK
Iodomethane	74-88-4	Methyl iodide; Iodomethane
Methyl methacrylate	80-62-6	Methyl methacrylate
Methyl methanesulfonate	66-27-3	Methyl methanesulfonate
	298-00-0	Methyl parathion; Parathion methyl
Dibromomethane	74-95-3	Methylene bromide; Dibromomethane
Methylenechloride	75-09-2	Methylene chloride; Dichloromethane
N-Nitroso-di-n-dipropylamine		
N-Nitrosodi-n-butylamine	924-16-3	N-Nitrosodi-n-butylamine
N-Nitrosodiethylamine	55-18-5	N-Nitrosodiethylamine
N-Nitrosodimethylamine	62-75-9	N-Nitrosodimethylamine

Table Att B-1. Comparison of 40CFR Part 264 App. IX List with 100-D Ponds Groundwater Analyte List (Page 6 of 8).

100-D Pond Analytes	CAS	40CFR Part 264 App. IX List
N-Nitrosodiphenylamine	86-30-6	N-Nitrosodiphenylamine
	621-64-7	N-Nitrosodipropylamine; Di-n-propylnitrosamine
N-Nitrosomethylethylamine	10595-95-6	N-Nitrosomethylethylamine
N-Nitrosomorpholine	59-89-2	N-Nitrosomorpholine
N-Nitrosopiperidine	100-75-4	N-Nitrosopiperidine
	930-55-2	N-Nitrosopyrrolidine
Naphthalene	91-20-3	Naphthalene
Nickel (Total)		Nickel
Nitrate		
Nitrite		
Nitrobenzene	98-95-3	Nitrobenzene
Nitrosopyrrolidine		
0,0,0-Triethyl phosphorothioate	126-68-1	0,0,0-Triethyl phosphorothioate
0,0-Diethyl 0-2-pyrazinyl phosphorothioate	297-97-2	0,0-Diethyl 0-2-pyrazinyl phosphorothioate; Thionazin
	95-48-7	o-Cresol
	95-50-1	o-Dichlorobenzene
	88-74-4	o-Nitroaniline
	88-75-5	o-Nitrophenol
o-Toluidine	95-53-4	o-Toluidine
p-Dimethylaminoazobenzene	60-11-7	p-(Dimethylamino)azobenzene
	59-50-7	p-Chloro-m-cresol
	106-47-8	p-Chloroaniline
	106-44-5	p-Cresol
	106-46-7	p-Dichlorobenzene
	100-01-6	p-Nitroaniline
	100-02-7	p-Nitrophenol
p-Phenylenediamine	106-50-3	p-Phenylenediamine
Parathion	56-38-2	Parathion
Pentachlorobenzene	608-93-5	Pentachlorobenzene
Pentachloroethane	76-01-7	Pentachloroethane
Pentachloronitrobenzene	82-68-8	Pentachloronitrobenzene
Pentachlorophenol	87-86-5	Pentachlorophenol
pH		pH
Phenacetin	62-44-2	Phenacetin
Phenanthrene	85-01-8	Phenanthrene
Phenol	108-95-2	Phenol
	298-02-2	Phorate
see Aroclors		Polychlorinated biphenyls; PCBs
		Polychlorinated dibenzo-p-dioxins; PCDDs
		Polychlorinated dibenzofurans; PCDFs
Phosphate		

Table Att B-1. Comparison of 40CFR Part 264 App. IX List with 100-D Ponds Groundwater Analyte List (Page 7 of 8).

100-D Pond Analytes	CAS	40CFR Part 264 App. IX List
Plutonium-238		
Plutonium-239/40		
Potassium		
Potassium-40		
Pronamide	23950-58-5	Pronamide
Ethyl cyanide	107-12-0	Propionitrile; Ethyl cyanide
Pyrene	129-00-0	Pyrene
Pyridine	110-86-1	Pyridine
Radium		
Radium-226		
Ruthenium-106		
Safrol	94-59-7	Safrole
Selenium (Total)		Selenium
Silver (Total)		Silver
	93-72-1	Silvex; 2,4,5-TP
Sodium		
Specific Conductivity		
Strontium		
Strontium-90		
Styrene	100-42-5	Styrene
Sulfate	18496-25-8	Sulfide
sym-Trinitrobenzene	99-35-4	sym-Trinitrobenzene
Technetium-99		
Temperature		
Tetrachloroethene	127-18-4	Tetrachloroethylene; Perchloroethylene;Tetrachloroethene
Tetrachlorophenols		
Tetraethyldithiopyrophosphate	3689-24-5	Tetraethyl dithiopyrophosphate; Sulfotepp
	(Total)	Thallium
Tetrahydrofuran		
Thorium-228		
Thorium-232		
Tin (Total)		Tin
Toluene	108-88-3	Toluene
Toxaphene	8001-35-2	Toxaphene
trans-1,2-Dichloroethylene	156-60-5	trans-1,2-Dichloroethylene
trans-1,3-Dichloropropene	10061-02-6	trans-1,3-Dichloropropene
Tributyl		
1,4-Dichloro-2-butene	110-57-6	trans-1,4-Dichloro-2-butene
Trichloroethene	79-01-6	Trichloroethylene; Trichloroethene
Trichloromonofluoromethane	75-69-4	Trichlorofluoromethane
Trichlorophenols		

Table Att B-1. Comparison of 40CFR Part 264 App. IX List with 100-D Ponds Groundwater Analyte List (Page 8 of 8).

100-D Pond Analytes	CAS	40CFR Part 264 App. IX List
Tritium		
Turbidity		
Uranium		
Uranium-233/234		
Uranium-234		
Uranium-235		
Uranium-238		
Vanadium (Total)		Vanadium
Vinyl acetate	108-05-4	Vinyl acetate
Vinyl chloride	75-01-4	Vinyl chloride
Xylene(m)	1330-20-7	Xylene (total)
Xylene(o)		
Xylene(p)		
Xylenes		
Zinc (Total)		Zinc
Zinc-65		

Analytes in **bold** are measured quarterly in the 100-D Ponds groundwater monitoring wells

Table Att B-2. Types of Analyses Performed for Each 100-D Ponds Monitoring Well Sampling Event.

Collection Date	199-D8-4	199-D8-5	199-D8-6	199-D5-13
3/1/92	G, I			
3/20/92		F, G, I, R, S		
4/16/92	F, G, I, R, S			F, G, I, R, S
4/21/92			F, G, I, R, S	
5/19/92	F, I, P, R, S, V	F, I, P, R, S, V		
5/27/92			F, I, P, R, S, V	F, I, P, R, S, V
6/3/92	F, G, I, R, S	F, G, I, R, S	F, G, I, R, S	F, G, I, R, S
8/13/92	F, G, I, P, R, S, V	F, G, I, P, R, S, V	F, G, I, P, R, S, V	F, G, I, P, R, S, V
9/2/92	F, G, I, R, S	F, G, I, R, S	F, G, I, R, S	F, G, I, R, S
12/14/92	F, G, I, P, R, S, V	F, G, I, P, R, S, V	F, G, I, P, R, S, V	F, G, I, P, R, S, V
2/17/93			G, I	
3/9/93	F, G, I, P, R, S, V	F, G, I, P, R, S, V	F, G, I, P, R, S, V	F, G, I, P, R, S, V
4/6/93			F, R	
6/1/93	F, G, I, R	F, G, I, R	F, G, I, R	F, G, I, R
12/7/93		F, G, I, R, S	F, G, I, R, S	F, G, I, R
12/8/93	F, G, I, R, S			
6/8/94		F, G, I, R	F, G, I, R	F, G, I, R
6/13/94	F, G, I, R			
8/9/94	F, G, I, R	F, G, I, R	F, G, I, R	F, G, I, R
8/26/94				F
11/3/94				F, G
3/14/95	F, G, I, R, S	F, G, I, R, S	F, G, I, R, S	F, G, I, R, S
5/2/95				F, G
8/16/95	F, G, I, R	F, G, I, R	F, G, I, R	F, G, I, R
11/14/95				F, G
12/15/95			F, G	
1/12/96			F, G	
2/27/96		F, G, I, R, S		F, G, I, R, S
2/28/96	F, G, I, R, S	G, I, R	F, G, I, R, S	
3/11/96	F, G		F, G	
5/15/96				F, G
8/5/96	F, G	F, G	F, G	F, G, I

Symbol	Definition	Example of analytes
F=	Field Analysis	conductivity, pH, temperature
G=	General Chemistry	anions, TOC,TOX, turbidity
I=	Inorganic Analysis	metals
P=	Pesticides	various organic compounds, including PCBs
R=	Radionuclides	gross alpha and beta, specific radionuclides
S=	Semivolatile organics	phenol, benzo(a)pyrene
V=	Volatile organics	benzene, toluene, vinyl chloride

APPENDIX C

DATA QUALITY OBJECTIVES SUMMARY REPORT AND DQO WORKSHOP MEETING MINUTES

APPROVAL PAGE

Data Quality Objectives Summary Report for the 100-D Ponds Voluntary Remediation Project

April, 1996

Recorded for the U.S. Department of Energy, Office of Environmental Restoration and Waste Management and the Washington State Department of Ecology Nuclear Waste Program

Bechtel Hanford, Inc.
Richland, Washington

APPROVALS

Keith Holliday, Washington State Department of Ecology, Unit Manager

Keith K. Holliday 4/23/96

Signature Date

Nicole Kimball, U.S. Department of Energy, Unit Manager

Nicole S. Kimball 4/23/96

Signature Date

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EXECUTIVE SUMMARY

The 100-D Ponds are two adjacent disposal ponds that comprise a *Resource Conservation and Recovery Act* (RCRA) interim status treatment, storage, or disposal (TSD) surface impoundment in the 100-D Area of the Hanford Site. The ponds were excavated into previously existing coal ash. The ponds were constructed so that the southern pond, the settling pond, received effluent from a water treatment facility. This pond contains a 2- to 5-ft-thick layer of sediment from backwashing of water filters and rinsate and effluent from the 100-D Area process sewer. The northern pond was an infiltration basin that received overflow water from the settling pond.

The Data Quality Objectives (DQO) process was initiated to identify sampling needs to support excavation of the sediment. The purpose of the sampling will be to provide data to support closure under Washington Administrative Code (WAC) 173-303 Dangerous Waste Regulations. No liquid or groundwater sampling, removal, or treatment is involved in the voluntary action. Results from the DQO process will be used as specifications to prepare a sampling and analysis plan (SAP) to support the closure of this TSD.

The DQO process was based on the U.S. Environmental Protection Agency's guidance of September 1994 (EPA QA/G-4), which uses a seven-step process to logically derive data needs. The process was implemented using the Environmental Restoration Contractor (ERC) Environmental Investigation Procedure (EIP) 1.2 (BHI-EE-01). This procedure identifies ERC responsibilities to support the decision making process. Participants included the Washington State Department of Ecology and the U.S. Department of Energy, Richland Operations Office. ERC supported the process through preparation of materials.

The result of the DQO process was agreement on the scope of sampling and analysis necessary to support the voluntary removal action. Analytes, detection limits, cleanup standards, numbers of samples, and sampling locations were defined. These data will contribute to the eventual closure of the facility. The defined sampling program will be sufficient to determine compliance with cleanup standards directly beneath the ponds near the top of the ash.

The focus of this DQO was to address the sampling and analysis needs of the voluntary action in support of final closure. This was accomplished, with the realization that certain elements necessary for closure of 100-D Ponds would be deferred and addressed at the appropriate time to support approval of the closure plan. Project participants concluded the DQO process had provided sufficient and appropriate scope, effort, and results for the immediate project needs.

DATA QUALITY OBJECTIVES SUMMARY REPORT FOR THE 100-D PONDS VOLUNTARY REMEDIATION PROJECT

1.0 SCOPE AND OBJECTIVES

1.1 Project Objective

The defined, final project objective was to remove sediments located in an inactive *Resource Conservation and Recovery Act* (RCRA) interim status surface impoundment in the 100-D Area of the Hanford Site. This removal action is a voluntary remedial action in compliance with requirements in the Washington Administrative Code (WAC) 173-303 Dangerous Waste Regulations for treatment, storage, or disposal (TSD) surface impoundments.

1.2 Data Quality Objectives

The Data Quality Objectives (DQO) process objective was to define sampling and analysis needs that will be used to support verification sampling, related to the remediation project, for the closure process.

1.3 Exclusions

This DQO process was constrained by several limitations that were defined during the process. The following exclusions on scope were imposed by agreement between participants in order to remain focused on the primary objectives:

- sampling and analysis to support waste designation and disposal
- characterization of the vertical extent of contamination
- definition of sampling needs to define a clean or modified closure.

The exclusions were imposed on the process by the participants for a number of reasons:

- Parallel decision processes, involving higher management levels, had been designated to address specific regulatory processes.

- Project schedule and budget confined the scope of the process.

- Technical support and decision-making structures, external to the process, were not in place to rapidly provide inputs to the process.

- Newly identified technical considerations and issues could not be resolved in a timely fashion to support possible inclusion in the sampling and analysis plan (SAP).

- Project participants agreed that sufficient resources had already been invested in the DQO process to permit the voluntary removal action to proceed as planned.

2.0 FACILITY AND PROJECT BACKGROUND

2.1 Physical Description

The 100-D Ponds (Figure 1) is an interim status RCRA TSD unlined surface impoundment (disposal ponds) in the 100-D Area of Hanford. The two ponds were excavated into previously existing coal ash [126-D-1 Ash Disposal Basin, a *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) unit] from the 184-D Powerhouse. The ponds were constructed so that a southern pond, the settling pond, received effluent from a water treatment facility and process sewer. This pond contains 2 to 5 ft of sediment. The adjacent northern pond was an infiltration basin that received overflow water from the settling pond.

2.2 Discharges and Process Knowledge

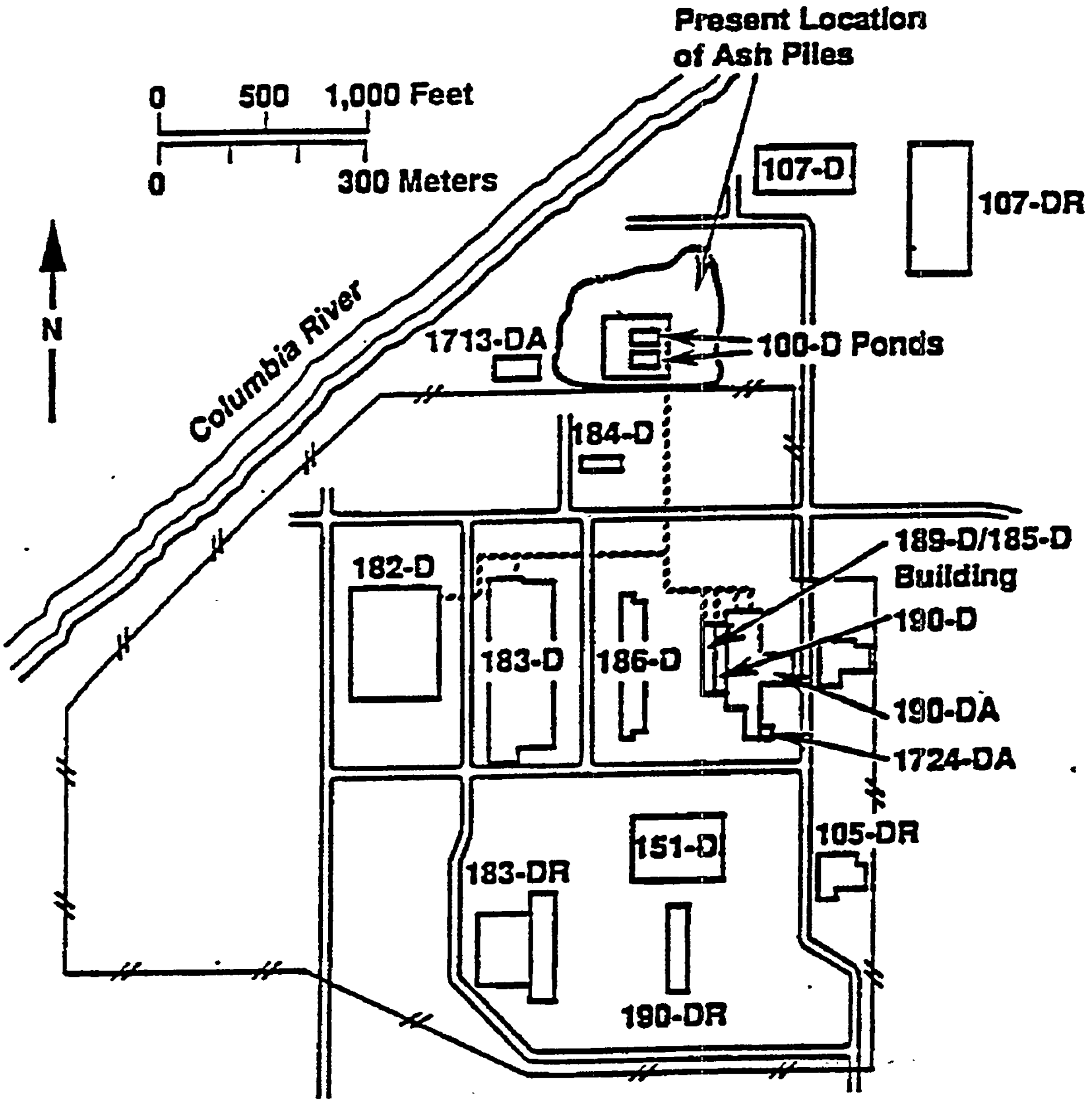
The ponds received aqueous effluent through the 100-D Area process sewer system from 1977 through 1988. The 100-D Ponds Closure Plan (DOE/RL-92-71, March 1993) provides the best available summary of process knowledge. The sources of the effluent were the 183-D Water Treatment Facility (WTF), the 182-D Reservoir, and the 189-D Mechanical Development Laboratory (MDL: 185-D/189-D, 190-D, 190-DA, and 1724-DA facilities). The total effluent volume from the MDL was 530,600 L. The MDL may have contributed volatile organic chemicals, corrosives, and polychlorinated biphenyls (PCBs) through 1988.

After 1988, discharges to the Ponds were from the Reservoir and the WTF only. The reservoir water was overflow of raw river water. The WTF water was an annual washdown effluent from filters and settling basin residues. Both of these effluent sources were nondangerous and nonradioactive (DOE/RL-92-71). All discharges to the ponds ceased in 1994.

2.3 Plan for Removal

The removal action will be a simple excavation, transportation, and disposal action with no known risks to the environment. Approximately 1,350 yd^3 of sediment will be removed down to the top of the ash. This excavation is anticipated to remove all previously identified waste materials and contamination.

Figure 1. Location Map.



2.4 Phase II Sampling Data

Phase II sampling data from BHI-00328, *Data Evaluation: 100-D Ponds, Rev.0,* and BHI-00405, *Data Validation Summary Report for the 100-DR-1 Operable Unit 100-D Ponds Phase II Sampling, Rev. 01,* were available to serve as major inputs of data to the DQO process. During the DQO process this data served as a major focal point of discussion and evaluation. As part of the DQO process, a recess of one month was taken to provide additional reviews of this data by agency chemists. As a result of this review and a review of prior DQO agreements, it was agreed that Phase II analytical data was useful to support the DQO decision-making process, but not compliant with requirements to provide closure verification data.

2.5 Groundwater Monitoring Data

Published groundwater monitoring data (Groundwater Impact Assessment Report for the 100-D Ponds, WHC-EP-0666, July 1993) and data from the Hanford Environmental Information System (HEIS) database were evaluated. To support the DQO process, historical groundwater data from the HEIS database were organized and plotted to identify any plumes and/or potential historical trends of contaminants. No contaminant discharges or plumes could be identified, other than modified pH. It was noted that the process water plume associated with 100-D Ponds was much cleaner than surrounding process waters in the aquifer. It was noted that upgradient plumes with contaminants are encroaching upon the 100-D Ponds area. In the DQO process the groundwater analytical data, monitoring network, and well data were evaluated and judged to be adequate for evaluating the impact of 100-D Ponds activities to groundwater quality.

3.0 PARTICIPANTS AND RESPONSIBILITIES

The key decision maker organizations (Table 1) were the Washington State Department of Ecology (Ecology) and the U.S. Department of Energy (DOE). The roles of the key decision makers were to evaluate available data and to determine the data needs for the SAP. The Environmental Restoration Contractor (ERC) provided technical support to the decision makers. A groundwater-monitoring staff member from Westinghouse Hanford Company (WHC) provided technical support for presentation and analysis of groundwater analytical data. ERC provided a facilitator charged by the procedure to provide independent, unbiased interfaces and logistical support. The facilitator was not included as part of the ERC technical support team. The facilitator was supported by recorders who captured major aspects for the process meetings in minutes for verification by the key decision makers.

Table 1. Participants and Meeting Dates.

PARTICIPANT	December 11, 1995	December 12, 1995	December 21, 1995	January 25, 1996	February 1,1996	February 21, 1996
Keith Holliday, Ecology, key decision maker	X	X	X	X	X	X
Joan Bartz, Ecology		X	X	X	X	
Stan Leja, Ecology			X	X	X	
Nicole Kimball, DOE, key decision maker	X	X	X	X	X	X
Scott Petersen, ERC, task lead	X	X	X	X	X	X
Greg Mitchem, ERC	X	X	X	X		X
Janet Badden, ERC	X	X	X	X	X	X
Chuck Hedel, ERC observer	X	X				
Bill McMahon, ERC			X			
Mary Hartman, WHC			X			
Tammy Ingraham, ERC recorder				X		
Rolanda Jundt, ERC recorder	X		X			
Michelle Kelley, ERC recorder		X				
Tara Childs, ERC recorder					X	X
Sebastian Tindall, ERC, facilitator						X
Scot Adams, ERC, facilitator	X	X	X	X	X	

4.0 PREPARATION

4.1 Interviews

As part of the ERC procedure, the facilitator interviewed key decision makers and ERC project staff. The interviews were used to prepare a draft project information sheet that included a list of planned participants and a summary of issues. The draft project information sheet was reviewed by the interviewees to ensure that concerns were accurately represented.

4.2 Scoping Summary Report

The ERC task lead used the revised project information sheet to prepare an agenda for the kickoff meeting. In response to the information sheet, the ERC task lead identified available input information for the kickoff meeting. During the course of the DQO process meetings, additional aspects of the scoping summary report were identified as attachments to minutes of meetings.

5.0 DATA QUALITY OBJECTIVES (DQO) PROCESS

The U.S. Environmental Protection Agency (EPA) DQO process is a seven-step process based on the September 1994 guidance document EPA QA/G-4. The major purposes of employing the DQO process are to ensure defensible, technical adequacy and to provide a forum for communication between DOE and Ecology. The seven steps provide a logical process to define requirements, evaluate alternatives, select the best, compliant data-acquisition strategies, and to provide for cooperative, interagency decision making.

The process was implemented using the ERC procedure BHI-EE-1.2 (Revision 1, of July 24, 1995). Based on interviews with DOE and regulators, this procedure establishes the site-specific roles and responsibilities and procedural processes for establishing and maintaining interfaces between ERC, DOE, and regulators. The procedure defines DOE and regulators as key decision makers. The ERC role is to support the key decision makers by consolidating data and providing bases for key decision makers to make well-informed and considered decisions. The procedure provides for accelerated face-to-face contacts between project participants, rather than involving multiple levels of hierarchial management structures providing slow-moving exchanges of written documentation. The procedure also incorporates the St. Louis agreement goals to attempt to reduce costs, to accelerate schedules, and to reduce administration and overhead costs.

The team agreed that the approved DQO summary report should be an appendix to the closure plan. If this report does not include the meeting minutes, Ecology has requested that the minutes either be attached or entered into the administrative record as they are approved.

5.1 DQO Step 1-Problem Statement

The first step in the EPA DQO process is the development of a generalized statement of the major objective to be addressed. For this DQO process, the problem statement continued to evolve as the process evolved. Following is the final problem statement:

The 100-D Ponds waste removal action needs to be supported by analysis of shallow coal ash materials underlying the impoundment sediments. The analyses are needed to demonstrate that removal meets the cleanup limits established in the DQO process and to contribute to the data required for closure.

5.2 DQO Step 2-Decisions/Questions

The EPA DQO step 2 involves identifying questions that need to be answered or decisions that need to be made as major contributors to resolving the problem statement in DQO step 1. In this DQO process, the decisions/questions evolved as the problem statement and objectives evolved.

The following are final decisions/questions that identify major considerations necessary to resolve the final problem statement:

1. What are the contaminants of concern (COCs) for supporting the 100-D Ponds waste removal action and will radionuclides be considered?
2. What are the cleanup levels for near-surface soil and what regulatory requirements apply to sampling to support the removal action?
3. Can existing groundwater monitoring data be used to establish equivalence, so that post-closure monitoring is unnecessary? Can the Summers model be used to demonstrate that groundwater will not be impacted by releases from the vadose zone?
4. Should the piping leading to the 100-D Ponds be identified as part of CERCLA remediation scopes of work?
5. Is chromium a COC and is it mobile?
6. How can field screening be used?
7. In what document should sampling and analysis for waste designation and disposal be identified? Should removed waste be segregated by area and will this affect verification sampling?
8. What cost and schedule savings are possible in response to the St. Louis agreements and how can analytical cost be reduced to 8% of project costs?

9. What cleanup scenarios will be considered?

10. Are ERC sampling and analysis procedures adequate?

11. How many samples will be collected to verify cleanup, and from where?

5.3 DQO Step 3-Inputs

This section relates how data (EPA DQO step 3 inputs) will be used to answer step 2 questions. A determination of data sufficiency is needed for existing data. From this, new data needs will be identified that will serve as primary specifications for subsequent data acquisition using a SAP.

QUESTION/PROBLEM	STEP 3-INPUTS	EXPLANATION/RESULT
1. What are the contaminants of concern (COCs) for supporting the 100-D Ponds waste removal action and will radionuclides be considered?	Process knowledge Existing soil analyses Phase II (BHI-00328 and BHI-00405) provided analyses, except Hg Need a major decision-"Is characterization data adequate?"	Provided in closure plan DOE/RL-92-71, Chapter 3 *It was agreed that existing data was not adequate with respect to mercury analyses.* *The COCs were agreed upon as presented in Table 2.* *The numbers of samples were agreed upon, based partly on information in Table 3.* *Detection limits will be evaluated by Ecology when the SAP is submitted for approval. Significant deviations from detection limits listed in Table 2 will be agreed upon by both parties.* *Methods for analyses were agreed upon in Table 2.* Microwave digestion will be used as it is developed as an EPA approved method for extraction for analysis of chrome VI.

QUESTION/PROBLEM	STEP 3-INPUTS	EXPLANATION/RESULT
(CONT.) 1. What are the contaminants of concern (COCs) for supporting the 100-D Ponds waste removal action and will radionuclides be considered?	Water analyses *The groundwater monitoring program was evaluated. (40CFR265.91, -.92)*	***The groundwater network is adequate for monitoring. The groundwater flow direction is adequately known.*** ***The SAP should only address soil sampling for verification. Groundwater and groundwater analyses were declared to be outside of the scope of this DQO process and the planned SAP.*** Groundwater analytical data was evaluated. It could not be concluded that 100-D Ponds released contaminants into the groundwater.
	Radionuclides (DOE Order 5820.2A)	***Radionuclide data will not affect the closure decision. The team agreed that radionuclides are not constituents of concern.*** Any 100-D Ponds-related radionuclide results would be provided to the CERCLA operable unit project.
	Organic analyses	***Existing organic analyses and process knowledge are adequate. Organic analyses, with the exception of PCBs, do not have to be included in the COCs.***
	Inorganic analyses	***Metal analyses need to be included in the COCs (Table 2).*** Ecology will require that additional, available non-COC metals be reported to aid Ecology in the evaluation of QC.
	Background levels	***Table 2 documents agreed- upon background- soil concentrations.*** These values are based upon those in DOE/RL-92-24. Revision 3, which was approved for use on February 20, 1996 (letter from M. Wilson to P.F.X. Dunigan, Jr.)

QUESTION/PROBLEM	STEP 3-INPUTS	EXPLANATION/RESULT
(CONT.) 1. What are the contaminants of concern (COCs) for supporting the 100-D Ponds waste removal action and will radionuclides be considered?	Evaluate PCB W001 inclusion data (ERC provided a rationale for concluding that PCBs were not listed waste, based on available process knowledge)	*Agreement was reached that PCBs would be COCs on Table 2, but would not designate sediments as W001 listed waste for disposal.*
	Verification sampling (the planned scope of the SAP-WAC 173-340-820 and -830)	*Key decision makers agreed to separate the discussion of the request for drilling of boreholes to groundwater for verification sampling from the DQO process.* *Verification of the deeper portions of the vadose zone will not be part of the voluntary action.* *Planned sampling will assess the success of remediation of the upper vadose zone by providing information supporting the waste-removal scope of work, but will not necessarily totally complete verification sampling for the deeper unsaturated zone.* Additional discussions will be held to determine if drilling and sampling are necessary to demonstrate clean closure or provide for modified closure.
	Ash and ash leaching chemistry (WAC 173-340-740)	Use of a demonstration of equivalence of ground water protection for clean closure or a modified closure was deferred until site closure is reexamined. Use of samples for conducting leaching tests was deferred until methods for closure were mutually defined and Ecology developed internal policies on demonstrations for groundwater protection.

QUESTION/PROBLEM	STEP 3-INPUTS	EXPLANATION/RESULT
2. What are the clean up levels for near-surface soil and what regulatory requirements apply to sampling to support the removal action?	MTCA B (WAC 173-340-740) Background levels 100X groundwater level Appendix IX list	*Cleanup levels were established in Table 2. It was agreed that if the MTCA B value is less than the agreed upon background, then the background will be used as a cleanup value.* The bases for selecting cleanup levels for COCs are presented in Table 4.
	Detection limits are lower than cleanup levels for some analytes.	Concern was expressed for the method detection limit for cadmium. Detection limits presented in the SAP will be approved by Ecology.
	Data analysis program (WAC 173-340-740)	Data will be analyzed in compliance with regulations and related guidance.
	Demonstration of groundwater protection (WAC 173-340-740)	*It was agreed to defer consideration of a demonstration until closure is planned.* Ecology will prepare for closure agreements by developing internal policies to implement the generalized WAC requirements.
	Summers model for groundwater protection (WAC 173-340-740)	*Agreement was reached to defer consideration of the use of the Summers model and equivalence until planning for closure is reconsidered.* Ecology will continue internal discussions. A list of input parameters and site-specific values will be needed from ERC.

QUESTION/PROBLEM	STEP 3-INPUTS	EXPLANATION/RESULT
3. Should the piping leading to the 100-D Ponds be identified as part of CERCLA remediation scopes of work?		***Agreement was reached to define the pipes as CERCLA Past Practice unit and not part of the 100-D Ponds TSD. The pipes must be addressed in a TPA primary document.*** Rationale: The pipes serviced earlier discharges to the ash before the ponds were installed and the ash pit is more extensive than the ponds.
4. Is chromium a contaminant of concern and is it mobile?	HEIS data Process knowledge TCLP Phase II analyses	***Chrome VI is a contaminant of concern.*** Chrome values by TCLP from Phase II analyses can not be used to exclude chromium.
5. How can field screening be used?	Field screening methods will not be accepted by Ecology to support closure verification for RCRA TSDs. TSDs will have to meet WAC requirements, not the CERCLA analytical strategy.	Field screening may be used for internal purposes only by ERC.
6. In what document should sampling and analysis for waste designation and disposal be identified?	The Work Plan, which contains the Transportation Plan, will detail disposal options.	***DOE and Ecology agreed that waste designation would be excluded from the scope of the DQO process.*** Rationale: The issue of disposition of waste needs to be addressed in a broader forum and at a higher level of management. DOE and ERC recognized that a major policy issue was involved and participants were not empowered sufficiently to address how RCRA materials could be sent to a CERCLA disposal unit. Also, additional Ecology staff would need to be involved to address waste management.

QUESTION/PROBLEM	STEP 3-INPUTS	EXPLANATION/RESULT
7. What cost and schedule savings are possible in response to the St. Louis agreements and how can analytical cost be reduced to eight percent of project costs??	Possible use of EAL or fixed labs, if Ecology approves of the use of EAL for soil analysis. Cost estimates/ total costs/ project costs/ analysis costs@ method/ # samples	Ecology does not have an accreditation program for soil analysis. EAL is accredited for water analyses. The use of the EAL will result in substantially lower analytical costs compared against outside commercial laboratories, based upon the relatively rapid turn-around time. Ecology has conditionally accepted use of EAL for 100-D Ponds verification samples. *The Tri-Party goal of limiting analytical costs to eight percent of project costs may not be achievable for the RCRA pathway.*
8. What cleanup scenarios will be considered?	Only one removal scenario was considered, because the removal action is extremely simple. Cleanup scenario is consistent with the 100-BC-1, 100-DR-1, and 100-HR-1 ROD.	*The removal scenario is not expected to affect sampling. Details related to removal will be discussed outside of this DQO process.*
9. Are ERC sampling and analysis procedures adequate?	ERC and Ecology agreement. List of QA/QC procedures.	*The SAP will ensure that field duplicates are correctly sampled in response to the concerns from Ecology. Letter 89-RB-115 notifies Ecology that they will have the opportunity to review procedures. They are on distribution for BHI-EE-01.*
10. Should removed waste be segregated by area and will this affect verification sampling?	Character and distribution of waste, especially radiological materials.	*The bulk of the waste will be removed as a single mass.*

QUESTION/PROBLEM	STEP 3-INPUTS	EXPLANATION/RESULT
11. How many samples will be collected to verify cleanup, and from where?	Need some level of statistical confidence (Table 3); consider earlier characterization data.	*Judgement samples will be collected at Phase II sampling locations TP1, TP2, S1, S5, S6, & S7. Three samples will be randomly collected from the center of the settling pond, and 5 from the percolation pond. The banks will be sampled on the lower third, with one sample collected for every 100 m^2 of surface area. A total of approx. 18 samples will be collected.*

Table 2. *Constituents of Concern, Bounding Values, and Cleanup Limits for 100-D Ponds.*

					Groundwater Criteria					
Analyte	*Highest value < 2'* mg/kg	*Highest value > 2'* mg/kg	*MTCA B Soil* mg/kg	*Sitewide BG* mg/kg	*Summers Model* mg/kg	*MCL*10 0* mg/kg	*MTCA B 100*GW* mg/kg	*Reg. limit to apply*	*Cleanup Limit* mg/kg	*DL*
Aroclor-1254	17.0	<0.036	0.13[a]	0	881	0.05	0.112	MTCA B	0.13	0.036
Aroclor-1260	12.0	<0.036	0.13[a]	0	881	0.05	0.112	MTCA B	0.13	0.036
Antimony	9.9	8.8	32	31[b]	13	0.6	0.64	DL	10	10
Arsenic	45.3	2.1	1.67	6.47	0.22	5	0.0058	BG	6.47	1
Barium	639	128	5600	132	41571	200	112	BG	132	20
Beryllium	1.3	0.58	0.23	1.51	0.60	0.4	0.002	BG	1.51	0.7
Cadmium	6.3	0.46	80	11[b]	356	0.5	1.6	DL	1	1
Chromium, total	226	12.8	80000	18.5	23755	10	1600	BG	18.5	2
Chromium VI	45.2[c]	2.56[c]	400				8	100*GW	8	0.1
Copper	202	17.8	2960	22	26368	130	59.2	100*GW	59.2	2.5
Lead	5191	3.8	250[e]	10.2	223		0.5c	BG	10.2	0.3
Manganese	421	590	11200	512	5939	5*	224	BG	512	1.5
Mercury[d]	18.3	0.031	24	0.33	214	0.2	0.48	BG	0.33	0.02
Nickel	24	13.9	1600	19.1	14253	10	32	BG	19	4
Silver	4.6	0	400	0.73	3563	10*	8	100*GW	8	20
Thallium	0.43	0	5.6	3.7[b]		0.2	0.112	DL	1	1
Vanadium	242	83.9	560	85.1	8314		11.2	BG	85.1	5
Zinc	1050	71.3	24000	67.8	213792	500*	480	100*GW	480	2

a MTCA B value is for total PCBs. CLARC II (Feb., 1996) lists Aroclor-1254 at 1.6 mg/kg.
b Highest background value, 90th percentile not calculated owing to paucity of data
c Value is extrapolation of TCLP analyses on SP-7, a Phase I surface sample from the settling pond
d Only 1 sample below 2' was analyzed, in an Ecology split sample
e MTCA Method A values used for lead, as required by Ecology* Secondary MCL
Cadmium: Value given is for volcanic ash found on Savage Island. Topsoil values range from DL to 3.1.

MTCA B=MTCA B soil value
BG=background
DL=detection limit
100*GW=100*MTCA B groundwater value
Sitewide BG = Lognormal 90th percentile of the Sitewide background data set

Table 3. Numbers of Samples Computed for 100-D Ponds Verification Sampling.

	Cleanup Level	Greater than 2 feet					Number of Samples
		mean	st.dev.	min	max	n	
Aluminum		4811.25	1033.59	3710	7050	8	
Antimony		6.43	1.55	4.7	8.8	7	
Arsenic	6.47	1.10	0.60	0.58	2.1	8	5
Barium	132	104.93	13.66	88	128	8	7
Beryllium	1.51	0.45	0.07	0.34	0.58	8	1
Cadmium	11	0.43	0.03	0.41	0.46	3	0
Calcium		7718.75	3741.45	3530	13900	8	
Chromium	18.5	6.34	2.86	4.1	12.8	8	15
Cobalt		12.33	1.91	9.4	16.1	8	
Copper	22	15.05	2.25	10.1	17.8	8	6
Iron		22162.50	6956.18	11200	31200	8	
Lead	10.2	2.35	0.75	1.5	3.8	8	3
Magnesium		4681.25	684.68	3470	5600	8	
Manganese	512	370.13	100.79	274	590	8	24
Nickel		9.19	2.56	6.2	13.9	8	
Potassium		574.75	168.66	366	800	8	
Silver					0	0	
Sodium		171.75	38.94	108	241	8	
Thallium					0	0	
Vanadium	85.1	61.40	11.81	42.9	83.9	8	12
Zinc	480	51.90	9.34	43.5	71.3	8	0

Sample size based on guidance in EPA-230-2-89-042, using :

- alpha = false positive rate = 0.05 i.e., 5% chance that site is declared clean when it is not
- beta = false negative rate = 0.80 i.e., 20% chance that site is declared dirty when it is not

Table 4. Bases of Cleanup Criteria. Pertinent regulations for cleanup levels cited in Table 2.

Criterion	Document(s)	Specific Reference	Application
MTCA B	-Model Toxics Control Act, Washington Administrative Code 173-340; January, 1991. -Model Toxics Control Act Cleanup Levels and Risk Calculation (CLARC II) Update; August, 1994.	WAC 173-340-740(3), Soil Cleanup Standards, Method B cleanup levels. Method B Formula Values.	Cleanup standard for residential scenario. Default cleanup unless superseded by other criteria listed below.
Background (BG)	-Model Toxics Control Act, Washington Administrative Code 173-340; January, 1991.	WAC 173-340-700(4)(d).	If cleanup level is less than natural background, background should be used as a cleanup level.
	-Washington State Department of Ecology Toxics Cleanup Program, Statistical Guidance for Ecology Site Managers; August, 1992.	Soil Cleanup Standards Based on Background Data, Section 4.3.3.2.	Background value is the 90th percentile of the lognormal distribution.
	-Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes, Rev. 3, DOE/RL-92-24; October, 1995.	90th percentile of the lognormal distribution, presented in Summary Table 2.	Background data set accepted by Ecology for evaluation of data for the Hanford Site.
Detection Limit (DL)	-Model Toxics Control Act, Washington Administrative Code 173-340; January, 1991.	WAC 173-340-707(2), Analytical considerations	If the practical quantitation limit is higher than the cleanup level for that substance, the practical quantitation limit will be the cleanup limit.
100*Groundwater Method B Cleanup Limit	-Model Toxics Control Act, Washington Administrative Code 173-340; January, 1991.	WAC 173-340-740(3)(a)(ii)(A).	Cleanup limit shall not be greater that one hundred times the groundwater cleanup level established in accordance with WAC 173-340-720, unless it can be demonstrated that a higher soil concentration is protective of ground water at the site.

5.4 DQO Step 4-Boundaries

Possible separation or subdivision of area was considered. *There will no subdivision of the two ponds.*

The lateral extent of contamination is to be addressed by sampling in the banks of the ponds.

The vertical extent of contamination remains to be addressed outside of the DQO process. Ecology has requested more data and DOE has responded with a rationale for setting the vertical extent of contamination near the top of the ash. The current status is that Ecology is concerned that the vertical extent remains to be identified and DOE is convinced that the potential for downward migration is limited. DOE has proposed using two different vadose zone transport models (the Summers model and the unit gradient model) to address groundwater protection. Ecology has proposed drilling three holes to groundwater and sampling at various intervals.

"Should the two ponds have separate sampling needs?" and "Should the waste be separated into layers as separate lifts?" was considered as a concern. ***It was agreed that the ponds should be addressed as a single unit.***

The project schedule (temporal boundary) is driven by the removal action in July and the planned availability of ERDF.

It was agreed that influent pipes would not be considered to be part of this TSD. Instead, they will be included in a CERCLA focused feasibility study or another primary CERCLA document, as defined in the TPA.

5.5 DQO Step 5-Decision Rules

In the DQO process model decision rules are prepared to identify how future (post-DQO process) decisions will be made.

Participants considered this step and concluded that the invested level of effort was sufficient to support the planned scope of work for this fiscal year. Additional considerations will need to be finalized in the next revision of the closure plan, as a minimum.

5.6 DQO Step 6-Uncertainty

In the DQO process this step addresses how statistical confidence and uncertainty is addressed. Under MTCA closures (WAC 173-340-740) mandatory statistical processes are identified. For this DQO process, the required MTCA processes will be deferred to the revision of the closure plan. For the verification that is planned for excavation to the base of the sediment in the ponds, a sampling scheme was adopted, loosely based on EPA guidance using a 95% false positive confidence rate. Additional sample locations have been added to address selected concerns.

Additional samples in the banks have been added to verify definition of the lateral extent of potential contamination. Participants considered this step and concluded that the invested level of effort was sufficient to support the planned scope of work for this fiscal year. Additional discussions will be extended outside of the DQO process to discuss the vertical extent of potential contamination in response to the Ecology concerns about confidence in the basis for defining the vertical extent of contamination.

5.7 DQO Step 7-Optimization

This step is designed to identify how planning improved efficiency. Participants considered this step and concluded that the invested level of effort was sufficient to support the planned scope of work for this fiscal year.

6.0 COST AND SCHEDULE SAVINGS

This section is required by the ERC DQO procedure in response to the Tri-Party Agreement St. Louis agreement to jointly improve the efficiency and effectiveness of planning. Ecology, EPA, and DOE have committed to reducing the cost of sampling and analysis to 8% of project costs. This DQO process included consideration of cost and schedule reductions. The process was only able to identify reduction of the COC list and use of the EAL laboratory as cost savings mechanisms. Because of a lack of an available basis for estimating costs, specific savings could not be estimated at the time of consideration. The number of samples to be taken is higher than anticipated before starting the process, because of the perceived poor confidence in establishing the extent of contamination.

7.0 LESSONS LEARNED

This DQO process provided a number of lessons as follows.

1. More complete development of the scoping summary report in advance of initiating the process could expedite the process. The ERC procedure needs to be more explicit about the importance of preparation of the report and the level of detail needed to support the DQO process.

2. The authority to reach agreements within the DQO process remains elusive as long as major policy issues remain outside the authority of participants. Various expedited approaches, such as use of field screening techniques to support closure, use of risk-and-depth-based human protection criteria, use of indicator parameters, etc., remain to be

accepted for use at RCRA sites, using the strict interpretation of RCRA and WAC standards.

3. To resolve waste management issues, additional organizational components within Ecology need to be included in the DQO teams.

4. The evaluation of new, proposed methods is problematic and will require an extensive to-be-determined process to achieve approval for use. In this DQO process acceptance of methods to demonstrate protection of groundwater were problematic. Acceptance of models and demonstrations remain to be achieved. Groundwater protection is a significant issue that needs to be addressed to permit RCRA units to be closed in the future. Probably, it is unrealistic to expect that acceptance of new methods will be achieved during the duration of a DQO process. A more effective approach may be to propose the new methods or approaches in advance of the DQO process to permit a longer duration of evaluation by various organizational offices and parallel organizations and levels of management. For this DQO the alternative methods were proposed by letter; perhaps the start of this consideration will aid subsequent RCRA processes involving similar concerns.

MEETING MINUTES FOR DECEMBER 11, 1995 100-D PONDS DQO KICKOFF MEETING

ATTENDEES
Keith Holliday/ Ecology/ 736-3036
Nicole Kimball/ DOE-RL/ 376-4670
Scott Petersen/ ERC/ 372-9574
Greg Mitchem/ ERC/ 372-9632
Janet Badden/ ERC/ 372-9033
Scot Adams/ ERC DQO Facilitator/ 372-9307
Rolanda Jundt/ ERC Recorder/ 372-9324
Chuck Hedel/ ERC (non-participating observer)/ 372-9637

SUMMARY OF MEETING

This meeting was the initial meeting for an EPA data quality objectives (DQO) process to establish the sampling requirements for verifying clean closure of the 100-D Ponds RCRA past-practice treatment, storage, disposal (TSD) facility. Verification sampling will be conducted after removal of sediment as a voluntary cleanup action. It was noted that this was the first DQO process with only one regulatory agency involved. A brief description of the proposed DQO process was distributed. Ecology requested documents so that the adequacy of past characterization could be evaluated. Consideration of available groundwater data was deferred until December 21 at which time groundwater data will be presented. Numerous action items were assigned to provide inputs to the DQO process.

DISCUSSION

A proposed agenda for discussion (Attachment 1) and a brief summary description (Attachment 2) were distributed. The summary description identified past characterization results and outlined the removal for closure of two feet of sediment from one of the two ponds, the settling pond. Ecology identified that two additional Ecology participants will be introduced into the DQO process. Joan Bartz will address analytical needs and Stan Leja will address hydrology (see action item DPOND3). The adequacy of existing characterization data (Attachments 3 and 4) was discussed. It was noted that a prior DQO agreement was used to drive characterization sampling (Attachment 5).

Ecology identified this proposed removal action as a low risk concern and as a voluntary removal action, rather than as an expedited response action. Ecology identified the need to review existing characterization data.

The boundary (DQO step 4) remains to be set for this TSD. A February 15, 1995 letter between Nemec and Rasmussen (Attachment 6) needs to be considered. DOE will evaluate the feasibility of including the concrete piping leading to the RCRA TSD ponds in the surrounding CERCLA operable unit and including the piping in a primary CERCLA document (action item DPOND1).

ERC presented a working draft table of potential analytes to use for cleanup verification (not attached). Action items DPOND2, DPOND4, and DPOND5 were assigned to continue developing this table. Radionuclides will be considered, but are not part of the TSD closure process. The cleanup values in this table will be applied below the two foot removal depth. ERC will develop proposed sampling tables to accompany the table (action item DPOND6). The table will include types of samples, numbers of samples, methods, and analytes. Ecology indicated that field analysis methods were of no interest to Ecology with respect to verification analyses. ERC will prepare a list of analytes to be dropped from additional attention.

AGREEMENTS

(Agreement statements are identified with underlining and bolding. These agreement statements are subject to revision through the remainder of the DQO process as additional aspects are introduced into the process.)

The team agreed that the approved DQO summary report should be an appendix to the closure plan.

The closure plan is not within the scope of this DQO process. (Rationale: Additional aspects will need to be considered for the closure plan. The closure plan will not be reconsidered until after July, 1996.)

The issue of disposition of waste will be outside of this DQO process. (Rationale: The issue of disposition of waste needs to be addressed in a broader format and at a higher level of management. The issue will need to address the Environmental Restoration Disposal Facility and RCRA-CERCLA integration issues. ERC will propose a process-knowledge basis for not using the W001 designation for waste relative to PCBs (action item DPOND7). Ecology will internally address the W001 waste issue as action item DPOND8. The implication of this agreement is that only analyses taken below the sediment will be included in this DQO process.)

The team agreed that radionuclide concerns are outside of the RCRA TSD scope. Any D Pond related radionuclide results would be provided to the CERCLA operable unit project.

It was agreed that if the MTCA B value is less than background, then the background will be used as a cleanup value.

NEW ACTION ITEMS

DPOND 1- Obtain internal DOE/RL agreement that piping will be identified as CERCLA-operable-unit scope in the next primary CERCLA document (possibly the low priority FFS), as identified by Ecology and EPA.
Nicole Kimball and Glenn Goldberg

DPOND2- Amend table of regulatory levels/potential action levels for analytes and date all working materials.
Scott Petersen

DPOND3- Conduct initial interviews with newly identified Ecology participants- Joan Bartz and Stan Leja.
Scot Adams

DPOND4- Revise tables to address PCB limits and to add missing or corrected values for other analytes. Add a column for selected standards. Document in short text format the rationale for selection of standards.
Scott Petersen

DPOND5- Prepare a description of proposed" demonstrations." Propose background values for Sb, Tl, and Cd. Make a list of proposed COPCs and identify cost savings of minimizing the number of analytes. This would be an accomplishment of the DQO process. Delete consideration of radionuclide analytes.
Scott Petersen

DPOND6- Prepare a strawman data acquisition list including analytes, types of samples, analytical and field analytical methods, and number of samples. Include justifications where appropriate. Include input from field sampling staff.
Scott Petersen

DPOND7- Prepare a proposed basis for the potential designation of W001 PCB waste for evaluation by Ecology.
Janet Badden

DPOND8- Obtain necessary Ecology support to make a decision relative to potential W001 waste.
Keith Holliday

DPOND9- Provide a clean, dated set of attachments to minutes including the following: December 11 version of the scoping summary report, the Phase II data report, the Phase II data validation report, the Phase II DQO record agreement, copy of the cited Ecology piping letter (2-15-95), and December 11 outline for discussion.

Scott Petersen and Greg Mitchem

DPOND10- Formulate DQO step 2 questions/decisions.
Scott Petersen

DPOND11- Provide a groundwater data package to Stan Leja.
Scott Petersen

ATTACHMENTS

Attachment 1. 100-D Ponds DQO Process: Outline for Discussion
Attachment 2. 100-D Ponds DQO Scoping Summary Report
Attachment 3. Data Evaluation: 100-D Ponds, BHI-00328, Rev. 01
Attachment 4. Data Validation Summary Report for the 100-DR-1 Operable Unit 100-D-Ponds Phase II Sampling, BHI-00405, Rev. 0
Attachment 5. 100-D Ponds (TSD# D-1-1) Data Quality Objectives Decisions/ Agreements/ Commitments (final approval date- December 16, 1994)
Attachment 6. February 15, 1995 letter between Nemec and Rasmussen

MEETING MINUTES FOR DECEMBER 12, 1995
100-D PONDS DQO MEETING

ATTENDEES

Keith Holliday/ Ecology/ 736-3036
Nicole Kimball/ DOE-RL/ 376-4670
Scott Petersen/ ERC/ 372-9574
Greg Mitchem/ ERC/ 372-9632
Janet Badden/ ERC/ 372-9033
Joan Bartz/ Ecology/ 736-5707
Scot Adams/ ERC DQO Facilitator/ 372-9307
Michelle Kelly/ ERC Recorder/ 372-9588
Chuck Hedel/ ERC(non-participating observer)/ 372-9637

SUMMARY OF MEETING

This meeting primarily dealt with completion of action items related to identifying and assembling data and to identifying objectives for this data quality objectives process. A large part of the meeting involved identifying how Ecology will evaluate the adequacy of existing data and identifying concerns of Ecology related to the prior characterization sampling and analysis. New action items were assigned to help set the stage for an ERC's groundwater briefing on December 21 and for actually beginning the DQO process steps on January 19.

ACTION ITEMS

PRIOR ACTION ITEMS

DPOND1- DOE agreed that piping will be including in a low priority CERCLA focused feasibility study.

DPOND2 and 4- Another version of the scoping summary report (Attachment 1) was distributed. Table 2 added highest values for samples above a depth 2 feet. A preliminary list of contaminants of potential concern (COPCs) was discussed.

Ecology stated that prior TCLP analyses probably could not be used to eliminate COPCs for verification sampling, if analytical values were close to regulatory limits. Ecology will review the table; Joan and an additional two Ecology chemists, Jerry Yokel and Alex Stone, will conduct the reviews. Because of holiday schedules, results of the reviews would not be available until the middle of January. Ecology will have offline discussions with Scott Petersen. These communications will be documented by cc:Mail. Ultimately a list of COPCs for verification analyses must be reached and must be documented by cc:Mail. It would be a time saving to document this agreement outside of a DQO meeting. PCBs should be considered.

Ecology noted that mercury was forgotten in the sampling plan for Phase II, written to the previous DQO process agreement. Ecology noted concerns about quality assurance and quality control, particularly in respect to field duplicates. Ecology requested that ERC procedures be reviewed by the ERC task lead to consider this concern. Ecology identified that TCLP characterization data was unusable for verification purposes, as identified in prior correspondence. According to Ecology, DOE was aware that this data was to be used for characterization only. ERC related that the most recent revision of the data report had incorporated Ecology's related concerns. DOE and contractors have the burden of proof to prove site is clean, anything with potential to be close to regulatory limit must be proved to be clean. Ecology requested that the use of the EAL laboratory be considered as a possible cost reduction measure.

ERC requested that Ecology propose COPCs during their evaluation. ERC proposed that an analog strategy used for the 183-H DQO be considered for use. Ecology stated that this strategy was not relevant and that field screening was not relevant to this DQO process for verification sampling.

DPOND3- Completed

DPOND5- Deferred to groundwater discussion on December 21.

DPOND6- ERC presented a table for proposed samples (Attachment 2) and explained that the proposed number of samples was selected using EPA guidance for random sampling.

Ecology noted that Phase II samples were all biased toward sampling hot spots. Ecology noted that because the sample set was biased, the surface area may have to be considered.

DPOND7: ERC distributed a draft "Determination of PCB Contaminated Soils at 100 D Settling Pond Will Not Designate as W001 Dangerous Waste" (Attachment 3). The text explained that the process knowledge does not fit the W001 waste designation definition; therefore, the waste is not designated at W001. A related Ecology letter to Bonneville Power Administration was distributed (Attachment 4).

DPOND8- Deferred to January 19 meeting.

DPOND 9- Completed.

Ecology requested a copy of the letter from A. Stone to N. A. Werdel (Dec. 94 - Administrative Record), that states that Phase II samples were to be used for characterization only.

DPOND10- Deferred to January 19.

DPOND11- Completed.

An additional draft action item 12 from the prior draft minutes was deleted by agreement.

NEW ACTION ITEMS

DPOND12- Review table of analytes, hold informal contacts with Scott Petersen, document by cc. Mail, evaluate proposed sample sizes, and provide written comments before January 19 meeting.
Keith Holliday and Joan Bartz

DPOND13- Provide a copy of the A. Stone and A. Huckaby to N.A. Werdel letter that states that analyses of samples from Phase II were only to be used for characterization purposes.
Greg Mitchem

DPOND14- Provide a summary of groundwater data to the team members.
Scott Petersen

DPOND15- Provide copies of the EPA G-4 standard and the ERC DQO procedure to Joan Bartz.
Scot Adams

DPOND16- Review the ERC sampling procedure(s) to verify that it (they) clearly distinguishes between splits and duplicates to ensure that "true field duplicates" are taken. Scott Petersen will speak with the Lead Sampler and check the sampling log book for clarification.
Scott Petersen

DPOND17- Review revision 01 of the characterization report (BHI-00328) by January 15 and provide written comments. (This review was intended to propose a COPC list.)
Joan Bartz

DPOND18- Provide a copy of the R.E.Cordts to J. M. Bruggeman letter of November 30, 1995.
Janet Badden

DPOND19- Provide a copy of the background data application guide/manual to Joan Bartz.
Scott Petersen

DPOND20- Provide a summary of RCRA groundwater monitoring data to Stan Leja (in advance of the groundwater data meeting).
Scott Petersen

DPOND21- Provide an agenda for the December 21 meeting to Keith Holliday.
Scot Adams and Scott Petersen

DISCUSSION

Ecology will want to check and see if the EAL will have capabilities to analyze verification samples and to review EAL detection limits.

A discussion was held relative to Ecology's concerns over Phase II sampling and related log books, locations, and prior review comments. A current revision of Phase II data (BHI-00328, Rev. 01) was provided to Ecology for formal written review. ERC identified specific changes that had been made in the latest draft.

ERC proposed that mercury samples should be included in future sampling.

ERC will provide a copy of an "extraction process" letter.

Ecology wants to distinguish between field screening and doing analyses in a fixed field laboratory. Ecology's (unwritten) position is that field screening done in the process of removal is of no regulatory concern to Ecology. It is for internal remediation assurance only. Ecology wants to ensure that any field screening is not included in the scope of the SAP. According to MTCA, field screening data are not admissible for comparison to MTCA values.

AGREEMENTS

(Agreement statements are identified with underlining and bolding. These agreement statements are subject to revision through the remainder of the DQO process as additional aspects are introduced into the process.)

It was agreed that influent pipes would not be considered to be part of this TSD. Instead, they will be included in a CERCLA focused feasibility study.

ATTACHMENTS

Attachment 1. 100-D Pond DQO Scoping Summary Report, December 12, 1995
Attachment 2. Sample size spread sheet with formula
Attachment 3. Determination that PCB Contaminated Soils at 100 D Settling Pond Will Not Designate as W001 Dangerous Waste
Attachment 4. Letter- Vern Meinz (Ecology) to Vernon Shipe (Bonneville Power Administration)

MEETING MINUTES FOR DECEMBER 21, 1995
100-D PONDS DQO MEETING

ATTENDEES

Keith Holliday/ Ecology/ 736-3036
Nicole Kimball/ DOE-RL/ 376-4670
Scott Petersen/ ERC/ 372-9574
Greg Mitchem/ ERC/ 372-9632
Janet Badden/ ERC/ 372-9033
Stan Leja/Ecology/ 736-3046
Joan Bartz/ Ecology/ 736-5707
Mary Hartman/WHC/ 376-9924
Bill McMahon/ ERC/ 372-9591
Scot Adams/ ERC DQO Facilitator/ 372-9307
Rolanda Jundt/ ERC Recorder/ 372- 9324

SUMMARY OF MEETING

This meeting involved a presentation on RCRA groundwater monitoring. The D Ponds were associated with the discharge of water that was comparatively significantly cleaner than adjacent effluent groundwater plumes. The D Ponds were located within coal ash pits. Basic groundwater is associated with water that infiltrated through the ash. Contaminants in the groundwater associated with the effluent waters and sediments of the D Pond remain to be identified as distinct from other sources. The locations and the history of locating wells were reviewed as related to the direction of flow and the effectiveness of downgradient monitoring. Action items were assigned to plot and interpret available data.

A brief discussion was held about the ERC proposal to use a demonstration of equivalency to permit closure without long-term monitoring.

A presentation was given as an introduction to the Summers model for protection of groundwater from infiltration through contaminated soil. Action items were assigned to evaluate the use of the model.

No decisions were made, because the purposes of the meeting were to present data and identify issues. The next DQO meeting will involve closing action items and working through the DQO process steps and reaching definitive agreements.

NEW ACTION ITEMS

DPOND22 - Plot HEIS groundwater data as concentrations versus time. The requested format is as histograms bar graphs ("block diagrams"). Regulatory limits (MTCA B and MCLs) should be superimposed as lines paralleling the time axis.
Scott Petersen

DPOND23 - Talk to Ecology staff to clarify review comments relative to an equivalency demonstration and to the placement of wells. A decision should be available by the next meeting on January 19, 1996.
Keith Holliday

DPOND24 - Provide a reprint or text supporting the Summers model to Stan.
Bill Mc Mahon

DISCUSSION

This meeting involved discussion of available data (DQO inputs) related to groundwater. These remain to be linked to DQO questions/questions and DQO steps.

Groundwater Data

Mary Hartman distributed materials relating to groundwater issues (Attachment 1), contaminants (Attachments 2 and 3), and 100 D Pond wells, water chemistry, flow direction, water table elevation, plumes, constituents, and time plots (Attachment 4). The effects of multiple influences were described- upgradient contaminant plumes, effects of coal ash, fluctuations in river levels, and effects of discharges to the D Pond. The water discharged to the D Ponds apparently was much cleaner than the surrounding process-effluent groundwater. The water under the D Ponds is degrading with time as upgradient chromium, nitrate, and tritium plumes migrate under the ponds.

The history and objectives of locating monitoring wells were reviewed. Multiple objectives were served to measure influences on the chemistry of associated waters by the approved locations of the monitoring wells. To date, no obvious specific impacts to groundwater have been inferred as related to waste constituents in the sludge in the ponds. The use of analyte lists from WAC 173-303-9905 and RCRA Appendix IX was discussed. The total volume of analytical results was overwhelming. Consequently, Ecology requested that the data be presented in a useable summary format (action item DPOND22).

ERC provided reprints related to the chemical effects of infiltration of effluents passing through coal ash (Attachments 5, 6, and 7).

Equivalence

ERC discussed the purpose and regulatory context of a demonstration of equivalence (Washington Administrative Code 173-303-645 and 40CFR270 and 40CFR271). Attachments 8 and 9 were provided to furnish additional regulatory interpretation of the equivalence issue. Ecology agreed to evaluate the strategy and to provide a proposed decision by January 19, 1996 (Action Item DPOND23). ERC recommended decontamination and a clean, final closure with an equivalence demonstration to avoid preparing a post-closure permit and incurring post-closure monitoring costs. The equivalence would provide a demonstration of protection of the groundwater.

Modeling for Protection of Groundwater

ERC presented an oral description of the Summers model for conservatively estimating the mobility of contaminants in the vadose zone and impacts to groundwater. Assumptions and site-specific variables were identified. Site-specific variables remain to be quantified.

Boundaries

The boundaries of the D Ponds TSD were discussed, but no related decisions were made. Identifying a bottom depth of the D Ponds was expressed as a particular concern. This will be addressed in a future meeting.

ATTACHMENTS

Attachment 1. Questions to Consider for Groundwater at 100-D Ponds
Attachment 2. Constituents Analyzed in D-Ponds Wells
Attachment 3. Constituents of Potential Concern at the 100-D Ponds
Attachment 4. 100-D Ponds Groundwater
Attachment 5. Effects of Ash Disposal Ponds on Groundwater Quality at a Coal-Fired Power Plant, Nat. Res., Vol. 21, No. 4, pp. 417-426, 1987
Attachment 6. The Effects of Fly Ash and Flue-Gas Desulfurization Wastes on Groundwater Quality in a Reclaimed Lignite Strip Mine Disposal Site, 1987
Attachment 7. Qualitative Model of Heterogeneous Equilibria in a Fly Ash Pond, Environmental Science and Technology, Vol.12, No. 9, pp. 1056- 1062, September, 1978
Attachment 8. 52FR 45788
Attachment 9. OSWER Policy Directive # 9476.00-18
Attachment 10. Summers model viewgraph

MEETING MINUTES FOR JANUARY 25, 1996
100-D PONDS DQO MEETING

ATTENDEES

Keith Holliday, Ecology, 736-3036
Stan Leja, Ecology, 736-3046
Joan Bartz, Ecology, 736-5707
Nicole Kimball, DOE, 376-4670
Scott Peterson, ERC, 372-9574
Greg Mitchem, ERC,372-9632
Janet Badden, ERC, 372-9033
Tammy Ingraham, ERC, DQO Recorder, 372-9324
Scot Adams, ERC, DQO Facilitator, 372-9207

SUMMARY

This meeting concentrated on completing existing action items. Materials were presented to close many of the action items. The existing materials were considered in the context of the DQO process steps.

ACTION ITEMS

PRIOR ACTION ITEMS

Prior action items were reviewed to agree upon which of the numerous items had been closed.

DPOND1 through DPOND4 are closed.
DPOND5 is closed except for the cost table, which may not be able to close during the DQO process. EAL costs will not be available until after the process is completed. It could require a couple of months to determine costs.
DPOND6 through DPOND11 are closed. For DPOND8 DOE is preparing a letter to Ecology and Ecology will respond (This DOE letter was sent on February 13 as G. I. Goldberg to S.M. Alexander. It is included as Attachment 8.) DPOND9 and DPOND13 were closed by Attachment 4.
DPOND10 is closed by Attachment 2.
DPOND 12 remains open.

DPOND13 is closed by Attachment 4.
DPOND 14 through 16 are closed.
DPOND17 remains open. Ecology will provide documentation on the BHI-00328 to the administrative record.
DPOND18 through 22 are closed. DPOND18 was closed by Attachment 5.
DPOND23 is open.
DPOND24 is closed.

NEW ACTION ITEMS

None.

AGREEMENTS

The existing radionuclide data is adequate. Radionuclide data will not affect the closure decision.

For monitoring the groundwater network is adequate. The groundwater flow direction is adequately known.

The SAP should only address soil sampling for verification. Groundwater and groundwater analyses are out of scope of this DQO process.

DISCUSSION

Prior action items were reviewed to agree upon which of the numerous items had been closed. ERC distributed a packet of data to complete action items (Attachment 1). Ecology reported that they were still having difficulty closing some of their action items from December, because additional discussions were necessary internally and with the Lacy office. Ecology broke for an hour during the meeting to hold a closed internal meeting to discuss open action items.

A working draft of the current status of the process in the DQO steps (Attachment 2) was provided to serve as a strawman to discuss the DQO process. This draft was provided to act as a logical basis of discussion of the process. Extensive changes were identified.

Prior meeting minutes were discussed, based on the Ecology markups of prior drafts (Attachment 6). DOE agreed to accept the changes for incorporation.

Ecology considered the contaminants of concern. Ecology agreed that organics, semivolatiles, volatiles, and pesticides could be excluded (Attachment 7). The ICP 6010 metals method, lead and arsenic by graphite furnace method, mercury by the cold vapor atomic absorption method, and chrome VI by the 3060A method should be included. Ecology expressed a request to include and report other metals for the purpose of quality control. PCBs are below 0.1 percent and only need to be considered for disposal of waste. Ecology proposed a working draft decision rule to be considered: if in deep sampling a contaminant is greater than 100 times the groundwater standard, then there would be a need to dig deeper or to do a modified closure.

ERC expressed concern that measurements near the detection limits and near regulatory standards would produce false positives. ERC would be more confident of values two to three times the detection limit.

ERC proposed using leach samples for supporting a demonstration. Ecology will discuss this with Lacy staff.

ATTACHMENTS

Attachment 1. Supporting Information for the 100-D Ponds Data Quality Objectives
Attachment 2. DQO Process for D Ponds(rough working draft of DQO steps)
Attachment 3. 53 FR 51444 excerpt (RCRA requirements at CERCLA sites)
Attachment 4. A. Huckaby letter to N. Werdel of December 20, 1994 (D Ponds Phase II objectives)
Attachment 5. R.E. Cordts letter to J.M Bruggeman of November 30, 1995 (chromium at 183-H)
Attachment 6. Ecology markups of prior action items
Attachment 7. Included and excluded analytes (viewgraph)
Attachment 8. G.I. Goldberg to S.M. Alexander letter of February 13,1996 (letter sent in response to closing action item DPOND8 as part of this DQO meeting)

MEETING MINUTES FOR FEBRUARY 1, 1996
100-D PONDS DQO MEETING

ATTENDEES

Keith Holliday, Ecology, 736-3036
Stan Leja, Ecology, 736-3046
Joan Bartz, Ecology, 736-5707
Nicole Kimball, DOE, 376-4670
Scott Peterson, ERC, 372-9574
Janet Badden, ERC, 372-9033
Tara Childs, ERC, DQO Recorder, 372-9394
Scot Adams, ERC, DQO Facilitator, 372-9207

SUMMARY

The prior action items were reviewed. The contaminants of concern were finalized. Detection limits and clean up levels were additionally evaluated.

Ecology identified a position that the extent of contamination had not been defined in prior characterization. Ecology proposed a verification sampling program for post-remediation sampling of the excavation surface, the banks of the ponds (for lateral migration), and subsurface sampling by drilling to groundwater to evaluate the vertical extent of contamination. The DQO process meeting was terminated to permit DOE and ERC to evaluate the sampling program proposed by Ecology.

ACTION ITEMS

PRIOR ACTION ITEMS

Prior action items were agreed to be closed with the exception of DPOND5, DPOND12, DPOND17, DPOND23. DPOND5 will remain open for a few weeks until better information is available about costs. DPOND8 is considered closed; DOE/RL will complete the transmittal of a draft letter to Ecology, as requested, and Ecology will respond.

DPOND12 will remain open to permit Ecology to continue internal discussions.

DPOND17 remains open to permit additional internal discussions within Ecology. No impacts are anticipated from the continued review, because Ecology is ready to complete the sampling needs for verification sampling.
Ecology plans to respond to the Administrative Record. Ecology does not anticipate that a Phase II document revision is necessary.

NEW ACTION ITEMS

DPOND25- A summary of proposed sampling and drilling locations, numbers of samples is needed by close of business on February 1. A specification sheet would be helpful.
Keith Holliday

DPOND26 - Meeting minutes need to be completed within one week.
Scot Adams

DISCUSSION

Extensive discussion of the equivalence approach occurred. Ecology requires more time for internal discussion of the approach. The use of the Summers model and possible leaching studies need more internal discussion. Discussion ensued relative to the technical demonstration of groundwater protection versus the regulatory (administrative) demonstration.

ERC noted that insolubility should be a consideration in protection of the groundwater. ERC requested that Ecology consider the demonstrations conducted by the Port Authority at Tacoma and other locations.

Extensive discussion was held about cleanup levels and detection limits on Attachment 1 (Table 2, 1/31/96 version). Relevant changes will be presented in the next meeting or the final DQO report.

Ecology wanted to know if additional process knowledge might be available. ERC represented that known resources had been exhausted.

The consistency of approaches between RCRA and CERCLA units was discussed. Ecology's position was that the RCRA/MTCA approach was quite explicit.

AGREEMENTS

(The following agreement statements were based upon the best available information. Participants may reevaluate the agreement statements at a later time as new information is developed.)

Agreement was reached on the contaminants of concern (COCs) as presented on Attachment 1. The list of COCs was established, but the detection limits and cleanup levels on the list need to be amended. A rerevised table will be presented for final verification at the next meeting. ***Some***

detection limits may be revised and will be reevaluated by Ecology when the SAP is submitted for approval.

INPUTS

Ecology presented a proposed verification sampling program. A minimum of samples were requested from the bottom of the unit to yield a density of one per ten meter grid. Both ponds were to be considered together as a single unit. These samples would verify the removal action at the interface with the underlaying ash. The sampling pattern should be a modified random approach combined with biased samples for potential hot spots. The minimum ten samples was based on a MTCA approach. Sampling will be needed in pits 1 and 2. Surface locations 1, 4, 5, 6, and 7 from the prior programs should be emphasized. ERC will support the identification of locations by reviewing prior locations, in particular, site number 7. There should be at least five samples in the settling pond. There should be five random samples from the middle of the percolation pond. There should be three random samples from the middle of the settling ponds, away from prior sampling locations. This represents a total of fifteen samples- seven from prior locations and eight random samples.

Ecology identified the need to establish the lateral and vertical extent of contamination (DQO boundaries). To establish the boundaries, bank sampling and drilling would be necessary. Ecology was particularly concerned about determining the vertical extent of contamination in the vadose zone down to the groundwater table. Ecology expressed concerns that the current drilling cost rates were excessive and that external costs were significantly lower. Ecology also offered the opinion that the Hanford practice of drilling wells without frequent sampling was not comparable to external practices. Ecology requested that DOE consider cheaper methods of drilling, such as hollow stem auguring with a split spoon.

Lateral migration should be evaluated using bank sampling at a depth of two feet in the side (layback) of the bank. One sample per ten by ten meter area should be taken.

Ecology requested two boreholes. The first should be located near the test pit two location or near the surface sample #7 location near the influent pipe in the settling pond. The second hole should be located in the percolation pond at the opposite end (the northwest corner). Ecology will consider requesting either five-foot or two-and-a-half-foot sampling intervals. Ecology will identify the entire, proposed, vadose-zone, sampling program (Action item DPOND25) by close of business February 1. Ecology was requested to provide a total number of requested samples. Ecology proposed that the ash-Ringold contact should be sampled. Particular emphasis should be given to mercury and chrome six.

FUTURE AGENDA

In the next meeting Ecology will present positions on demonstration projects, the Summers, model, and agreements at the Port Authority. DOE and ERC will prepare an evaluation on the proposed Ecology verification sampling program. The remaining DQO steps will be evaluated.

ADDENDUM

Subsequent to the conclusion of the meeting, Ecology completed action item DPOND25 and presented additional details (Attachment 2):

- A minimum of ten or up to fifteen surface samples, as identified,
- Bank sampling, with samples from the lower third of the bank collected to provide coverage of one sample per 100 square meters,
- Three boreholes with sampling at 0 to 2 feet, 8 to 10 feet, at the coal ash-Hanford Formation (sic, Ringold) contact, and then sampling at every 5 feet to the water table. Continuous sampling should occur adjacent to the ash-Hanford(sic, Ringold) contact. Note: This adds a third borehole along the northern wall of the percolation pond.

ATTACHMENTS

Attachment 1. Revised Table 2, Maximum Values above and below 2 Feet (61 cm), and Potential Cleanup Limits Associated with Them
Attachment 2. CC Mail Ecology to distribution- Sampling Needs for Cleanup Closure of 100-D Ponds, February 1, 1996

MEETING MINUTES FOR FEBRUARY 21, 1996
100-D PONDS DQO MEETING

ATTENDEES

Keith Holliday, Ecology, 736-3036
Nicole Kimball, DOE, 376-4670
Scot Peterson, ERC, 372-9574
Greg Mitchem, ERC, 372-9632
Janet Badden, ERC, 372-9033
Sebastian Tinsdall, ERC DQO Facilitator, 372-9195
Tara Childs, Recorder, ERC DQO Recorder, 372-9394

SUMMARY

This meeting was held to complete action items and to complete the DQO process for the 100-D Ponds removal action. The table of analytes with associated , action levels and detection limits was completed. An agreement to separate potential Ecology verification concerns from this DQO process was made. In effect, this agreement shifted the major objectives of the DQO process from the clean closure objective to verification samples for the bottom of the excavation. The current analytical agreements provide for completing a sampling and analysis plan for verification of removal, but eliminates clean closure as an immediate goal. Consideration of the need for sampling of the vadose-zone materials and for sampling of waste materials will continue outside of this DQO process.

ACTION ITEMS

PRIOR ACTION ITEMS

DPOND5- The description of proposed demonstrations is considered closed, because clean closure is no longer part of this DQO process. However, Bill Mc Mahon provided related ERC inputs to Ecology (Attachment 5).

DPOND12- The table of analytes was closed as a final version.

DPOND17- The written review of the latest draft of BHI-00328 is considered closed because Ecology did not identify the need for another revision of the document. Written comments were not presented to ERC.

DPOND23- The Ecology position on demonstrations is open, but the action item is considered closed for this DQO, because clean closure has been excluded from the DQO process. Ecology will continue internal discussions for when closure requirements need to be defined.

NEW ACTION ITEMS

DPOND27- Schedule a technical meeting to present DOE perspectives on the need for deep vadose zone sampling. (This will continue discussions outside of the DQO process.)
Scott Petersen

DPOND28- Verify the chromium VI value for the detection limit. (The action was completed on February 21).
Scott Petersen

AGREEMENTS

(The following agreement statement was based upon the best available information.)

Key decision makers agreed to separate the discussion of the request for deep vadose zone verification sampling from the DQO process. Verification of the vadose zone will not be part of the voluntary action.

DISCUSSION

Prior to this meeting, DOE provided a draft rationale (Attachment 1) in response to the Ecology request for drilling three boreholes for verification sampling to establish the vertical extent of contamination. Prior to the meeting, it was informally agreed that the DQO process would continue without inclusion of discussion of the boreholes. Because Ecology's position is that this TSD cannot be clean closed without vadose zone verification data, this aspect would be separated from the DQO process. To continue on schedule with the proposed removal action in July, the sampling and analysis plan needs to be completed as soon as possible. Ecology will review the presented conceptual model. A DOE- Ecology meeting will be jointly scheduled to discuss the potential extent of contamination in the vadose zone and need for sampling. The 100 Area ROD strategy and 183-H will be considered in respect to a D Ponds strategy. It was agreed that a facilitator will not be needed for the technical discussions about the vadose zone verification sampling.

ERC distributed a rough draft of a proposed sampling map (Attachment 2). This map incorporates the Ecology requested sampling strategy, except for the borehole sites, from the prior DQO meeting.

ERC provided copies of modeled depths of contaminant migration using the unigradient flow model (Attachment 3) in preparation for meetings to discuss deep vadose zone verification.

Ecology concluded that additional internal consideration is needed to evaluate this model. However, since the issue of closure was being deferred along with the drilling issue, the time urgency for these two aspects was not immediate.

ERC presented a revised Table 2 of analytes, cleanup limits, and detection limits (Attachment 4).

DOE and Ecology approved the draft minutes from the February 1 DQO.

The prior agreement to exclude waste management and disposition from the DQO process was reaffirmed. It was identified that these issues are being confronted by the 183-H closure .

A preliminary draft DQO summary report should be completed in about a week. A final approved DQO summary report is planned for completion by the end of March.

ATTACHMENTS

1. 100-D Ponds TSD ERC Technical Arguments against Need for Borehole Samples
2. Draft Proposed Sampling Map (unlabeled)
3. Unigradient Flow Model and Results 100-D Ponds(table)
4. Revised and Final (2/21/96) Table 2. Maximum Values above and below 2 feet(61 cm), and Potential Cleanup Limits Associated with Them
5. Extracts from EPA/540/2-89/057 Determining Soil Response Action Levels Based on Potential Contaminant Migration to Ground Water: A Compendium of Examples

dpnd2_21.min, prepared by S. Adams

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