AR TARGET SHEET

The following document was too large to scan as one unit, therefore, it has been broken down into sections.

EDMC#: 0062811
SECTION: 6 OF 15

DOCUMENT #: WA7890008967 Rev 8

TITLE: Hanford Facility RCRA Permit, Dangerous Waste Portion, Rev 008, 9/04

ATTACHMENT 28
PUREX Storage Tunnels

Contents

1.0 Part A Dangerous Waste Permit .... Attachment 28.1.i
2.0 Unit Description .... Attachment 28.2.i
3.0 Waste Analysis Plan .... Attachment 28.3.i
4.0 Process Information .... Attachment 28.4.i
6.0 Procedures to Prevent Hazards .... Attachment 28.6.i
7.0 Contingency Plan .... Attachment 28.7.i
8.0 Personnel Training .... Attachment 28.8.i
10.0 Waste Minimization .... Attachment 28.10.i
11.0 Closure and Financial Assurance .... Attachment 28.10.i
12.0 Reporting and Recordkeeping .... Attachment 28.12.i
13.0 Other Relevant Laws .... Attachment 28.13.i

This page intentionally left blank.

Contents

1.0 PART A DANGEROUS WASTE PERMIT .... Att 28.1.1

This page intentionally left blank.

FORM 3

DANGEROUS WASTE PERMIT APPLICATION

I. EPA/State I.D.. No. W A 7 8 9 0 0 0 8 9 6 7

R OFFICIAL USE ONLY

Application Approved	Date Received (month/ day / year)	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 revised 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/STATE I.D. Number in Section I above.

A. First Application (place an "X" below and provide the appropriate date)

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

MO	DAY	YEAR
03	22	1943

*For existing facilities, provide the date (mo/day/yr) operation began or the date construction commenced. (use the boxes to the left)

*The date construction of the Hanford Facility commenced

☐ **2. New Facility** (Complete item below.)

MO	DAY	YEAR

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 entering codes. If more lines are needed, enter the codes(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe the 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 used. Only the units of measure that are listed below should be used.

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
STORAGE:		
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
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	Unit of Measure	Unit of Measure Code	Unit of Measure	Unit of Measure Code
Gallons	G	Liters Per Day	V	Acre-Feet	A
Liters	L	Tons Per Hour	D	Hectare-Meter	F
Cubic Yards	Y	Metric Tons Per Hour	W	Acres	B
Cubic Meters	C	Gallons Per Hour	E	Hectares	Q
Gallons Per Day	U	Liters Per Hour	H		

III. PROCESS – CODES AND DESIGN CAPACITIES (continued)

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 No.	A. Process Code *(from list above)*			B. Process Design Capacity: 1. Amount *(Specify)*	B. Process Design Capacity: 2. Unit of Measure *(enter code)*			For Official Use Only			
X-1	S	0	2	600		G					
X-2	T	0	3	20		E					
1	X	9	9	24,007		C					
2	* Process Code X99 is being used to designate the PUREX Storage Tunnels as a "Miscellaneous Unit" per WAC 173-303-680.										
3											
4											
5											
6											
7											
8											
9											
10											

C. Space for additional process codes or for describing other process (code "T04"). For each process entered here include design capacity.

<u>X99</u>

The PUREX Storage Tunnels, a miscellaneous unit (X99), are used for storage of mixed waste subject to the requirements of WAC 173-303-680. The two tunnels store waste from the PUREX Plant and other onsite sources. Since being placed into service, mixed waste has been stored in the tunnels on railcars. Not all material stored in the tunnels contains mixed waste.

The construction of Tunnel Number 1 was completed in 1956. The tunnel is approximately 5.8 meters (19 feet) wide by 6.7 meters (22 feet) high by 109 meters (358 feet) long and provides storage space for eight railcars. Between June 1960 and January 1965, all eight railcar positions were filled and the tunnel subsequently was sealed. The combined volume of the equipment stored on the eight railcars presently in Tunnel Number 1 is approximately 596 cubic meters (780 cubic yards). The maximum process design capacity for storage in Tunnel Number 1 is approximately 4,129 cubic meters (5,400 cubic yards).

The construction of Tunnel Number 2 was completed in 1964. Tunnel Number 2 is approximately 5.8 meters (19 feet) wide by 6.7 meters (22 feet) high by 514 meters (1,686 feet) long and provides storage space for 40 railcars. The first railcar was placed in Tunnel Number 2 in December 1967 and as of August 2000, 28 railcars have been placed in the tunnel. The combined volume of equipment stored on the 28 railcars presently in Tunnel Number 2 is approximately 2,204 cubic meters (2,883 cubic yards). The maximum process design capacity for storage in Tunnel Number 2 is approximately 19,878 cubic meters (26,000 cubic yards).

IV. DESCRIPTION OF DANGEROUS WASTES

Dangerous Waste Number – Enter the digit number from Chapter 173-303 WAC for each listed dangerous waste you will handle. If you handle langerous 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 odes 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 the 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 in 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 right 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 Waste 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 of 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 with 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 year 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 corrosive only and there will be an estimated 200 pounds per year of each waste.

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)*			2. Process Description *(if a code is not entered in D(1))*
X-1	K	0	5	4	900		P		T03	D80		
X-2	D	0	0	2	400		P		T03	D80		
X-3	D	0	0	1	100		P		T03	D80		
X-4	D	0	0	2					T03	D80		*Included with above*

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

I.D. Number *(enter from page 1)*											
W	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)*				2. Process Description *(if a code is not entered in D(1))*
1.	D	0	0	5	454*		K		X99				Storage - Miscellaneous
2.	D	0	0	6	454*		↓		↓				↓
3.	W	T	0	2			↓		↓				↓
4.	D	0	0	7	454*		↓		↓				↓
5.	D	0	0	8	8,000*		↓		↓				↓
6.	D	0	0	9	45*		↓		↓				↓
7.	D	0	1	0	454*		↓		↓				↓
8.	D	0	1	1	680*		↓		↓				↓
9.	D	0	0	1			↓		↓				↓
10.	W	T	0	2	454		↓		↓				Included with above
11.	* The estimated annual quantity of waste listed above represents the maximum quantity of waste placed in either tunnel in a given year.												
12.													
13.													
14.													
15.													
16.													
17.													
18.													
19.													
20.													
21.													
22.													
23.													
24.													
25.													
26.													
27.													
28.													
29.													
30.													
31.													
32.													
33.													
34.													
35.													
36.													
37.													
38.													
39.													
40.													
41.													

IV. DESCRIPTION OF DANGEROUS WASTE (continued)

Use this space to list additional process codes from Section D(1) on page 3.

The waste stored in the tunnels could include barium(D005), cadmium (D006), chromium (D007), lead (D008), mercury (D009), selenium (D010), silver (D011), and light mineral oil (WT02, state-only, toxic, dangerous waste) contained in oil absorption material. The silver is predominately in the form of salts and is considered ignitable (D001) because of the presence of silver nitrate ($AgNO_3$). Cadmium also could be considered state-only, toxic, dangerous waste (WT02).

V. FACILITY DRAWING

Refer to attached drawing(s).

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

VI. PHOTOGRAPHS

Refer to attached photograph(s).

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 XI 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 Number *(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	Revision 5 signed 09/26/96

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.

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

09/26/96
Date Revision 5 Signed

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

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

09/13/96
Date Revision 5 Signed

Contents

2.0 UNIT DESCRIPTION .... Att 28.2.1

2.1 PUREX STORAGE TUNNELS .... Att 28.2.1
2.1.1 Tunnel Number 1 (218-E-14) .... Att 28.2.1
2.1.2 Tunnel Number 2 (218-E-15) .... Att 28.2.2

2.2 TOPOGRAPHIC MAP .... Att 28.2.4

Figures

Figure 2.1. The PUREX Facility .... Att 28.2.5
Figure 2.2. The PUREX Plant (Building 202-A) .... Att 28.2.6
Figure 2.3. The PUREX Storage Tunnel Number 1 .... Att 28.2.7
Figure 2.4. The PUREX Storage Tunnel Number 2 .... Att 28.2.8

This page intentionally left blank.

2.0 UNIT DESCRIPTION

2.1 PUREX STORAGE TUNNELS

The PUREX Storage Tunnels branch off from the railroad tunnel and extend southward from the east end of the PUREX Plant (Figure 2.1). The tunnels are used for storage of mixed waste from the PUREX Plant and from other onsite sources. Each storage tunnel is isolated from the railroad tunnel by a water-fillable shielding door. There are no electrical utilities, water lines, drains, fire detection or suppression systems, or communication systems provided inside the PUREX Storage Tunnels.

Material selected for storage is loaded on railcars modified to serve as both transport and storage platforms. Normally, a remote-controlled, battery-powered locomotive was used to position the railcar in the storage tunnel. In the past and possibly in the future, other remote movers, e.g., standard locomotive with a string of railcar spacers, power winch, etc., have or could be used to position a railcar into the tunnel or to withdraw a car from the tunnel. The railcar storage positions are numbered sequentially, commencing with Position 1 that abuts the railstop bumper at the south end of each tunnel. Position 2 is the location of the railcar that abuts the railcar in Position 1 and so forth. The railcars and material remain in the storage tunnel until retrieval is required. Each railcar is retrievable; however, because the railcars are stored on a single, dead-end railroad track, the railcars can be removed only in reverse order (i.e., last in, first out).

Transfers into or out of the PUREX Storage Tunnels were infrequent and were not manpower-intensive operations. A more detailed description of the operation of the PUREX Storage Tunnels is provided in Attachment 28, Chapter 4.0.

2.1.1 Tunnel Number 1 (218-E-14)

Construction of Tunnel Number 1 was completed in 1956 and consists of three areas: the water-fillable door, the storage area, and the vent shaft (Figure 2.3). The water-fillable door is located at the north end of Tunnel Number 1 and separates the storage tunnel from the PUREX railroad tunnel. The door is 7.5 meters high, 6.6 meters wide, and 2.1 meters thick, and is constructed of 1.3 centimeter steel plate. The door is hollow so that the door can be filled with water to act as a shield when the door is in the down (closed) position. If the door is filled with water, the water must be pumped from the door before the door can be raised.

Above the door is a reinforced concrete structure into which the door is raised to open the tunnel. Electric hoists used for opening and closing the door are located on the top of this concrete structure.

Pumps and valves used for filling and draining the door are located in a room northwest of the door closure. Operational controls are located in the PUREX Plant on the north wall at the east end of the pipe and operating gallery.

Beneath the water-fillable door is a sump with a 15.2-centimeter drain that connects to a railroad tunnel sump; water was pumped to the Double-Shell Tank System. The drain was sealed as part of deactivation activities.

The storage area is that portion of the tunnel that extends southward from the water-fillable door. Inside dimensions of Tunnel Number 1 are 109.1 meters long, 6.7 meters high, and 5.9 meters wide. Ceiling and walls are 35.6 centimeters thick and constructed of 30.5- by 35.6-centimeter creosote pressure-treated Douglas fir timbers arranged side by side. The first 30.5 meters of the east wall are constructed of 0.9-meter-thick reinforced concrete (Section AA of Figure 2.3). A 40.8-kilogram- mineral-surface roofing material was used to cover the exterior surface of the timbers before placement of 2.4 meters of earth fill. The earth cover serves as protection from the elements and as radiation shielding. The timbers that form the walls rest on reinforced concrete footings 0.9 meter wide by 0.3 meter thick. The floor consists of a railroad track laid on a gravel bed. The space between the ties is filled to top-of-tie with gravel ballast. The tracks are on a 1.0 percent downward slope to the south to ensure that the railcars remain in their storage position. A railcar bumper is located 2.4 meters from the south end of the tracks to act as a stop. The capacity of the storage area is eight, 12.8-meter-long railcars.

From 1962 through 1980, nine pipe risers were installed through the roof of Tunnel Number 1. Seven of the nine risers were used for wood sampling of the tunnel ceiling timbers. The other two risers were used to obtain air samples and temperature data of the internal environment of the tunnel. Currently, all risers are capped.

The results of the wood strength survey (conducted in 1980) concluded that the wood beams in Tunnel Number 1 were within standards for present day wood. Design calculations performed at the time also found the tunnel to be within safe limits (Silvan 1980). Air sampling conducted in Tunnel Number 1 did not identify the presence of any combustible gases and found oxygen levels to be at about 21 percent with carbon dioxide at about 0.3 percent. The reported temperature in Tunnel Number 1 remains consistent at 15.6 °C (Rambosek and Foster 1972).

An independent evaluation of the 1980 data collected by Silvan was conducted in 1991 to further evaluate the structural integrity of PUREX Storage Tunnel Number 1 (Hand and Stevens 1991). This study concluded that any degradation of the treated timbers because of decay or insect attack should be minimal and found that the tunnel timbers structurally should be sound. This study also confirmed the reasonableness of the values used and agreed with the findings of the Silvan study. In addition, the study concluded that the methods used by Silva to calculate the loss of timber strength were sufficiently conservative to accurately determine the soundness of the timbers. The exposure of the timbers to the high gamma radiation field emitted by the material stored within the tunnel was factored into the evaluation.

A vent shaft is located at the south end of Tunnel Number 1. The shaft is approximately 1.5 meters by 1.5 meters in cross-section and is constructed of reinforced concrete. The vent stack extends approximately 0.3 meter above grade and was capped with a single-stage, high-efficiency particulate air (HEPA) filter, a 283-cubic-meter per minute exhaust fan, and a 6.1-meter tall exhaust stack. After filling Tunnel Number 1 to capacity, the tunnel was sealed. Sealing activities included de-energizing the ventilation system and blanking the ventilation system to prevent interaction of the tunnel air with external air. Deactivation of the vent system is described in Attachment 28, Chapter 4.0, §4.1.6.1. A further discussion of the tunnel ventilation system is provided in Attachment 28, Chapter 4.0.

In June 1960, the first two railcars were loaded with a single, approximately 12.5-meter-long, failed separation column and placed in Tunnel Number 1. Between June 1960 and January 1965, six more railcars were placed in Tunnel Number 1, filling the tunnel. After the last car was placed in the northern-most storage position (Position 8), the water-fillable door was closed, filled with water, and deactivated electrically. The Tunnel Number 1 door was drained as part of PUREX Facility transition activities.

2.1.2 Tunnel Number 2 (218-E-15)

Construction of Tunnel Number 2 was started and completed in 1964. Like Tunnel Number 1, Tunnel Number 2 consists of three functional areas: the water-fillable door, the storage area, and the vent shaft. Construction of Tunnel Number 2 differs from that of Tunnel Number 1 as follows.

- A combination of steel and reinforced concrete was used in the construction of the storage area for Tunnel Number 2 (Figure 2.4) rather than wood timbers, as used in Tunnel Number 1.
- Tunnel Number 2 is longer, having a storage capacity of five times that of Tunnel Number 1.
- The floor of Tunnel Number 2, outboard of the railroad ties, slopes upward to a height of approximately 1.8 meters above the railroad bed, whereas the floor in Tunnel Number 1 remains flat all the way out to the sidewalls.
- The railroad tunnel approach to Tunnel Number 2 angles eastward then angles southward to parallel Tunnel Number 1 (Figure 2.1). The approach to Tunnel Number 1 is a straight extension southward from the PUREX Plant. Center-line to center-line distance between the two tunnels is approximately 18.3 meters.

The physical structure of the water-fillable door at the north end of Tunnel Number 2 essentially is identical to the water-fillable door for Tunnel Number 1. The water-fillable door for Tunnel Number 2 is approximately 57.9 meters south and 18.3 meters east of the water-fillable door for Tunnel Number 1 (Figure 2.3).

Controls for operation of the water-fillable door are located above the tunnel on the east exterior wall of the door enclosure (Attachment 28, Chapter 4.0, Figure 4.1). Attachment 28, Chapter 4.0 provides additional operational information on the Tunnel Number 2 water-fillable door. Presently, the door is empty and there are no plans to fill it. Procedures for filling and draining the door are presented in Attachment 28, Chapter 4.0.

The storage area of Tunnel Number 2 is that portion of the tunnel extending southward from the water-fillable door. Construction of this portion of Tunnel Number 2 consists of a 10.4-meter diameter, steel (0.5 centimeter plate), and semicircular-shaped roof, supported by internal I-beam wales attached to external, reinforced concrete arches. The concrete arches are 0.4-meter thick and vary in width from 0.4 to 1.8 meters. The arches are spaced on 4.8-meter centers. This semicircular structure is supported on reinforced concrete grade beams approximately 1.8 meters wide by 1.2 meters thick (one on each side) that run the full length of Tunnel Number 2. The interior and exterior surfaces of the steel roof are coated with a bituminous coating compound to inhibit corrosion. The entire storage area is covered with 2.4 meters of earth fill to serve as shielding.

The nominal inside dimensions of Tunnel Number 2 are 514.5 meters long, 7.9 meters high, and 10.4 meters wide. However, because of the arch-shaped cross-section of Tunnel Number 2 and entry clearance at the water-fillable door, the usable storage area (width and height above top-of-rail) is 6.7 meters high and 5.8 meters wide, the same dimensions as for Tunnel Number 1. The floor consists of a railroad track laid on a gravel bed. The space between ties is filled to top-of-tie with gravel ballast. Commencing at the ends of the 2.4-meter-long ties, the earth floor is sloped upward on a 1 (vertical) to 1 1/2 (horizontal) grade. The tracks are on a 1/10 of 1 percent downgrade slope to the south to ensure the railcars remain in their storage position. A railcar bumper is located 2.4 meters from the south end of the tracks to act as a stop. The capacity of the storage area is 40, 12.8-meter-long railcars.

There are 17 tunnel ports located along the ridge of the tunnel roof (for details, refer to Drawing H-2-58195). The ports are on 29.3-meter centers. A 7.6-centimeter diameter bar plug is located in the center of each tunnel port and is secured in place with a length of chain and a padlock. Operations administer access control of these tunnel ports.

The vent shaft, located at the south end of Tunnel Number 2, is approximately 1.5 meters by 1.5 meters in cross-section and is constructed of reinforced concrete. The vent shaft extends approximately 0.3 meter above grade and is capped with an exhaust system consisting of a single-stage, HEPA filter, a 153-cubic meter per minute exhaust fan, and a 6.1-meter-tall exhaust stack. The ventilation system currently is inactive (Attachment 28, Chapter 4.0, §4.6.1.2); however, when operating the exhaust fan normally is dampered to provide only about 100 cubic meters per minute of exhaust flow. A further discussion of the tunnel ventilation system is provided in Attachment 28, Chapter 4.0.

The first railcar was placed in storage in December 1967. Attachment 28, Chapter 3.0, Table 3-1 contains current storage inventory data.

2.2 TOPOGRAPHIC MAP

Topographic map (Drawing H-13-000264), shows the distance of at least 305 meters around the PUREX Storage Tunnels. This map is at a scale of 1-unit equals 2,000 units. The contour interval clearly shows the pattern of surface water flow in the vicinity of each storage tunnel. The map contains the following information:

- Map scale
- Date
- Prevailing wind speed and direction
- A north arrow
- Surrounding land use
- Buildings
- Access road location
- Access control
- Monitoring and sampling well locations
- TSD unit locations.

Figure 2.1. The PUREX Facility

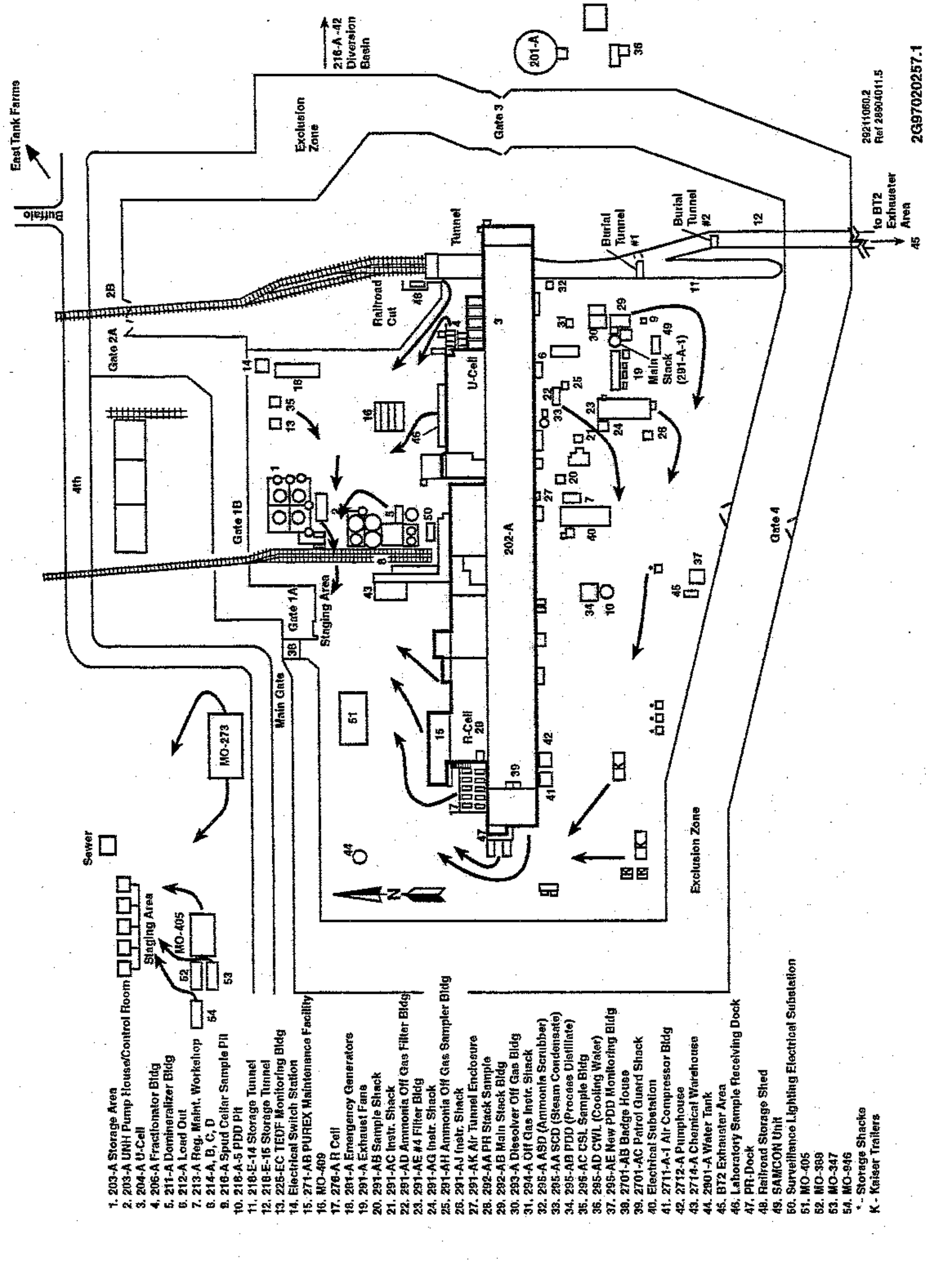


Figure 2.2. The PUREX Plant (Building 202-A)

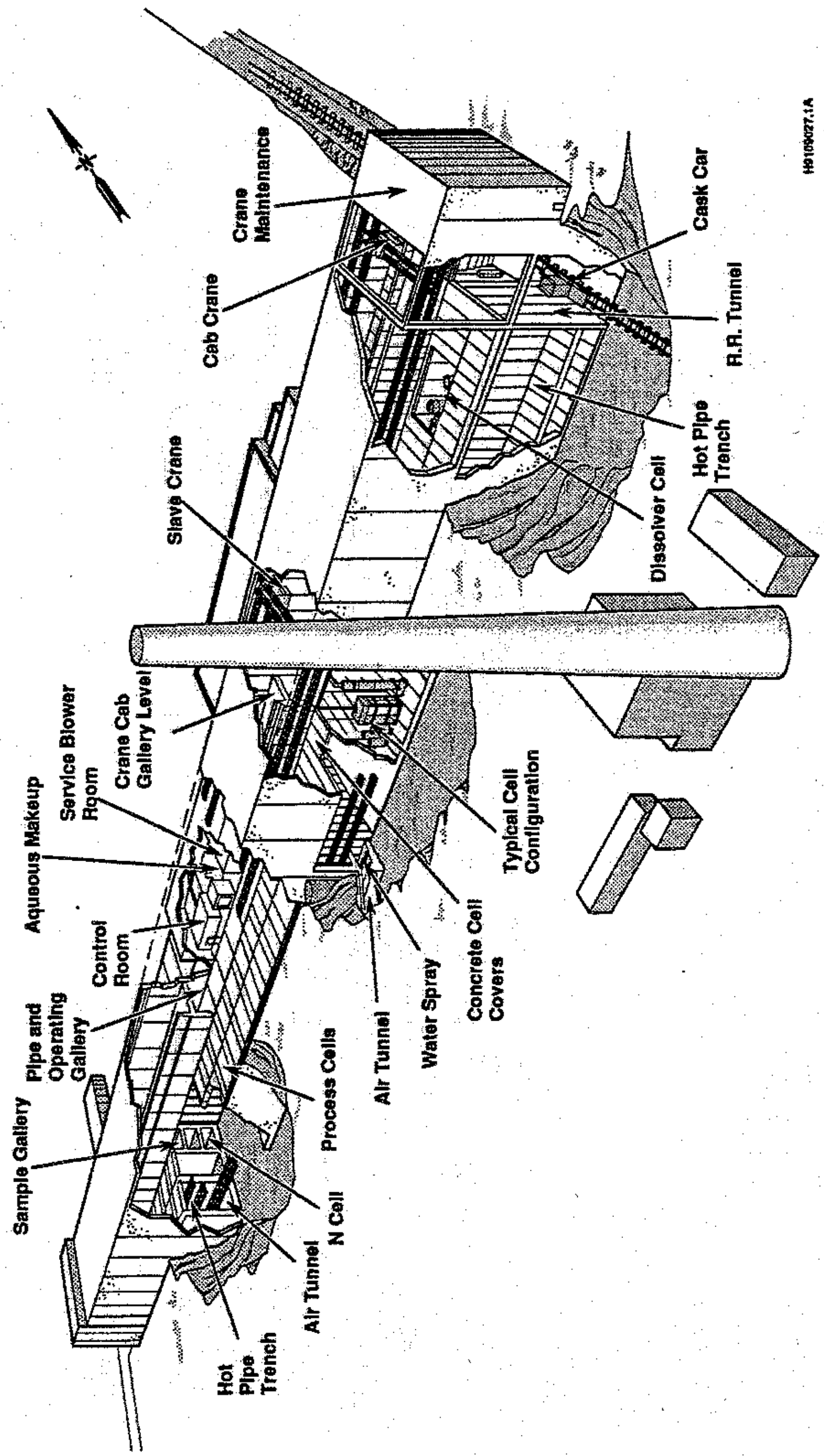


Figure 2.3. The PUREX Storage Tunnel Number 1

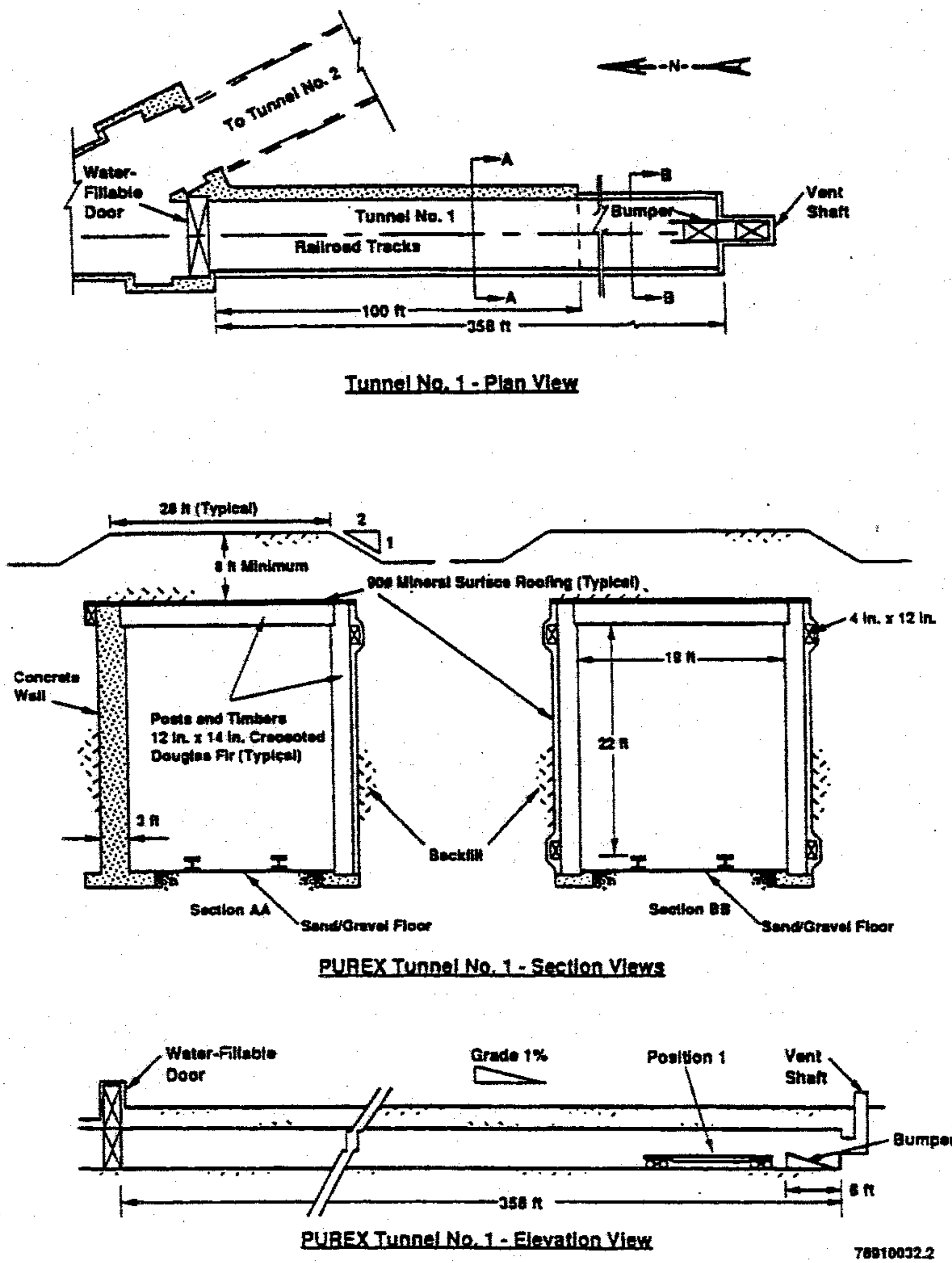
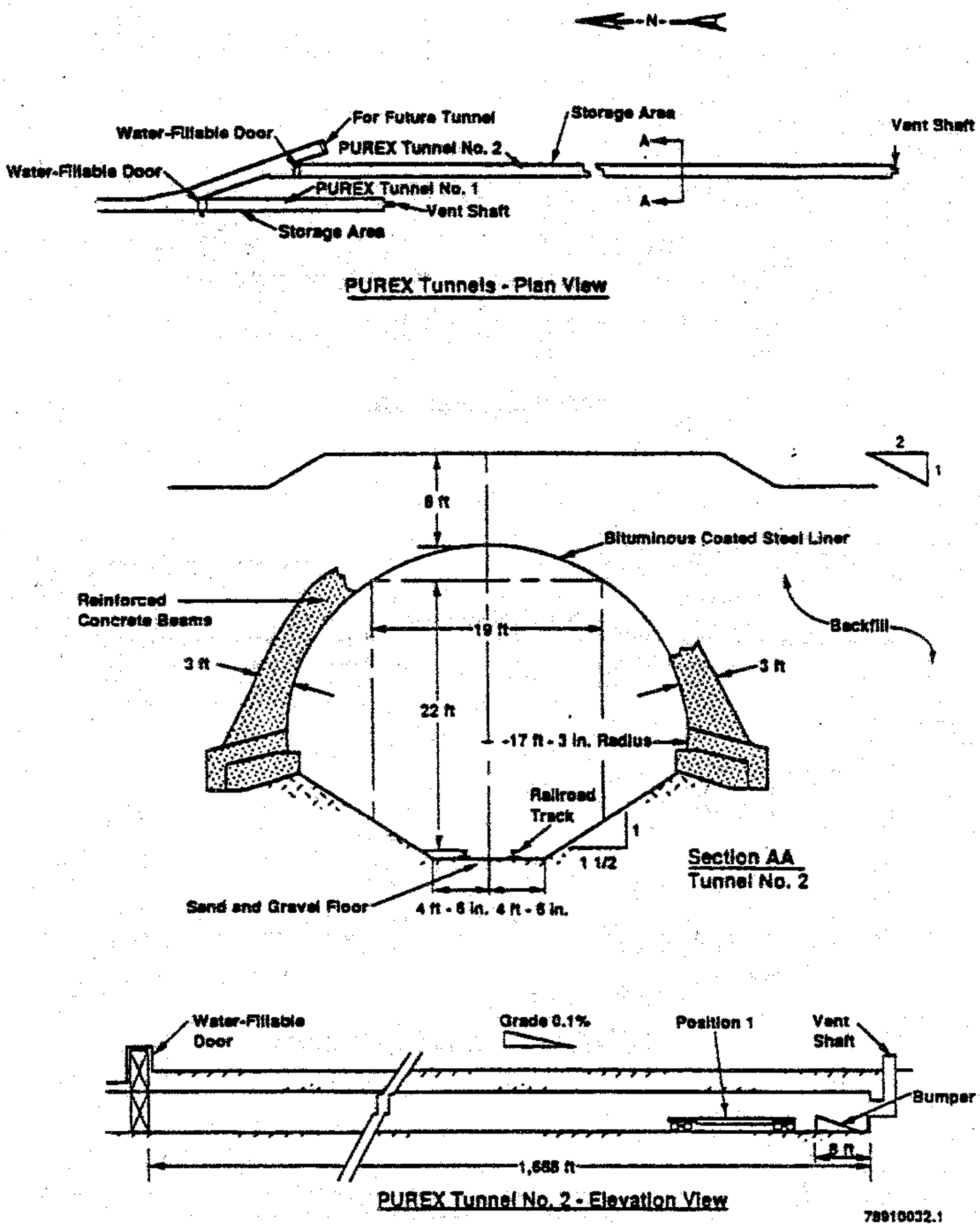


Figure 2.4. The PUREX Storage Tunnel Number 2



Contents

3.0 WASTE ANALYSIS PLAN....Att 28.3.1

3.1 CHEMICAL, BIOLOGICAL, AND PHYSICAL ANALYSES....Att 28.3.1

3.2 TRACKING SYSTEM....Att 28.3.1

3.3 FACILITY DESCRIPTION....Att 28.3.2
3.3.1 Process and Activities....Att 28.3.4
3.3.2 Physical Characterization of Material to be Stored....Att 28.3.4

3.4 IDENTIFICATION/CLASSIFICATION AND QUANTITIES OF DANGEROUS WASTE MANAGED WITHIN THE PUREX STORAGE TUNNELS....Att 28.3.5

3.5 WASTE ANALYSIS PARAMETERS....Att 28.3.5
3.5.1 Waste Identification....Att 28.3.5
3.5.2 Parameter and Rationale Selection Process....Att 28.3.9
3.5.3 Rationale for Parameter Selection....Att 28.3.10
3.5.4 Special Parameter Selection....Att 28.3.11
3.5.5 Selection of Sampling Procedures....Att 28.3.11
3.5.6 Sampling Strategies....Att 28.3.11
3.5.7 Selection of Sampling Equipment....Att 28.3.12
3.5.8 Maintaining and Decontaminating Field Equipment....Att 28.3.12
3.5.9 Sample Preservation and Storage....Att 28.3.12
3.5.10 Quality Assurance and Quality Control Procedures....Att 28.3.12
3.5.11 Health and Safety Protocols....Att 28.3.12

3.6 LABORATORY SELECTION AND TESTING AND ANALYTICAL METHODS....Att 28.3.13
3.6.1 Laboratory Selection....Att 28.3.13
3.6.2 Testing and Analytical Methods....Att 28.3.13

3.7 WASTE RE-EVALUATION FREQUENCIES....Att 28.3.13

3.8 SPECIAL PROCEDURAL REQUIREMENTS....Att 28.3.13
3.8.1 Procedures for Receiving Wastes Generated Offsite....Att 28.3.13
3.8.2 Procedures for Ignitable, Reactive, and Incompatible Waste....Att 28.3.13
3.8.3 Provisions for Complying with Land Disposal Restriction Requirements....Att 28.3.14
3.8.4 Deviations from the Requirements of this Plan....Att 28.3.14

3.9 RECORDKEEPING....Att 28.3.14

3.10 REFERENCES....Att 28.3.14

Table

Table 3.1. PUREX Storage Tunnels Inventory....Att 28.3.15

This page intentionally left blank.

GLOSSARY

ALARA	as low as reasonably achievable
ECOLOGY	Washington State Department of Ecology
EHW	extremely hazardous waste
EPA	U.S. Environmental Protection Agency
pH	negative logarithm of the hydrogen-ion concentration
PUREX	plutonium-uranium extraction
QA/QC	quality assurance and quality control
TSD	treatment, storage, and/or disposal
WAC	Washington Administrative Code
WAP	waste analysis plan

METRIC CONVERSION CHART

The following conversion chart provides the reader an aid in conversion.

Into metric units			Out of metric units		
If you know	Multiply by	To get	If you know	Multiply by	To get
Length			Length		
inches	25.40	millimeters	millimeters	0.0393	inches
inches	2.54	centimeters	centimeters	0.393	inches
feet	0.3048	meters	meters	3.2808	feet
yards	0.914	meters	meters	1.09	yards
miles	1.609	kilometers	kilometers	0.62	miles
Area			Area		
square inches	6.4516	square centimeters	square centimeters	0.155	square inches
square feet	0.092	square meters	square meters	10.7639	square feet
square yards	0.836	square meters	square meters	1.20	square yards
square miles	2.59	square kilometers	square kilometers	0.39	square miles
acres	0.404	hectares	hectares	2.471	acres
Mass (weight)			Mass (weight)		
ounces	28.35	grams	grams	0.0352	ounces
pounds	0.453	kilograms	kilograms	2.2046	pounds
short ton	0.907	metric ton	metric ton	1.10	short ton
Volume			Volume		
fluid ounces	29.57	milliliters	milliliters	0.03	fluid ounces
quarts	0.95	liters	liters	1.057	quarts
gallons	3.79	liters	liters	0.26	gallons
cubic feet	0.03	cubic meters	cubic meters	35.3147	cubic feet
cubic yards	0.76456	cubic meters	cubic meters	1.308	cubic yards
Temperature			Temperature		
Fahrenheit	subtract 32 then multiply by 5/9ths	Celsius	Celsius	multiply by 9/5ths, then add 32	Fahrenheit

Source: *Engineering Unit Conversions*, M. R. Lindeburg, PE, Second Ed., 1990, Professional Publications, Inc., Belmont, California.

3.0 WASTE ANALYSIS PLAN

This chapter provides information on the chemical, biological, and physical characteristics of the dangerous waste stored in the PUREX Storage Tunnels. Waste in the tunnels is stored and managed as mixed waste. The PUREX Storage Tunnels provide the necessary shielding for the protection of employees and the environment from mixed waste.

3.1 CHEMICAL, BIOLOGICAL, AND PHYSICAL ANALYSES

Regulated material presently stored in the PUREX Storage Tunnels contains the following dangerous waste:

- Lead
- Mercury
- Silver and silver salts
- Chromium
- Cadmium
- Barium
- Mineral oil.

In general, dangerous waste is either attached to, contained within, or actually is material removed from the PUREX Plant and other onsite sources. Changes in dangerous waste stored is updated annually in the annual dangerous waste report submitted to Ecology. Future storage of barium and selenium may occur in Tunnel Number 2. The PUREX Storage Tunnels are permitted as a miscellaneous unit under WAC 173-303-680 because the tunnels are not a typical containerized storage unit. That is, the bulk of the material stored in the tunnels is not placed in a container; rather, this material is placed on a portable device (railcar) used as a storage platform. The mixed waste stored in the PUREX Storage Tunnels is encased or contained within carbon or stainless steel plate, pipe, or vessels that meet the WAC 173-303-040 definition of container. Therefore, the mixed waste normally is not exposed to the tunnel environment.

The only free-liquid dangerous waste stored in the tunnels is elemental mercury. The mercury is contained within thick-walled (0.8-centimeter) thermowells. The amount of mercury per thermowell is less than 1.7 liters.

Other liquid containers, such as large discarded process tanks, are stored in the PUREX Storage Tunnels. These containers are 'empty' [per WAC 173-303-160(2)(a)]. In the future, containers will be flushed and the final rinsate sampled and analyzed to verify that the residual heel is not a dangerous waste.

The only stored mixed waste that is designated as either reactive or ignitable (D001) is silver nitrate in the silver reactors [WAC 173-303-090(5)]. There is no mixed waste designated as reactive (D003). The potential for ignition from this source is considered negligible because this material is dispersed on ceramic packing and is physically isolated from contact with any combustible material or ignition source.

3.2 TRACKING SYSTEM

Specific waste tracking forms for the movement of waste destined for the PUREX Storage Tunnels are used. These waste tracking forms effectively track waste inventories from generation through storage.

The waste tracking forms and other supporting documentation will be maintained at the Hanford Facility for a minimum of 5 years following closure of the PUREX Storage Tunnels.

3.3 FACILITY DESCRIPTION

This waste analysis plan (WAP) has been prepared for the PUREX Storage Tunnels, located on the Hanford Facility, Richland, Washington. This WAP applies to all mixed waste (containing dangerous components) regulated by Washington Administrative Code (WAC) 173-303 that is transferred to and/or contained in the PUREX Storage Tunnels.

The PUREX Storage Tunnels are permitted as a miscellaneous unit under WAC 173-303-680. The bulk of the waste stored in the PUREX Storage Tunnels is not placed in a typical container; rather, this waste is placed on a portable device (railcar) that is used as a storage platform. In general, the mixed waste stored in the PUREX Storage Tunnels is encased or contained within carbon or stainless steel plate, pipe, or vessels. Therefore, the mixed waste normally is not exposed to the tunnel environment.

The PUREX Facility, located in the 200 East Area, consists of two separate treatment, storage, and/or disposal (TSD) units, the PUREX Plant (202-A Building) and the PUREX Storage Tunnels. Access to the PUREX Storage Tunnels is by means of the railroad tunnel.

The PUREX Storage Tunnels branch off from the railroad tunnel and extend southward from the east end of the PUREX Plant. The tunnels are used for storage of mixed waste from the PUREX Plant and from other onsite sources. Each storage tunnel is isolated from the railroad tunnel by a water-fillable shielding door. There are no electrical utilities, water lines, drains, fire detection or suppression systems, or communication systems provided inside the PUREX Storage Tunnels.

Material selected for storage is loaded on railcars modified to serve as both transport and storage platforms. Normally, a remote-controlled, battery-powered locomotive was used to position the railcar in the storage tunnel. In the past and possibly in the future, other remote movers, e.g., standard locomotive with a string of railcar spacers, power winch, etc., have or could be used to position a railcar in the tunnel or to withdraw a car from the tunnel. The railcar storage positions are numbered sequentially, commencing with Position 1 that abuts the rail stop bumper at the south end of each tunnel. Position 2 is the location of the railcar that abuts the railcar in Position 1 and so forth. The railcars and material remain in the storage tunnel until final disposition is determined. Each railcar is retrievable; however, because the railcars are stored on a single, dead-end railroad track, the railcars can be removed only in reverse order (i.e., last in, first out).

Construction of Tunnel Number 1 was completed in 1956. The Tunnel has three areas, the water-fillable door, the storage area, and the vent shaft. The water-fillable door is located at the north end of Tunnel Number 1 and separates the storage tunnel from the railroad tunnel. The door is 7.5 meters high, 6.6 meters wide, and 2.1 meters thick, and is constructed of 1.3-centimeter steel plate. The door is hollow so that the door can be filled with water to act as a shield when the door is in the down (closed) position. If the door is filled with water, the water must be pumped from the door before the door can be raised. Above the door is a reinforced concrete structure in which the door is raised to open the tunnel. Electric hoists used for opening and closing the door are located on the top of this concrete structure.

The storage area is that portion of the tunnel that extends southward from the water-fillable door. Inside dimensions of Tunnel Number 1 are 109.1 meters long, 6.7 meters high, and 5.9 meters wide. Ceiling and walls are 35.6-centimeters thick and constructed of 30.5- by 35.6-centimeter creosote pressure-treated Douglas fir timbers arranged side by side. The first 30.5 meters of the east wall are constructed of 0.9-meter-thick reinforced concrete. A 40.8-kilogram mineral-surface roofing material was used to cover the exterior surface of the timbers before placement of 2.4 meters of earth fill. The earth cover serves as protection from the elements and as shielding. The timbers that form the walls rest on reinforced concrete footings 0.9 meter wide by 0.3 meter thick. The floor consists of a railroad track laid on a gravel bed. The space between the ties is filled to top-of-tie with gravel ballast. The tracks are on a 1.0 percent downward slope to the south to ensure that the railcars remain in their storage position. A railcar bumper is located 2.4 meters from the south end of the tracks to act as a stop. The capacity of the storage area is eight, 12.8-meter-long railcars.

In June 1960, the first two railcars were loaded with a single, approximately 12.5-meter-long, failed separation column and placed in Tunnel Number 1. Between June 1960 and January 1965, six more railcars were placed in Tunnel Number 1, filling the tunnel. After the last car was placed in the northern-most storage position (Position 8), the water-fillable door was closed, filled with water, and deactivated electrically.

Construction of Tunnel Number 2 was started and completed in 1964. Like Tunnel Number 1, Tunnel Number 2 consists of three functional areas: the water-fillable door, the storage area, and the vent shaft. Construction of Tunnel Number 2 differs from that of Tunnel Number 1 as follows.

- A combination of steel and reinforced concrete was used in the construction of the storage area for Tunnel Number 2 rather than wood timbers, as used in Tunnel Number 1.
- Tunnel Number 2 is longer, having a storage capacity of five times that of Tunnel Number 1.
- The floor of Tunnel Number 2, outboard of the railroad ties, slopes upward to a height of approximately 1.8 meters above the railroad bed, whereas the floor in Tunnel Number 1 remains flat all the way out to the sidewalls.
- The railroad tunnel approach to Tunnel Number 2 angles eastward then angles southward to parallel Tunnel Number 1. The approach to Tunnel Number 1 is a straight extension southward from the PUREX Plant. Center-line to center-line distance between the two tunnels is approximately 18.3 meters.

The physical structure of the water-fillable door at the north end of Tunnel Number 2 essentially is identical to the water-fillable door for Tunnel Number 1. The water-fillable door for Tunnel Number 2 is approximately 57.9 meters south and 18.3 meters east of the water-fillable door for Tunnel Number 1. As of March 1997, the door is empty and there is no plan to fill the door.

The storage area of Tunnel Number 2 is that portion of the tunnel extending southward from the water-fillable door. Construction of this portion of Tunnel Number 2 consists of a 10.4-meter diameter, steel (0.5 centimeter plate), and semicircular-shaped roof, supported by internal I-beam wales attached to external, reinforced concrete arches. The concrete arches are 0.4 meter thick and vary in width from 0.4 to 1.8 meters. The arches are spaced on 4.8-meter centers. This semicircular structure is supported on reinforced concrete grade beams approximately 1.8 meters wide by 1.2 meters thick (one on each side) that run the full length of Tunnel Number 2. The interior and exterior surfaces of the steel roof are coated with a bituminous coating compound to inhibit corrosion. The entire storage area is covered with 2.4 meters of earth fill to serve as shielding.

The nominal inside dimensions of Tunnel Number 2 are 514.5 meters long, 7.9 meters high, and 10.4 meters wide. However, because of the arch-shaped cross-section of Tunnel Number 2 and entry clearance at the water-fillable door, the usable storage area (width and height above top-of-rail) is 6.7 meters high and 5.8 meters wide, the same dimensions as for Tunnel Number 1. The floor consists of a railroad track laid on a gravel bed. The space between ties is filled to top-of-tie with gravel ballast. Commencing at the ends of the 2.4-meter-long ties, the earth floor is sloped upward on a 1 (vertical) to 1 1/2 (horizontal) grade. The tracks are on a 1/10 of 1 percent downgrade slope to the south to ensure the railcars remain in their storage position. A railcar bumper is located 2.4 meters from the south end of the tracks to act as a stop. The capacity of the storage area is 40, 12.8-meter-long railcars.

The first railcar was placed in storage in December 1967. Table 3.1 contains an approximate inventory of waste stored in the PUREX Storage Tunnels.

The only free-liquid dangerous waste stored in the tunnels is mercury. The mercury is contained within thick-walled 0.8-centimeter thermowells constructed from 7.6-centimeter Schedule 80, 304L stainless steel pipe. The top of the thermowell is closed with a 304L stainless steel nozzle plug with a metal-to-metal seal. The amount of mercury per thermowell is less than 1.7 liters.

Other liquid containers, such as large discarded process tanks or vessels, are stored in the PUREX Storage Tunnels. The containers in storage are empty [per WAC 173-303-160(2)(a)]. Before storage, the vessels have been flushed and in recent years, the final rinsate sampled and analyzed to verify that the residual heel is not a dangerous waste.

The only stored dangerous waste that is either reactive or ignitable is silver nitrate in the silver reactors, which is designated as ignitable (D001) [WAC 173-303-090(5)]. The potential for ignition is considered negligible because this material is dispersed on ceramic packing and is physically isolated from contact with any combustible material or ignition source.

3.3.1 Process and Activities

The function of the PUREX Tunnels is to store mixed waste until the waste can be processed for final disposal. When waste is to be placed in the storage tunnels, a work plan, describing the overall transfer activities, and a storage tunnel checklist are prepared. The work plan and storage tunnel checklist are routed for review and concurrence by key personnel and forwarded to management for approval.

3.3.2 Physical Characterization of Material to be Stored

Physical characterization of waste includes an evaluation of the following physical properties:

- Length, width, and height
- Gross weight and volume
- Preferred orientation for transport and storage
- Presence of dangerous waste constituents.

Information sources used in physical characterization include equipment fabrication and installation drawings, operational records, and process knowledge. Physical characterization provides information necessary to describe the waste material. Such information also is used to design and fabricate, if required, supports on the railcar.

Before removal from service, the equipment could be flushed to minimize loss of products, to reduce contamination, and to reduce dangerous waste constituents present in a residual heel to nonregulated levels. When equipment is flushed, analysis of the rinsate is used to determine when these goals have been achieved.

3.4 IDENTIFICATION/CLASSIFICATION AND QUANTITIES OF DANGEROUS WASTE MANAGED WITHIN THE PUREX STORAGE TUNNELS

Table 3.1 contains an approximation of the total amount of waste stored within the PUREX Storage Tunnels.

3.5 WASTE ANALYSIS PARAMETERS

Analytical requirements were selected based on knowledge required for the safe handling and storage of the waste within the PUREX Storage Tunnels, including any operational compliance issues.

3.5.1 Waste Identification

A prerequisite step in proper waste management is to address whether waste being considered for management within the PUREX Storage Tunnels falls within the scope of this unit's permit. This includes identifying any dangerous waste in accordance with regulatory and permit requirements and applicability of any land disposal restrictions.

This section provides information on how the chemical and physical characteristics of the mixed waste currently stored in the PUREX Storage Tunnels were determined so that the waste is stored and managed properly.

Regulated material presently stored in the PUREX Storage Tunnels contains the following dangerous waste:

- Lead
- Mercury
- Silver and silver salts
- Chromium
- Cadmium
- Barium
- Mineral oil.

Storage of non-PUREX Plant waste is reviewed on a case-by-case basis. Sampling, chemical analysis, process knowledge (as discussed in the following section), and/or inventory information from waste tracking forms provided from other onsite sources are required to confirm the characteristics and quantities of mixed waste to be stored. Future waste and dangerous constituents might not be in the same configuration or form as described in the following sections.

3.5.1.1 Lead

Lead stored was used in various capacities during past Hanford Facility operations. Primary functions of lead included use as weights, counterweights, and shielding. Often the lead is encased in steel (carbon or stainless) to facilitate its attachment to various types of equipment.

Lead exhibits the characteristic of toxicity as determined by the toxicity characteristics leaching procedure and is designated D008 [WAC 173-303-090(8)]. The quantity of lead present could produce an extract greater than 500 milligrams per liter should the lead be exposed to a leachate. However, because the bulk of the lead is encased in steel, is stored inside a weather-tight structure, and is elevated above floor level on railcars that isolate the lead from other materials stored, the potential for exposure of bare lead to a leachate is considered negligible.

Sampling and chemical analysis is not performed on lead associated with the material placed in the PUREX Storage Tunnels. Therefore, the accuracy of the estimate on the amount of lead presently stored in each tunnel is limited to the data available from process knowledge. Counterweights on equipment dunnage and lead used for shielding cannot be quantified by existing historical records and are not included for lead listed on Table 3.1. However, if removed from the tunnels, the material will be examined and any suspect attachments will be removed, evaluated, and disposed of in accordance with established methods.

3.5.1.2 Mercury

Mercury is contained within thermowells that are an integral part of spent reactor fuel dissolvers used at the PUREX Plant. The dissolvers are large 304L stainless steel process vessels that are approximately 2:7 meters in diameter, 7.3 meters tall, and weigh approximately 26,309 kilograms. The outer shell is constructed of a 1-centimeter-thick plate. The dissolvers were used in decladding and dissolving spent reactor fuel in the PUREX Plant.

Depending on the specific dissolver in question, 19.1 or 45.4 kilograms of mercury (1.4 or 1.77 liters) were poured in each of the two thermowells per dissolver (38.2 or 90.8 kilograms total per dissolver) following vertical installation of the dissolvers inside the PUREX canyon and before the dissolver was installed in a process cell. The mercury served to transfer heat from the dissolver interior to the thermohm temperature sensor mounted within the thermowell. This mercury remains within the thermowells of discarded dissolvers. In preparation for storage, the thermohms were removed and the upper end of each thermowell was plugged with a 304L stainless steel nozzle plug. In storage, the discarded dissolver rests in an inclined position in a cradle on the railcar. The mercury contained in the thermowells remains in the lower portion of each thermowell and, under normal conditions, is never in contact with the mechanical closure on the nozzle end of the thermowell.

Mercury exhibits the characteristic of toxicity as determined by the toxicity characteristics leaching procedure and is designated D009 [WAC 173-303-090(8)].

The potential for mercury to become exposed to leachate is considered negligible. The PUREX Storage Tunnels are designed and constructed as weather-tight structures. Further, the mercury is encased in a stainless steel pipe within a stainless steel vessel that is stored on a railcar above the floor level of the tunnels. Therefore, exposure of the mercury stored in the tunnels to leachate is not considered a credible occurrence.

Sampling and chemical analysis is not performed on mercury associated with the dissolvers stored in Tunnel Number 2. The quantity of mercury present in each thermowell is documented on Table 3.1.

3.5.1.3 Silver

Silver, mostly in the form of silver salts deposited on unglazed ceramic packing, is contained within the discarded silver reactors stored in Tunnel Number 2. The silver reactors were used to remove iodine from the offgas streams of the spent reactor fuel dissolvers. The reactor vessel is approximately 1.4 meters in diameter by 4.1 meters tall and is constructed of 1-centimeter 304L stainless steel. The vessel contains two 1.2-meter-deep beds of packing. Each bed consists of a 30.5-centimeter depth of 2.5-centimeter unglazed ceramic saddles topped with a 0.6-meter depth of 1.3-centimeter unglazed ceramic saddles. The two beds are separated vertically by a distance of about 0.6 meter, and each bed rests on a support made of stainless steel angles and coarse screen. The packing was coated initially with 113.4 kilograms of silver nitrate used for iodine retention. Nozzles on the top of the reactor were provided to allow flushing and/or regeneration of the packing with silver nitrate solution as the need arose.

Because of competing reactions, which include conversion of silver nitrate to silver iodide, reduction of silver nitrate to metallic silver, and formation of silver chloride, the packing of a stored silver reactor contains a mixture of silver nitrate, silver halides, and silver fines.

Silver salts exhibit the characteristics of toxicity as determined by the toxicity characteristics leaching procedure and are designated D011 [WAC 173-303-090(8)]. Silver salts exhibit the characteristic of ignitability and are designated as D001 [WAC 173-303-090(5)].

The potential of silver, including silver salts, stored in the PUREX Storage Tunnels to become exposed to leachate is considered negligible. Silver is contained within a stainless steel vessel, stored inside a weather-tight structure, and elevated above floor level on a railcar. Therefore, exposure of the silver stored in the tunnels to leachate is not considered a credible occurrence. In addition, the contained silver is isolated from contact with any combustibles; therefore, the possibility of ignition is considered extremely remote.

Provisions for taking samples of the packing were not provided in the design of the vessels. Therefore, sampling and chemical analysis are not performed for silver salts before placing a silver reactor in storage. However, for accountability, the total silver content (Table 3.1) is considered silver nitrate, the salt that exhibits the characteristics of both ignitability and toxicity.

The quantity of silver salts contained within a discarded silver reactor is a function of silver nitrate regeneration history. Operating records (process knowledge) of regenerations and flushes are used to estimate the total accumulation of silver within each reactor.

3.5.1.4 Chromium

Presently, chromium stored in Tunnel Number 2 is contained within a failed concentrator removed from the PUREX Plant, and within stainless steel containers received from the 324 Building. The concentrator is a vertical tube structure that was used to concentrate aqueous streams from the final uranium cycle, final plutonium cycles, final neptunium cycles, and condensate from the acid recovery system for recycle. Following service, the concentrator was inspected and found to contain silicate solids with high levels of chromium from the corrosion of stainless steel. The existence of chromium within the 324 Building waste was determined through process knowledge. Chromium exhibits the characteristic of toxicity as determined by the toxicity characteristics leaching procedure and is designated D007 [WAC 173-303-090(8)]. The potential for the chromium stored in Tunnel Number 2 to become exposed to leachate is considered negligible. Tunnel Number 2, is designed and constructed to be weather-tight. Further, the chromium is encased within stainless steel vessels and containers that are stored on railcars above the floor level of the tunnel. Therefore, exposure of the chromium stored in the tunnel to leachate is not considered a credible occurrence.

The quantity of chromium within the concentrator was estimated by calculating the volume of silicate solids and the percentage of chromium within the silicate solids. The quantity of chromium in the 324 Building waste was based on process knowledge.

3.5.1.5 Cadmium

Presently, cadmium stored in the PUREX Storage Tunnel Number 2 is associated with shielding and with a dissolver moderator removed from the PUREX Plant, and within stainless steel containers received from the 324 Building. The cadmium was used to shield equipment and consists of sheets of the metal attached to lead, both of which could be encased in steel. The cadmium received from the 324 Building was used in waste technology research and development programs.

The dissolvers are annular vessels that are geometrically favorable for criticality safety. The dissolvers were placed over cadmium lined (neutron absorbers) moderators for additional criticality safety. The moderator is a centrally located, cylindrical, cadmium-jacketed 0.08-centimeter-thick concrete 15.2-centimeter-thick neutron absorber. The moderators are approximately 4.4 meters tall by approximately 1.5 meters outer diameter.

Cadmium exhibits the characteristic of toxicity as determined by the toxicity characteristics leaching procedure and is designated D006 [WAC 173-303-090(8)]. If exposed to a leachate, the quantity of cadmium present could produce an extract having a concentration of greater than or equal to 1 milligram per liter, but less than 100 milligrams per liter; therefore, the mixed waste is managed as a WT02 [WAC 173-303-100(5)].

The potential for the cadmium stored in Tunnel Number 2 to become exposed to leachate is considered negligible. Tunnel Number 2 is designed and constructed to be weather-tight. Further, the cadmium is stored on railcars above the floor level of the tunnel. Therefore, exposure of the cadmium stored in the tunnel to leachate is not considered a credible occurrence.

3.5.1.6 Barium

Presently, barium is stored in Tunnel Number 2 in stainless steel containers received from the 324 Building. The waste was generated during numerous research and development programs conducted in B-Cell of the Waste Technology Engineering Laboratory (324 Building). The existence of barium within the 324 Building waste was determined through process knowledge.

Barium exhibits the characteristic of toxicity as determined by the toxicity characteristics leaching procedure and is designated D005 [WAC 173-303-090(8)].

The potential for barium stored in Tunnel Number 2 to become exposed to leachate is considered negligible. Tunnel Number 2 is designed and constructed to be weather-tight. Further, the barium is encased in steel containers stored on a railcar above the floor level of the tunnel. Therefore, exposure of the barium stored in the tunnel to leachate is not considered a credible occurrence.

3.5.1.7 Mineral Oil

Presently, mineral oil is stored in Tunnel Number 2 in stainless steel containers received from the 324 Building. The mineral oil was used in the B-Cell viewing windows in the 324 Building. Oil leaking from the windows was absorbed on rags and clay absorbent material.

The material safety data sheet for the mineral oil lists a lethal dose (LD50) of 2 grams per kilogram (dermal rabbit). Therefore, the oil designates as a Toxic Category A WT02 [WAC 173-303-100(5)].

The potential for the absorbed mineral oil stored in Tunnel Number 2 to become exposed to leachate is considered negligible. Tunnel Number 2 is designed and constructed to be weather-tight. Further, the mineral oil is encased in steel containers stored on a railcar above the floor level of the tunnel. Therefore, exposure of the mineral oil stored in the tunnel to leachate is not considered a credible occurrence.

3.5.1.8 Identification of Incompatible Waste

The next step is to ensure that sufficient information concerning the waste has been provided so the waste can be managed properly. This includes identifying incompatible waste. These safety issues primarily are related to prevention of unwanted chemical reactions that could create a catastrophic situation, such as a fire, an explosion, or a large chemical release.

3.5.1.9 Operational Considerations

Sufficient information must be available to ensure that incoming waste meets operational acceptance limits, e.g., physical size, ALARA concerns, and WAC 173-303 requirements. These operating specifications are limits and controls imposed on a process or operation that, if violated, could jeopardize the safety of personnel, and could damage equipment, facilities, or the environment. Operating specifications have been established from operating experience, process knowledge, and calculations.

3.5.2 Parameter and Rationale Selection Process

This WAP describes the process to ensure that the dangerous waste components of the material stored in the tunnels are properly characterized and designated so that dangerous and mixed waste is managed properly.

The parameters considered for waste designation under WAC 173-303-070(3) and the rationale for there application is discussed in the following sections.

3.5.2.1 Discarded Chemical Products

The first category of dangerous waste designation is "Discarded Chemical Products" (WAC 173-303-081). The waste stored in the tunnels does not fit the definitions in WAC 173-303-081 for a discarded chemical product. Therefore, the waste stored in the PUREX Storage Tunnels is not designated as a discarded chemical product.

3.5.2.2 Dangerous Waste Sources

The second category of dangerous waste designation is "Dangerous Waste Sources" (WAC 173-303-082). The waste stored in the tunnels is not listed on the "Dangerous Waste Sources List" (WAC 173-303-9904). Therefore, the waste stored in the PUREX Storage Tunnels is not designated as a dangerous waste source.

3.5.2.3 Dangerous Waste Characteristics

The third category of dangerous waste designation is "Dangerous Waste Characteristics" (WAC 173-303-090). The characteristics are as follows.

- Characteristic of Ignitability – Although the solid silver nitrate has not been tested in accordance with Appendix F of 49 CFR 173, the waste is assumed to be an oxidizer as specified in

49 CFR 173.127(a). Therefore, the silver nitrate waste is assumed to exhibit the characteristic of ignitability under WAC 173-303-090(5) and is designated as D001.

- Characteristic of Corrosivity – Some of the material stored within the tunnels either has contained or has been in contact with corrosive liquids. The standard operating procedure has been to flush vessels with water to recover as much special nuclear material as practical. In addition, flushing removes much of the mixed waste contamination, minimizing the spread of contamination during handling. Currently, the final aqueous rinse is sampled and analyzed to confirm that the pH is greater than 2 and less than 12.5. Therefore, the waste stored in the PUREX Storage Tunnels is not designated as corrosive waste.
- Characteristic of Reactivity – The waste stored in the tunnels does not meet any of the definitions of reactivity as defined in WAC 173-303-090(7). The waste material is not unstable, does not react violently with water, does not form explosive mixtures, or does not generate toxic gases. Therefore, the waste stored in the PUREX Storage Tunnels is not designated as reactive waste.
- Characteristic of Toxicity – Lead, mercury, silver, chromium, barium, and cadmium are identified on the Toxicity Characteristics list. The quantity of these materials stored in the tunnels is sufficient that, should the substances come in contact with a leachate (an event considered unlikely), the concentration of the extract could be above the limits identified in the list. Therefore, this waste is designated D005, D006, D007, D008, D009, and D011.

The PUREX Storage Tunnels also are permitted for selenium (D010). Currently, there is no waste stored in the tunnels that is designated for D010; however, there is a potential for waste with this waste number to be stored within the tunnels.

3.5.2.4 Dangerous Waste Criteria

The fourth category of dangerous waste designation is "Dangerous Waste Criteria" (WAC 173-303-100). The criteria are as follows:

- Toxicity Criteria – Cadmium meets the toxicity criteria in WAC 173-303-100(5) when performing a book designation. Because of the concentrations present, the waste containing these constituents is designated as dangerous waste (DW) and is assigned the dangerous waste number of WT02.
- Persistence Criteria – Currently, no waste stored in the tunnels has been designated as persistent per WAC 173-303-100(6).

3.5.2.5 Waste Designation Summary

The mixed waste currently stored in the PUREX Storage Tunnels is designated as follows:

- Lead – D008; EHW
- Mercury – D009; EHW
- Silver and silver salts – D001, D011; EHW
- Chromium – D007; EHW
- Cadmium – D006, WT02; DW
- Barium – D005; EHW
- Mineral Oil – WT02; DW.

3.5.3 Rationale for Parameter Selection

Refer to Section 3.5.2.

3.5.4 Special Parameter Selection

Refer to Section 3.5.2.

3.5.5 Selection of Sampling Procedures

The following sections discuss the sampling methods and procedures that will be used. Sampling usually will be in accordance with requirements contained in the pertinent sampling analysis plan, procedures, and/or other documents that specify sampling and analysis parameters.

3.5.6 Sampling Strategies

The only analysis presently used in support of the PUREX Storage Tunnels operation is a corrosivity check on the final in-place aqueous rinse of discarded vessels before the vessels are released for storage. The pH is determined by a pH meter using U.S. Environmental Protection Agency (EPA) Test Method 9040 or 9041 in Test Methods for the Evaluation of Solid Waste: Physical/Chemical Methods (EPA 1986). The RCRA sampling will not be performed on any waste currently stored in the PUREX Storage Tunnels.

Waste received that is not generated at the PUREX Plant could require sampling strategies associated with this waste that will be developed on a case-by-case basis.

3.5.6.1 Sampling Methods

Process knowledge of the characteristics and the quantities of the dangerous waste to be stored in the PUREX Storage Tunnels is considered sufficient to properly designate and manage the stored waste.

The waste currently stored in the tunnels is lead, mercury, chromium, cadmium, barium, mineral oil, silver, and silver salts. Sampling and chemical analysis of the lead, mercury, cadmium, barium, mineral oil, or chromium to confirm their presence would not provide additional data beneficial to proper management of the waste and would not comply with ALARA principles. The silver salts are dispersed over a large area on ceramic packing contained within a large stainless steel reactor vessel. Representative sampling of the ceramic packing is not considered to be practical and therefore was not performed.

If RCRA sampling is required for operation of the PUREX Storage Tunnels, representative sampling methods referenced in WAC 173-303-110 or some other method approved by the Washington State Department of Ecology (Ecology) will be used. For waste received from other Hanford Facility activities, existing sampling, chemical analysis, and/or process knowledge documentation is used to confirm the characteristics and quantities of mixed waste to be stored. Storage of non-PUREX Facility waste is reviewed on a case-by-case basis.

3.5.6.2 Frequency of Analyses

Because the dangerous waste components of mixed waste stored in the PUREX Storage Tunnels are stable and will remain undisturbed for a long time, the waste designations and quantities present will remain the same as assigned at the time of storage. Therefore, repeated analysis is not considered necessary to ensure that waste designation data are representative.

3.5.7 Selection of Sampling Equipment

The only analysis presently used in support of the PUREX Storage Tunnels operation is for corrosivity on the final in-place aqueous rinse of discarded vessels before the vessels are released for storage. The pH is determined by Method 9040 or 9041 (SW-846). The RCRA sampling methods, as referenced in WAC 173-303-110, will not be performed on any waste currently stored in the PUREX Storage Tunnels.

3.5.8 Maintaining and Decontaminating Field Equipment

All RCRA sampling equipment used to collect and transport samples must be free of contamination that could alter test results. Equipment used to obtain and contain samples must be clean. Acceptable cleaning procedures for sample bottles and equipment include, but are not limited to, washing with soap or solvent, and steam cleaning. After cleaning, cleaning residues must be removed from all equipment that could come in contact with the waste. One method to remove these residues would be a solvent (acetone or other suitable solvent) rinse followed by a final rinse with deionized water. Equipment must be cleaned before use for another sampling event.

After completion of sampling, equipment should be cleaned as indicated previously. If decontamination of the equipment is not feasible, the sampling equipment should be disposed of properly.

3.5.9 Sample Preservation and Storage

Following RCRA sampling, sample preservation follows methods set forth for the specific analysis identified. Preservation is in accordance with the methods stated in SW-846 or any of the test methods adopted by the Hanford Facility that meet WAC 173-303 requirements. No preservation method will be used when there are ALARA concerns.

3.5.10 Quality Assurance and Quality Control Procedures

The only test method presently used in support of the PUREX Storage Tunnels operation is a corrosivity check on the final in-place aqueous rinse of discarded vessels before the vessels are released for storage. The RCRA sampling will not be performed on any waste currently stored in the PUREX Storage Tunnels. Field duplicates, field blanks, trip blanks, and equipment blanks will not be taken. Split samples could be taken at the request of Ecology.

Generally, quality assurance and quality control (QA/QC) requirements for sampling will be divided between paperwork requirements, such as chain-of-custody, and sampling and analysis activities. This section addresses sampling QA/QC requirements. Analytical QA/QC is discussed in Section 3.6.

A chain-of-custody procedure is required for all sampling identified by this WAP. At a minimum, the chain of custody must include the following: (1) description of waste collected, (2) names and signatures of samplers, (3) date and time of collection and number of containers in the sample, and (4) names and signatures of persons involved in transferring the samples.

3.5.11 Health and Safety Protocols

The safety and health protocol requirements established for the Hanford Site must be followed for all RCRA sampling activities required by this WAP.

3.6 LABORATORY SELECTION AND TESTING AND ANALYTICAL METHODS

This section discusses laboratory selection and the types of acceptable analytical methods for RCRA samples.

3.6.1 Laboratory Selection

Laboratory selection is limited as only a few laboratories are equipped to handle mixed waste because of the special equipment and procedures that must be used to minimize personnel exposure to mixed waste. Laboratory selection depends on laboratory capability, nature of the sample, timing requirements, and cost. At a minimum, the selected laboratory must have the following:

- A comprehensive QA/QC program (both qualitative and quantitative)
- Technical analytical expertise
- An effective information management system.

These requirements will be met if the selected laboratory follows the pertinent requirements contained in the Hanford Analytical Services Quality Assurance Plan (DOE/RL-94-55). The selected laboratory also can meet these requirements by having some other type of QA/QC program as long as equivalent data quality is achieved.

3.6.2 Testing and Analytical Methods

The testing and analytical methods for corrosivity used by the various onsite analytical laboratories are outlined in SW-846. These methods in some cases deviate from SW-846 and American Society for Testing and Materials-accepted specifications for holding times, sample preservation, and other specific analytical procedures. These deviations are discussed in Analytical Methods for Mixed Waste Analyses at the Hanford Site (DOE/RL-94-97).

3.7 WASTE RE-EVALUATION FREQUENCIES

Re-evaluation of waste within the PUREX Storage Tunnels will not occur because of the personnel and environmental exposure to mixed waste and the way the railcars are positioned in the tunnels. The waste is expected to remain stable.

3.8 SPECIAL PROCEDURAL REQUIREMENTS

The following sections describe special procedural requirements associated with waste in the PUREX Storage Tunnels.

3.8.1 Procedures for Receiving Wastes Generated Offsite

The PUREX Storage Tunnels do not accept waste generated off the Hanford Site.

3.8.2 Procedures for Ignitable, Reactive, and Incompatible Waste

Presently, the only ignitable, reactive, or incompatible dangerous waste stored in the PUREX Storage Tunnels is the silver nitrate coating on the ceramic packing inside the silver reactors. This material is confined to the interior of a large stainless steel vessel (Section 3.5.1.1) that separates this material from all other waste material stored in the tunnel. The requirements in WAC 173-303-395(1)(a) require 'No Smoking' signs be conspicuously placed wherever there is a hazard present from ignitable or dangerous waste. 'No Smoking' signs are not considered appropriate at the PUREX Storage Tunnels because of ALARA principles. Smoking is not allowed in any area with ALARA concerns and rules prohibiting smoking are strictly enforced. This policy serves to achieve the no smoking intent of WAC 173-303-395(1)(a), posting and maintaining 'No Smoking' signs are not considered appropriate.

Isolated areas within the PUREX Storage Tunnels make periodic inspections inconsistent with ALARA guidelines[e.g., an annual fire inspection as required by WAC 173-303-395(1)(d) for storage areas containing ignitable waste]. Therefore, such inspections are not performed.

3.8.3 Provisions for Complying with Land Disposal Restriction Requirements

Operation of the PUREX Storage Tunnels does not involve land disposal or treatment of dangerous waste. The information provided by the generating unit regarding land disposal restrictions of dangerous waste is sufficient to operate the PUREX Storage Tunnels in compliance with land disposal restriction requirements. When final disposition of the waste occurs, this information will be passed on for final treatment or disposal of the waste.

3.8.4 Deviations from the Requirements of this Plan

Management may approve deviations from this plan if special circumstances arise that make this prudent. These deviations must be documented in writing with a copy to be retained by the management.

3.9 RECORDKEEPING

Records associated with this waste analysis plan and waste verification program are maintained on the Hanford Facility. These records will be maintained until closure of the PUREX Storage Tunnels. Records associated with the waste inventory will be maintained for 5 years.

3.10 REFERENCES

DOE/RL-94-55, Hanford Analytical Services Quality Assurance Plan, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-94-97, Analytical Methods for Mixed Waste Analyses at the Hanford Site, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

EPA, 1986, Test Methods for the Evaluation of Solid Waste: Physical/Chemical Methods, SW-846, 3rd ed., U.S. Environmental Protection Agency, Washington, D.C.

Table 3.1. PUREX Storage Tunnels Inventory

PUREX #1 Storage Tunnel (218-E-14)

Tunnel #1 is at its Capacity as of 1/22/65

PUREX #1 Storage Tunnel is located at the southeast end of the PUREX Plant and is an extension of the railroad tunnel. The storage area is approximately 109 meters long, 6.9 meters high, and 5.8 meters wide. The tracks have a one percent downgrade toward the south end of the tunnel. The capacity of the Storage Tunnel is eight modified railroad cars, 12.8 meters long.

Position	PUREX #1 Storage Tunnel (218-E-14)
1. & 2.	HA column and miscellaneous jumpers in box placed in Tunnel #1 on 6/60 HA 4,700 Cu. Ft. Jumpers 2,190 Cu. Ft., Pb-~115 Kg
3.	E-F11 #1 (1WW Waste) Concentrator failed 7/24/60. Placed in Tunnel #1 on 7/29/60, 1,900 Cu. Ft.
4.	G-E2 Centrifuge, miscellaneous jumpers in box and two tube bundles. Placed in Tunnel #1 on 12/24/60. (FUG SER# 762) 2,465 Cu. Ft., Pb-~115 Kg.,
5.	E-H4 (3WB) Concentrator failed 1/4/61. Placed in Tunnel #1 on 1/4/61, 2,336 Cu. Ft.
6.	E-F6 (2\NW Waste) Original Concentrator failed 4/21/61. Placed in Tunnel #1 on 4/21/61, 2,336 Cu. Ft.
7.	E-F11 (1WW Waste) #2 Concentrator failed 2/1/62. Placed in Tunnel #1 on 2/8/62, 2,336 Cu. Ft.
8.	E-F6 (2WW Waste) #3 Spare Concentrator failed 5/23/64. Placed in Tunnel #1 on 1/22/65 Flat Car 3621, 2400 Cu. Ft.

Table 3.1. PUREX Storage Tunnels Inventory

The storage area is approximately 514.5 meters long, 7.9 meters high, and 10.4 meters wide. The tracks have a one percent downgrade toward the south end of the tunnel. The capacity of the Storage Tunnel is 38-40 modified railroad cars, 12.8 meters long. The Tunnel contains 21 cars as of 2/95.

Position	PUREX #2 Storage Tunnel (218-E-15)
1.	E-F6 # (2WW Waste) Concentrator, TK F 15-2, One tube bundle and agitator motors, placed in Tunnel on 12/12/67 on Car 61439. 2,400 Cu. Ft.
2.	E-F6 #5 (E-H4 3WB) Concentrator, two tube bundles placed in Tunnel on 3/26/69. On Car MILW 60883, 2,400 Cu. Ft.
3.	E-F6 #6 (2WW Waste) Concentrator, two tube bundles failed placed in Tunnel on 3/19/70. On Car 3612, 2,400 Cu. Ft.
4.	L Cell Package in a sealed steel box (H2-66012) placed in Tunnel on 12/30/70 on Car MILW 60033, 2,400 Cu. Ft.
5.	F2 Silver Reactor, F6 Demister, Vessel Vent Line, Steel Catwalk and Guard Rails, placed in Tunnel on 2/26/71. On Gondola Car 4610, 2,400 Cu. Ft., Ag-~625 Kg
6.	Modified A3-1 tower, scrubber, liquid, and vapor line placed in Tunnel on 12/12/71. On Gondola Car 4611, 2,400 Cu. Ft.
7.	A3 Dissolver placed in Tunnel on 12/22/71. On 9 Ft. shortened Car B58, 2,400 Cu. Ft., Hg--~45 Kg.
8.	A1W1 Fuel ends in steel liner box and NPR fuel handling equipment. Used with the suspected canisters, on Car 19808. Placed in Tunnel on 8/29/72, 800 Cu. Ft.
9.	C3 Dissolver placed in Tunnel on 9/30/72, on Car 19811, 1590 Cu. Ft., Hg-~45 Kg.
10.	E-H4 (3WB) Concentrator, #61 tube bundle, prototype cooling coil, and F-FI Filter Tank, placed in Tunnel 8/30/83, on Car CDX-1, 2,400 Cu. Ft.
11.	A3 Dissolver (Vessel #10 and Heater Vessel #6), placed in Tunnel on 1/18/86, on Car 3613, 3960 Cu. Ft. Hg-~40 Kg., Cd-~43 Kg
12.	White box (H2-58456) containing eight tube bundles #S 57.
13.	J5 Tank (Vessel #30), FL condenser (Vessel #13), and F12-B Cell Block, old four-way dumper, disc yoke, and flange plate placed in Tunnel on 1/21/86, on Car 19806, 2,500 Cu. Ft.
14.	L-I Pulser, 2-column cartridges, 1-jumper cutter, 3-jumper alignment tools, 9-exterior dumping trunnions, 10-pumps, 3-agitators, 4-tube bundles, 2-vent jumpers and 7-yokes placed in Tunnel on 11/18/87, on Car PX-10 (10A-19380) & Rack H2-96629.50. 50 tons, 3,600 Cu. Ft., Pb-~2540 Kg.

Position	PUREX #2 Storage Tunnel (218-E-15)
15.	Silver Reactor, E-F2 steam heater, and storage liner (H2-65095), full of cut up jumpers placed in Tunnel on 5/13/88, on Car PX-9 (10A-19809) & S/R Cradle SK-GLR-11-2-87. 20 tons, 2,775 Cu. Ft., Cd-~13 Kg., Ag-~115 Kg., Pb-~230 Kg.
16.	E-J8-1 Unitized Concentrator Vessel #1 H2-52477, failed 3/11/89. Placed on storage Car H2-99608, Px-6 (10A-19028) and in #2 Tunnel 4/6/89 graveyards. Estimated 42 tons, 6,000 Cu. Ft.
17.	North storage liner H2-65095 containing six pumps, one agitator, and cut up jumper (14 tons). South storage liner H2-65095 containing one pump, one #15 yoke and cut up jumpers (11.5 tons). Placed on storage Car PX-19 (10A-19030) and in #2 Tunnel on days 8/5/89. Estimated 25.5 tons, 2,574 Cu. Ft.
18.	T-F5 Acid absorber, ID#1-T-F5/F-168713, H2-52535 and H2-52487/488. Placed on storage Car PX-2 and in #2 Tunnel on 4/8/94. Estimated 22 tons, 835 Cu. Ft.
19.	Four metal liner storage boxes H-2-65095-3/H-2-100187-0 containing failed jumpers and miscellaneous obsolete canyon equipment items. Placed on storage Car PX-23 and in #2 Tunnel 9/16/94. Estimated 60 tons, 4032 Cu. Ft.
20.	E-H4-1 unitized concentrator (H-2-52477/56213)/(E-H4-1) Placed in Tunnel on 1/27/95, on Car Px-28. Estimated 40 tons, 5,760 Cu. Ft., Cr-~8 Kg.
21.	Tank E-5 (H-2-52453)/(F-166955), lead storage box assembly (H-2-131629)/ (H-2-131629-1), H4 concentrator tower (H-2-58102)/(F-223017-CBT-4), hot shop cover plate (H-2-52222)/("Q"), tube bundle wash capsule (H-2-58647), dissolver charging insert (H-2-75875)/ (H-2-75875-1), lifting yoke #7A (H-2-96837), lifting yoke #9 (H-2-52458). Placed in tunnel on 2/8/95 on Car PX-3609. Estimated 44 tons, 3,457 Cu. Ft., Pb-~1830 Kg
22.	Metal uner box (H-2-65096) containing jumpers and failed/obsolete canyon equipment. F7 neutron monitor (H-2-75825), lead storage box (H-2-131629) containing jumper counterweights and miscellaneous lead items, scrap hopper (H-2-57347) containing miscellaneous canyon equipment, canister capping station (H-2-821831), test canister containing various lengths of carbon steel pipe. Placed in Tunnel on 3-11-06, on Car #3616. Estimated weight 22 tons, 1,712 Cu. Ft., Pb-~3232 Kg., Cd-~2 Kg.
23.	Two burial boxes (H-2-100187) containing jumpers and failed/obsolete canyon equipment, lifting yoke (H-2-99652). Placed in Tunnel 3-11-96 on Car #PX-31. Estimated weight 21 tons, 2,116 Cu. Ft.
24.	Concrete burial box (H-1-44980) storing 8 containers of 324 Building, B-Cell waste. For additional details, see PUREX Work Plan WP-P-95-60. Placed in Tunnel on Car #PX-29, on April 26, 1996. Estimated weight 36 tons, 1,890 Cu. Ft. Cd-~10.5 kg., absorbed oil-~8.5 kg., Cr-~1 kg., Ba-~ 3 kg

Position	PUREX #2 Storage Tunnel (218-E-15)
25.	Concrete burial box (H-1-44980) storing 9 containers of 324 and 325 Building waste. For additional details, see PUREX Work Plan WP-P-96-015. Placed in tunnel on Car #10A-3619, on June 12, 1996. Estimated weight 46.5 tons, 1,890 Cu. Ft. Ba-~4g., Cd-<1g., Cr-~2g., Pb- <1g
26.	20,000-gallon liquid waste tank Car HO-10H-18580, empty per RCRA, placed in Tunnel on June 19, 1996, approximately 30 tons.
27.	20,000 gallon liquid waste tank Car HO-10H-18579, empty per RCRA, placed in Tunnel on June 19, 1996, approximately 30 Tons
28.	20,000-gallon liquid waste tank Car HO-10H-18582, empty per RCRA, placed in Tunnel on June 19, 1996, approximately 30 tons.

1

Contents

4.0 PROCESS INFORMATION .... Att 28.4.1

4.1 OPERATION OF THE PUREX STORAGE TUNNELS .... Att 28.4.1
4.1.1 Preparation for Tunnel Activities .... Att 28.4.1
4.1.2 Tunnel Storage Activities .... Att 28.4.2
4.1.3 Removal of Stored Material .... Att 28.4.3
4.1.4 Filling the Water-Fillable Door (Tunnel Number 2) .... Att 28.4.4
4.1.5 Poststorage Activities .... Att 28.4.4
4.1.6 Operation of the Tunnel Ventilation System .... Att 28.4.4

4.2 CONTAINERS .... Att 28.4.5
4.2.1 Containers with Free Liquids .... Att 28.4.5
4.2.2 Containers without Free Liquids that do not Exhibit Ignitability or Reactivity .... Att 28.4.5
4.2.3 Protection of Extremely Hazardous Waste in Containers .... Att 28.4.6
4.2.4 Prevention of Reaction of Ignitable, Reactive, and Incompatible Waste in Containers .... Att 28.4.6

4.3 ENGINEERING DRAWINGS .... Att 28.4.7

Figure

Figure 4.1. Water Fillable Door Exterior (Tunnel Number 2) .... Att 28.4.8

This page intentionally left blank.

4.0 PROCESS INFORMATION

This chapter discusses the processes involved in the operation of the PUREX Storage Tunnels. The PUREX Storage Tunnels are used for the storage of mixed waste from the PUREX Plant and other onsite sources.

The PUREX Storage Tunnels were designed and constructed to provide a means of protecting personnel and the environment from exposure to mixed waste associated with stored material. This design also serves to protect personnel and the environment from the dangerous waste component of the mixed waste stored inside the tunnels.

The PUREX Storage Tunnels are being permitted as a miscellaneous unit under WAC 173-303-680. The WAC regulations require that miscellaneous unit permit terms and provisions address appropriate requirements provided for other TSD units. Because the operation and construction of the PUREX Storage Tunnels most closely resemble that of a container storage unit, the appropriate requirements prescribed for a container storage unit are addressed in this chapter.

4.1 OPERATION OF THE PUREX STORAGE TUNNELS

This section describes the selection, characterization, preparation, placement, and removal activities associated with storage of mixed waste in the PUREX Storage Tunnels.

4.1.1 Preparation for Tunnel Activities

Management, with the concurrence of an appropriate cognizant engineer, determines when material is to be removed and transported to the PUREX Storage Tunnels. A job specific work plan describing the overall transfer activities is prepared.

4.1.1.1 Storage/Removal Equipment Preparation

A remotely controlled, battery-powered locomotive normally was used to move railcars into and out of the PUREX Storage Tunnels. Other mechanical means such as a standard locomotive or a winch also can be used independently or in combination with the remote locomotive should the need arise. Methods for use of the remote locomotive are described in this chapter as this represents the normal placement and removal of railcars at the PUREX Storage Tunnels. Should storage activities require the use of a mechanical means other than the remote locomotive to place or withdraw a railcar, methods for that application will be developed.

Preparatory activities associated with the remote-controlled locomotive included the following:

- Charging the batteries for both the locomotive and the radio transmitter
- Performing operational checks
- Installing a plastic shroud over the locomotive to facilitate decontamination
- Installing an anticoupling device on the south coupler of the locomotive (storage only)
- Performing physical inspections of the railroad track within the railroad tunnel to ensure that the track switches are positioned properly and the track is clear of obstructions.

4.1.1.2 Water-Fillable Door Preparation

Each PUREX Storage Tunnel has a water-fillable door that isolates the storage area from the PUREX railroad tunnel.

Currently, the water-fillable door to Tunnel Number 2 is empty and is not expected to be filled. Operational checks are performed on the door hoists. Before performing operational checks on the water-fillable door, the operator confirms with a dispatcher that the railroad tunnel area is clear of personnel.

4.1.1.3 Other Preparation Tasks

Before material storage, the following preparatory tasks are completed.

- The storage tunnel exhaust fan is verified to be operating.
- Labels will be attached to the railcar in accordance with WAC 173-303-395(6) and 173-303-630(3) if the material contains dangerous waste components.

4.1.2 Tunnel Storage Activities

This section describes the placement of material within the PUREX Storage Tunnels.

4.1.2.1 Physical Characterization of Material to be Stored

Physical characterization includes an evaluation of the following physical properties:

- Length, width, and height
- Gross weight and volume
- Preferred orientation for transport and storage
- Presence of mixed waste.

Information sources used in physical characterization include equipment fabrication and installation drawings, operational records, and process knowledge. Physical characterization provides information necessary to appropriately describe the mixed waste materials. Such information also is used to design and fabricate, if required, supports on the railcar.

Specific material known to contain constituents that would cause the equipment to be designated as mixed waste is discussed in the waste analysis plan (Attachment 28, Chapter 3.0). The material includes but is not limited to dissolvers that contain elemental mercury; silver reactors that contain silver salts; jumpers and other equipment that have elemental lead counterweights; a concentrator that contains chromium; neutron absorbing equipment containing cadmium. Characteristics of these materials when stored as mixed waste are described in Attachment 28, Chapter 3.0. Waste transferred to the PUREX Storage Tunnels from other than PUREX Plant also would be physically characterized.

4.1.2.2 Material Flushing

Before removal from service, the material from the PUREX Plant was flushed to minimize loss of products, to reduce contamination, and to reduce to nonregulatory levels the concentration of any dangerous chemicals present in a residual heel. In the future the analysis of the rinsate will be used to determine when these goals have been achieved. The analysis of the final flush will be retained as part of the PUREX Storage Tunnel records. Material removed from other onsite units will be prepared for transfer to the tunnels in accordance with this dangerous waste permit.

4.1.2.3 Railcar Preparation

Railcars are modified to serve as dedicated storage platforms and transporters for material placed in the PUREX Storage Tunnels. The wooden decking on the railcars is removed to minimize the amount of combustible material placed in the PUREX Storage Tunnels. The south coupler is disabled or removed to prevent the railcar from coupling to the railcar stored ahead. Brakes are disabled to ensure freewheeling of the railcar. Steel decking, catch pans filled with absorbent, and equipment cradles are provided as needed to modify the railcar for its specific task.

4.1.2.4 Placement of Material into Storage Position

With all preparations complete and with the approval of cognizant management, transferring material to the PUREX Storage Tunnels proceeds as follows.

- The water-fillable door to the storage tunnel is opened.
- The railcar is loaded as specified in the storage tunnel checklist.
- An inventory of items loaded on the railcar and a record of their location on the railcar are recorded in the storage tunnel checklist.
- A survey is obtained of the loaded railcar at a distance commensurate with ALARA practices.
- The railcar is pushed into the storage tunnel to its storage position.
- Once the railcar is in position, the water-fillable door is closed.

4.1.3 Removal of Stored Material

Removal of material stored within the PUREX Storage Tunnels is not conducted routinely. It is planned that the material will remain in storage until a means to accommodate processing and repackaging of the material for disposal or further storage or until another final disposition option becomes available. Removal of material from storage within the PUREX Storage Tunnels would proceed after the preparation activities identified in Section 4.1.1.

With all preparations complete and approval of management, removal of material from the storage area of the PUREX Storage Tunnels would proceed as follows.

- The equipment that will be used to remove material is positioned in the PUREX railroad tunnel.
- Verification is made that the PUREX railroad tunnel is configured properly to proceed with entrance into the PUREX Storage Tunnels (i.e., tunnel ventilation system is operating, the overhead door is closed and a survey of the area is performed for ALARA concerns).
- The water-fillable door is opened.
- The equipment that will be used to remove material is moved into the storage tunnel and connected to the railcar.
- Verification is made that the railcar is connected to the removal equipment and the railcar is extracted from the storage tunnel and positioned within the PUREX railroad tunnel.
- The water-fillable door is closed.

The loaded railcar retrieved from the tunnel would be remotely viewed and measurements may be obtained to determine the possibility of mixed waste containment failure during storage in the PUREX Storage Tunnels. If evidence of containment failure is detected, the specific details (i.e., material, location on railcar, storage position) would be documented and attached to the waste tracking form. This information would be maintained in the files and would be used to establish sampling locations within the tunnels at closure. After remote viewing and surveying, the railcar and associated material may be prepared as required for transfer to an appropriate onsite TSD unit for treatment or further storage.

4.1.4 Filling the Water-Fillable Door (Tunnel Number 2)

If shielding beyond that provided by the empty water-fillable door becomes necessary, the door can be filled with water. In the past, this was accomplished by connecting a fire hose from the water hydrant to the wall stub on the exterior of the door housing (Figure 4.1). Once the fire hose was in place, the hydrant valve was opened and the door was filled with water.

The hydrant was closed by personnel when a high-level indicator light illuminated. Although attendance by an operator is required at all times during filling operations, should the door overfill, excess water is channeled through a vent/spill pipe to the door sump. A 15.2-centimeter drain is provided in each door sump. Water accumulated in the door sump was pumped out to the Double-Shell Tank System, and the sump and drain were made inoperable during PUREX Facility deactivation activities. The drain was sealed during PUREX Facility deactivation. In the future, a temporary source of water could be provided for filling the water-fillable door.

4.1.5 Poststorage Activities

The following poststorage activities would conclude the tunnel storage task.

- Decontamination activities, if required, are performed.
- Management is notified of any unusual conditions observed during the storage/retrieval activities.

4.1.6 Operation of the Tunnel Ventilation System

The ventilation systems for Tunnel Number 1 and Tunnel Number 2 were designed to ventilate air from within the tunnels so the airborne contamination is vented through a HEPA filtered exhaust system.

4.1.6.1 Tunnel Number 1 Ventilation

Active ventilation of Tunnel Number 1 presently is not provided. After placement of the last railcar into Tunnel Number 1, the tunnel was sealed (Attachment 28, Chapter 2.0). As part of the sealing activities, the ventilation fan was deactivated electrically and the exhaust stack and filter were isolated from the system by installing blanks upstream and downstream of both the exhaust fan and filter and the stack was removed. In the event railcar removal activities are initiated, it is planned that the ventilation system would be reactivated. Operation of the ventilation system would be similar to that for Tunnel Number 2.

4.1.6.2 Tunnel Number 2 Ventilation

The Tunnel Number 2 ventilation system presently is inactive. As part of PUREX Facility deactivation, the water-fillable door and outer PUREX railroad tunnel door were sealed. The seal may be temporary or permanent depending on the future need for storing waste in the tunnel. The ventilation system may be operated continuously, or de-energized and reactivated during waste placement activities. During deactivation, a blank was installed on the downstream side of the filter and the stack was capped. When the determination has been made that Tunnel Number 2 will no longer receive waste, the ventilation system will be blanked and deactivated electrically similar to the Tunnel Number 1 ventilation system. While the Tunnel Number 2 ventilation system is operating and the water-fillable door is closed, the exhaust system, which discharges approximately 100 cubic meters per minute, maintains a slightly negative pressure in the tunnel. The exhaust air is replaced by infiltration around the water-fillable door and through the porosity of the tunnel structure (e.g., the rail-bed ballast). When the water-fillable door is open (during transfer activities), inward airflow is maintained through the open doorway. This inward airflow channels airborne radioactive contamination away from both the railroad tunnel and personnel following railcars (if allowed) into the storage tunnel. A HEPA filter provides filtration of all exhaust air before release to the atmosphere. When the ventilation system is operating, the HEPA filter is tested in place at least annually to ensure radioactive particulate removal efficiency. Exhausted air is sampled periodically and analyzed for airborne radionuclides.

4.2 CONTAINERS

This section describes the various types of containment used to isolate mixed waste stored in the PUREX Storage Tunnels. The PUREX Storage Tunnels are considered to be a miscellaneous unit most closely resembling that of a container storage unit. The mixed waste stored in the PUREX Storage Tunnels is contained and is not considered a risk to human health or to the environment.

4.2.1 Containers with Free Liquids

The only mixed waste stored as a free liquid is elemental mercury. A small quantity, less than 1.7 liters, of mercury is contained in each of the two thermowells attached to and contained within each dissolver (Attachment 28, Chapter 3.0). Primary containment of the mercury is provided by the all-welded construction of the thermowell itself, which is fabricated from 7.6-centimeter, Schedule 80, 304L stainless steel pipe. The open upper end of the thermowell was plugged with a 304L stainless steel nozzle plug in preparation for storage. The dissolver rests on a cradle on its railcar in an inclined position. This ensures that the mercury remains in the lower portion of the thermowell and is not in contact with the mechanical closure on the nozzle end of the thermowell.

A secondary containment barrier for mercury, should it leak from the thermowell, is provided by the dissolver itself. The dissolver is a 304L stainless steel process vessel constructed from 1-centimeter-thick plate and is approximately 2.7 meters in diameter. The dissolver is of all-welded construction and contains no drains or nozzle outlets in the bottom several feet of its lower section, which contains both thermowells.

The 304L stainless steel used to contain the elemental mercury is both compatible with the waste itself and the storage environment. The potential for significant deterioration of either the primary or secondary containment barrier material before closure is considered to be negligible.

The dissolvers stored within the PUREX Storage Tunnels are not labeled as containing characteristic toxic mercury (D009) [WAC 173-303-090(8)(c)]. Procedures for labeling were not in place at the time of storage. Personnel access into the storage area for purposes such as labeling is not feasible and cannot be justified under ALARA guidelines. Based on ALARA, mixed waste presently within the PUREX Storage Tunnels will remain unlabeled. However, during future transfers of mixed waste into the PUREX Storage Tunnels the railcars will be labeled as specified by WAC 173-303-395(6) and WAC 173-303-630(3).

4.2.2 Containers without Free Liquids that do not Exhibit Ignitability or Reactivity

Most lead is fully contained in all-welded encasements of either carbon steel or 304L stainless steel (refer to Attachment 28, Chapter 3.0, Table 1). The encasement serves as support, protection against mechanical damage, and protection of the lead from exposure to the environment. Also, lead has been placed in burial boxes of appropriate size. The boxes provide secondary containment for the lead in the unlikely event the primary encasement should fail. Although boxes may be open on the top, the PUREX Storage Tunnels are enclosed; therefore, the containers are protected from the elements.

Both carbon steel and 304L stainless steel used to encase the lead are compatible with the waste and the storage environment. Significant deterioration of either the primary or secondary containment barrier materials before closure is not considered to be credible.

In the past, material that contains lead or that has encased lead attached was not labeled as containing characteristic toxic lead (D008) [WAC 173-303-090(8)], because the requirements were not yet on line. As stated in Section 4.2.1, personnel entry into the tunnel storage area for purposes of labeling would be inconsistent with ALARA guidelines. However, during future storage of material containing lead the railcars will be labeled in accordance with WAC 173-303-395(6) and WAC 173-303-630(3).

4.2.3 Protection of Extremely Hazardous Waste in Containers

The present amount of mixed waste stored in the PUREX Storage Tunnels is sufficient to characterize this material as extremely hazardous waste. Because the PUREX Storage Tunnels are enclosed totally, protective covering from the elements and from run-on is provided for the storage of extremely hazardous waste. Periodic inspection of the equipment stored in the PUREX Storage Tunnels is not feasible and cannot be justified under ALARA guidelines. Safe management of this waste is based on the following considerations.

- The operation of the PUREX Storage Tunnels is passive, i.e., once a storage position is filled, the storage position remains undisturbed until closure.
- The extremely hazardous waste is compatible with its storage container and the storage environment.

4.2.4 Prevention of Reaction of Ignitable, Reactive, and Incompatible Waste in Containers

There is no reactive or incompatible waste known to be stored in the PUREX Storage Tunnels. The only mixed waste stored in the PUREX Storage Tunnels considered an ignitable waste is the silver nitrate in Tunnel Number 2. The silver nitrate fraction of the silver salts, within the silver reactors, exhibits the characteristic of ignitability as defined in 49 CFR 173.127(a). Therefore, the silver salts are managed as an ignitable dangerous waste in accordance with WAC 173-303-395.

- The risk of fire associated with the storage of silver nitrate in the PUREX Storage Tunnels is considered to be extremely low. This conclusion is based on the following considerations.
- The operation of the PUREX Storage Tunnels is passive; i.e., once a storage position is filled, the storage position remains undisturbed until closure.
- The silver nitrate is contained within large, heavy-walled stainless steel vessels that isolate the silver nitrate from contact with any combustibles that might be in the tunnels.
- The silver nitrate is dispersed over a large surface area on a ceramic packing substraight and is not conducive to build-up of heat that could lead to spontaneous combustion.
- Personnel access to the occupied areas of the tunnels is not permitted, thereby precluding activities that could present a fire hazard (e.g., smoking, flame cutting, welding, grinding, and other electrical activities).

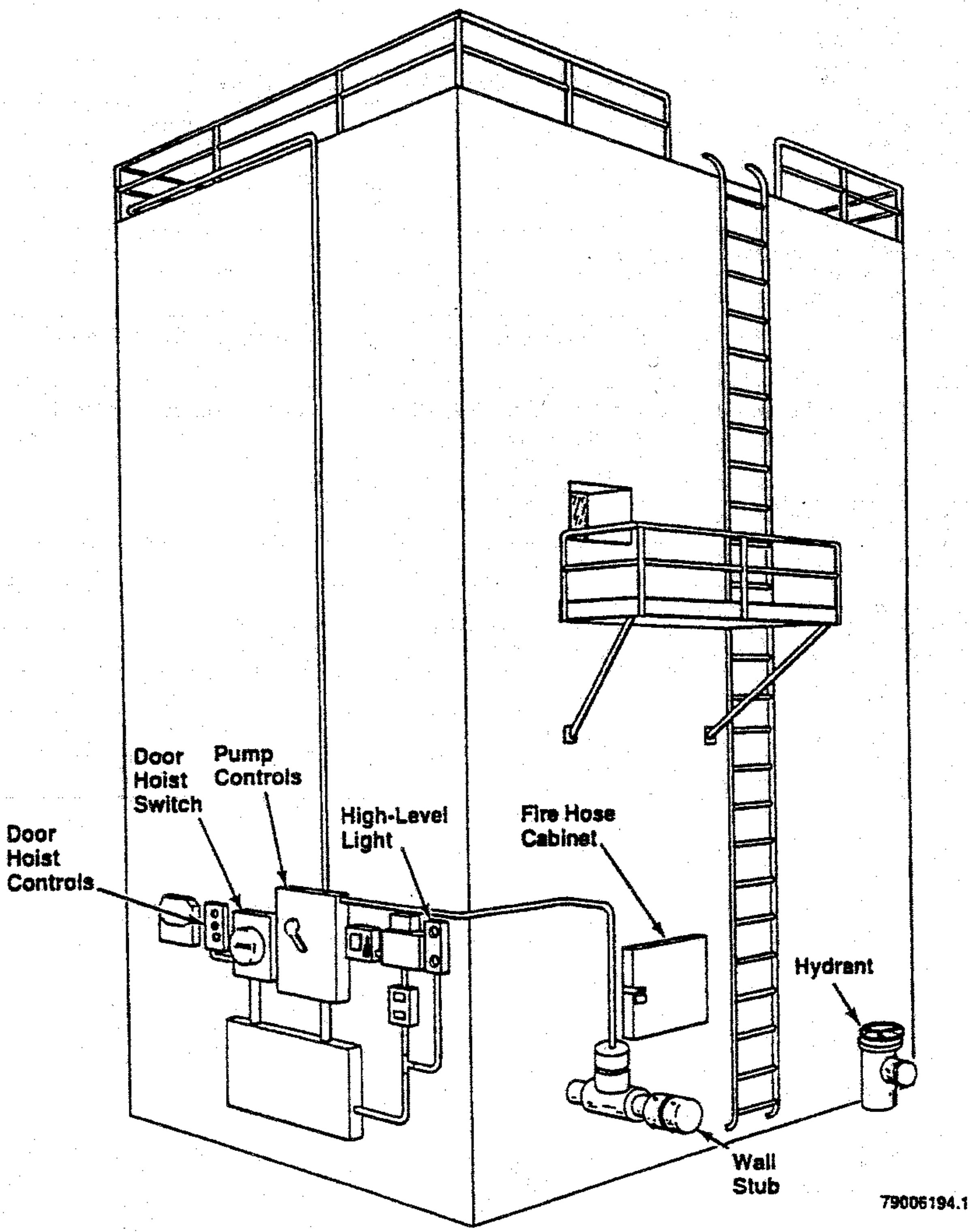
Although ignitable waste storage units are required by WAC 173-303-395(1)(d) to have inspections conducted at least yearly by a fire marshall or professional fire inspector familiar with the requirements of the uniform fire code, the ALARA concerns within the PUREX Storage Tunnels make such inspections impractical. These inspections are not considered appropriate or necessary for the safe operation of the unit because of the nature of the ignitable waste, the means of storage, and ALARA concerns (Attachment 28, Chapter 6.0, §6.2).

4.3 ENGINEERING DRAWINGS

As-built drawings for the PUREX Storage Tunnels:

H-2-55587	218-E-14 Structural Floor Plan and Section
H-2-55588	Structural Sections and Details: Disposal Facility for Failed Equipment
H-2-55589	Structural Sections and Details: Disposal Facility for Failed Equipment
H-2-55590	Door and Hoist Details
H-2-55591	Door and Hoist Details
H-2-55592	Door and Hoist Details
H-2-55593	Electrical Details
H-2-55594	Shielding Door Fill and Drain Lines Arrangement: Disposal Facility for Failed Equipment
H-2-55599	Electrical Door Control Plan, Elementary Diagram and Miscellaneous Details: Disposal Facility for Failed PUREX Equipment
H-2-58134	Ventilation Details; Sheet 1, Sheet 2, Sheet 3, Sheet 4
H-2-58175	PUREX Tunnel
H-2-58193	Sump Details
H-2-58194	Sump Details
H-2-58195	Structural Sections and Details: Equipment Disposal - PUREX
H-2-58206	Sump Details
H-2-58208	Fan Details; Sheet 1, Sheet 2, Sheet 3
H-2-94756	Filter Details; Sheet 1, Sheet 2

Figure 4.1. Water Fillable Door Exterior (Tunnel Number 2)



Contents

6.0 PROCEDURES TO PREVENT HAZARDS .... Att 28.6.1

6.1 SECURITY .... Att 28.6.1
6.1.1 Security Procedures and Equipment .... Att 28.6.1
6.1.2 Waiver .... Att 28.6.1

6.2 INSPECTION PLAN .... Att 28.6.2

6.3 PREPAREDNESS AND PREVENTION REQUIREMENTS .... Att 28.6.2
6.3.1 Equipment Requirements .... Att 28.6.2
6.3.2 Aisle Space Requirement .... Att 28.6.3

6.4 PREVENTIVE PROCEDURES, STRUCTURES, AND EQUIPMENT .... Att 28.6.3
6.4.1 Unloading Operations .... Att 28.6.3
6.4.2 Run-Off .... Att 28.6.3
6.4.3 Water Supplies .... Att 28.6.3
6.4.4 Equipment and Power Failures .... Att 28.6.4
6.4.5 Personnel Protection Equipment .... Att 28.6.4

6.5 PREVENTION OF REACTION OF IGNITABLE, REACTIVE, AND/OR INCOMPATIBLE WASTE .... Att 28.6.4

This page intentionally left blank.

Contents

7.0 CONTINGENCY PLAN .... Att 28.7.1

7.1 GENERAL INFORMATION .... Att 28.7.1
7.1.1 Facility Name .... Att 28.7.1
7.1.2 Facility Location .... Att 28.7.1
7.1.3 Owner .... Att 28.7.1
7.1.4 Facility Manager .... Att 28.7.1
7.1.5 Description of Facility and Operations .... Att 28.7.1
7.1.6 Building Evacuation Route .... Att 28.7.2

7.2 EMERGENCY COORDINATORS/BUILDING EMERGENCY DIRECTOR .... Att 28.7.2

7.3 IMPLEMENTATION OF THE PLAN .... Att 28.7.2
7.3.1 Dangerous and/or Mixed Waste .... Att 28.7.3
7.3.2 Fire or Explosion .... Att 28.7.3
7.3.3 Seismic Event/Tornado .... Att 28.7.4
7.3.4 Aircraft Crash .... Att 28.7.4
7.3.5 Bomb Threat/Explosive Device .... Att 28.7.5
7.3.6 Damaged Dangerous and/or Mixed Waste Shipment .... Att 28.7.5

7.4 UNIT/BUILDING EMERGENCY RESPONSE PROCEDURES .... Att 28.7.5
7.4.1 Notification .... Att 28.7.5
7.4.2 Identification of Released/Spilled Materials .... Att 28.7.6
7.4.3 Prevention of Recurrence or Spread of Fires, Explosions, Releases .... Att 28.7.6
7.4.4 Termination of Event .... Att 28.7.6
7.4.5 Incident Recovery and Restart of Operations .... Att 28.7.6
7.4.6 Incompatible Waste .... Att 28.7.7
7.4.7 Post Emergency Equipment Maintenance and Decontamination .... Att 28.7.7

7.5 EMERGENCY EQUIPMENT .... Att 28.7.7

7.6 COORDINATION AGREEMENTS .... Att 28.7.7

7.7 REQUIRED REPORTS .... Att 28.7.8

7.8 REFERENCES .... Att 28.7.8

Figure

Figure 7.1. PUREX Storage Tunnels Evacuation Route .... Att 28.7.9

Table

Table 7.1. Emergency Coordinator/Building Emergency Director [a] .... Att 28.7.2

This page intentionally left blank.

Contents

8.0 PERSONNEL TRAINING....................Att 28.8.1

8.1 OUTLINE OF INTRODUCTORY AND CONTINUING TRAINING PROGRAMS .....Att 28.8.1
8.1.1 Introductory Training ....Att 28.8.1
8.1.2 Continuing Training ....Att 28.8.2

8.2 DESCRIPTION OF TRAINING DESIGN ....Att 28.8.2

8.3 DESCRIPTION OF TRAINING PLAN ....Att 28.8.3

This page intentionally left blank.

8.0 PERSONNEL TRAINING

This chapter discusses personnel training requirements based on WAC 173-303 and the HF RCRA Permit (DW Portion). In accordance with WAC 173-303-806(4)(a)(xii), the *Hanford Facility Dangerous Waste Part B Permit Application* must contain two items: (1) "an outline of both the introductory and continuing training programs by owners or operators to prepare persons to operate or maintain the TSD facility in a safe manner as required to demonstrate compliance with WAC 173-303-330" and (2) "a brief description of how training will be designed to meet actual job tasks in accordance with the requirements in WAC 173-303-330(1)(d)." The HF RCRA Permit, (DW portion) Condition II.C (Personnel Training) contains training requirements applicable to Hanford Facility personnel and non-Facility personnel.

Compliance with these requirements at the PUREX Storage Tunnels is demonstrated by information contained both in Attachment 33, General Information Portion, Chapter 8.0 (DOE/RL-91-28) and this chapter. This chapter supplements Attachment 33, General Information Portion, Chapter 8.0 (DOE/RL-91-28).

8.1 OUTLINE OF INTRODUCTORY AND CONTINUING TRAINING PROGRAMS

The introductory and continuing training programs are designed to prepare personnel to manage and maintain the TSD unit in a safe, effective, and environmentally sound manner. In addition to preparing personnel to manage and maintain TSD units under normal conditions, the training programs ensure that personnel are prepared to respond in a prompt and effective manner should abnormal or emergency conditions occur. Emergency response training is consistent with the description of actions contained in Attachment 28, Chapter 7.0, Contingency Plan. The introductory and continuing training programs contain the following objectives:

- Teach Hanford Facility personnel to perform their duties in a way that ensures the Hanford Facility's compliance with WAC 173-303
- Teach Hanford Facility personnel dangerous waste management procedures (including implementation of the contingency plan) relevant to the job titles/positions in which they are employed, and
- Ensure Hanford Facility personnel can respond effectively to emergencies.

8.1.1 Introductory Training

Introductory training includes general Hanford Facility training and TSD unit-specific training. General Hanford Facility training is described in Attachment 33, General Information Portion, Section 8.1 (DOE/RL-91-28), and is provided in accordance with the HF RCRA Permit (DW Portion), Condition II.C.2. TSD unit-specific training is provided to Hanford Facility personnel allowing those personnel to work unescorted, and in some cases is required for escorted access. Hanford Facility personnel cannot perform a task for which they are not properly trained, except to gain required experience while under the direct supervision of a supervisor or coworker who is properly trained. Hanford Facility personnel must be trained within 6 months after their employment at or assignment to the Hanford Facility, or to a new job title/position at the Hanford Facility, whichever is later

General Hanford Facility training: Refer to description in Attachment 33, General Information Portion, Section 8.1 (DOE/RL-91-28).

Contingency Plan training: Hanford Facility personnel receive training on applicable portions of Attachment 4, *Hanford Emergency Management Plan* (DOE/RL-94-02) in general Hanford Facility training. In addition, Hanford Facility personnel receive training on content of the description of actions contained in contingency plan documentation in Attachment 28, Chapter 7.0 to be able to effectively respond to emergencies.

Emergency Coordinator training: Hanford Facility personnel who perform emergency coordinator duties in WAC 173-303-360 (e.g., Building Emergency Director) in the Hanford Incident Command System receive training on implementation of the contingency plan and fulfilling the position within the Hanford Incident Command System. These Hanford Facility personnel must also become thoroughly familiar with applicable contingency plan documentation, operations, activities, location, and properties of all waste handled, location of all records, and the unit/building layout.

Operations training: Dangerous waste management operations training (e.g., waste designation training, shippers training) is determined on a unit-by-unit basis and considers the type of waste management unit (e.g., container management unit) and the type of activities performed at the waste management unit (e.g., sampling). For example, training provided for management of dangerous waste in containers is different than the training provided for management of dangerous waste in a tank system. Common training required for compliance within similar waste management units can be provided in general training and supplemented at the TSD unit. Training provided for TSD unit-specific operations is identified in the training plan documentation based on: (1) whether a general training course exists, (2) the training needs to ensure waste management unit compliance with WAC 173-303, and (3) training commitments agreed to with Ecology.

8.1.2 Continuing Training

Continuing training meets the requirements for WAC 173-303-330(1)(b) and includes general Hanford Facility training and TSD unit-specific training.

General Hanford Facility training: Annual refresher training is provided for general Hanford Facility training. Refer to description in Attachment 33, General Information Portion, Section 8.1 (DOE/RL-91-28).

Contingency plan training: Annual refresher training is provided for contingency plan training. Refer to description above in Section 8.1.1.

Emergency coordinator training: Annual refresher training is provided for emergency coordinator training. Refer to description above in Section 8.1.1.

Operations training: Refresher training occurs on many frequencies (i.e., annual, every other year, every three years) for operations training. When justified, some training will not contain a refresher course and will be identified as a one-time only training course. The TSD unit-specific training plan documentation will specify the frequency for each training course. Refer to description above in Section 8.1.1.

8.2 DESCRIPTION OF TRAINING DESIGN

Proper design of a training program ensures personnel who perform duties on the Hanford Facility related to WAC 173-303-330(1)(d) are trained to perform their duties in compliance with WAC 173-303. Actual job tasks, referred to as duties, are used to determine training requirements. The first step taken to ensure Hanford Facility personnel have received the proper training is to determine and document the waste management duties by job title/position. The second step compares waste management duties to general waste management unit training curriculum. If general waste management unit training curriculum does not address the waste management duties, the training curriculum is supplemented and/or on-the-job training is provided. The third step summarizes the content of a training course necessary to ensure that the training provided to each job title/position addresses associated waste management duties. The last step is to assign training curriculum to Hanford Facility personnel based on the previous evaluation. The training plan documentation contains this process.

Waste management duties include those specified in Section 8.1 as well as those contained in WAC 173-303-330(1)(d). Training elements of WAC 173-303-330(1)(d) applicable to the PUREX Storage Tunnels operations include the following:

- Communications or alarm systems
- Response to fires or explosions

Hanford Facility personnel who perform these duties receive training pertaining to their duties. The training plan documentation described in Section 8.3 contains specific information regarding the types of training Hanford Facility personnel receive based on the outline in Section 8.1.

8.3 DESCRIPTION OF TRAINING PLAN

In accordance with HF RCRA Permit (DW Portion), Condition II.C.3, the unit-specific portion of the *Hanford Facility Dangerous Waste Permit Application* must contain a description of the training plan. Training plan documentation is maintained outside of the *Hanford Facility Dangerous Waste Part B Permit Application* and the HF RCRA Permit. Therefore, changes made to the training plan documentation are not subject to the HF RCRA Permit modification process. However, the training plan documentation is prepared to comply with WAC 173-303-330(2).

Documentation prepared to meet the training plan consists of hard copy and/or electronic media as provided by HF RCRA Permit (DW Portion), Condition II.C.1. The training plan documentation consists of one or more documents and/or a training database with all the components identified in the core document.

A description of how training plan documentation meets the three items in WAC 173-303-330(2) is as follows:

1. -330(2)(a): "The job title, job description, and name of the employee filling each job. The job description must include requisite skills, education, other qualifications, and duties for each position."

   Description: The specific Hanford Facility personnel job title/position is correlated to the waste management duties. Waste management duties relating to WAC 173-303 are correlated to training courses to ensure training properly is assigned.

   Only names of Hanford Facility personnel who carry out job duties relating to TSD unit waste management operations at the PUREX Storage Tunnels are maintained. Names are maintained within the training plan documentation. A list of Hanford Facility personnel assigned to the PUREX Storage Tunnels is available upon request.

   Information on requisite skills, education, and other qualifications for job titles/positions are addressed by providing a reference where this information is maintained (e.g., human resources). Specific information concerning job title, requisite skills, education, and other qualifications for personnel can be provided upon request.

2. -330(2)(b): "A written description of the type and amount of both introductory and continuing training required for each position."

   Description: In addition to the outline provided in Section 8.1, training courses developed to comply with the introductory and continuing training programs are identified and described in the training plan documentation. The type and amount of training is specified in the training plan documentation.

3. -330(2)(c): "Records documenting that personnel have received and completed the training required by this section. The Department may require, on a case-by-case basis, that training records include employee initials or signature to verify that training was received."

Description: Training records are maintained consistent with Attachment 33, General Information Portion, Section 8.4 (DOE/RL-91-28)

Contents

10.0 WASTE MINIMIZATION .... Att 28.10.1

This page intentionally left blank.

10.0 WASTE MINIMIZATION

To fulfill the requirements of 40 CFR 264.73(b)(9), a certification form that the PUREX Storage Tunnels have a waste minimization/pollution prevention program in place will be entered, annually, into the PUREX Storage Tunnels operating record.

This page intentionally left blank.

Contents

11.0 CLOSURE AND FINANCIAL ASSURANCE .... Att 28.11.1

11.1 IN SITU DISPOSAL OPTIONS .... Att 28.11.1
11.1.1 Backfilling the PUREX Storage Tunnels with Gravel .... Att 28.11.1
11.1.2 Injecting the PUREX Storage Tunnels with Grout .... Att 28.11.1
11.1.3 Combination of Grout Injection and Backfilling .... Att 28.11.1

11.2 RETRIEVAL/CLEAN CLOSURE OPTIONS .... Att 28.11.2
11.2.1 Retrieval and Disposal in the PUREX Plant .... Att 28.11.2
11.2.2 Retrieval and Physical Processing (size reduction) in the PUREX Plant and Subsequent Disposal .... Att 28.11.2
11.2.3 Construction of a New Facility for Retrieval, Processing, and Treatment of Equipment for Disposal .... Att 28.11.2

This page intentionally left blank.

11.0 CLOSURE AND FINANCIAL ASSURANCE

Closure of the PUREX Storage Tunnels requires coordination with closure of the PUREX Plant to ensure a cost effective closure for both units. In addition, the nature of the mixed waste located within the PUREX Plant and PUREX Storage Tunnels precludes the determination of the type of treatment and/or disposition of the waste at this time.

The PUREX Storage Tunnels will be managed as a RCRA storage unit until closure can be coordinated with the final closure plan for the PUREX Plant. The PUREX Storage Tunnels closure plan will be submitted after any required National Environmental Policy Act of 1969 documentation and land usage agreements, which initiate disposition and aid in identifying or developing necessary disposition activities, have been adopted. The PUREX Storage Tunnels closure plan will be submitted for Ecology approval with the PUREX Plant closure plan.

The PUREX Storage Tunnels closure plan will be written to meet the requirements of WAC 173-303-140 and WAC 173-303-610. This closure plan might consider but will not be limited to the following options for either in situ disposal or retrieval/clean closure of this unit.

Federal facilities are not required to comply with WAC 173-303-620 as is stated in the regulations and as described in Permit Condition II.H.3 of the Hanford Facility RCRA Permit (Ecology 1994).

11.1 IN SITU DISPOSAL OPTIONS

This closure plan might consider but will not be limited to the following options for in situ disposal of waste in this unit.

11.1.1 Backfilling the PUREX Storage Tunnels with Gravel

This option could involve backfilling the tunnels with gravel to eliminate void space and prevent ground subsidence. A modified commercially available centrifugal rock-throwing device could be placed in newly constructed risers evenly spaced along each tunnel roof. Fill material could be supplied and dispersed into the tunnels by automated controls. Following the fill process, all equipment could be removed from the tunnel roofs and all means of access to the tunnels could be permanently sealed. Final activities could involve the construction of a final surface barrier that meets RCRA landfill cover requirements to prevent water from leaching mixed waste contained in the tunnels.

11.1.2 Injecting the PUREX Storage Tunnels with Grout

This option could involve the injection of grout material into each tunnel to stabilize and immobilize contained materials and prevent ground subsidence. A grout injector could be alternately placed in newly constructed risers evenly spaced along each tunnel roof. Grout material could be supplied and dispersed into the tunnels by automated controls. The grout material could be injected in lifts to accommodate curing and heat dissipation normally associated with the use of this type of material. Final activities could involve the construction of a final surface barrier that meets RCRA landfill cover requirements to prevent water from leaching mixed waste contained in the tunnels.

11.1.3 Combination of Grout Injection and Backfilling

This option combines grout injection with gravel backfilling similar to the processes discussed previously. Grout could be injected first to fill void spaces under the railcars and provide a basal structure. Gravel could be dispersed to fill remaining void space and prevent ground subsidence. Final activities could involve the construction of a final surface barrier that meets RCRA landfill cover requirements to prevent water from leaching mixed waste contained in the tunnels.

11.2 RETRIEVAL/CLEAN CLOSURE OPTIONS

This closure plan might consider but will not be limited to the following options for retrieval/clean closure of this unit.

11.2.1 Retrieval and Disposal in the PUREX Plant

Railcars stored in both tunnels could be remotely retrieved one at a time and moved beneath the horizontal door of the railroad tunnel extension for remote viewing, and if possible, characterization. Transfer procedures could be initiated to move waste material from the railcars to the PUREX Plant canyon deck area. Following transfer of the waste material, the railcars could be decontaminated and removed for final disposition at other onsite units. Final disposition of the waste transferred to the canyon deck area could be in accordance with PUREX Plant closure documentation. The PUREX Storage Tunnels could be closed after submittal and implementation of a PUREX Storage Tunnels closure plan in conjunction with PUREX Plant closure documentation. The PUREX Storage Tunnels closure plan will detail verification sampling and analysis to be performed as a part of closure activities.

11.2.2 Retrieval and Physical Processing (size reduction) in the PUREX Plant and Subsequent Disposal

Retrieval of waste material stored in the tunnels could be similar to that described in the previous section. Once the waste material was transferred to the PUREX Plant canyon deck area, characterization and size reduction of waste material could proceed. An area located on the canyon deck or in a process cell could be modified to include all necessary equipment to perform characterization and size reduction activities. Size reduction could be performed through various technologies that include, but are not limited to, flame cutting, water jet cutting, sawing, or other technologies. Final disposition of the processed waste material either onsite or offsite could be in accordance with regulations and procedures in place at that time. The PUREX Storage Tunnels could be closed after submittal and implementation of a PUREX Storage Tunnels closure plan in conjunction with PUREX Plant closure documentation. The PUREX Storage Tunnels closure plan will detail verification sampling and analysis to be performed as a part of closure activities.

11.2.3 Construction of a New Facility for Retrieval, Processing, and Treatment of Equipment for Disposal

This option involves the construction of a new unit that is either mobile or stationary to excavate, retrieve, and treat waste material stored in the tunnels. The unit could be constructed in a manner consistent with the retrieval and handling requirements for large, contaminated waste material. Following retrieval, the waste material could be treated in accordance with final onsite or offsite disposition requirements identified at such time. The excavated tunnels could have a temporary surface barrier placed in position until verification and sampling analysis could be performed as a part of closure activities to be performed in conjunction with PUREX Plant closure.

Contents

12.0 REPORTING AND RECORDKEEPING .... Att 28.12.1

This page intentionally left blank.

12.0 REPORTING AND RECORDKEEPING

Reporting and recordkeeping requirements that could be applicable to the Hanford Facility are described in Attachment 33, General Information Portion, Chapter 12.0 (DOE/RL-91-28). Not all of these requirements and associated reports and records identified in Attachment 33, General Information Portion, Chapter 12.0 are applicable to the PUREX Storage Tunnels. Those reporting and recordkeeping requirements determined to be applicable to the PUREX Storage Tunnels are summarized as follows:

- Hanford Facility Contingency Plan and incident records (as identified in the General Information Portion):
  - Immediate reporting
  - Written reporting
  - Shipping paper discrepancy reports.
- Unit-specific permit documentation and associated plans
- Personnel training records
- Inspection records (unit)
- Onsite transportation documentation
- Land disposal restriction records
- Waste minimization and pollution prevention.

In addition, the following reports prepared for the Hanford Facility will contain input, when appropriate, from the PUREX Storage Tunnels:

- Quarterly Hanford Facility RCRA Permit modification report
- Anticipated noncompliance
- Required annual reports.

Annual reports updating projections of anticipated costs for closure and postclosure will be submitted when the PUREX Storage Tunnels closure plan is submitted with the PUREX Plant closure plan for Ecology approval (Attachment 28, Chapter 11.0).

The PUREX Tunnels Operating Record 'records contact' is kept on file in the General Information file of the Hanford Facility Operating Record (refer to Attachment 33, General Information Portion, Chapter 12.0 [DOE/RL-91-28]).

This page intentionally left blank.

Contents

13.0 OTHER FEDERAL AND STATE LAWS.. Att 28.13.1

This page intentionally left blank.

13.0 OTHER FEDERAL AND STATE LAWS

Other federal and state laws and local requirements applicable to the PUREX Storage Tunnels (*Atomic Energy Act of 1954*, *Clean Air Act Amendments of 1990*, *Toxic Substances Control Act of 1976*, *State Environmental Policy Act of 1971*, *Federal Facilities Compliance Act of 1992*, and the *Federal Insecticide, Fungicide, and Rodenticide Act of 1975*) are discussed in Attachment 33, General Information Portion, Chapter 13.0 (DOE/RL-91-28).

This page intentionally left blank.

ATTACHMENT 31

300 Area Process Trenches

Contents

1.0 PART A DANGEROUS WASTE PERMIT .... Att 31.1.i

2.0 INTRODUCTION 300-FF-1 PROPOSED PLAN DISCUSSIONS AND EFFECTS ON THE 300-FF-1 PHASE III FEASIBILITY STUDY AND 300 AREA PROCESS TRENCHES MODIFIED CLOSURE/POSTCLOSURE PLAN .... Att 31.2.i

3.0 300 AREA PROCESS TRENCHES GROUNDWATER MONITORING PLAN .... Att 31.3.i

8.0 POSTCLOSURE PLAN .... Att 31.4.i

This page intentionally left blank.

Contents

1.0 PART A DANGEROUS WASTE PERMIT .... Att. 31.1.i

This page intentionally left blank

FORM 3

DANGEROUS WASTE PERMIT APPLICATION

I. EPA/State I.D. No.

W	A	7	8	9	0	0	0	8	9	6	7

FOR OFFICIAL USE ONLY

Application Approved	Date Received (month/ day / year)	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 revised 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/STATE I.D. Number in Section I above.

A. First Application (place an "X" below and provide the appropriate date)

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

MO	DAY	YEAR
03	22	1943

*For existing facilities, provide the date (mo/day/yr) operation began or the date construction commenced. (use the boxes to the left)

*The date construction of the Hanford Facility commenced

☐ **2. New Facility** (Complete item below.)

MO	DAY	YEAR

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 DESIGN 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 entering codes. If more lines are needed, enter the codes(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe the 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 used. Only the units of measure that are listed below should be used.

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
STORAGE:		
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
	S06	Cubic yards or cubic meters*
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
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	Unit of Measure	Unit of Measure Code	Unit of Measure	Unit of Measure Code
Gallons	G	Liters Per Day	V	Acre-Feet	A
Liters	L	Tons Per Hour	D	Hectare-Meter	F
Cubic Yards	Y	Metric Tons Per Hour	W	Acres	B
Cubic Meters	C	Gallons Per Hour	E	Hectares	Q
Gallons Per Day	U	Liters Per Hour	H		

*Add per request of Washington State Department of Ecology (01/2001)

III. PROCESS – CODES AND DESIGN CAPACITIES (continued)

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 No.	A. Process Code (from list above)			B. Process Design Capacity 1. Amount (Specify)	2. Unit of Measure (enter code)			For Official Use Only			
X-1	S	0	2	600		G					
X-2	T	0	3	20		E					
1	D	8	4	11,356,200		V					
2											
3											
4											
5											
6											
7											
8											
9											
10											

C. Space for additional process codes or for describing other process (code "T04"). For each process entered here include design capacity.

D84

The 300 Area Process Trenches received nonregulated process cooling water from operations in the 300 Area of the Hanford Site. The process trenches also received dangerous waste from several research and development laboratories and from the fuels fabrication process. The waste was discharged to the 300 Area Process Trenches and allowed to percolate into the soil column underlying the trenches. The annual quantity of waste identified under item IV.B. reflects the total flow to the process trenches in 1 year, and not a volume of dangerous waste discharged to the unit. This estimate was made because accurate records are unavailable regarding dangerous waste volumes discharged to the trenches. The process trenches were designed to percolate up to 11,356,200 liters (3,000,000 gallons) per day of wastewater. The 300 Area Process Trenches no longer receive dangerous waste and will be closed. The process design capacity reflects the maximum volume of water that was discharged daily, rather than the physical capacity of the unit. Closure activities have been completed and postclosure groundwater monitoring is being conducted.

IV. DESCRIPTION OF DANGEROUS WASTES

A. Dangerous Waste Number – Enter the 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 odes 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 the 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 in 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 right 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 Waste 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 of 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 with 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 year 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 corrosive only and there will be an estimated 200 pounds per year of each waste.

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)*				2. Process Description *(if a code is not entered in D(1))*
X-1	*K*	*0*	*5*	*4*	*900*		*P*		*T03*	*D80*			
X-2	*D*	*0*	*0*	*2*	*400*		*P*		*T03*	*D80*			
X-3	*D*	*0*	*0*	*1*	*100*		*P*		*T03*	*D80*			
X-4	*D*	*0*	*0*	*2*					*T03*	*D80*			*Included with above*

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

I.D. Number *(enter from page 1)*											
W	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	D	0	0	2	453,592,370		K		D84				Percolation
2	D	0	0	7			K		D84				Percolation
3	F	0	0	1			K		D84				Percolation
4	F	0	0	2			K		D84				Percolation
5	F	0	0	3			K		D84				Percolation
6	F	0	0	5			K		D84				Percolation
7	U	2	1	0			K		D84				Percolation
8	W	T	0	2			K		D84				Percolation
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													
32													
33													
34													
35													
36													
37													
38													
39													
40													

IV. DESCRIPTION OF DANGEROUS WASTE (continued)

E. Use this space to list additional process codes from Section D(1) on page 3.

The 300 Area Process Trenches received dangerous waste discharges from research and development laboratories in the 300 Area and from the fuels fabrication process. This waste consisted of state-only toxic, dangerous waste (WT02), discarded chemical product (U210), corrosive waste (D002), chromium (D007), spent halogenated solvents (F001, F002, and F003), and spent nonhalogenated solvent (F005). Accurate records are unavailable concerning the amount of dangerous waste discharged to the trenches. The estimated annual quantity of waste (item IV.B.) reflects the total quantity of both regulated and nonregulated waste water that was discharged to the unit in one year.

V. FACILIITY DRAWING Refer to attached drawing(s).

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

VI. PHOTOGRAPHS Refer to attached photograph(s).

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 Number *(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
Keith A. Klein, Manager U.S. Department of Energy Richland Operations Office	[signature]	7/1/02

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.

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.

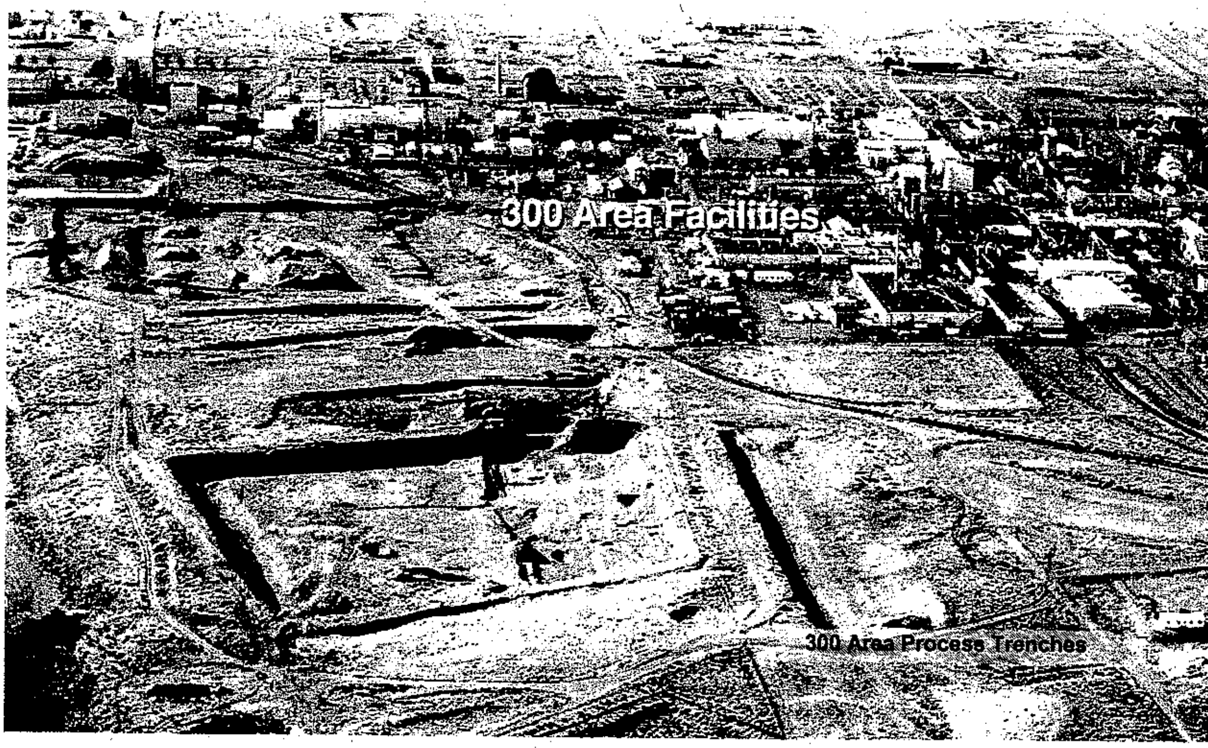
Owner/Operator
Keith A. Klein, Manager
U.S. Department of Energy
Richland Operations Office

Date 7/1/02

/FOR
Co-operator
E. Keith Thomson
President and Chief Executive Officer
Fluor Hanford

Date 5-30-02

300 Area Process Trenches



E0203055_1.JPG
(PHOTO TAKEN 2002)

Contents

2.0 300-FF-1 Proposed Plan Discussions and Effects on the 300-Ff-1 Phase III Feasibility Study and 300 Area Process Trenches Modified Closure/Postclosure Plan.......................... 31-2.1

2.1 INTRODUCTION.. 31-2.1

This page intentionally left blank.

2.0 300-FF-1 PROPOSED PLAN DISCUSSIONS AND EFFECTS ON THE 300-FF-1 PHASE III FEASIBILITY STUDY AND 300 AREA PROCESS TRENCHES MODIFIED CLOSURE/POSTCLOSURE PLAN

2.1 INTRODUCTION

The purpose of this addendum is to document the discussions and present the data and evaluations that have been developed after submittal of the 300-FF-1 Phase III Feasibility Study (FS) to the regulatory agencies for review. A number of issues were raised by the regulatory agencies that have been addressed over the past several months. Discussions of issues between the U.S. Environmental Protection Agency (EPA), the Washington State Department of Ecology (Ecology), and the U.S. Department of Energy (DOE) resulted in additional technical reviews of analytical data and site conditions that, in some cases, enhance or modify certain aspects within the 300-FF-1 Phase III FS and the 300 Area Process Trenches (300 APT) Modified Closure/Postclosure Plan. Rather than completely revise each document, this addendum is included which summarizes the discussions, data review, evaluations, and technical changes made. It supersedes related discussions in both documents and by inclusion in these documents is made part of the 300-FF-1, 300-FF-5, and 300 Area APT Administrative Records.

A listing of topics the addendum addresses is discussed in the next paragraph. The first item on that list is very important and warrants discussion in the introduction. A key conclusion resulting from using data collected prior to the Remedial Investigation (RI)/FS is that several chemical constituents are identified above regulatory standards for the 300 APT. The text in the 300 APT Modified Closure/Post Closure Plan currently indicates no chemical constituents are above *Model Toxics Control Act* (MTCA) Level C Industrial Soil Cleanup Values. This results in a substantial change to the conclusions made within the closure plan. Exceedance of this regulatory standard is a new regulatory driver to take cleanup action in the 300 APT in addition to the previously documented uranium risk driver. There were no changes to conclusions in the 300-FF-1 Phase III FS risk assessment using the older data. The magnitude of this change suggests that it is very important for reviewers to read this addendum as it supersedes some analyses in both the 300-FF-1 Phase III FS and the 300 APT Modified Closure/Postclosure Plan.

The key areas addressed in the addendum are (1) change in use of (SW-846) data collected prior to *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) characterization activities, (2) evaluation and use of additional cobalt-60 data from the South Process Pond, (3) development of a uranium cleanup standard, (4) evaluation of a cost-efficient technique to meet MTCA C Industrial Soil Cleanup Values, (5) review of volume and cost estimates, (6) revision of remedial alternatives, and (7) establishing proposed preferred remedial alternatives.

Another topic that merits a brief discussion here is the combining of the 300-FF-1 and 300-FF-5 Operable Units Proposed Plans. During review of the separate 300-FF-1 and 300-FF-5 Proposed Plans, the regulators determined that the documents should be combined to create a more integrated approach. Therefore, the proposed plan has been written to combine information from both operable units. Once the Public Comment Period is completed, the remedial alternatives for both operable units and the 300 APT will be presented in the Record of Decision. In addition, 300 APT-specific permit conditions will be administratively incorporated into the site-wide permit.

This page intentionally left blank.

Contents

3.0 300 AREA PROCESS TRENCHES GROUNDWATER MONITORING PLAN .... Att 31.3.i

SUPPORTING DOCUMENT

1. Total Pages 159

2. Title	3. Number	4. Rev No.
Groundwater Monitoring Plan for the 300 Area Process Trenches	WHC-SD-EN-AP-185	0

5. Key Words

RCRA, Final Status, Compliance Monitoring

6. Author

Name: J. W. Lindberg
C. J. Chou
V. G. Johnson

Signature 5-17-95
C.J. Chou 5-19-95

Organization/Charge Code DM623/R4CHA

7. Abstract

This document outlines the groundwater monitoring plan, under RCRA regulations in 40 CFR 264 Subpart F and WAC 173-300-645, for the 300 Area Process Trenches. The 300 Area Process Trenches will go into final status in September 1995 and sampled under a compliance monitoring program. This plan provides current program conditions and requirements.

8. RELEASE STAMP

OFFICIAL RELEASE BY WHC 20

DATE MAY 23 1995

Sta. 21

A-6400-073 (08/94) WEF124

CONTENTS

1.0 INTRODUCTION 1-1
  1.1 HISTORY OF GROUNDWATER MONITORING AT THE 300 APT 1-1
  1.2 CHANGES FROM INTERIM-STATUS GROUNDWATER MONITORING 1-2

2.0 FACILITY DESCRIPTION AND OPERATION HISTORY 2-1

3.0 HYDROGEOLOGY AND GROUNDWATER MONITORING RESULTS 3-1
  3.1 GEOLOGY 3-1
    3.1.1 Holocene Surficial Deposits 3-1
    3.1.2 Hanford Formation 3-11
    3.1.3 Ringold Formation 3-12
    3.1.4 Saddle Mountains Basalt 3-13
  3.2 GROUNDWATER HYDROLOGY 3-14
    3.2.1 Aquifers 3-14
    3.2.2 Aquifer Properties 3-14
    3.2.3 Groundwater Flow 3-18
  3.3 GROUNDWATER CONTAMINATION HISTORY 3-21
    3.3.1 Geohydrology and Ground-Water Quality Beneath the 300 Area, Hanford Site, Washington 3-21
    3.3.2 Perchloroethylene Plume 3-22
    3.3.3 Early Resource Conservation and Recovery Act of 1976 Monitoring 3-22
    3.3.4 Recent Resource Conservation and Recovery Act of 1976 Groundwater Monitoring 3-31
  3.4 CONCEPTUAL MODEL FOR LOCALIZED "DEEP" AQUIFER OCCURRENCE OF CHLORINATED HYDROCARBONS 3-43

4.0 GROUNDWATER MONITORING PROGRAM 4-1
  4.1 OBJECTIVES OF GROUNDWATER MONITORING PROGRAM 4-1
  4.2 DANGEROUS WASTE CONSTITUENTS 4-3
  4.3 GROUNDWATER MONITORING WELLS 4-9
  4.4 COMPLIANCE MONITORING 4-9
    4.4.1 Concentration Limits 4-12
    4.4.2 Point of Compliance 4-12
    4.4.3 Compliance Period 4-12
  4.5 SAMPLING AND ANALYSIS 4-13
    4.5.1 Constituents to be Analyzed 4-13
    4.5.2 Background Values 4-14
    4.5.3 Sample Frequency 4-14
    4.5.4 Analytical Procedures 4-15
    4.5.5 Geochemical Evaluation of Iron and Manganese 4-16
  4.6 STATISTICAL METHODS 4-16
    4.6.1 Tolerance Intervals 4-18
    4.6.2 Confirmation Sampling 4-19
    4.6.3 Non-detects 4-20
    4.6.4 Outliers 4-20
  4.7 DETERMINING RATE AND DIRECTION OF GROUNDWATER FLOW 4-21

CONTENTS (cont.)

5.0 DATA MANAGEMENT AND REPORTING 5-1
5.1 DATA VERIFICATION AND VALIDATION 5-1
5.2 REPORTING 5-1

6.0 CORRECTIVE ACTION PROGRAM 6-1

7.0 REFERENCES 7-1

APPENDICES

A. Summary of Constituents Sampled to 1988 . . . . . A-1

B. Analytical Data, May 1986 - June 1988 . . . . . B-1

C. Concentration vs. Time Plots for Detected Constituents and Constituents Exceeding MCLs C-1

D. Well Construction and Completion Summaries D-1

LIST OF FIGURES

2-1. Location of the 300 Area and the Hanford Site 2-2

2-2. Locations of Main Facilities in the 300 Area 2-3

2-3. Schematic Cross Section of the 300 Area Process Trenches 2-4

2-4. Topography in the vicinity of the 300 Area Process Trenches . . . 2-5

3-1. Location Map of 300 Area Wells 3-2

3-2. Generalized Geologic Column for the 300 Area Near the Process Trenches 3-6

3-3. Location Map for the Geologic Cross Sections 3-7

3-4. Geologic Cross Section A-A' 3-8

3-5. Geologic Cross Section B-B' 3-9

3-6. Geologic Cross Section C-C' 3-10

3-7. Generalized Hydrogeology Comparison of Geologic and Hydrologic Units in the 300 Area 3-15

3-8. 300 Area Water Table Map, September 20-21, 1994 3-19

3-9. 300 Area Water Table Map, June 22-23, 1994 3-20

3-10. Location Map for Wells Used in the Study by Lindberg and Bond 1979 3-23

3-11. Locations of Monitoring Wells Added to the Network in 1986 and 1987 3-32

3-12. Locations of Monitoring Wells in Current Network 3-33

3-13. Trichloroethene 3-40

3-14. CIS 1,2-Dichloroethene Plume 3-41

3-15. Uranium Plume 3-42

4-1. A Statistical Perspective of the Sequence of Groundwater Monitoring Requirements Under the Resource Conservation and Recovery Act of 1976 4-2

4-2. Locations of Monitoring Wells Proposed for the Revised 300 Area Process Trenches Groundwater Monitoring Plan 4-11

4-3. Profiles of Eh, Dissolved Oxygen, and Ferrous Ion with Depth . . . 4-17

LIST OF TABLES

2-1. An Estimate of Chemicals Discharged to the 300 Area Process Trenches Prior to February 1, 1985 2-6

3-1. Characteristics of 300 Area Wells 3-3

3-2. Hydraulic Conductivities Estimated from Aquifer Tests in Wells Near the 300 Area Process Trenches 3-17

3-3. Standard List of Analyses for the 300 Area Network 3-25

3-4. Additional Analytical Parameters 3-28

3-5. Monitoring Wells Used for the 300 Area Process Trenches 3-34

3-6. Appendix IX Constituents Not in WAC 173-303-9905 List 3-35

3-7. Constituents Analyzed in the Current Monitoring Well Network . . . 3-38

4-1. Status of Monitoring Results for Constituents in the 300 Area Process Trenches for Groundwater Protection 4-4

4-2. Status of Monitoring Results for Other Hazardous Chemical Constituents in the 300 Area Process Trenches for Groundwater Protection 4-6

4-3. Status of Monitoring Results for Radiological Constituents in the 300 Area Process Trenches for Groundwater Protection . . . 4-7

4-4. Status of Monitoring Results for Detected VOA Constituents in the 300 Area Process Trenches for Groundwater Protection . . . 4-8

4-5. Proposed Wells for the 300 Area Process Trenches Monitoring Well Network 4-10

4-6. Wells Used for Semiannual Depth-to-Water Measurements 4-22

ACRONYMS

CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
DOE	U.S. Department of Energy
DQO	data quality objectives
DWS	Drinking Water Standards
ECOLOGY	State of Washington Department of Ecology
Eh	redox potential
EPA	U.S. Environmental Protection Agency
ERA	expedited response action
GeoDAT	Geosciences Data Analysis ToolKit
HEIS	Hanford Environmental Information System
MCL	maximum contaminant level
OU	operable unit
PCE	perchloroethylene
POC	point of compliance
PNL	Pacific Northwest Laboratory
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act of 1976
TCE	trichloroethylene
TSD	treatment, storage, and disposal
VOA	Volatile Organic Analysis
WHC	Westinghouse Hanford Company

This page intentionally left blank.

1.0 INTRODUCTION

This document describes the groundwater monitoring program for the Hanford Site 300 Area Process Trenches (300 APT). The 300 APT are a *Resource Conservation and Recovery Act of 1976* (RCRA) regulated unit. The 300 APT are included in the *Dangerous Waste Portion of the Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous Waste*, Permit No. WA890008967, (referred to herein as the Permit) (Ecology 1994) and are subject to final-status requirements for groundwater monitoring (Ecology 1994).

This document describes a compliance monitoring program for groundwater in the uppermost aquifer system at the 300 APT. This plan describes the 300 APT monitoring network, constituent list, sampling schedule, statistical methods, and sampling and analysis protocols that will be employed for the 300 APT. This plan will be used to meet groundwater monitoring requirements from the time the 300 APT becomes part of the Permit and through the postclosure care period until certification of final closure.

1.1 HISTORY OF GROUNDWATER MONITORING AT THE 300 APT

An extensive groundwater monitoring program was carried out during the operational life of the 300 APT (1975 to 1994). Prior to, and continuing beyond the time the 300 APT went into service, many of the wells in the 300 Area were monitored for both radioactive and nonradioactive constituents, as well as water levels. In 1994, Ecology issued a RCRA Permit for the Hanford Site (Ecology 1994). The effective date of the Permit was September 28, 1994. RCRA treatment, storage, and disposal (TSD) units included in the Permit are required to conduct a final status groundwater monitoring program (see Section 1.2). Only five TSD units were included in this Permit originally. The 300 APT is scheduled to be included in the Permit as a TSD unit undergoing closure through the permit modification process in September 1995. Currently, the *Comprehensive Environmental Response, Compensation and Liability Act* (CERCLA) Record of Decision is not completed. Consequently, final closure specifications (e.g., cleanup levels, remediation methodology) are not yet known to the closure process. In 1977, Pacific Northwest Laboratory (PNL) initiated a site-specific program of groundwater monitoring. During the first year of the program, groundwater samples were collected monthly from approximately 30 wells, and water levels were measured weekly. A reduced level of effort was continued on this program until 1985.

From 1985 to the present the 300 ATP site has been regulated under RCRA. The first groundwater monitoring compliance plan was initiated in 1986 (Schalla et al. 1986). In the *Consent Agreement and Compliance Order* (Ecology and EPA 1986) the 300 ATP site was placed in an interim-status groundwater quality assessment monitoring program. The assessment-" level status was based on the decision that (1) the groundwater monitoring wells around the 300 APT were inadequate for alternate groundwater monitoring as described in 40 CFR 265.90(d) (EPA 1984) and Washington Administrative Code (WAC) 173-303-400 (Ecology 1986) and (2) the groundwater quality in the 300 Area had been adversely impacted by the operations of the 300 APT. In response to the *Consent Agreement and Compliance Order* over 20 additional wells were installed and monitored. The 300 ATP site was extensively characterized (Schalla et al. 1988b), and a revised groundwater monitoring compliance plan (Schalla et al. 1988a) was implemented in 1988. The plan has been modified as groundwater data were collected and analyzed. The data are reported to the State of Washington Department of Ecology (Ecology) quarterly, along with data from other RCRA-regulated units at the Hanford Site. Interpretive reports are submitted to Ecology annually.

The 300 APT are located in the 300-FF-1 source operable unit (OU) and 300-FF-5 groundwater OU, under the authority of RCRA TSD and CERCLA past practice. In an expedited response action (ERA) in 1991, sediment from the sides and bottom of the trenches was removed and stored at the northern ends of the trenches. The action lowered the concentrations of uranium and various nonradioactive constituents, but uranium, trichloroethylene (TCE), and cis-1,2-dichloroethylene (cis-DCE) are still detected in downgradient wells. Any additional corrective action deemed necessary will be deferred until decisions are made regarding the 300-FF-1 and 300-FF-5 OUs.

1.2 CHANGES FROM INTERIM-STATUS GROUNDWATER MONITORING

Interim- and final-status groundwater regulations differ in several respects. The "assessment" program under interim status is equivalent to a "compliance" program in final status. In compliance monitoring, specific constituents are chosen and compared to concentration limits. If these limits are exceeded, the site enters a corrective action phase. Statistical methods proposed in this document are different than those used under interim status. Final-status regulations require independent samples, which involves waiting periods between samples, rather than filling multiple bottles at once (replicates). In final status, samples are required at least semiannually rather than quarterly as in interim status.

The proposed program has a smaller monitoring well network and a shorter constituent list than the previous program. A complete description of the proposed groundwater monitoring program is presented in Section 4.0.

2.0 FACILITY DESCRIPTION AND OPERATION HISTORY

The 300 APT are located in the 300 Area of the Hanford Site (Figure 2-1). The 300 Area is a research and former nuclear fuels operations area encompassing approximately 2.9 km^2 (720 acres) in the southeastern portion of the Hanford Site. Figure 2-2 shows the 300 Area main facilities.

The 300 APT began operating in 1975 and was the main facility for disposal of most liquid process wastes generated in the 300 Area until the trenches were removed from service. The liquid waste discharged to the 300 APT consisted mostly of wastewater with relatively low concentrations of chemical contaminants. More concentrated wastes were generally not discharged to the 300 APT. The discharge rate has varied over the years, but it reached a maximum average of about 8,641 L/min (2,283 gal/min) during 1979. Total discharge for 1979 was 4.5E9 L (1.2E9 gal). Since 1987, when fuels fabrication ceased in the 300 Area, the wastewater has consisted of cooling water with small quantities of nonhazardous maintenance and process waste. When the 300 APT were in use, the east and west trenches were used alternately for periods of up to approximately 8 months. The west trench was removed from service in November 1992; the east trench remained in service with an average discharge of 814 L/min (215 gal/min). The 300 APT was administratively isolated from receiving further discharges in December 1994 and was physically isolated in January 1995.

The 300 APT consist of two separate 457-m- (1,500-ft-) long trenches excavated 3.7 m (12 ft) into the subsurface and separated by an earthen berm. The unlined trenches are excavated into the sandy gravels of the Hanford formation, and the bottoms of the trenches are about 6.1 m (20 ft) above the water table. Figure 2-3 contains a schematic cross section showing the dimensions and relationship of the eastern trench to the water table and the nearby Columbia River. Figure 2-3 also shows the area in plan view with the location of the schematic cross section, some example well locations, and nearby facilities. If the cross section were continued to the west to include the western trench, it would look very similar to the eastern trench except for the enlarged northern end which is caused by a natural depression (Figure 2-4). In 1990, the depression was separated from the west trench by a berm needed to support a birdscreen placed over the trench. The north 91 m (300 ft) of the original trenches, including the depression, are now an impoundment area for covered, low-level radioactive and low-level, mixed waste soils.

A concrete weir box is located at the south end of the trenches. Process sewer effluent reached the trenches through 24-inch-diameter 300 Area Process Sewer System piping that is connected to the weir box. The weir box measures 21.3 m (70 ft) long (east-west dimension), 3 m (10 ft) high, and 3 m (10 ft) wide. It has two sluice gates that, in the past, allowed the trenches to be operated alternately.

Administrative controls to prevent disposal of dangerous wastes to the 300 APT were instituted on February 1, 1985. Prior to that time, a variety of chemical wastes was included with the wastewater. However, no large quantity of any one waste was included in the process wastes. Estimated amounts of chemicals discharged to the 300 APT are summarized in Table 2-1. From the

Figure 2-1. Location of the 300 Area and the Hanford Site.

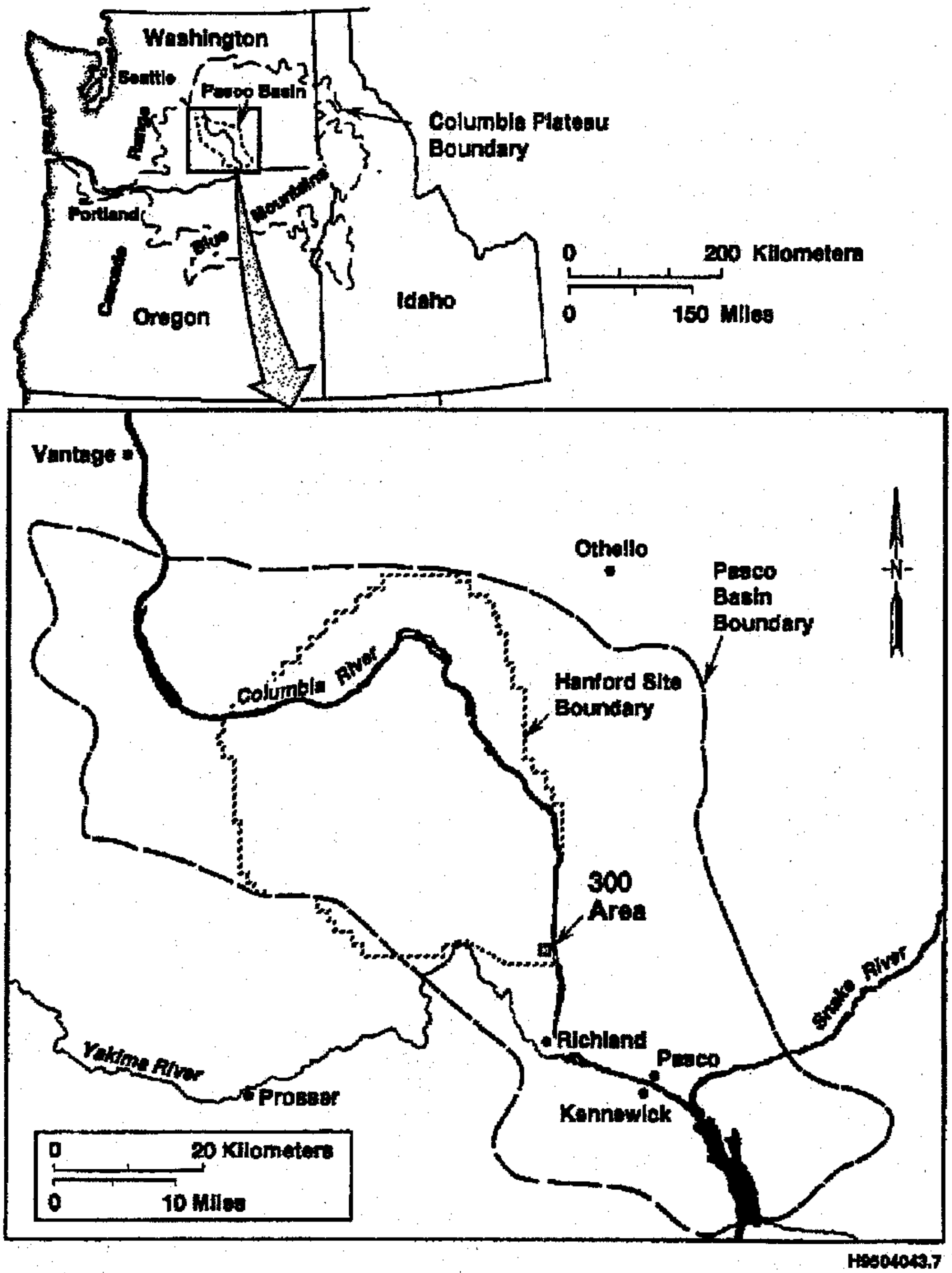


Figure 2-2. Locations of Main Facilities in the 300 Area.

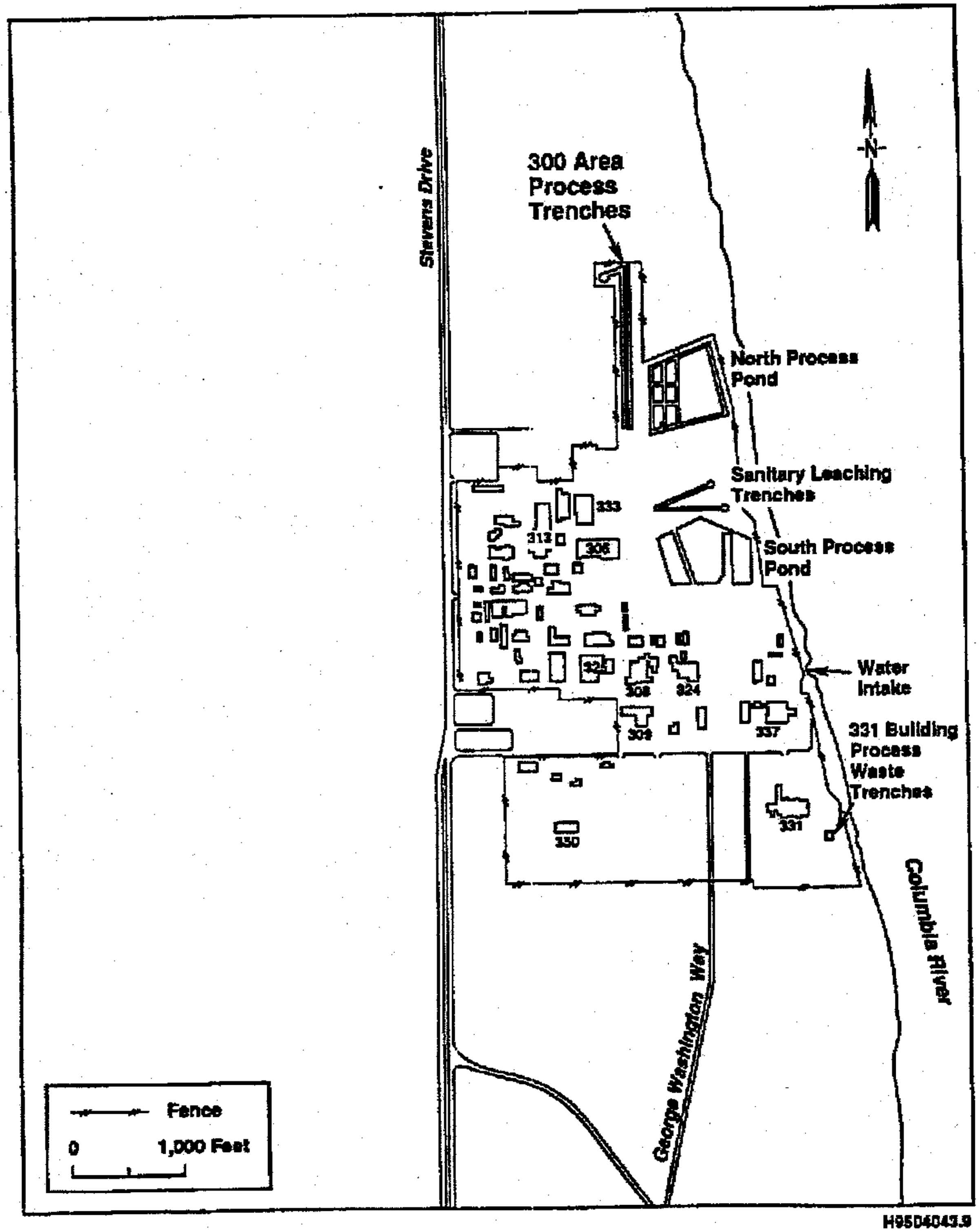


Figure 2-3. Schematic Cross Section of the 300 Area Process Trenches (modified from Schalla et al. 1988b).

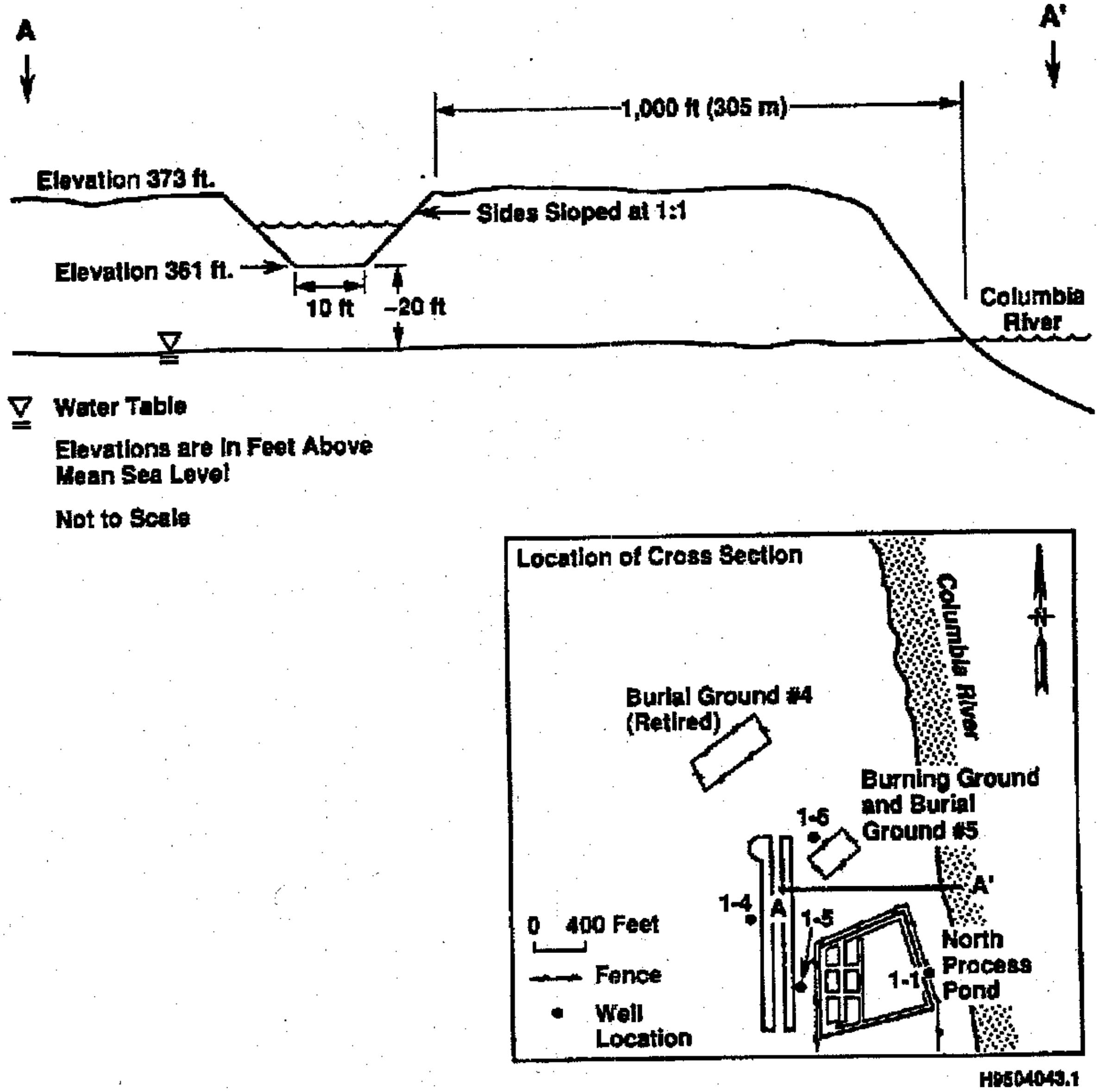


Figure 2-4. Topography in the Vicinity of the 300 Area Process Trenches.

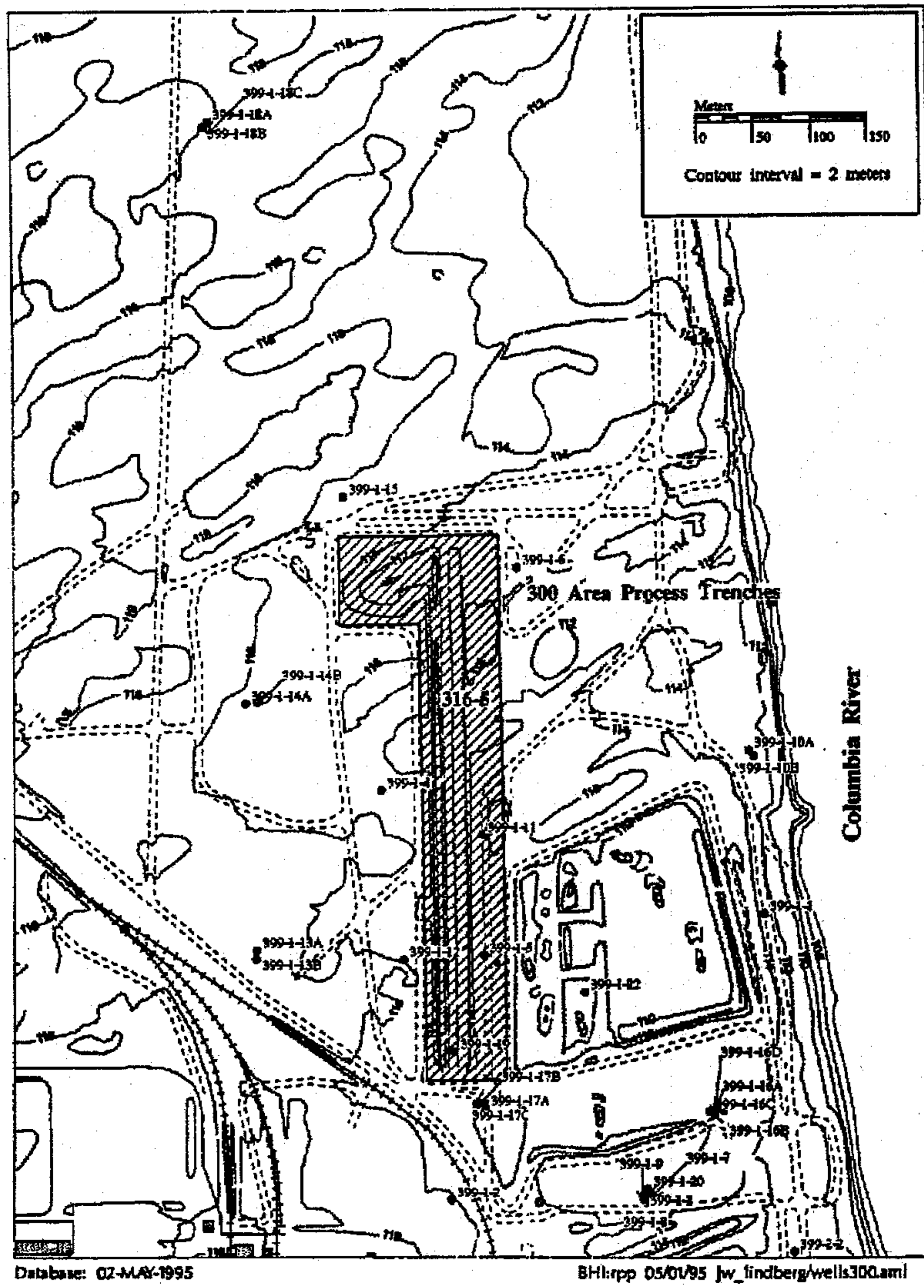


Table 2-1. An Estimate of Chemicals Discharged to the 300 Area Process Trenches Prior to February 1, 1985 (modified from Schalla et al. 1988a).

Intermittent Discharges		Later Discharges[a]	
<Grams	<Kilograms		
Ammonium bifluoride	Benzene	Copper	30 kg/mo[b]
Antimony	Carbon tetrachloride	Detergents	≤30 kg/mo[b]
Arsenic	Chromium	Ethylent glycol	≤200 L/mo
Barium	Chlorinated benzenes	Hydrofluoric acid	100 kg/mo[b]
Cadmium	Degreasing solvents	Nitrates	≤2,000 kg/mo
Dioxane	Formaldehyde	Nitric acid	≤300 L/mo
Dioxin[c]	Formic acid	Sodium hydroxide	≤300 L/mo
Hydrocyanic acid	Hexachlorophene	Paint solvents	≤100 L/mo
Pyridine	Kerosene	Photo chemicals	≤700 L/mo[b]
Selenium & compounds	Lead	Sodium chloride	75 tons/yr
Thiourea	Methy ethyl ketone	Uranium	20 kg/mo[b]
Misc. laboratory chemicals	Mercury	Perchloroethylene	450 L[d]
	Napthalene	Heating oil	300 L[d]
	Nickel		
	Phenol		
	Silver		
	Sulfuric acid		
	Tetrachloroethylene (perchlorethylene)		
	Toluene		
	Tributylphosphate (paraffin hydrocarbon solvents)		
	1,1,1-Trichloroethane (methyl chloroform)		
	Trichloroethylene		
	Xylene		

[a]These discharges were relatively continuous.
[b]Discharged at least through 1988.
[c]Included only because of the potential for dioxin to exist as a trace impurity in chlorinated benzenes.
[d]Known spills.

beginning of operations in 1975 until October 1993, a continuous, composite sampler was located at the headwall to analyze the wastewater at the point of discharge to the trenches. Since 1993, the effluent has been analyzed by a sampler located outside the unit.

In 1991 an ERA was undertaken at the 300 APT. This action was initiated because of concerns about analytical results of trench sampling in 1986 (DOE-RL 1990, Table 15). The ERA objective was to reduce the potential migration of contaminants in the soil at the bottom of trenches to groundwater. The specific ERA goal was to reduce the measurable level of radiation in the trenches to less than three times the upper tolerance limit of background. This was accomplished by removing contaminated sediments, using them to fill in the north end of the trenches, and immobilizing them. In the process much of the inorganic constituents (including heavy metals) were removed as well (DOE-RL 1992).

Approximately 5,400 m^3 (7,000 yd^3) of sediment were removed f[illegible] trench and relocated to the north ends of the trenches. About 0[illegible] of chemically and radioactively contaminated soil from the sides [illegible] 1.3 m (4 ft) from the bottom of each trench were removed. The le[illegible]vely contaminated sediments (<2,000 cpm) were relocated to the n[illegible] of each trench. The more radioactively contaminated sediments (>2,[illegible] cpm) were consolidated in the depression located at the northwest corner of the west trench. Contaminated soils in the depression were isolated from the effluent and then covered with a plastic barrier and a layer of clean aggregate. Results of pre- and post-ERA sampling and analysis (DOE-RL 1992) indicate that the ERA successfully reduced trench contamination at all areas of the trenches other than the position where contaminated soils were stockpiled. Results of groundwater sampling and analysis after the ERA also show a drop in constituents of concern. As an example, uranium concentrations in well 399-1-17A declined following ERA (see Section 3.3).

This page intentionally left blank.

3.0 HYDROGEOLOGY AND GROUNDWATER MONITORING RESULTS

Information about geology, groundwater hydrology, and groundwater contamination in the vicinity of the 300 APT has been derived predominantly from wells. Since the first 300 Area groundwater monitoring well was installed in 1943 (399-3-6), many additional wells of a variety of construction types have been installed to monitor the groundwater and characterize the geology. Most wells fit into one of two types: (1) a pre-1985 type that is nominal 0.15 to 0.30 m (6 in. up to 12 in. diameter) carbon steel casing that was perforated (early design) or screened (later design) in the saturated zone and (2) a 1985 to recent type that meets the requirements of WAC 173-160, *Minimum Standards for Construction and Maintenance of Wells* (REFERENCE). These more modern regulatory-compliant wells have nominal 10-cm (4-in.) stainless steel casing with stainless steel, wire-wrap screens in the saturated zone, and extensive annular and surface seals. Figure 3-1 is a map of the 300 Area showing well locations. Table 3-1 provides well construction details.

3.1 GEOLOGY

This section summarizes the geology in the vicinity of the 300 APT. More detailed discussions are found in Lindberg and Bond (1979), Schalla et al. (1988b), Delaney et al. (1991), Gaylord and Poeter (1991), and Swanson et al. (1992). From youngest to oldest, the geologic units found beneath the 300 Area are:

- Holocene surficial deposits
- Hanford formation
- Ringold Formation
- Saddle Mountains Basalt.

These units are discussed in the following sections.

A stratigraphic column (Figure 3-2) and a series of geologic cross sections (Figures 3-3 through 3-6) show the distribution and characteristics of geologic units within the 300 Area. The 300 Area is located within one of the broad, flat synclines (Pasco syncline) within the larger Pasco Basin. The basalts and overlying sediments are essentially horizontal. The following sections discuss the geologic units beneath the 300 Area in more detail.

3.1.1 Holocene Surficial Deposits

Holocene surficial deposits in the vicinity of the 300 Area include eolian sandy silts and fluvial deposits associated with the Columbia River. The eolian deposits are in the form of thin (0 to 2 m [0 to 6.6 ft]) sheets and thicker (2 to 5 m [6.6 to 16 ft]) dunes. Dunes are especially well developed and remain active in the area to the north of the 300 Area. Inside the perimeter fence of the 300 Area the eolian deposits are mostly absent or reduced in thickness as a result of construction activities. Recent fluvial deposits such as overbank silts and channel deposits of sand and gravel are found in areas immediately adjacent to the Columbia River.

Figure 3-1. Location Map of 300 Area Wells.

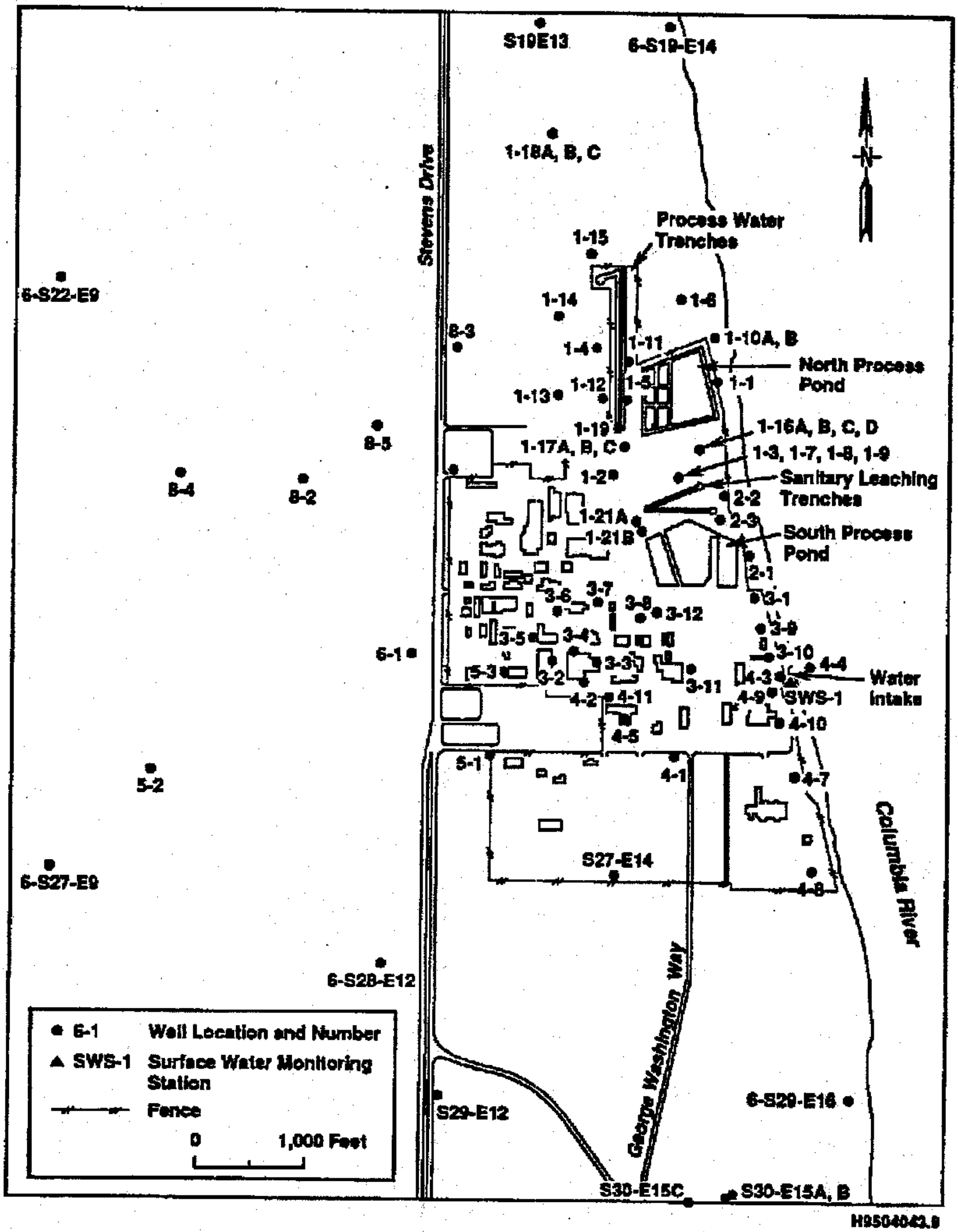


Table 3-1. Characteristics of 300 Area Wells. (3 sheets)

Well	Completed	T	WL	B	S/P	Aquifer	WAC
Original 16 Wells in Groundwater Monitoring Plan (Schalla 1988b)							
699-S19E13	11/71	50	51	78	P	TU	N
399-1-6	2/75	22	33	43	S	TU	N
399-1-4	5/50	23	38	70	P	TU	N
399-1-5	2/75	23	35	45	S	TU	N
399-1-1	11/48	40	33	75	P	TU	N
399-8-2	5/50	43	50	72	P	TU	N
399-1-2	4/50	25	42	75	P	TU	N
399-1-3	4/50	25	34	70	P	TU	N
399-1-7	3/85	25	37	70	S	TU	N
399-1-8	8/85	85	40	105	S	BU	N
399-2-1	11/48	18	34	75	P	TU	N
399-3-7	1/44	45	--	60	P	TU	N
399-3-10	9/76	34	40	49	S	TU	N
399-4-1	2/51	25	50	80	P	TU	N
399-4-7	11/61	21	36	46	P	TU	N
699-S30E15A	10/71	58	65	78	S	TU	N
Wells Completed in 1986 and 1987 in Response to the *Tri-Party Agreement*							
399-4-11	11/26/86	55	63	70	S	TU	Y
399-1-9	2/12/87	170	10	178	S	C	Y1
399-1-10A	12/23/86	23	31	39	S	TU	Y2
399-1-11	11/20/86	26	35	47	S	TU	Y
333-1-12	11/3/86	45	42	60	S	TU	Y
399-1-13A	11/5/86	38	46	53	S	TU	Y2
399-1-14A	11/14/86	31	39	47	S	TU	Y2
399-1-15	11/17/86	29	36	44	S	TU	Y
399-1-16A	12/5/86	32	39	48	S	BU	Y2
399-1-16B	2/10/87	105	38	115	S	C	Y
399-1-16C	1/16/87	167	40	178	S	TU	Y
399-1-17A	11/13/86	25	35	40	S	BU	Y

Table 3-1. Characteristics of 300 Area Wells. (3 sheets)

Well	Completed	T	WL	B	S/P	Aquifer	WAC
399-1-17B	12/19/86	100	33	110	S	C	Y
399-1-17C	1/16/87	161	3	171	S	TU	Y
399-1-18A	11/12/86	38	47	54	S	BU	Y2
399-1-18B	1/23/87	109	43	119	S	C	Y
399-1-18C	1/6/87	130	45	140	S	TU	Y
399-1-19	5/23/86	--	33	--	--	TU	N1
Miscellaneous Wells							
399-1-10B	10/8/91	105	38	115	S	BU	Y
399-1-14B	10/31/91	99	38	110	S	BU	Y
399-2-2	10/3/76	35	39	55	S	TU	N
399-2-3	10/4/76	45	40	55	S	TU	N
399-3-1	10/26/48	20	40	65	P	TU	N
399-3-2	10/13/47	40	51	75	P	TU	N
399-3-3	2/9/48	52	51	81	P	TU	N
399-3-6	8/43	42	49	55	P	TU	N
399-3-8	3/17/70	28	44	48	P	TU	N
399-3-9	8/30/76	45	55	55	S	TU	N
399-3-11	9/17/76	45	53	65	S	TU	N
399-4-9	9/26/76	38	38	58	S	TU	N
399-4-10	9/27/76	30	34	50	S	TU	N
399-5-1	2/19/51	23	51	58	P	TU	N
399-6-1	6/2/50	25	45	50	P	TU	N
399-8-1	6/6/50	35	52	60	P	TU	N

Table 3-1. Characteristics of 300 Area Wells. (3 sheets)

Well	Completed	T	WL	B	S/P	Aquifer	WAC
399-8-3	3/7/51	25	50	72	P	TU	N
699-S27-E14	4/15/48	45	58	1005	P	TU	N
699-S29-E12	11/5/71	59	38	79	S	TU	N

Aquifer = Which aquifer screened or casing perforated in which aquifer?
B = Depth to bottom of screen or perforations in feet.
BU = Bottom of unconfined aquifer.
C = Confined aquifer.
Completed = Completion date.
N1 = Carbon steel casing, not perforated or screened, open at hole bottom.
P = Access to aquifer through perforations in casing.
S = Access to aquifer through well screen.
S/P = Screen or perforations in carbon steel casing?
T = Depth to top of screen or perforations in feet.
TU = Top of unconfined aquifer.
WAC = Well construction complies with WAC 173-160?
WL = Depth to water in feet.
Y/N = Yes/No.
Y1 = Well has a 10-in. carbon steel casing that was left in hole to 100 ft.
Y2 = Two screens, telescoping screen left in hole.

Figure 3-2. Generalized Geologic Column for the 300 Area Near the Process Trenches.

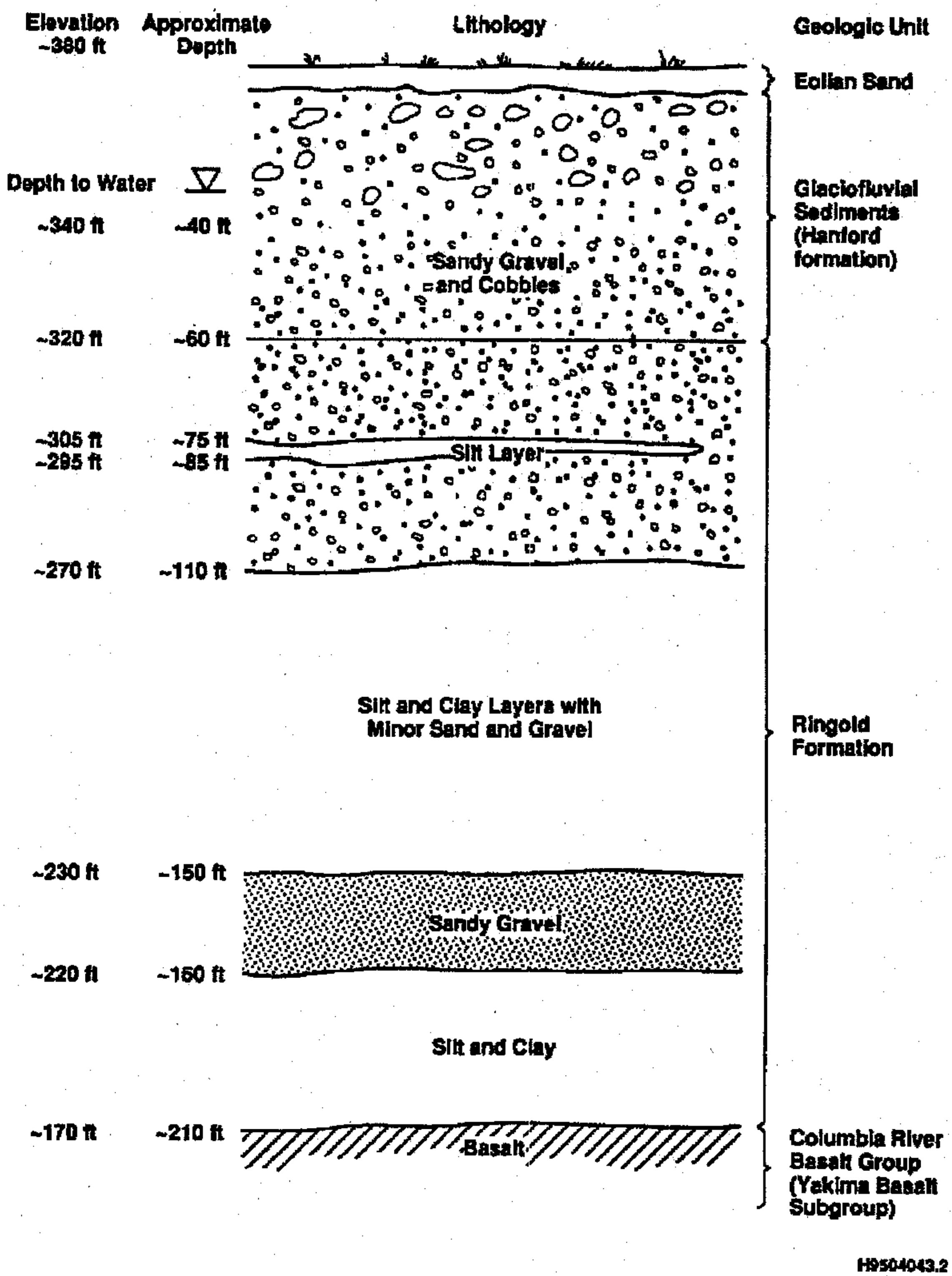
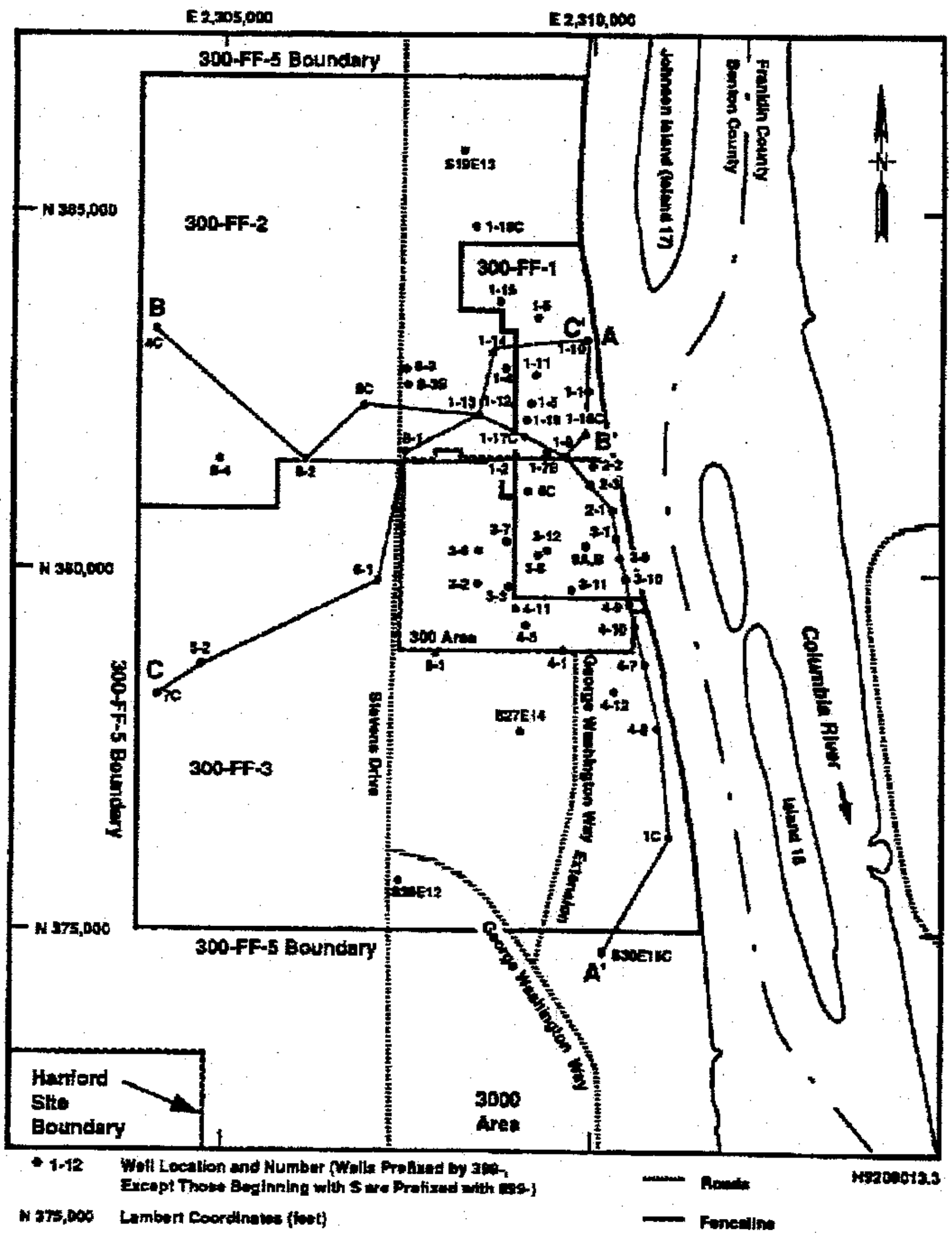
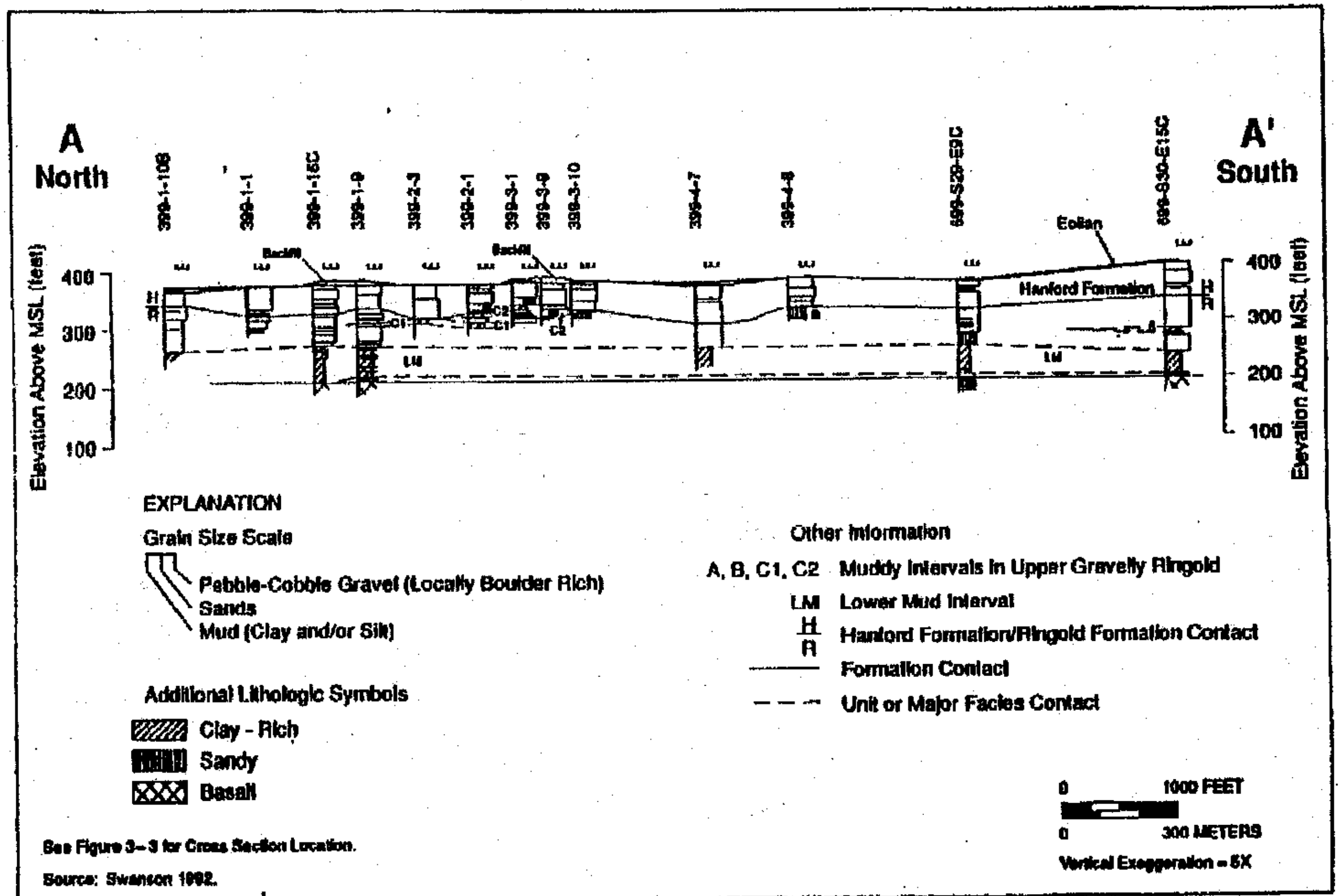


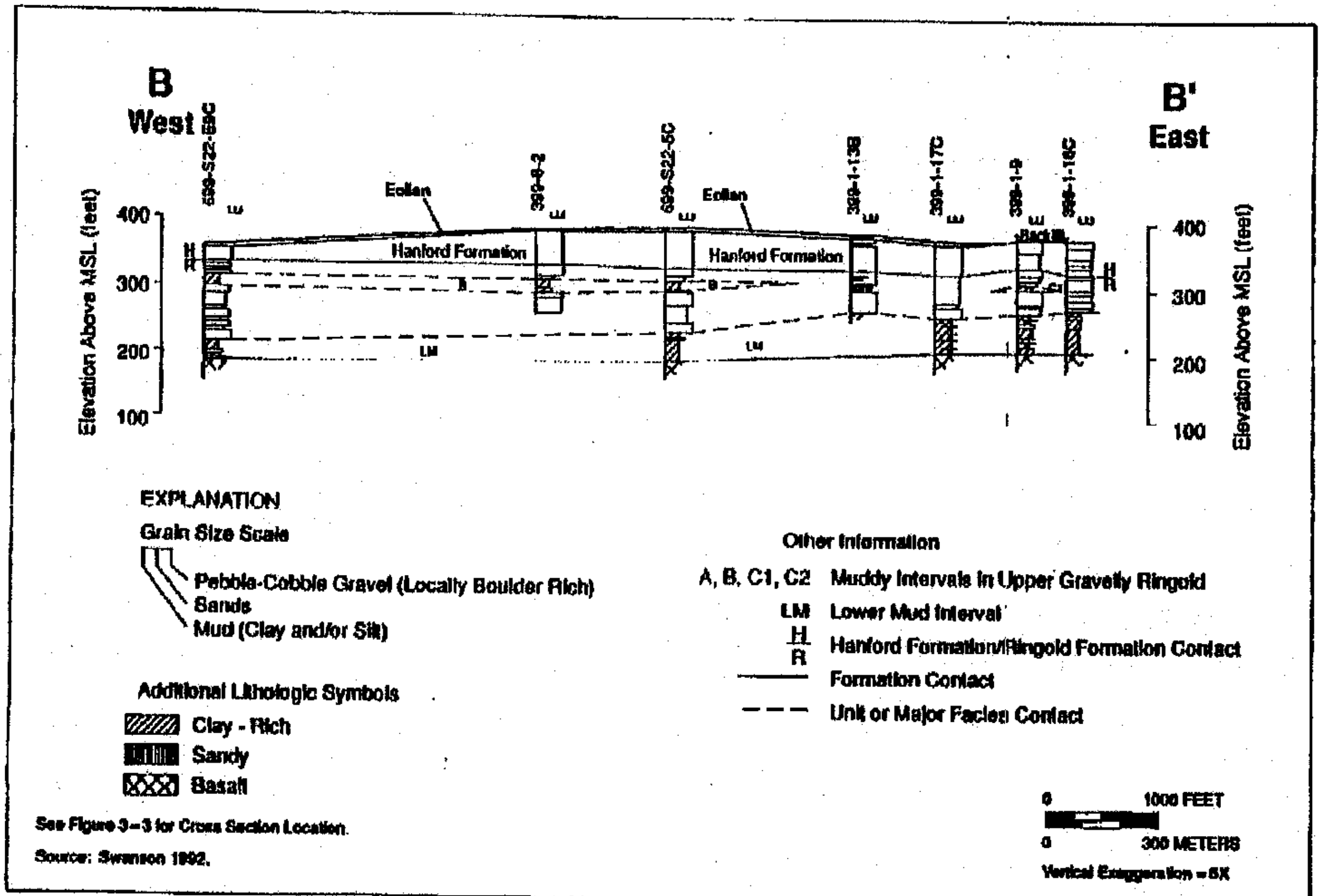
Figure 3-3. Location Map for the Geologic Cross Sections.





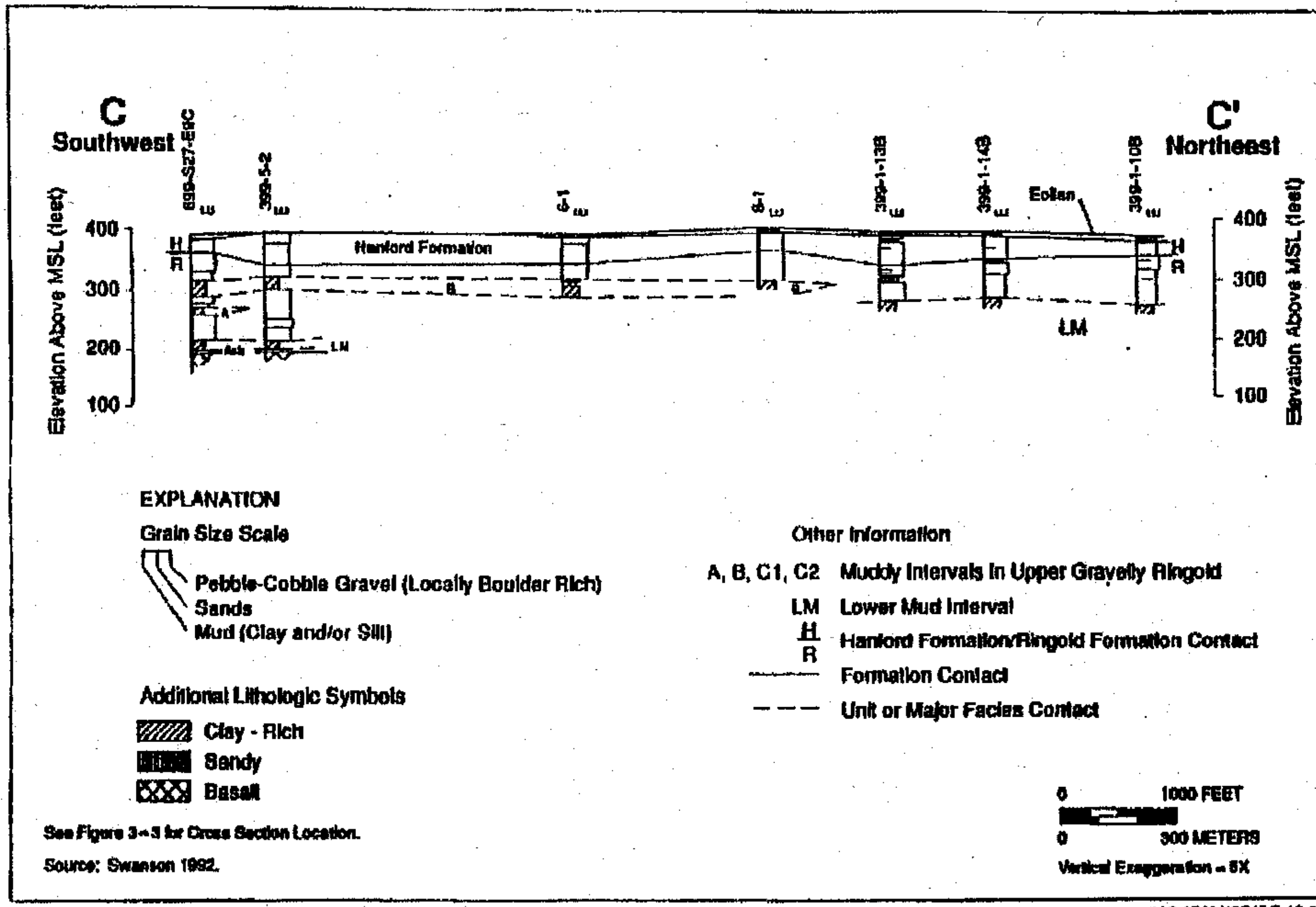
913-1760/45745/5-18-93

Figure 3-4. Geologic Cross Section A-A'.



913-1760/45744/6-16-93

Figure 3-5. Geologic Cross Section B-B'.



913-1769/45743/5-16-93

Figure 3-6. Geologic Cross Section C-C'.

3.1.2 Hanford Formation

Delaney et al. (1991) discuss three main facies associated with the Hanford formation: (1) gravel-dominated facies, (2) sand-dominated facies, and (3) slackwater deposits composed of interbedded silts and fine sands. The Hanford formation in the vicinity of the 300 Area contains two of the three facies, (1) first and (2) second. Slackwater deposits composed of interbedded silts and fine sands, the third facies discussed in Delaney et al. (1991), are absent, although silts occasionally occur as minor portions of the other two facies. The main characteristics of the two facies that comprise the Hanford formation in the 300 Area are summarized as follows:

1. Gravel-dominated. The gravel-dominated facies generally consists of granule to boulder gravel with a dominantly sandy matrix. These sediments display massive and planar to low-angle bedding, and large-scale scour cut-and-fill structures (such as channels) and foreset bedding in outcrops. They are usually matrix poor and sometimes display open-framework texture. Lenticular sand and silt beds sometime are intercalated throughout the facies. Gravel clasts are predominantly basalt (50-80%). Other clast types include Ringold Formation and Plio-Pleistocene unit rip-ups, coarse-grained plutonic rocks such as granites, and metamorphic clasts composed of quartzite and gneiss. The gravel-dominated facies was deposited by relatively high-energy floodwaters within main channelways associated with Pleistocene cataclysmic flooding.

2. Sand-dominated. The sand-dominated facies is characterized by fine- to coarse-grained sand and granule gravel displaying plane lamination and cross bedding and sometimes channel-fill sequences. These sands may contain small pebbles and rip-up clasts in addition to pebble-gravel interbeds and silty interbeds less than 1 m (3.3 ft.) thick. The silt content of these sands is variable, but where it is low, an open framework texture is common. These sands are usually composed of predominantly basaltic grains and are often referred to as black, gray, or salt-and-pepper sands. The sand-dominated facies was deposited adjacent to main flood channelways during the waning stages of cataclysmic flooding or in areas of reduced velocity as water spread out in more open areas downstream of flow restrictions such as canyons or channelways.

The Hanford formation in the vicinity of the 300 APT is about 15.2 m (50 ft) thick and is mostly the gravel-dominated facies. Locally the gravel-dominated facies can be further divided into two types, pebble to cobble gravel and boulder gravel. The pebble to cobble gravel type is the most abundant Hanford formation sediment in the 300 Area. Except for minor interbedded strata consisting of boulder-rich deposits and a few sand-rich horizons (sand-dominated facies), this sediment type makes up the bulk of the Hanford formation. The boulder-rich gravels are distinguished from the pebble to cobble gravels on the basis of increased boulder content. Boulder-rich gravels contain greater than approximately 25% boulder-sized clasts (>25.6 cm [>10 in.] diameter). The thickest occurrence of boulder-rich gravels in the 300 Area is found between boreholes 399-1-16ABC and 399-3-9 where up to 18 m (60 ft) of such strata have been logged. These gravels do not extend west of boreholes 399-1-17ABC, although they may extend to the southwest. A second boulder-rich zone up to 6 m (20 ft) is located at or near the uppermost portions of the Hanford formation in the southern portion of the 300 Area, and a third one occurs in the northernmost part of the 300 Area. The first and second zones may interfinger near wells 399-3-3, 399-2-3, and 399-2-1, but the third zone appears to be separate from the other boulder-rich zones by pebble to cobble gravels.

The sand-dominated facies of the Hanford formation in the 300 Area consists largely of basaltic coarse-grained sand and granules with an open-framework texture. Silt content is low. Thick occurrences of this facies are rare in the 300 Area, and the thinner horizons that do occur are too thin to be easily shown on the cross sections (Figures 3-4 to 3-6). However, thin beds of the sand-dominated facies are common and often intercalated with layers in the pebble to cobble gravel of the gravel-dominated facies.

3.1.3 Ringold Formation

The Ringold Formation near the 300 APT is about 37 m (120 ft) thick and contains three of the five Ringold Formation facies. The three occurring Ringold Formation facies are (1) fluvial gravel, (2) overbank deposits, and (3) lacustrine deposits. These facies are described in detail in Delaney et al. (1991) and Lindsey (1991). They can be summarized as follows:

1. Fluvial gravel. Clast-supported granule-to-cobble gravel with a sandy matrix dominates the facies. Intercalated lenses of sand and mud are common. Clast lithologies are dominated by quartzite and basalt with subordinate lithologies including silicic plutonic rock, intermediate to silicic volcanic rocks, gneiss, volcanic breccias, and greenstone. Matrix sand is sublithic, subarkosic, and arkosic with the feldspars being dominated by plagioclase. Sand beds in the association generally are quartz-felspathic, with basalt content usually ranging between 5% and 25%. Low-angle to planar stratification, massive bedding, wide shallow channels, and large-scale cross bedding are found in outcrops. Compaction and cementation are highly variable with most cementation consisting of $CaCO_3$ and iron oxides. The association was deposited in a gravelly fluvial braidplain characterized by wide, shallow, shifting channels.

2. Overbank deposits. This facies dominantly consists of laminated to massive silt, silty fine-grained sand, and paleosols containing variable amounts of pedogenic calcium carbonate. Overbank deposits occur as thin (<0.5 to 2 m [1.6 to 6.6 ft]) lenticular interbeds in the fluvial gravel facies and as thick (up to 10 m [33 ft]) laterally continuous sequences. These sediments record deposition in proximal levee to more distal floodplain conditions.

3. Lacustrine deposits. Plane laminated to massive clay with thin silt and silty sand interbeds displaying some soft-sediment deformation characterize this association. Coarsening upward sequences less than 1 to 10 m (3.3 to 33 ft) thick are common. Strata comprising the association were deposited in a lake under standing water to deltaic conditions.

Ringold Formation strata in the 300 Area are generally divided into a lower, mud-dominated sequence and an upper, gravelly sequence (Figures 3-4 to 3-6). The lower 17 m (55 ft) composed of mud is laterally extensive and consists of lacustrine deposits overlying overbank deposits. It is correlated to the lower mud sequence found elsewhere throughout the Pasco Basin near the bottom of the Ringold Formation. The gravelly sequence overlying the lower mud sequence is composed dominantly of the fluvial gravel facies and is roughly correlated to Ringold Formation gravel units (B, C, and E) (Delaney et al. 1991, Lindsey 1991).[1] Two mud-dominated intervals are found in the upper gravel sequence in the 300 Area. They are discontinuous, pinch out, and are not found in the immediate vicinity of the 300 APT. However, they do occur to the west and south and consist dominantly of paleosols typical of overbank deposits.

There is evidence of erosion and channelization of the top of the Ringold Formation throughout the 300 Area (Lindberg and Bond 1979, Schalla et al. 1988b, and Swanson et al. 1992). These channels cause the upper Ringold Formation surface (and overlying Hanford gravels) to be lower by approximately 3 to 9 m (10 to 30 ft) in the channels. One of these channels may occur in the vicinity of wells 399-1-17ABC and 399-1-16ABC as inferred by Lindberg and Bond (1979). However, well spacing in the 300 Area is too large to resolve structural details of these channels (such as size and orientation) on the Hanford-Ringold Formation contact.

3.1.4 Saddle Mountains Basalt

Underlying the 52 m (or 170 ft) of Hanford and Ringold formation sediments is the Saddle Mountains Basalt. The uppermost basalt member of this formation in the vicinity of the 300 Area is the approximately 24 m (80 ft) thick Ice Harbor Member, which contains three flows that erupted from vents near Ice Harbor Dam east of Pasco, Washington (Helz 1978, Swanson et al. 1979, DOE 1988). These basalt flows are typical in that they have rubbly or scoriacious flow tops and bottoms and relatively dense interiors. Locally, these flows have an abundant amount of palagonite indicating they were in contact with wet conditions as they were emplaced. Underlying the lowest Ice Harbor Member flow is the Levey interbed, which is one of the intercalated members of the Ellensburg Formation. The Levey interbed locally is about 5 m (or 17 ft) thick and, like other Ellensburg Formation interbeds, consists of a mix of volcaniclastic and silisiclastic sediments usually as sands, gravelly sands, or sandy silts. Underlying the Levey interbed is the Elephant Mountain Member (two basalt flows) and below that the Rattlesnake Ridge interbed of the Ellensburg Formation.

---

[1]Note: The letters A, B, and C are also used to identify muddy units on the geologic cross sections (Figures 3-4, 3-5, and 3-6). This is a unique usage. The letters A, B, and C after Delaney et al. (1991) and Lindsey (1991) are in more widespread use and refer to gravelly units in the Ringold Formation throughout the Hanford Site.

3.2 GROUNDWATER HYDROLOGY

This section discusses the different aquifers within the suprabasalt aquifer system (Delaney et al. 1991). Aquifers below the suprabasalt aquifer system, although mentioned, are not relevant to this groundwater monitoring plan and are not discussed in detail.

3.2.1 Aquifers

Aquifers within the suprabasalt aquifer system are those that are above the uppermost, regionally extensive, confining layer (Figure 3-7). In the 300 Area the uppermost, regionally extensive, confining layer (aquitard, aquiclude) is the lower mud unit of the Ringold Formation. Other mud units (designated A, B, C on the geologic cross sections [see Figures 3-4 through 3-6]) exist within the Ringold Formation, but they are discontinuous.[2]

In the 300 Area the muds that exist above the lower mud unit pinch out and are not present below the 300 APT. Therefore, the unconfined aquifer extends from the water table (at about 10.1 m [33 ft] below ground surface) to the top of the Ringold Formation lower mud unit. Elsewhere in the 300 Area where one or more of the upper muds are present, the aquifer(s) between the partially confining mud units is (are) partially confined. In the immediate vicinity of the 300 APT the unconfined aquifer is composed of the lowermost 5 m (17 ft) of Hanford formation and approximately 20 m (65 ft) of Ringold Formation. The Hanford formation there is composed primarily of the gravel-dominated facies, and the Ringold Formation above the lower mud unit is dominantly the fluvial-gravel facies.

Aquifers below the Ringold Formation lower mud unit are completely confined. These confined aquifers include any coarse-grained Ringold Formation sediments below the lower mud unit, high permeability zones within basalt flows such as rubbly or scoriacious flow tops and bottoms, and interbeds of the Ellensburg Formation if the permeability is high. These confined aquifers are intercalated with- and confined by- dense interiors of the basalt flows.

3.2.2 Aquifer Properties

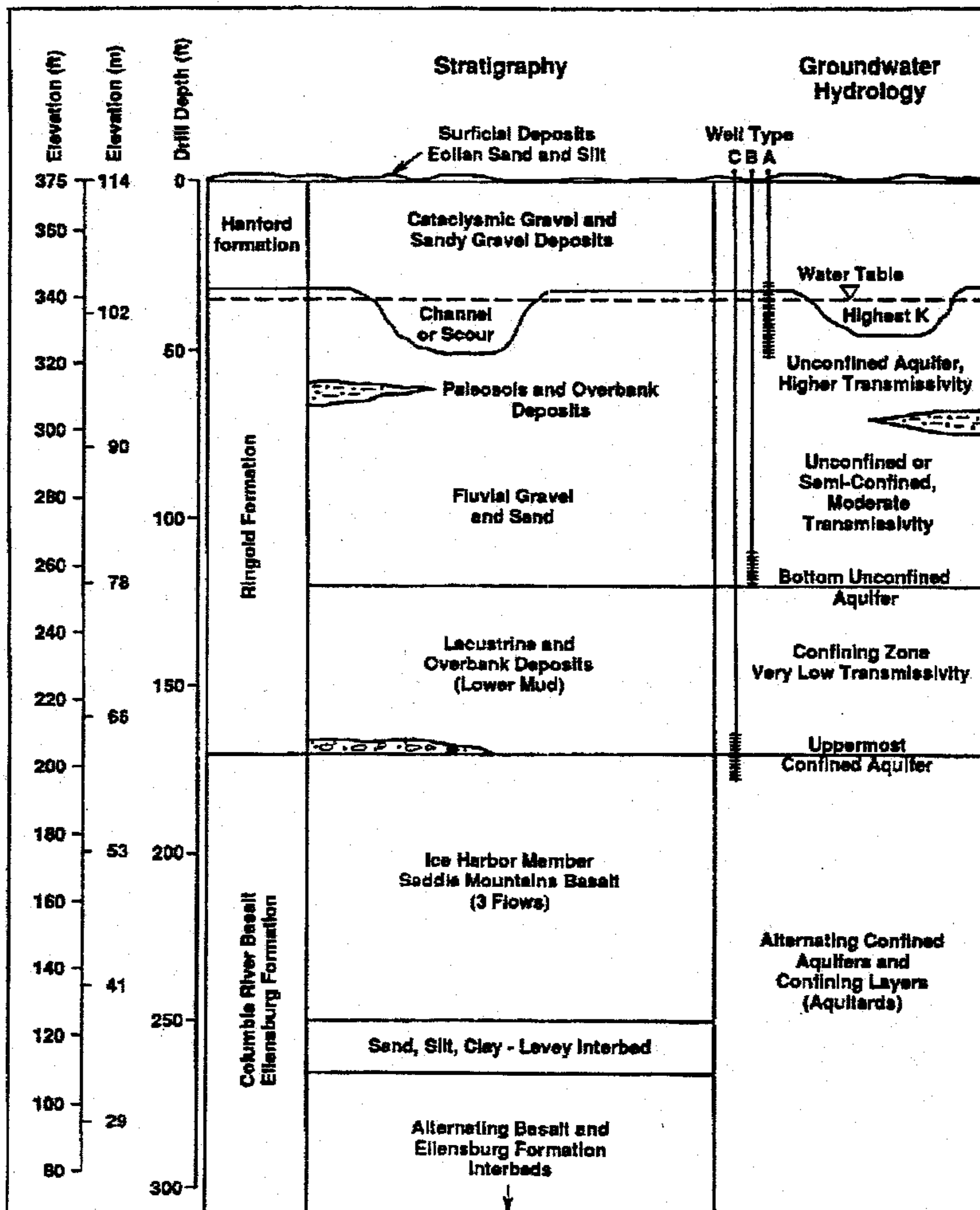
The most recent aquifer tests and laboratory tests of borehole samples are reported in Swanson et al. 1992. The following are pertinent conclusions of the testing reported in that report.

- The best estimate for unconfined aquifer properties came from multiple-well analysis of constant discharge tests. Test results for the uppermost portion of the unconfined aquifer at well

---

[2]Note: The letters A, B, and C are also used to identify gravel units in the Ringold Formation. The use of the letters for muddy units is unique to the 300 Area. The letters A, B, and C after Delaney et al. (1991) and Lindsey (1991) are in more widespread use throughout the Hanford Site for the gravelly units.

Figure 3-7. Generalized Hydrogeology Comparison of Geologic and Hydrologic Units in the 300 Area.



clusters 699-S22-E9ABCD and 699-S27-E9ABCD (Figure 3-1) were 36 and 49 m/d (120 and 161 ft/d) for horizontal hydraulic conductivity, 2.1 and 5.5 m/d (7 and 18 ft/d) for vertical hydraulic conductivity, 0.37 and 0.02 for specific yield, and 0.013 and 0.005 for storativity.

- Water levels measured at the two sites (cluster wells in lower Ringold Formation confined aquifer, lower unconfined aquifer, and upper unconfined aquifer) show an upward hydraulic gradient, demonstrating that the this area is probably a discharge area for the semiconfined and confined aquifers below the unconfined aquifer. (The unconfined aquifer, in turn, discharges to the Columbia River.)

- Barometric efficiencies estimated for wells screened at the bottom of the unconfined aquifer (B wells) are 10% and 18% for the two cluster sites. For the uppermost confined aquifer (C wells) the efficiencies are 28% and 22% for the two cluster sites. These results indicate that the bottom of the unconfined aquifer, and, of course, the uppermost confined aquifer in the Ringold Formation, are at least partially confined in the vicinity of the 699-S22-E9 and 699-S27-E9 well cluster sites. (Because the two upper mud units in the Ringold Formation are missing in the vicinity of the 300 APT, the bottom of the unconfined aquifer in the vicinity of the 300 APT may not show the same results.)

- The specific yield result of 0.02 may indicate a semiconfining condition.

- Laboratory test results on split-tube samples yielded vertical hydraulic conductivities that were at least one order of magnitude lower than the best estimated horizontal values.

The well clusters used for the aquifer testing reported in Swanson et al. (1992) are effectively screened entirely in the Ringold Formation because the water table is either at or lower than the Ringold/Hanford formation contact at those well sites. However, the water table near the 300 APT is within the Hanford formation, possibly because of channeling in the top of the Ringold Formation.

Table 3-2 shows previously collected hydraulic conductivity data derived from well pumping tests (Schalla et al. 1988b, Appendix D). These data are from wells that are closer to the 300 APT than the wells reported in Swanson et al. (1992). As expected, hydraulic conductivities at the top of the unconfined aquifer in wells near the 300 APT are higher. It is suspected that these higher hydraulic conductivities in the wells closer to the 300 APT are the result of a greater contribution of groundwater from the Hanford formation which generally has a higher hydraulic conductivity than the Ringold Formation.

Table 3-2. Hydraulic Conductivities Estimated from Aquifer Tests in Wells Near the 300 Area Process Trenches (from Schalla et al. 1988b).

Well	Hydraulic Conductivity m/d (ft/d)		Aquifer
A-Wells			
399-1-13	3353	(10,998)	Top of Unconfined*
399-1-18A	15240	(49,987)	Top of Unconfined*
399-1-16A	152	(499)	Top of Unconfined*
B-Wells			
399-1-18B	0.58	(1.90)	Bottom of Unconfined
399-1-17B	3.66	(12.0)	Bottom of Unconfined
399-1-16B Test #1	0.61	(2.00)	Bottom of Unconfined
399-1-16B Test #2	0.91	(2.98)	Bottom of Unconfined
C-Wells			
399-1-18C	1.83	(6.00)	Uppermost Confined
399-1-17C	79.2	(260)	Uppermost Confined
399-1-16C	2.72	(8.92)	Uppermost Confined
399-1-9	1.83	(6.00)	Uppermost Confined

*Top of the unconfined aquifer at this well is within the lower portion of the Hanford formation.

3.2.3 Groundwater Flow

Groundwater flow direction in the unconfined aquifer near the 300 APT is predominantly to the east or southeast with slight changes caused by fluctuations in Columbia River stage. This determination is made from depth-to-water measurements taken monthly from 33 wells in the 300 Area. Figure 3-8 shows the elevation of the water table from September 20 to 21, 1994, during the low stage period of the Columbia River. Flow direction was to the southeast in the immediate vicinity of the 300 APT. Figure 3-9 shows the elevation of the water table June 22 to 23, 1994, when the river stage was very near the high for the year. Sometimes a localized flow reversal occurs when the river stage is higher than the water level in the unconfined aquifer. The area involved in these flow reversals depends on the elevation of the high river stage and its duration. On June 22 and 23, 1994, the reversal was only experienced along the shore of the river and inland in the area of wells 399-3-12. In the area of the 300 APT the flow direction in the unconfined aquifer remained mainly toward the southeast, but the southern portion of the 300 APT had a more south to southwesterly flow. However, if the rise in river stage is more than 1 m (3.3 ft) for a sufficient duration (a week or more) the groundwater flow direction throughout most of the area of the 300 APT can be to the south or southwest (Schalla et al. 1988b, Figure 3-12).

Previous estimates of flow direction in the unconfined aquifer near the 300 APT have been based mainly on water table maps. Water table maps of the area of the 300 APT generally show a groundwater mound or southeast-trending lobe due to the discharge of water from the trenches. This mound or lobe may have a significant effect on the direction of groundwater flow in the area. However, as of January 1995, all discharges of water to the 300 APT have ceased. If the mound or lobe due to water discharge did indeed affect groundwater flow direction while the 300 APT was in operation, then shutting off the water will have an undetermined effect that will be evident in future water table maps.

There is an upward gradient between the uppermost confined aquifer and the unconfined aquifer. At wells 399-1-17A and 399-1-17C the head difference is about 11 m (35 ft). This supports the conclusion of Swanson et al. (1992) that the 300 Area is within a discharge area for the uppermost confined aquifer, and that, if communication is established between the confined aquifer and overlying unconfined aquifer, the flow direction is upward.

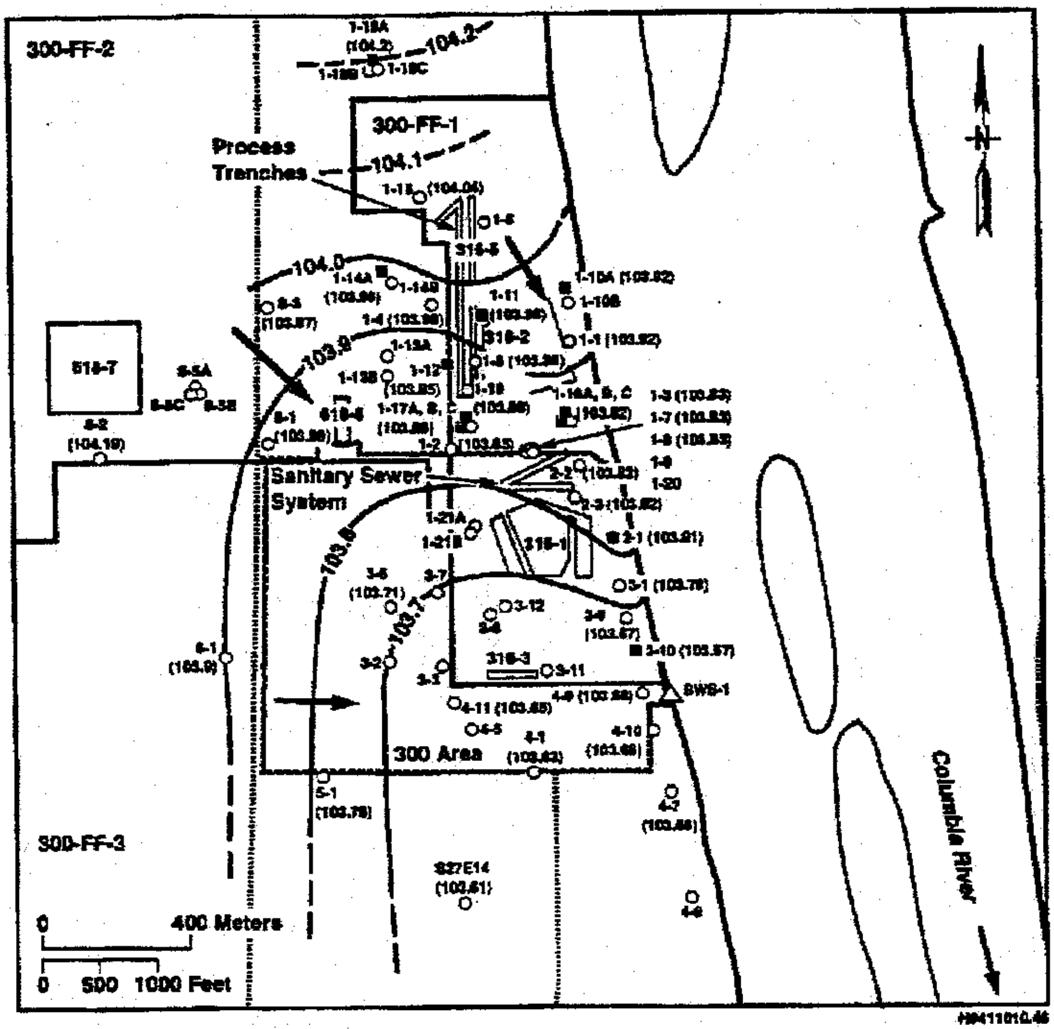
The flow rate in the top of the unconfined aquifer has been reported as about 10.7 m/d (35 ft/d) near the 300 APT based on a perchloroethylene spill (Cline et al. 1985). The rate of flow can also be estimated roughly by using the Darcy equation.

$$v = \frac{Ki}{n_e} \qquad (1)$$

where:

v = average linear groundwater velocity
K = hydraulic conductivity
i = hydraulic gradient
n_e = effective porosity.

Figure 3-8. 300 Area Water Table Map, September 20-21, 1994.



○ 5-1 (103.78) Well Location and Number (Wells Prefixed by 399-, Except Those Beginning with S are Prefixed with 699-) (Number in parenthesis is water table elevation in meters)

■ 1-12 (103.85) Monitoring Network Well (Number in parenthesis is water table elevation in meters)

△ SWS-1 Surface-Water Monitoring Station

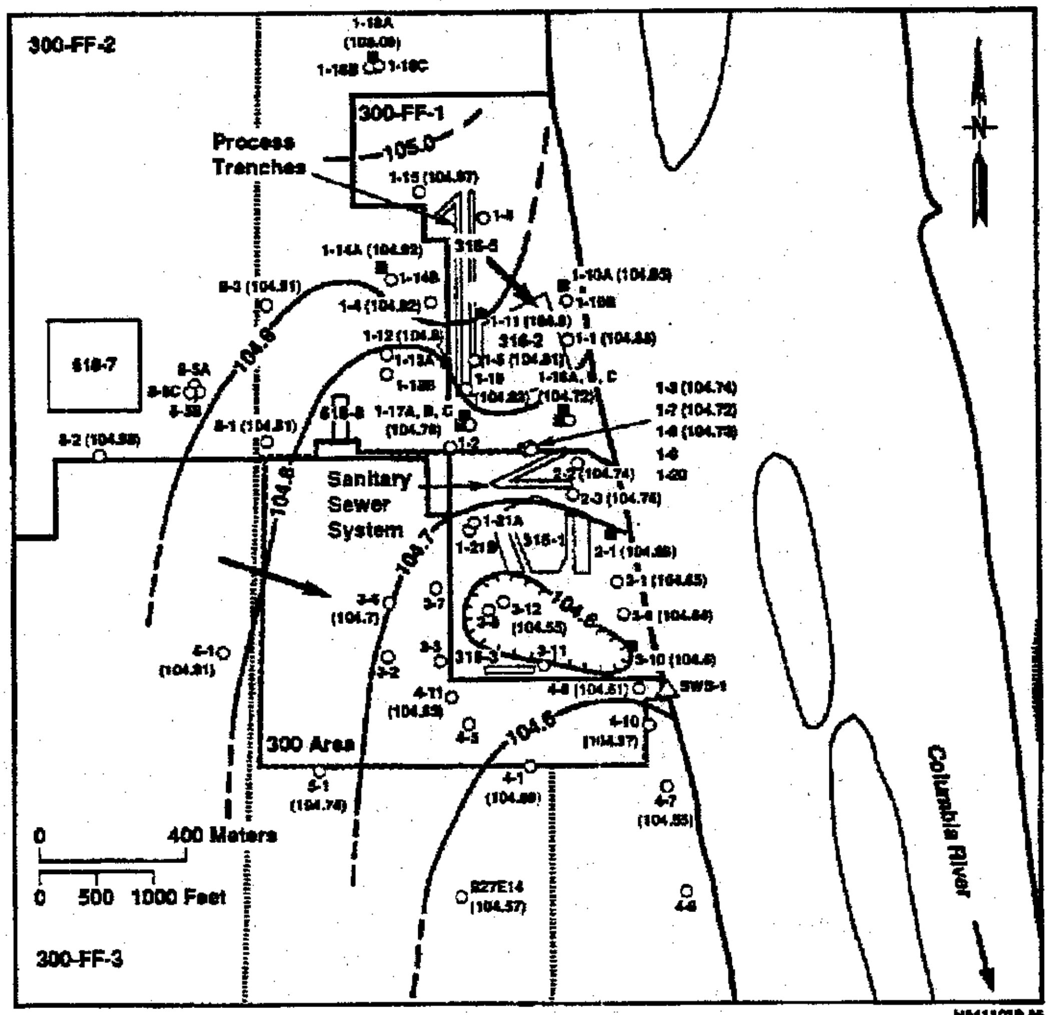
Roads

103.8 Water Table Contour in Meters. Contour Interval = 0.1 Meters. (Note: Change meters to feet by multiplying by 3.28).

Generalized Groundwater Flow Direction

Gradient 0.0004.

Figure 3-9. 300 Area Water Table Map, June 22-23, 1994.



○ 5-1 (104.74) Well Location and Number (Wells Prefixed by 399-, Except Those Beginning with S are Prefixed with 899-)
(Number in parenthesis is water table elevation in meters)

■ 1-14A (104.92) Monitoring Network Well
(Number in parenthesis is water table elevation in meters)

△ SWS-1 Surface-Water Monitoring Station

Roads

—104.7— Water Table Contour in Meters. Contour Interval = 0.1 Meters.
(Note: Change meters to feet by multiplying by 3.28).

Generalized Groundwater Flow Direction

Gradient 0.0003.

Schalla et al. (1988b) reported values of hydraulic conductivity for the unconfined aquifer in the vicinity of the 300 APT from 150 to 15,000 m/d (500 to 50,000 ft/d) (Table 3-2). Swanson et al. (1992) reported hydraulic conductivities for the Ringold Formation as 36 and 49 m/d (120 and 161 m/d) for two well sites southwest of the 300 APT. The hydraulic gradient near the 300 APT was 0.0003 for the water table depicted in Figure 3-9 (June 22-23, 1994) and 0.0004 for the water table depicted in Figure 3-8 (September 20-21, 1994). Estimates of effective porosity for the unconfined aquifer range from 0.10 and 0.30. Using the above-stated values for input parameters to the Darcy equation, the range of average linear groundwater velocity is 0.036 m/d (0.11 ft/d) to 61.0 m/d (200 ft/d). The large range in flow velocity values is a result of the large range in values of hydraulic conductivity reported for the aquifer. If it is assumed that the Hanford formation is a major contributor to the hydraulic conductivity parameter in the vicinity of the 300 APT (because of the presence of channels that cause the water table to be within the Hanford formation), then the average flow velocity may be closer to the upper portion of the range, which is supported by the estimate of Cline et al. (1985).

The estimates of groundwater flow rate are based on aquifer conditions in the vicinity of the 300 APT when at least 800 L/min (215 gal/min) are discharged to the trenches. However, flow rates in the future may be much lower than those calculated, since wastewater discharges to the trenches have ceased. After discharges cease, the entire volume of groundwater available in the unconfined aquifer near the trenches must come through the less permeable Ringold Formation sediments upgradient (northwest) of the trenches. Without the mounding effect due to 300 APT discharge, the water table gradient may decrease enough to significantly lower the flow rate (DOE-RL 1995c). Water table maps constructed in the future, after the local unconfined aquifer has adjusted to the lack of 300 APT discharges, will be helpful in determining any significant change in gradient.

3.3 GROUNDWATER CONTAMINATION HISTORY

3.3.1 Geohydrology and Ground-Water Quality Beneath the 300 Area, Hanford Site, Washington (Lindberg and Bond 1979)

The earliest major study of groundwater contamination in the 300 Area is reported in Lindberg and Bond (1979). In that study, groundwater samples were collected monthly for one year (during calendar year 1977) from 29 wells in the 300 Area (see Figure 3-10). The samples were analyzed for the following constituents.

Radioactive Constituents	Nonradioactive Constituents
Gross alpha	Bicarbonate
Gross beta	Carbonate
Gamma scan	Calcium
Uranium	Magnesium
Tritium	Sodium
	Chloride
	Sulfate
	Nitrate
	Chromium
	Copper
	Potassium
	Fluoride
	pH
	Specific conductivity

The 29 wells in the sampling network at that time were all constructed of perforated carbon steel casing with dedicated submersible electric pumps. This well type does not meet current regulatory standards (WAC 173-160).

Results showed that calcium, magnesium, sodium, bicarbonate and sulfate were lower in concentration near the 300 APT than in background wells (dilution). Constituents that were found to be in higher concentrations near and downgradient of the 300 APT were gross alpha, uranium, chloride, and nitrate. Presumably, discharges to the trenches were responsible for the constituents with higher concentrations.

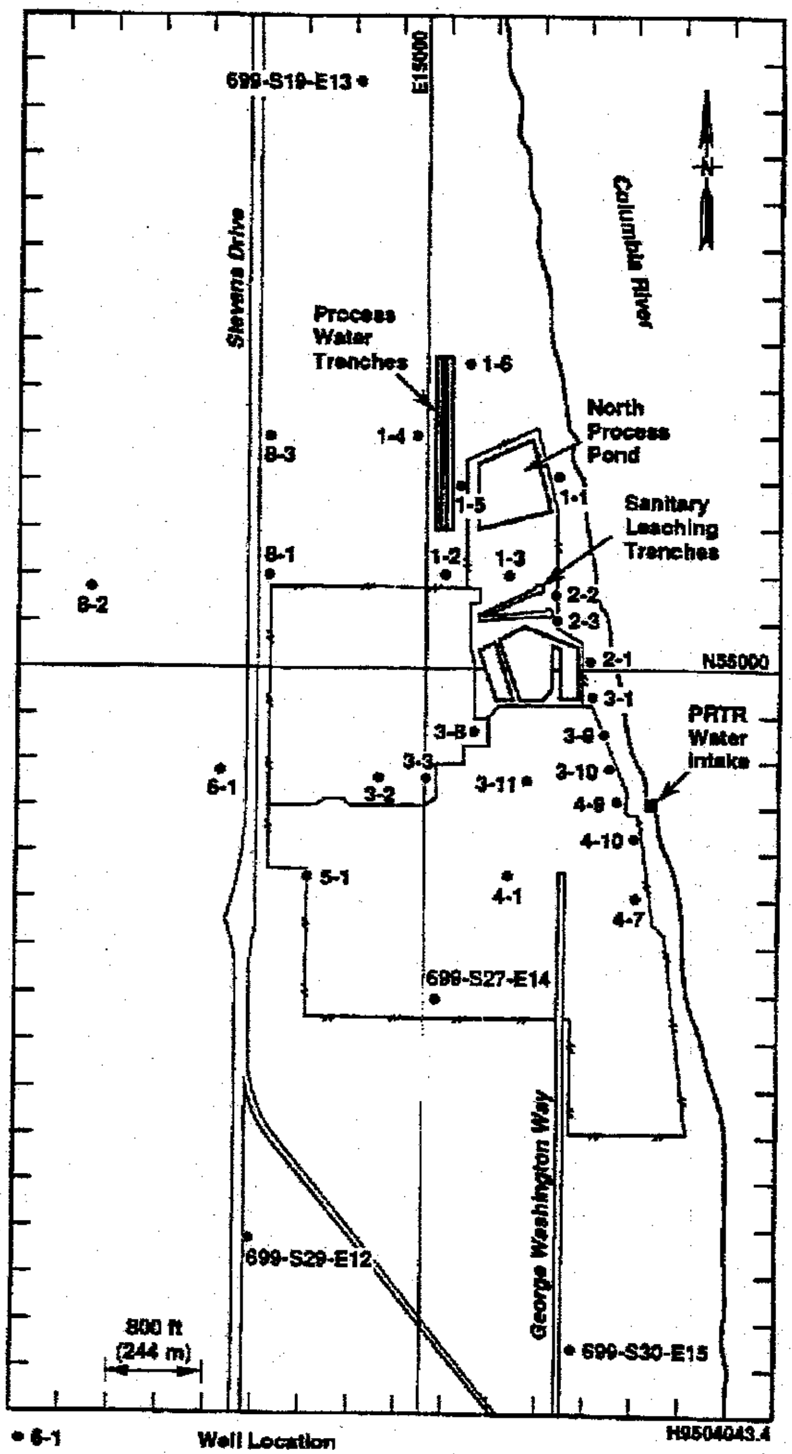
3.3.2 Perchloroethylene Plume (Cline et al. 1985)

Following two accidental releases of perchloroethylene (PCE) to the 300 APT (454 L [120 gal] on November 4, 1982, and 76 L [20 gal] on July 6, 1984), several wells were closely monitored to track the plume. The following wells showed elevated levels of PCE: 399-1-5, -1-2, -1-3, -2-1, -2-2, -3-1, -4-7, and -4-10. Peak concentration of PCE (1,840 ppb) was found in well 399-1-5 about 5 days after the first release. Movement of the peak concentration was estimated at 10.7 m/d (35 ft/d) (Cline et al. 1985).

3.3.3 Early Resource Conservation and Recovery Act of 1976 Monitoring (Schalla et al. 1988a and 1988b)

By 1985, a RCRA interim-status groundwater monitoring program for the 300 APT was in effect. The effort was based on the groundwater monitoring requirements in 40 CFR 265.90 (EPA 1984), WAC 173-303-400 (Ecology 1986), and past groundwater monitoring conducted in the 300 Area. The well network,

Figure 3-10. Location Map for Wells Used in the Study by Lindberg and Bond 1979.



• 6-1 Well Location
• 699-S29-E12 Well Location Outside 300 Area
Fence

which was sampled monthly, consisted of the following 16 wells. Fourteen monitored the upper portion of the unconfined aquifer and two (399-1-8 and -4-1) monitored the base of the unconfined aquifer. The wells are shown on Figure 3-1):

399-1-1	399-1-5	399-2-1	399-4-10
399-1-2	399-1-6	399-3-7	399-8-2
399-1-3	399-1-7	399-3-10	699-S19-E13
399-1-4	399-1-8	399-4-1	699-S30-E16A

Six of the wells have stainless-steel screens, and the other 10 have perforated casings (Table 3-1).

Based on instructions given in *Test Methods for Evaluating Solid Waste* (EPA 1986) and information provided by the facility manager concerning the composition of the wastes, the constituents listed in Table 3-3 were analyzed in the groundwater samples collected from the 16 wells. The U.S Environmental Protection Agency (EPA) guidance suggested that analyses should be conducted for the Primary Drinking Water Standards (DWS) and for specific dangerous waste constituents known to have been discharged to the unit. Additional parameters, such as the contamination indicator parameters that are required for a detection-level program (but not necessary for an alternate or assessment-level program), were added to provide consistency with other interim-status programs. In addition, samples from two wells sampled quarterly were also being analyzed for some additional parameters, including the dangerous waste constituents in WAC 173-303-9905 (Ecology 1986). These additional analyses (Table 3-4) provided information needed for the permitting process and to further ensure that potential contaminants are not being overlooked. The two wells chosen for the extra analyses included one upgradient well (699-S19-E13) and one downgradient (399-1-3).

The dangerous waste constituents list in WAC 173-303-9905 is very similar to the Appendix IX list of 40 CFR 264, Subpart F. However, there are some differences. Those constituents in Appendix IX that are not in WAC 173-303-9905 are listed in Table 3-6. All of the constituents listed in Table 3-6 were analyzed later in all 11 of the wells of the current 300 APT program.

Results of the early analyses under the interim-status program are documented in Schalla et al. (1988a, Tables 6 and 7) and Schalla et al. (1988b). Schalla et al. (1988a), Table 6, (Summary of Constituents Sampled to Date) shows that the herbicides and pesticides on the Interim Primary DWS list were never reported above detection limits nor were the phenols in the list of water quality parameters. Very few of the constituents in the site-specific list and almost none of the additional constituents sampled as part of the WAC 173-303-9905 list were detected. Several other constituents have only been reported above detection limits sporadically. Among those constituents that are regularly reported as being above the detection limit are gross alpha, gross beta, barium, nitrate, sodium, iron, sulfate, chloride, copper, ammonium, vanadium, potassium, chloroform, and methylchloride.

Schalla et al. (1988a), Table 7, (Analytical Data, June 1988-May 1986), compiles the results for those constituents that had at least one value reported above detection limits. Gross alpha and beta both exceeded their

Table 3-3. Standard List of Analyses for the 300 Area Network (from Schalla et al. 1988a). (3 sheets)

Constituent	Collection[a] and Preservation[b]	Method[c]	Detection Limit, ppb[d]
Barium Cadmium Chromium Silver Sodium Nickel Copper Aluminum Manganese Iron Calcium Zinc	P, HNO_3 to pH <2	SW-846, #6010	6 2 10 10 100 10 10 150 5 50 50 5
Arsenic	P, HNO_3 to pH<2	SW-846, #7060	5
Mercury	P, HNO_3 to pH<2	SW-846, #7470	0.1
Selenium	P, HNO_3 to pH<2	SW-846, #7740	5
Lead	P, HNO_3 to pH<2	SW-846, #7421	5
Nitrate Sulfate Fluoride Chloride	P, None	70-IC[e,f]	500 500 500 500
Cyanide	P, NaOH to pH>12	SW-846, #9010	10
Sulfide	P, zinc acetate + NaOH to pH>9	SW-846, #9030	1,000
Radium	P, HNO_3 to pH<2	EPA Method #903.0	1 pCi/L
Gross alpha	P, HNO_3 to pH<2	EPA Method 680/4-75-001	4 pCi/L
Gross beta	P, HNO_3 to pH<2	EPA Method 680/4-75-001	8 pCi/L
Natural uranium[g]	P, HNO_3 to pH<2	20-U-03[h]	4 pCi/L
Strontium-90[g]	P, HNO_3 to pH<2	20-Sr-02[h]	5 pCi/L
Gamma scan[g]	P, HNO_3 to pH<2	30-GS & 40-07[h]	20 pCi/L (Cs)
Total organic halogen	G, No headspace	SW-846, #9020	100
Total organic carbon	G, H_2SO_4 to pH<2	Std. Methods #505	1,000

Table 3-3. Standard List of Analyses for the 300 Area Network (from Schalla et al. 1988a). (3 sheets)

Constituent	Collection[a] and Preservation[b]	Method[c]	Detection Limit, ppb[d]
Ammonium ion	G, H_2SO_4 to pH<2	Std. Methods #417 A-E	50
Hydrazine	G, None	70-DAI[e,k]	3,000
Endrin Methoxychlor Toxaphene Lindane (4 isomers)	G, None	SW-846, #8080[i]	1 1 1 1
2,4-D 2,4,5-TP silvex	G, None	SW-846, #8150[i]	1 1
1,1,1-trichloroethane Perchloroethylene Chloroform Methylene chloride 1,1,2-trichloroethane 1,1,2-trichloroethylene Methylethyl ketone	G, No headspace	SW-846, #8240	10 10 10 10 10 10 10
Coliform bacteria	P, None	Std. Methods #908A	2.2 MPN[j]
Temperature	Field measurement		0.1°C

Table 3-3. Standard List of Analyses for the 300 Area Network (from Schalla et al. 1988a). (3 sheets)

Constituent	Collection[a] and Preservation[b]	Method[c]	Detection Limit, ppb[d]
Specific conductance	Field measurement		1 µmho
pH	Field measurement		0.01 pH unit

[a]P = plastic, G = glass.
[b]All samples cooled to 4°C upon collection.
[c]Constituents grouped together within brackets are analyzed by the same method.
[d]Detection limit units except where indicated.
[e]In-house analytical method (PNL).
[f]IC = ion chromatography.
[g]Analyzed quarterly on selected wells.
[h]From US Testing Company Procedure Manual, UST-RD-PM-9-80
[i]Analyzed on quarterly basis only.
[j]MPN = most probable number.
[k]DAI = direct aqueous injection.

Table 3-4. Additional Analytical Parameters (modified from Schalla et al. 1988a). (3 sheets)

Constituent	Collection[a] and Preservation[b]	Method[c]	Detection Limit, ppb[d]
Beryllium Osmium Strontium Antimony Vanadium Potassium	P, HNO_3 to pH<2	SW-846, #6010	5 300 300 100 5 100
Thallium	P, HNO_3 to pH<2	SW-846, #7840	200
Thiourea 1-acetyl-2-thiourea 1-(o-chlorophenyl) thiourea Diethylstilbesterol Ethylenethiourea 1-naphthyl-2-thiourea N-phenylthiourea	G, None	SW-846, #8330 (modified)	200 200 200 200 200 200 200
DDD DDE DDT Heptachlor Heptachlor epoxide Dieldrin Aldrin Chlordane Endosulfan I Endosulfan II Chlorobenzilate	G, None	SW-846, #8180	1 1 1 1 1 1 1 1 1 1 100
2,4,5-T	G, None	SW-846, #8150	1
Perchlorate Phosphate	P, None	70-IC[e,f]	1,000 1,000
Carbophenothion Tetraethylpyrophosphate Disolfoton Dimethoate Methyl parathion Parathion	G, None	SW-846, #8140	2 100 2 5 2 2
Citrus red #2	G, None	AOAC, #34.015B	1,000

Table 3-4. Additional Analytical Parameters (modified from Schalla et al. 1988a). (3 sheets)

Constituent	Collection[a] and Preservation[b]	Method[c]	Detection Limit, ppb[d]
Paraldehyde	G, None	DAI[e,g]	3,000
Cyanogen bromide			3,000
cyanogen chloride			3,000
acrylamide			3,000
Allyl alcohol			3,000
Chloral			3,000
Chloroacetaldehyde			3,000
3-chloropropionitrile			3,000
Cyanogen			3,000
Dichloropropanol			3,000
Ethyl carbamate			3,000
Ethyl cyanide			3,000
Ethylene oxide			3,000
Fluoroacetic acid			3,000
Glycidylaldehyde			3,000
Isobutyl alcohol			3,000
Methyl hydrazine			3,000
n-propylamine			3,000
2-propyn-1-ol			3,000
1,1-dimethyl hydrazine			3,000
1,2-dimethyl hydrazine			3,000
Acetronitrile			3,000
Tetrachloromethane	G, None	SW-846, #8240	10
Xylene-o,p			10
Xylene-m			10
Formaldehyde			500
Additional volatiles			10

Table 3-4. Additional Analytical Parameters (modified from Schalla et al. 1988a). (3 sheets)

Constituent	Collection[a] and Preservation[b]	Method[c]	Detection Limit, ppb[d]
Hexachlorophene Naphthalene Phenol Kerosene Hexachlorobenzene Pentachlorobenzene 1,2-dichlorobenzene 1,3-dichlorobenzene 1,4-dichlorobenzene 1,2,3-trichlorobenzene 1,3,5-trichlorobenzene 1,2,3,4-tetrachlorobenzene 1,2,3,5-tetrachlorobenzene 1,2,4,5-tetrachlorobenzene Additional semi-volatiles	G, None	SW-846, #8270	10 10 10 10 ppm 10 10 10 10 10 10 10 10 10 10 10
Ethylene glycol	G, None	GC/FID[e,h]	10 ppm

[a]P = plastic, G = glass.
[b]All samples cooled to 4°C upon collection.
[c]Constituents grouped together within brackets are anlyzed by the same method.
[d]Detection limit units except where indicated.
[e]In-house analytical method (PNL).
[f]IC = ion chromatography.
[g]DAI = direct aqueous injection.
[h]GC/FID = gas chromatography/flame ionization detector.

screening limit for Interim Primary DWS. Gross alpha and uranium are closely correlated (Schalla et al. 1988b). However, subtraction of uranium from gross alpha would probably bring gross alpha to below the "adjusted " gross alpha limit (15 pCi/L). Chromium, mercury, selenium, and fluoride were reported as being above Interim Primary DWS at least once.

3.3.4 Recent Resource Conservation and Recovery Act of 1976 Groundwater Monitoring

In 1986 and 1987, 18 new wells (Figure 3-11) were installed to enhance the understanding of hydrogeology at the 300 APT and to help characterize the direction and extent of contamination in Hanford and Ringold Formation sediments. The new wells, which were designed to meet WAC 173-160 standards, included three well clusters (399-1-16ABC, 399-1-17ABC, and 399-1-18ABC) and eight single wells. Each well cluster included one well in the upper portion of the unconfined aquifer ("A" well), one well at the bottom of the unconfined aquifer ("B" well), and one well in the uppermost confined aquifer below the Ringold Formation lower mud unit ("C" well). Total number of wells in the network temporarily rose to 34 (16 original plus 18 new wells). The samples from the network of 34 monitoring wells were analyzed for a list of constituents, which included the list of dangerous waste constituents in WAC 173-303-9905 (PNL 1988). Later some wells were dropped because they did not meet WAC 173-160 standards. However, other wells (e.g., 399-2-1 and 399-3-10) were added even though they did not meet WAC 173-160 standards. They were added because they were in good positions to intercept contaminants flowing southeast from the 300 APT that had passed wells closer to the trenches. Wells added that did not conform to WAC 173-160 standards provided data for information and supplementary purposes only. Important RCRA unit decisions could not be made based on data from wells that did not meet the WAC 173-160 standards.

Since 1989, wells were periodically dropped from the network and the sampling schedule was changed from monthly to quarterly and eventually to semiannually. These changes were made because data quality objectives (DQO) in the groundwater monitoring plan (Schalla et al. 1988a) regarding hydrogeology and contamination were satisfied, the ERA in 1991 significantly reduced contamination in the trenches, and fewer wells sampled less frequently would still provide adequate groundwater monitoring. Currently the well network has been reduced to 11 wells sampled semiannually (Figure 3-12). Table 3-5 lists the 11 wells, the aquifers screened, sampling frequency, frequency of water level measurements, and compliance with WAC 173-160 standards. Table 3-7 lists the contaminant constituents analyzed in the current monitoring well network and the frequency of the sampling. One well (399-1-17A) is still sampled quarterly in order to comply with regulatory requirements for quarterly sampling for sites under groundwater quality assessment programs and to provide a rapid detection or early warning for any new contaminants inadvertently discharged to the 300 APT prior to January 1995 when lines to the trenches were "blanked" off.

Figure 3-11. Locations of Monitoring Wells Added to the Network in 1986 and 1987.

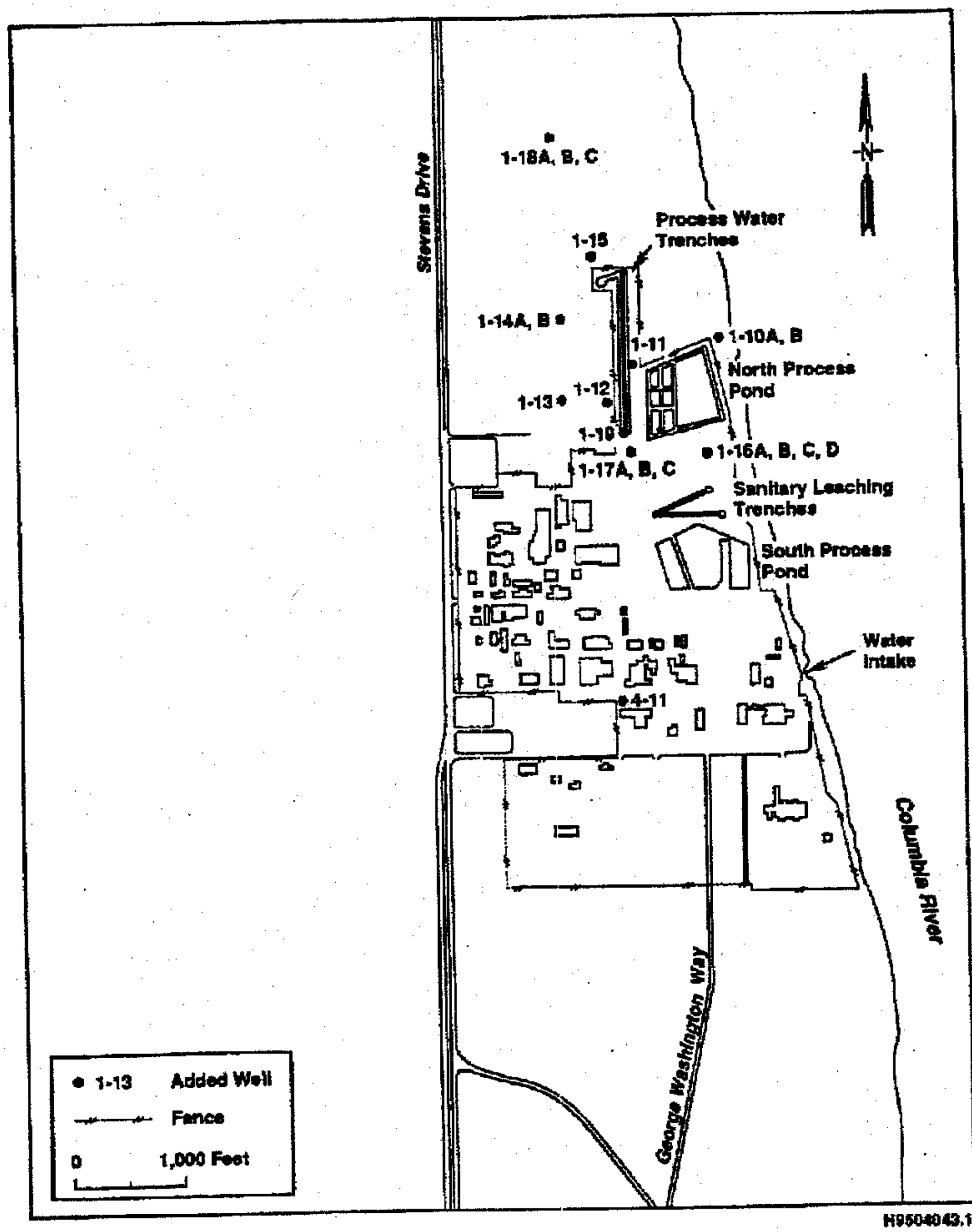


Table 3-6. Appendix IX Constituents Not in WAC 173-303-9905 List.* (3 sheets)

Appendix IX Constituent	SW-846 Method*
Acenaphthalene	8270
Acenaphthylene	8270
Acetone	8240
Allyl chloride	8240
Aniline	8270
Anthracene	8270
Antimony	6010
Aramite	8270
Benzo[k]fluoranthene	8270
Benzo[ghi]perylene	8270
Benzyl alcohol	8270
alpha-BHC	8080
beta-BHC	8080
delta-BHC	8080
gamma-BHC; Lindane	8080
Bis(2-chloro-1-methyl-ethyl) ether; 2,2'-Dichlorodiisopropyl ether	8270
Bromodichloromethane	8240
4-Chlorophenyl phenyl	8270
Chloroprene	8240
Cobalt	6010
Copper	6010
Dibenzofuran	8270
Dibromochloromethane; Chlorodibromomethane	8240
1,2-Dibromo-3-chloro-propane; DBCP	8240
p-(Dimethylamino) azobenzene	8270
Dinoseb; DNBP; 2-sec-Butyl-4,6-dinitrophenol	8270
Ethylbenzene	8240

Table 3-6. Appendix IX Constituents Not in WAC 173-303-9905 List.* (3 sheets)

Appendix IX Constituent	SW-846 Method*
Fluorene	8270
Isodrin	8270
Isophorone	8270
Methoxychlor	8270
Methylene bromide; Dibromomethane	8240
Methylene chloride; Dichloromethane	8240
2-Methylnaphthalene	8270
4-Methyl-2-pentanone; Methyl isobutyl ketone	8240
o-Nitroaniline	8270
m-Nitroaniline	8270
Nitrobenzene	8270
p-Nitrophenol	8270
N-Nitrosodiphenylamine	8270
N-Nitrosodipropylamine; Di-n-propylnitrosamine	8270
Phenanthrene	8270
Pyrene	8270
Safrole	8270
Styrene	8240
Sulfide	9030
Tin	6010
Vanadium	6010

Table 3-6. Appendix IX Constituents Not in WAC 173-303-9905 List.[a] (3 sheets)

Appendix IX Constituent	SW-846 Method[a]
Vinyl acetate	8240
Xylene	8240
Zinc	6010

[a]Constituents listed here were analyzed in all 11 wells of the 300 APT (Figure 3-12) by the methods listed.

[a]SW-846 Methods.

6010 - ICP Metals (see Table 4-1, this document).

8240 - Volatile Organic Analysis (Gas Chromatograph since 1994, Gas Chromatograph/Mass Spectrometer before 1994 - See Table 4-4, this document).

8270 - Semi-Volatile Organic Analysis (Analyzed in all eleven 300 APT wells during the period 5/88-5/90).

8080 - Pesticides (see Table 4-1, this document).

9030 - Sulfide (Analyzed in all 11 300 APT wells 2/87-5/90).

Table 3-7. Constituents Analyzed in the Current Monitoring Well Network.

Semiannual Schedule - All 11 300 APT Network Wells

Alkalinity
Gross Alpha
Gross Beta
Uranium
Coliform
Specific Conductance (Lab)
ICP Metals (including arsenic, selenium, and lead) - unfiltered
ICP Metals (including arsenic, selenium, and lead) - filtered
Mercury - unfiltered
Mercury - filtered
pH (Lab)
Radium
TOC
TOX
Tritium
Volatile Organics Analysis (GC)

Quarterly Schedule - Well 1-17C Only

Anions
Specific Conductance (Lab)
Gamma Scan
pH (Lab)
Strontium-90
TOX
TOC
Isotopic Uranium
Uranium
Volatile Organics Analysis (GC)

Results of groundwater sampling and analysis since Schalla et al. (1988a; 1988b) are reported quarterly (data only) and annually (including interpretations) as RCRA reports by the Westinghouse Hanford Company (WHC) Groundwater Management Group for the U.S. Department of Energy (DOE). The following is a summary of results since 1987.

Only chromium, lead, selenium, lindane, and gross alpha have values larger than the maximum contaminant levels (MCLs). Chromium exceedances (Appendix C) may be the result of an excessive amount of suspended particles (turbidity) in groundwater samples because the exceedances are associated with unfiltered samples. Lead exceedances occurred prior to the ERA (1991) in two wells that did not meet WAC 173-160 standards for construction. Since the ERA, lead concentrations have been below the MCL of 50 µg/L. Exceedances of selenium and lindane may actually be analytical problems due to detection limits that are higher than respective MCLs. Other constituents of interest such as gamma-emitting radionuclides and strontium-90, copper, sulfate, zinc, chloride, and silver were all below the Primary and Secondary DWS or the 4 mrem/yr equivalent concentration for radionuclides (Appendix C). (Gross alpha and uranium are discussed later).

Volatile Organic Analysis (VOAs) results indicate that several constituents are detected in downgradient wells of the 300 APT well network. The detected VOA constituents include PCE, toluene, xylene, benzene, TCE, chloroform, ethylbenzene, and cis-DCE (Appendix C). However, only TCE and cis-DCE are consistently above the DWS of 5 and 70 µg/L, respectively. The well showing the exceedances of TCE and cis-DCE is 399-1-16B, which is a downgradient well screened at the bottom of the unconfined aquifer (Figures 3-13 and 3-14).

Concentrations of iron and manganese in filtered samples are consistently higher than DWS for two wells, iron in well 399-1-17B and manganese in well 399-1-16B and 399-1-17B (Appendix C). Both wells are screened at the bottom of the unconfined aquifer. These results may be due to reducing conditions and the effect on well structures such as stainless steel casing and the effects of drilling. A similar relationship between sampling depth and concentration profiles for redox-sensitive species has been documented in Johnson et al. (1994).

Uranium continues to be detected in several wells in the vicinity of the 300 APT and is correlated with gross alpha (Schalla et al. 1988b, Section 7.2; Appendix C; Figure 3-15). The 1991 ERA reduced the concentrations of gross alpha and uranium (Appendix C) significantly in wells downgradient of the 300 APT. Currently, uranium concentrations at wells 399-1-17A and 399-1-10A are above the EPA (proposed) guidance value of 20 µg/L for total uranium (EPA 1991). The MCL for gross alpha is based on the exclusion of the uranium component, which is referred to as "adjusted" gross alpha. In a few cases, the adjusted gross alpha concentrations have exceeded the 15 pCi/L (adjusted) gross alpha standard (EPA 1991; 40 CFR 141.15). However, on the average, the standard is not exceeded in any of the downgradient wells. The occasional exceedances of the adjusted gross alpha standard are attributed to random fluctuations in the measurement of gross alpha and uranium, and/or perhaps due to the presence of some residual radon decay products. Specific isotopic analyses (e.g., plutonium-238, 239, 240 and americium-241) would be needed to

Figure 3-13. Trichloroethene Plume.

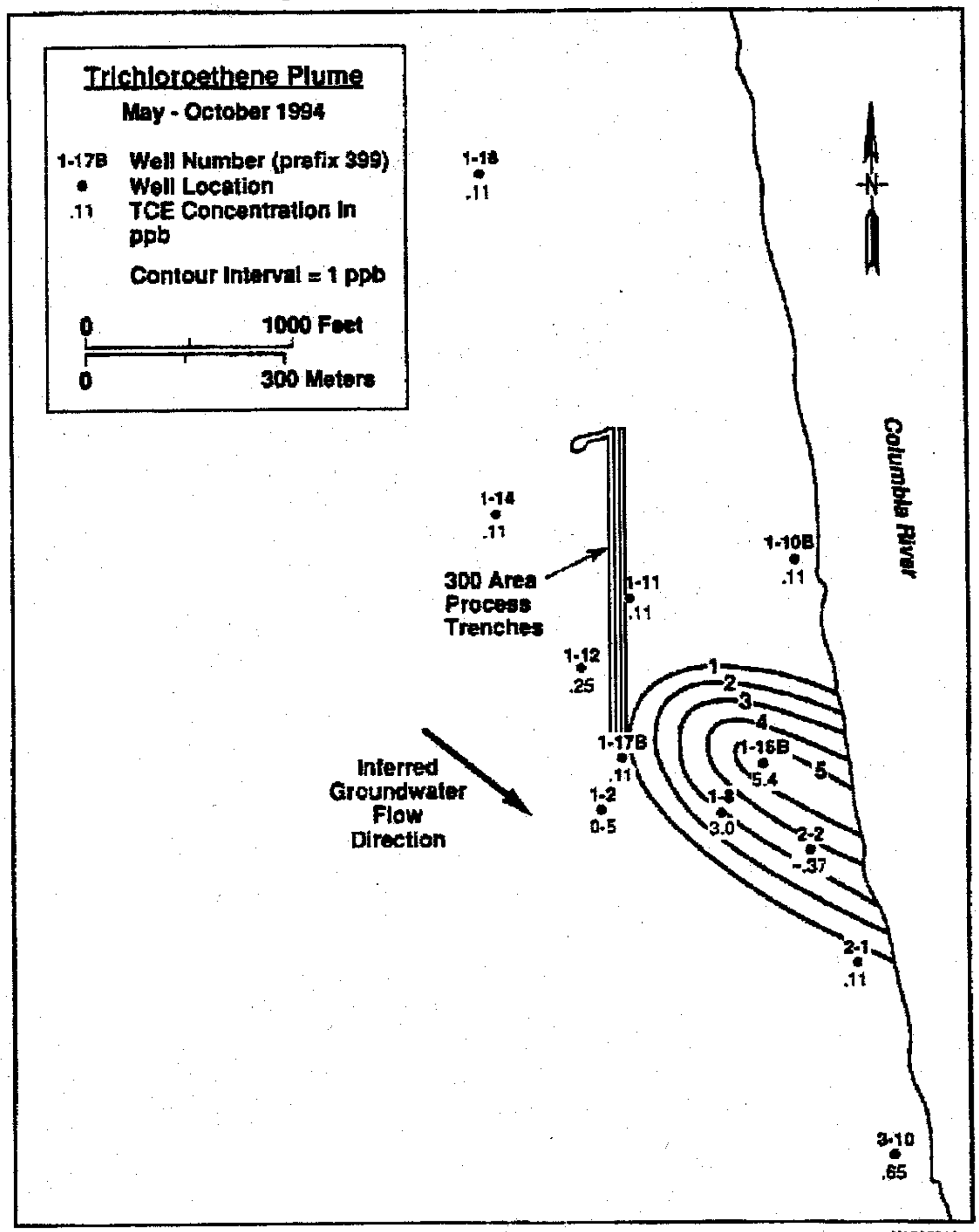


Figure 3-14. CIS 1,2-Dichloroethene Plume.

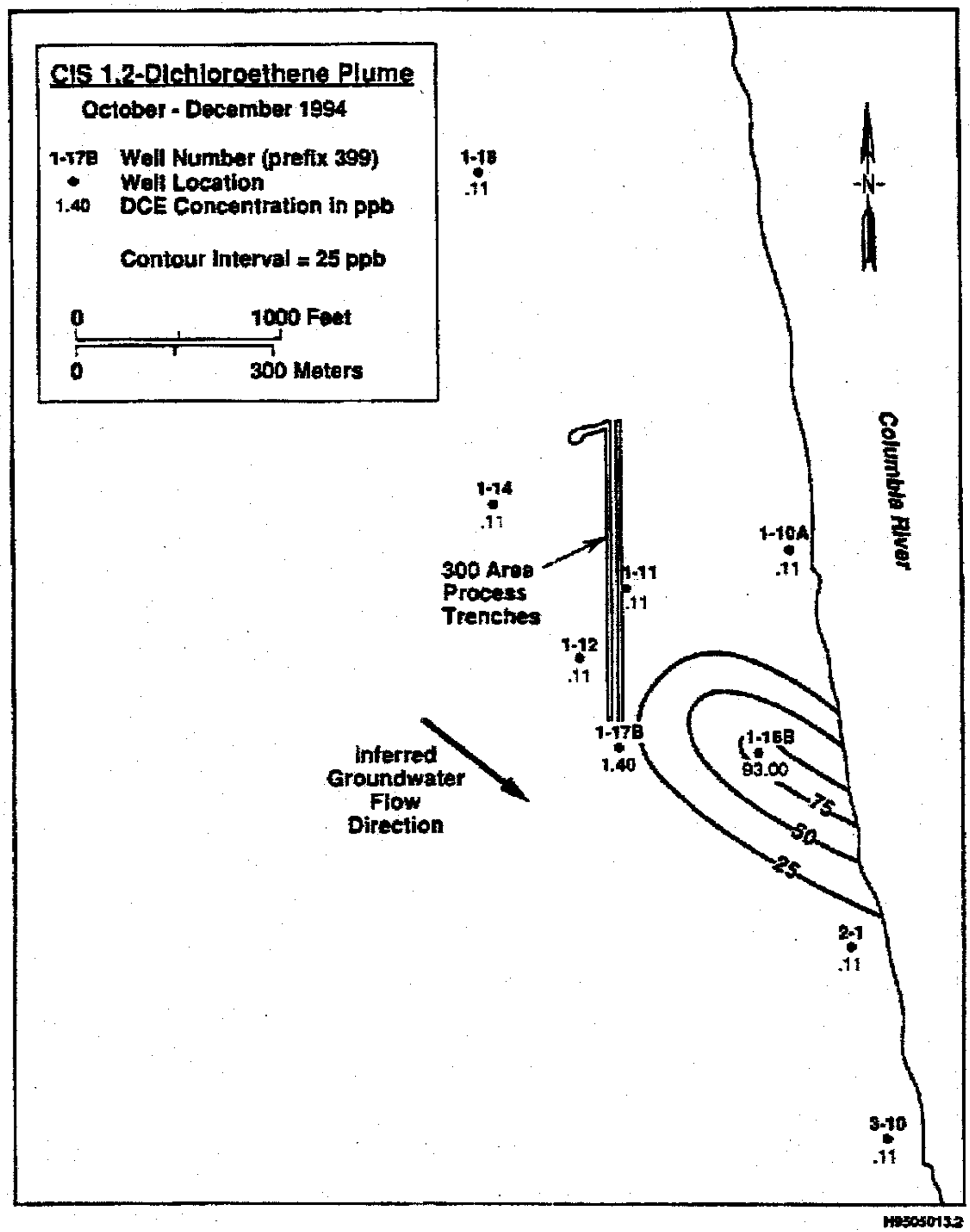
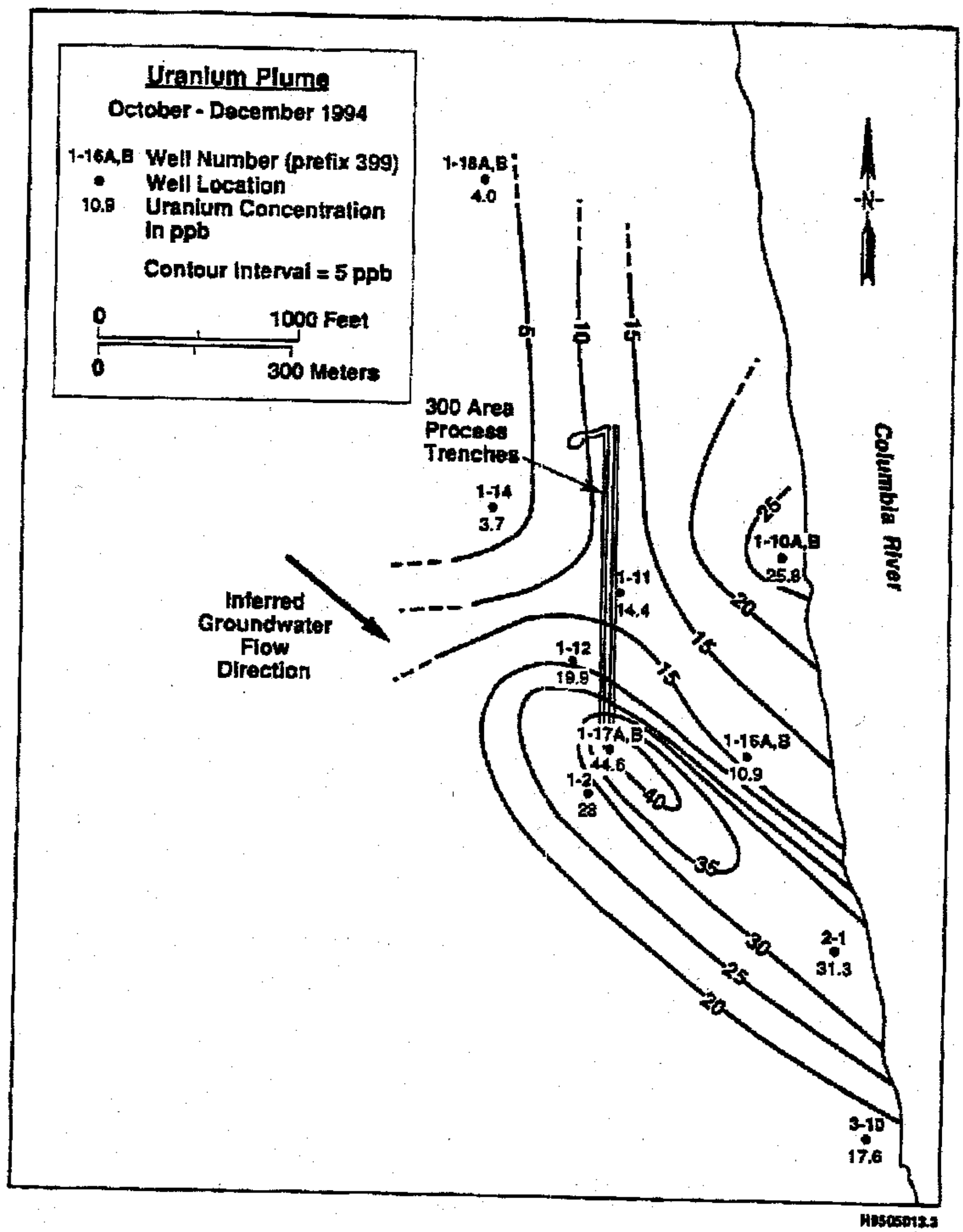


Figure 3-15. Uranium Plume.



rule out the presence of other alpha emitters in groundwater at this site since they have not been previously excluded on the basis of direct measurements in groundwater at the 300 APT. However, based on soil column analytical results (DOE-RL 1995a, Appendix 7D) and the expected chemical behavior of plutonium and americium, it is highly unlikely that transuranics are present in groundwater beneath the 300 APT.

3.4 CONCEPTUAL MODEL FOR LOCALIZED "DEEP" AQUIFER OCCURRENCE OF CHLORINATED HYDROCARBONS

A conceptual model is needed to explain the persistent occurrence of TCE and related degradation products in one downgradient well completed at the bottom of the unconfined aquifer (-16B) (Figures 3-13 and 3-14). One possible explanation is that a liquid phase of PCE (density 1.6 g/ml) settled to the bottom of the aquifer beneath the 300 APT. Slow dissolution and microbial degradation of the free phase would then provide a long-term source of PCE and degradation products (TCE and DCE) to the deeper zone of the unconfined aquifer. Since well -16B is downgradient from the trenches, this well would be in the contaminant plume from such a source. If this explanation is correct, it should be consistent with the hydrogeology and hydraulic setting previously discussed.

For example, the Darcy velocity, see Equation (I), is 0.0016 m/d using an average hydraulic conductivity of 1.4 m/d for the bottom of the unconfined aquifer at 300 APT (Table 3-2), an average gradient of 0.00035, and an effective porosity of 0.3. The observation well is over 300 m (984 ft) downgradient from the trench, suggesting a travel time of greater than 500 years. Since the recorded spills occurred in 1982 and 1984, the computed travel time is inconsistent with this conceptual model. It is also noteworthy that PCE and degradation products were detected shortly after well -16B was installed in 1987 (Appendix C).

Thus, it seems unlikely that the observed chlorinated hydrocarbons in -16B are related to the recorded spills in 1982 and 1984. One alternative possibility is that, during the early years of operations, undocumented ground disposal occurred in the upgradient vicinity of the well. Since this is currently the only well with a persistent occurrence of significant concentrations of chlorinated hydrocarbons, a local source near the well is suggested.

Additional field work would be needed to investigate the possibility of soil dump sites near well -16B and or to distinguish among other possible alternatives. These possibilities should be considered if the groundwater MCL exceedances for TCE and related degradation products persist.

This page intentionally left blank.

4.0 GROUNDWATER MONITORING PROGRAM

Chapter 4.0 describes the groundwater monitoring activities to be conducted at the 300 APT during the compliance period (including the closure period) for this unit. The groundwater monitoring program is designed to (1) protect human health and the environment; (2) comply with the intent of final status groundwater monitoring requirements of WAC 173-303-645 (Ecology 1986) and 40 CFR 264 Subpart F; and (3) conduct groundwater investigations or remediation, should it become necessary, in a technically sound and cost effective manner.

Three levels of groundwater monitoring programs are identified under final status regulations: (1) detection monitoring, (2) compliance monitoring, and (3) corrective action (Figure 4-1). Each monitoring program is briefly described below.

Detection level monitoring program. Indicator parameter data (e.g., pH, specific conductance, TOC, TOX, or heavy metals, waste constituents, or reaction products) from downgradient compliance point wells are compared with background wells data semiannually to determine if the unit is impacting the groundwater quality.

Compliance level monitoring program. If groundwater sampling during the detection level monitoring program reveals a statistically significant increase (or pH decrease) over upgradient background concentrations for groundwater, a compliance level monitoring program is established. The monitoring objective is to determine whether groundwater concentration limits have been exceeded at the downgradient (compliance) wells.

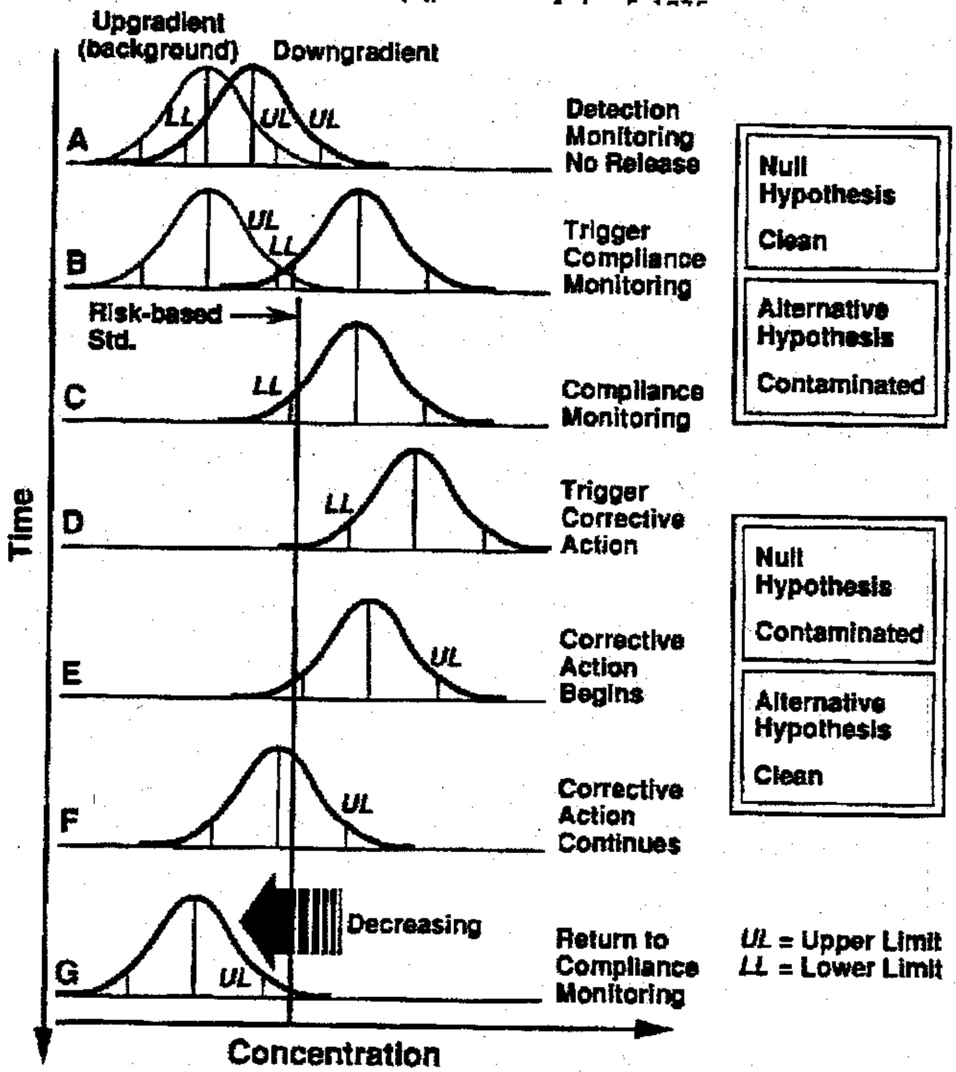
Corrective action level monitoring program. If the referenced concentration limit(s) for a given groundwater parameter or parameters are significantly exceeded during compliance monitoring, a corrective action level monitoring program will be developed and implemented to protect human health and the environment.

4.1 OBJECTIVES OF GROUNDWATER MONITORING PROGRAM

The 300 APT groundwater monitoring program bypassed the detection-level stage and went directly into a RCRA interim-status (assessment) level program in June 1985. The detection-level monitoring program was bypassed because groundwater was already known to be contaminated. Monitoring wells were constructed in response to a Consent Agreement and Compliance Order issued jointly by Ecology and the EPA (Ecology and EPA 1986).

The 300 APT is scheduled to be included the final-status RCRA Permit as a TSD unit undergoing closure through the permit modification process in September 1995. The groundwater near the 300 APT needs to be monitored under a final status program that is comparable or equivalent to the assessment level initiated under the interim status. Hence, a compliance monitoring program is proposed for the 300 APT. The proposed compliance monitoring program will (1) obtain samples that are representative of existing groundwater conditions; (2) identity key monitoring constituents that are

Figure 4-1. A Statistical Perspective of the Sequence of Groundwater Monitoring Requirements Under the Resource Conservation



(Notice that until contamination above a risk standard is documented (D) the null hypothesis is that the facility is clean. Once the facility has been proven to be in exceedance of a health criteria then the null hypothesis is that the facility is contaminated until proven otherwise (G).

H9401016.1

attributable to past operations of the 300 APT; (3) determine applicable groundwater concentration limits (e.g., risk-based maximum concentration limits); and (4) determine whether referenced groundwater concentration limit(s) for a given parameter or parameters are exceeded. A DQO process is used to guide the groundwater monitoring activities to be conducted for the 300 APT. The primary purpose of the DQO process is to ensure that the type, quantity, and quality of groundwater monitoring data used in the decision-making process are appropriate for their intended applications. Details concerning the DQO process can be found in EPA (1993).

4.2 DANGEROUS WASTE CONSTITUENTS

Section 4.2 identifies constituents that are attributable to past operations of the 300 APT. Groundwater chemistry samples are collected quarterly from well 399-1-17A to provide near-trench monitoring of contaminants. All other wells in the monitoring network are sampled semiannually. Monitoring results have been reported in the RCRA quarterly and annual reports. Since 1987, a very large amount of hydrogeologic and contaminant data have been collected from the 300 APT wells. Consequently, the rate, extent, and concentrations of groundwater contaminants originating from the 300 APT are well understood (WHC 1990). Furthermore, an ERA was initiated in July 1991. The ERA removed a layer of contaminated sediments containing uranium, copper, chromium, and silver. In January 1995, the 300 APT was permanently isolated from the process sewer (its only source of effluent), therefore eliminating the trenches as a source of groundwater recharge.

Groundwater monitoring results are available from the Hanford Environmental Information System (HEIS) and the Geosciences Data Analysis ToolKit (GeoDAT). The following are considered when deriving a constituent list appropriate for the 300 APT:

- Inventory/process knowledge
- Driving force
- Contaminant mobility
- Preferential pathways
- Monitoring objectives
- Detection history at the unit.

Per WAC 173-303-645 and 40 CFR 264, Subpart F, groundwater concentration limits must be established in the facility permit (by the regulators). These limits are not to be exceeded. These concentration limits may be different than the risk-based groundwater cleanup standards as required by the Method C (industrial scenario) of the Model Toxics Control Act, WAC 173-340-720(4). Table 4-1 summarizes the status of 14 constituents where groundwater concentration limits have been established (see WAC 173-303-645(5)(a), Table 1).

Only chromium, lead, selenium, and lindane have values larger than the MCLs given in WAC 173-303-645(5)(a), Table 1. Chromium exceedances were isolated events that were probably caused by suspended particulate in the unfiltered samples. Lead exceedances were observed, prior to the 1991 ERA, in two non-RCRA wells. After the ERA, lead concentrations have been below the

Table 4-1. Status of Monitoring Results for Constituents in the 300 Area Process Trenches for Groundwater Protection.

Constituent[a]	MCL (mg/L)	MCL (μg/L)	Exceed (Y/N)	Concentration Range[b] (μg/L)
Arsenic	0.05	50	N	<0.64 - 6.7 (unfiltered) <0.64 - 6.2 (filtered)
Barium	1.0	1,000	N	<2.0 - 70 (unfiltered) <2.0 - 70 (filtered)
Cadmium	0.01[c]	10[c]	Y[d]	<10 (unfiltered) <10 (filtered)
Chromium	0.05[c]	50[c]	Y	4 occurrences observed in unfiltered samples from wells 3-1-12 (150 ppb), 3-1-16A (147 ppb), 3-1-17A (140 ppb), 3-1-18A (120 ppb).
Lead	0.05	50	Y	2 occurrences (in 1985) observed in unfiltered samples from non-RCRA standards wells 3-2-1 (55 and 58 ppb) and 3-3-10 (77.5 and 73.5 ppb).
Mercury	0.002	2	N	<0.2 (unfiltered) <0.2 (filtered)
Selenium	0.01	10	Y[d]	<20 (unfiltered) <10 (filtered)
Silver	0.05	50	N	<20 (unfiltered) <20 (filtered)
Endrin	0.0002	0.2	Y[d]	<1 (all samples)
Lindane	0.004	4	N	<0.05 (all samples)
Methoxychlor	0.1	100	N	<2 (all samples)
Toxaphene	0.005	5	N	<2 (all samples)
2,4-D	0.1	100	N	<10 (all samples)
2,4,5-TP silvex	0.01	10	N	<2 (all samples)

MCL = maximum contaminant level. Y/N = yes/no.
[a]from WAC 173-303-645 (5)(a).
[b]from results analyzed by DataChem Laboratories (after 12/31/91).
[c]MCLs for chromium and cadmium have been revised to 0.1 mg/L (100 μg/L) and to 0.005 mg/L (5 μg/L), respectively, per 40 CFR 141.62 (b)(5), effective 7/30/92.
[d]all samples were essentially not detected (exceedances due to detection limits larger than required MCLs).

MCL of 50 µg/L. All samples analyzed for cadmium, selenium, and lindane were essentially non-detects and the exceedances were caused by detection limits that were higher than the respective MCLs. Other constituents of interest (e.g., copper, sulfate, zinc, chloride, silver, gamma-emitting radionuclides, and strontium-90) were all below the Primary and Secondary DWS or the 4 mrem/yr equivalent concentrations for radionuclides (see Tables 4-2 and 4-3). Gross alpha and uranium exceedances were observed in all wells in the monitoring network except for wells 3-1-14A, 3-1-16B, 3-1-17B, and 3-1-18A. Gross beta exceedances were observed in wells 3-1-10A, 3-1-11, and 3-1-16A. In general, the excess beta can be accounted for by the beta decays associated with the uranium-238 present in the groundwater samples from the 300 APT wells that exhibit gross beta levels >50 pCi/L.

An evaluation of VOA results revealed that detected analytes include PCE, toluene, xylene, benzene, TCE, chloroform, ethylbenzene, and cis-DCE (see Table 4-4). Only TCE and DCE have been observed in well 3-1-16B consistently above the DWS of 5 and 70 µg/L, respectively. Unplanned releases (two spills) of PCE occurred in 1982 and 1984.

Concentrations of iron and manganese in filtered samples are consistently higher than the respective DWS in two wells (3-1-17B for iron, 3-1-16B and 3-1-17B for manganese) of the 300 APT network (see Table 4-3). These two wells were completed at the bottom of the unconfined aquifer. The elevated iron and manganese concentrations observed in the "deep" unconfined aquifer are probably influenced by chemical reducing conditions (i.e., the absence of oxygen and negative oxidation-reduction potentials). A similar relationship between sampling depth and concentration profiles for redox sensitive species has been documented in WHC (Johnson et al. 1994). A limited follow-up geochemical investigation is needed. Measurements of Eh (redox potential) and dissolved oxygen should be determined for these two wells to confirm that the hypothesized reducing conditions exist at these wells. Metals (iron and manganese) will be added to the list of monitoring constituents if it can be demonstrated that the elevated concentrations are caused by other than chemical reducing conditions.

Uranium was the most significant and widespread groundwater contaminant resulting from past operations of the 300 APT. The mitigating action of the ERA reduced uranium concentrations in well 3-1-17A significantly. Currently, uranium concentrations at wells 3-1-17A and 3-1-10A have remained above the EPA <u>proposed</u> guidance value of 20 µg/L for total uranium (EPA 1991). However, the EPA proposed standard of 20 µg/L applies to community and nontransient, noncommunity water systems. This may be ultra conservative for the 300 APT.

Based on the above considerations, the following constituents are proposed for the initial monitoring program to comply with WAC 173-303-645(4). The list will be reassessed periodically and revised should there be a need to update the monitoring list.

Table 4-2. Status of Monitoring Results for Other Hazardous Chemical Constituents in the 300 Area Process Trenches for Groundwater Protection.

Constituent[a]	MCL (mg/L)	MCL (µg/L)	Exceed (Y/N)	Concentration Range[b] (µg/L)
Copper	1.0	1,000	N	<2.0 - 20.0 (unfiltered) <2.6 - 20.0 (filtered)
Iron	0.3	300	Y	3-1-17B (320 - 450), in filtered samples
Manganese	0.05	50	Y	3-1-16B (67 - 74), in filtered samples 3-1-17B (67 - 83), in filtered samples
Sulfate	250	250,000	N	(11,000 - 53,000)
Total Dissolved Solids (TDS)	500	500,000	N	(221,000 - 248,000), TDS data in well 3-1-10A only
Zinc	5	5,000	N	<3.44 - 24.0 (unfiltered) <3.44 - 23.0 (filtered)
Chloride	250	250,000	N	(4,600 - 150,000)

MCL = maximum contaminant level. Y/N = yes/no.
[a]from 40 CFR 143.3 Secondary Maximum Contaminant Levels.
[b]from results analyzed by DataChem Laboratories (after 12/31/91).

Table 4-3. Status of Monitoring Results for Radiological Constituents in the 300 Area Process Trenches for Groundwater Protection.

Constituent	MCL (pCi/L)	MCL ($\mu g/L$)	Exceed (Y/N)	Concentration Range[b] ($\mu g/L$)
Gross Alpha	15		Y	exceedance observed in all wells except for in wells 3-1-14A, 3-1-16B, 3-1-17B, and 3-1-18A
Uranium		20[a]	Y	exceedance observed in all wells except for in wells 3-1-14A, 3-1-16B, 3-1-17B, and 3-1-18A
Gross Beta	50		Y	exceedance observed in wells 3-1-10A (13.6 - 68), 3-1-11 (6.51 - 63), and 3-1-16A (20 - 88)
Sr-90	8		N	essentially all ND
Tc-99	900		N	(10 - 281) in 3-1-10A, where the upper value 281 was flagged with a "R" (rejected) for gross α and gross β analyses
Tritium	20,000		N	highest range of concentrations were observed in well 3-1-18A, (10,900 - 11,500) indicating upgradient source of contamination
Cs-137	200		N	essentially all ND
Co-60	100		N	essentially all ND

MCL = maximum contaminant level.
Y/N = yes/no.
[a]From Federal Register, Vol. 56, No. 138, 7/18/1991, Proposed Rule: National Primary Drinking Water Regulations, Radionuclides (EPA 1991).
[b]From results analyzed by DataChem Laboratories (after 12/31/91).

Table 4-4. Status of Monitoring Results for Detected VOA Constituents in the 300 Area Process Trenches for Groundwater Protection.

Constituent[a]	MCL (mg/L)	MCL (μg/L)	Exceed (Y/N)	Concentration Range[b] (μg/L)
Ethylbenzene	0.7	700	N	0.06 - 0.08
Toluene	1	1,000	N	0.03 - 0.06
Tetrachloroethylene	0.005	5	N	0.09 - 0.74
Xylenes	10	10,000	N	0.05 - 0.08
Cis-1,2-DCE	0.070	70	Y	exceedance observed in well 3-1-16B[c]
Chloroform	None	None	NA	0.06 - 9.30 (GC) 1.40 - 22.0 (GC/MS)
Benzene	0.005	5	N	0.02 - 0.06
TCE	0.005	5	Y	exceedance observed in well 3-1-16B[c]

MCL = maximum contaminant level.
Y/N = yes/no.
NA = not applicable.
[a]VOA analyzed by Gas Chromatography (GC) and/or Gas Chromatography/Mass Spectrometry (GC/MS).
[b]From results analyzed by DataChem Laboratories (after 12/31/91).
[c]See time vs concentration plots in Appendix C.

- Radionuclides--chemical uranium
- VOAs--TCE and DCE
- Metals--iron and manganese will be added to the list depending on the outcome of follow-up geochemical investigations (i.e., if elevated levels are not due to chemical reducing conditions.

Additional constituents will be collected (see Section 4.5.1).

4.3 GROUNDWATER MONITORING WELLS

The proposed groundwater monitoring network for the 300 APT contains eight wells set up as four pairs of deep and shallow wells for the unconfined aquifer (Table 4-5). Three of the well pairs are downgradient and one pair is upgradient (Figure 4-2). The wells were selected in order to fulfill the requirements for monitoring well networks for RCRA sites in compliance programs of final status (WAC 173-303-645). Appendix A contains the well construction and completion summaries, including schematics, for the eight wells. Specifically, the objective was to select wells that would monitor the appropriate portion of the aquifer for waste constituents of concern. In the case of the 300 APT the constituents of concern are TCE, DCE, uranium, and possibly iron and manganese (see Section 4.2). All but TCE and DCE are migrating through the upper portions of the unconfined aquifer. TCE and cis-DCE are detected in wells monitoring the base of the unconfined aquifer (see Section 3.4). Therefore, wells screened in the bottom portion of the aquifer are appropriate too, both down- and up-gradient. The three downgradient well pairs (399-1-10AB, 399-1-16AB, and 399-1-17AB) are east, southeast, and south, respectively, of the 300 APT to intercept any groundwater contaminants emanating from the 300 APT and flowing with the groundwater in directions consistent with historical data. Based on the Monitoring Efficiency Model (Jackson et al. 1991), the proposed downgradient wells should provide a monitoring efficiency of approximately 88%, assuming a groundwater flow direction of south-southeast (S.27°E or 153° azimuth). The upgradient well pair (399-1-18AB) was chosen because it was close to the 300 APT but not too close to the trenches to encounter contaminants temporarily flowing in a reverse direction when the Columbia River stage is high. All eight of the proposed wells were constructed to WAC 173-160 standards.

4.4 COMPLIANCE MONITORING

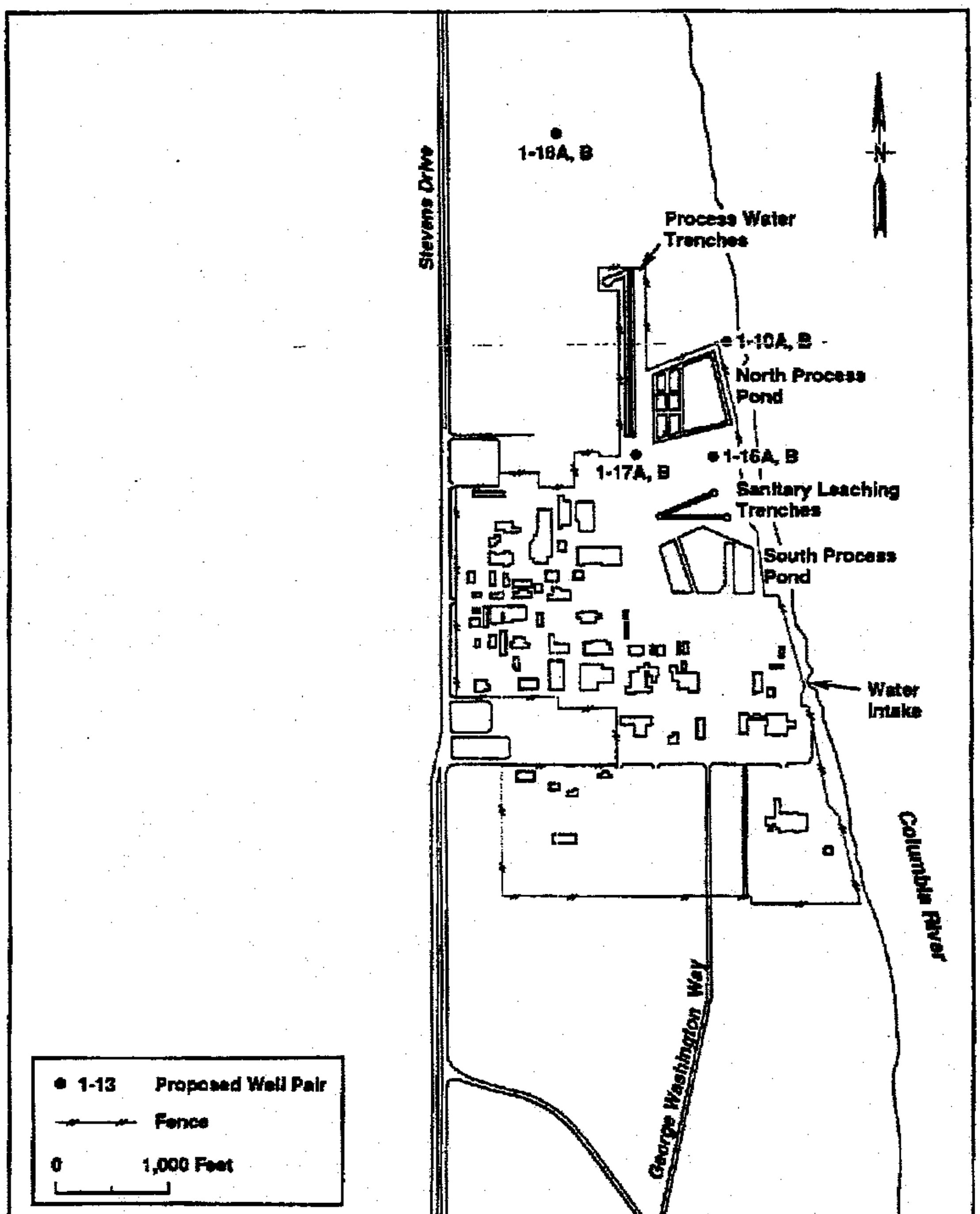
Groundwater protection regulations establish requirements concerning groundwater monitoring and corrective action standards for the permitted regulated units (e.g., surface impoundment, land disposal unit). Furthermore, for each dangerous waste constituent entering the groundwater from a regulated unit, the unit permit must include a concentration limit that cannot be exceeded. These concentration limits are the "triggers" that determine the need for further action.

Table 4-5. Proposed Wells for the 300 Area Process Trenches Monitoring Well Network.

Well	Aquifer	Sampling Frequency	Water Levels	Well Standards
399-1-10A[86]	Top Unconfined	Semiannual	Quarterly	WAC 173-160
399-1-10B[91]	Bottom Unconfined	Semiannual	Quarterly	WAC-173-160
399-1-16A[86]	Top Unconfined	Semiannual	Quarterly	WAC 173-160
399-1-16B[87]	Bottom Unconfined	Semiannual	Quarterly	WAC 173-160
399-1-17A[86]	Top Unconfined	Semiannual	Quarterly	WAC 173-160
399-1-17B[86]	Bottom Unconfined	Semiannual	Quarterly	WAC 173-160
399-1-18A[86]	Top Unconfined	Semiannual	Quarterly	WAC 173-160
399-1-18B[87]	Bottom Unconfined	Semiannual	Quarterly	WAC 173-160

Note: Superscript following well number denotes the year of construction.

Figure 4-2. Locations of Monitoring Wells Proposed for the Revised 300 Area Process Trenches Groundwater Monitoring Plan.



H9504043.12

4.4.1 Concentration Limits

For the 300 APT constituents of concern, the proposal is to use the following MCLs as the concentration limits.

1. For TCE, the MCL is 5 µg/L. This limit is based on National Primary DWS (40 CFR 141.61(a)). This limit is also the MCL set forth in WAC 246-290-310.

2. For cis-DCE, the MCL is 70 µg/L. This limit is based on National Primary DWS (40 CFR 141.61(a)).

3. For uranium, there is no DWS established. However, 20 µg/L for total uranium in public drinking water supplies was included in proposed changes to 40 CFR 141 (EPA 1991). This value is proposed for the 300 APT until the rule containing the subject standard is promulgated.

Groundwater quality criteria for TCE is set at a different level, 3 µg/L, in WAC 173-303-200. However, the purpose of WAC 173-303-200 is to set groundwater quality standards that are (1) preventative in nature and (2) protective of existing and future beneficial uses through the reduction or elimination of contaminants discharged to the subsurface. Therefore, these standards are more stringent than other types of standards in order to control the source discharged to groundwater. Once contaminants have reached groundwater, the applicable standard should be set at the MCL and/or the state required cleanup standard.

4.4.2 Point of Compliance

The point of compliance (POC) is defined in 40 CFR 264.95 and WAC 173-303-645(6) as a "vertical surface" located at the hydraulically downgradient limit of the waste management area that extends down into the uppermost aquifer underlying the regulated unit. The POC is the place in the uppermost aquifer where groundwater monitoring takes place and the groundwater protection standard is set. For the 300 APT, the POC should be the downgradient monitoring wells as provided in Section 4.3. (i.e., monitoring wells 3-1-10A and -10B, 3-1-16A and -16B, 3-1-17A and -17B).

4.4.3 Compliance Period

The compliance period is defined as the number of years equal to the active life of the waste management area (including any waste management activity prior to permitting and the closure period). Typically, groundwater monitoring is required for a period of 30 years following completion of closure activities, although this time frame may be shortened or extended by the regulatory authority. If corrective action is engaged by the owner or operator (due to exceedance of groundwater concentration limit), then the compliance period will be extended until it can be demonstrated that the applicable limit has not been exceeded for a period of three consecutive years.

4.5 SAMPLING AND ANALYSIS

Section 4.5 describes or references procedures for sample collection, sample preservation and shipment, chain of custody requirements, analytical procedures, and quality assurance. Specific sampling and analysis procedures are referenced. Work by subcontractors shall be conducted to their equivalent approved standard operating procedures.

All field sampling activities will be recorded in the proper field logbook as specified in EII 1.5 and subsequent revisions (WHC 1988). Electric submersible or Hydrostar[3] pumps will continue to be used in existing monitoring wells for purging and sampling. Before sampling each well, the static water level will be measured and recorded as specified in EII 10.2 (WHC 1988). Based on the measured water level and well construction details, the volume of water in the well will be calculated and documented in the well sampling form or field notebook. These steps will be performed electronically in the field. As specified in EII 5.8, each well will be purged before sampling until the approved criteria are met (WHC 1988). Purge water will managed according to EII 10.3 (WHC 1988). In the situations where the well pumps dry because of very slow recharge, the sample will be collected after recharge. Samples will be collected and field preserved as specified in EII 5.8. Sampling equipment decontamination will follow procedures specified in EII 5.4 (WHC 1988).

Sample chain-of-custody, sample packaging, and shipping required by WAC 173-303-645(8)(d) are discussed in EII 5.1 and 5.11 (WHC 1988). The general quality assurance/control (QA/QC) protocols will include the site-specific analytes for this plan (WHC 1993). The purpose of the QC activities is to determine and documente that samples were carefully collected and transferred to an analytical laboratory, that the quality of the analytical results being produced by the laboratory are defensible, and that corrective actions will be taken as necessary.

Under the proposed compliance-level monitoring program, water-level elevation data will be evaluated annually to determine if the monitoring wells ae strategically located. If the evaluation indicates that existing wells are no longer adequately located, the groundwater monitoring network will be modified to bring it into compliance with WAC 173-303-645(8)(a). Descriptions of monitoring constituents, monitoring frequency, and analytical procedures specific to the 300 APT are provided below.

4.5.1 Constituents to be Analyzed

The constituents to be analyzed initially for the 300 APT include:

(1) <u>The detected constituents of concern identified in Section 4.2 (incuding uranium and biodegradation products of tetrachloroethylene).</u> These constituents of concern will be sampled independently four times in each sampling event (semiannually).

---

[3]Hydrostar is a registered trademark of Instrumentation Northwest, Inc.

(2) Metals (iron and manganese). Groundwater samples will be analyzed semiannually for these metals together with dissolved oxygen and redox potential as part of the follow-up geochemical investigation (Section 4.2). They will be added to the constituents of concern list if elevated levels are not due to chemical reducing conditions.

(3) Four constituents required by Ecology including thallium, PCBs, chrysene, and benzo(a)pyrene. These four constituents are required by Ecology in response to their concern about dangerous wastes leaching from the relocated sediments stockpiled at the north ends of the trenches. Groundwater samples will be analyzed for these constituents semiannually for two years (four sampling periods). If the constituents are detected they will be added to the list of constituents of concern.

(4) Field parameters that are routinely measured at the well head (including pH, conductivity, turbidity, and temperature).

A large number of wells were sampled periodically during the 1988-1991 time period for dangerous waste constituents per WAC 173-303-9905 and site specific constituents (see Section 3.3). This effort established the constituents of concern for the interim remedial action and the final status monitoring plan. Since 300 APT discharges have ceased, only residual contaminants from past practice discharges should be present in groundwater in the vicinity of the trenches. Thus, previous groundwater characterization and monitoring data (historical data) are considered adequate for addressing the Appendix IX requirements for this final status monitoring plan.

4.5.2 Background Values

Background values (area) are defined as the levels of chemical, physical, biological, or radiological constituents or parameters upgradient of a unit, practice, or activity that have not been affected by the unit. Groundwater monitoring data obtained from upgradient wells will be used to track the encroachment of upgradient sources of contaminant plumes. Background data also will be reevaluated if changes in groundwater flow directions result in changes in definition of upgradient wells.

4.5.3 Sample Frequency

In compliance with regulations, all wells (compliance and background) will be sampled at least semiannually during the compliance period. During each semiannual sampling event, a sequence of at least four independent samples will be collected from compliance wells and results compared to the groundwater concentration limits established in Section 4.4.1. Statistical methods are discussed in Section 4.6.

The requirement of obtaining four independent samples could be accomplished by reference to the uppermost aquifer's effective porosity (n_e); horizontal hydraulic conductivity (K_h); and hydraulic gradient (i). The minimum time interval between sampling events that will provide an independent sample of groundwater is estimated as follows (EPA 1989):

1. Calculate the horizontal component of the average linear velocity of groundwater (V_h) using the Darcy equation

$$V_h = \frac{(K_h * i)}{n_e}$$

with:

K_h = 43 m/d (Swanson et al. 1992)

i = 0.0003 or 0.0004 (DOE-RL 1995b, Figures 6.1-4 and 6.1-5)

n_e = 0.2

V_h = (43 m/d * 0.0003)/0.2 - 0.0645 m/d, or

V_h = (43 m/d * 0.0004)/0.2 = 0.086 m/d

2. The horizontal component of the average linear velocity of groundwater, V_h, has been estimated to be from 0.0645 to 0.086 m/d. Monitoring well diameters at the 300 APT are 0.1016 m. Therefore, the minimum travel time, T, to obtain an independent sample for this unit is:

T = (0.1016 m)/(0.0645 m/d) = 1.6 d (based on i = 0.0003)

or

T = (0.1016 m)/(0.086 m/d) = 1.2 d (based on i = 0.0004).

Based on the above calculations, sampling every other day would provide the required independent samples. However, a "disturbed zone" due to purging may create a larger "effective" diameter than used in the above calculation. Therefore, to account for the disturbed zone and/or to reduce the autocorrelation effects (which may happen if groundwater is sampled too close in time), a monthly sampling interval is recommended. Sampling will be accomplished in months when the water level is high (March, April, May, and June) and again when the water level is low (September, October, November, and December).

4.5.4 Analytical Procedures

The laboratory approved for the groundwater monitoring program will operate under the requirements of current laboratory contracts and will use standard laboratory procedures as listed in the SW-846 (EPA 1986) or an alternate equivalent. Alternate procedures, when used, will meet the guidelines of SW-846, Chapter 1.0. Analytical methods and quality control for the RCRA groundwater monitoring activities are described in WHC (1993).

4.5.5 Geochemical Evaluation of Iron and Manganese

The hypothesis that elevated iron and manganese is due to reducing conditions in certain wells completed at the bottom of the unconfined aquifer will be tested by analyzing key redox (oxidation-reduction) indicator parameters:

- Fe II
- dissolved oxygen
- Eh.

Under reducing conditions, low dissolved oxygen (<1 ppm) and low or negative redox potentials (Eh) (see Figure 4-3), iron and manganese associated with sediments as oxide coatings on mineral grains can be converted to lower oxidation states (Fe^{+2} and Mn^{+2}). This results in dissolution at the solid-liquid interface (i.e., between pore fluid and surfaces of the oxide coatings). The resultant manganese and iron dissolved in the pore fluid is thus free to pass through a membrane filter when the sample is pumped from the well and directly through the filter holder at the well head. The occurrence of elevated iron and manganese under the above conditions is thus a natural consequence of the aquifer host material (i.e, presence of oxide coatings) and the isolation of the test zone from atmospheric oxygen.

The location of the screened interval at the bottom of the aquifer for the two "deep" wells in the 300 APT with anomalous dissolved iron and manganese and the correspondingly low hydraulic conductivities (wells -16B and -17B) support the "redox" hypothesis. The additional hydrochemical measurements needed to test the hypothesis will be made in the field using (1) a special sample pump to ensure that in-leakage of air (oxygen) does not occur during sample extraction and (2) flow-through test equipment to record dissolved oxygen, Eh, temperature, and pH continuously during an extended purge cycle (up to six bore volumes). Confirmatory measurements of divalentiron will be made in the field using HACH™ kit methods. Low dissolved oxygen (<1 ppm) low or negative Eh potentials, and the presence of Fe^{+2}, will be taken as indirect evidence for accepting the hypothesized natural occurrence of elevated manganese and iron.

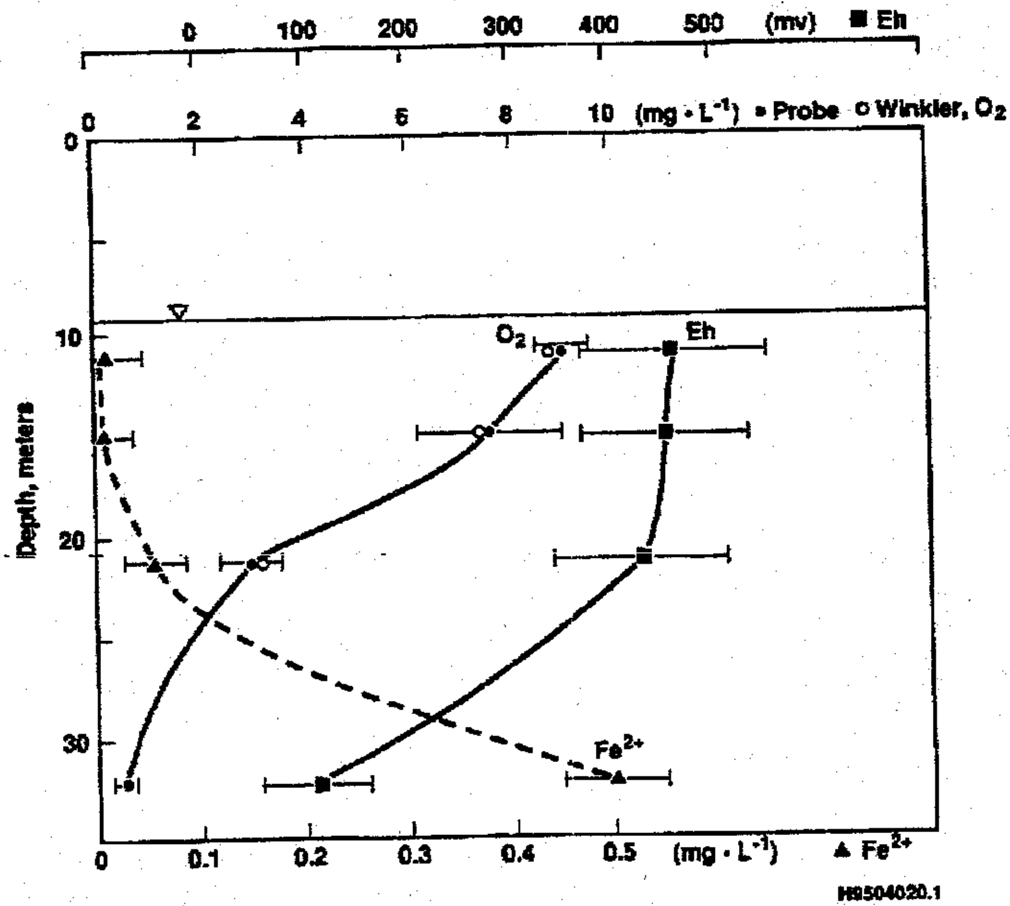
4.6 STATISTICAL METHODS

Section 4.6 proposes statistical evaluation procedures for use with the 300 APT monitoring program. Statistical evaluation of groundwater monitoring data will comply with requirements set forth in the WAC 173-303-645 (8)(h) final status regulations. Specifically, procedures outlined in the following EPA technical guidance documents will be followed:

- *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Interim Final Guidance* (EPA 1989)

- *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities - Draft Addendum to Interim Final Guidance* (EPA 1992).

Figure 4-3. Profiles of Eh, Dissolved Oxygen, and Ferrous Ion with Depth.



For a compliance-level groundwater monitoring program, the monitoring objective is to determine if a groundwater concentration limit such as an MCL has been exceeded. This is a very different problem than the detection-level monitoring where the objective is to detect leakage from the unit by employing upgradient/downgradient comparisons.

4.6.1 Tolerance Intervals

For a compliance-level groundwater monitoring program, the choice of an appropriate statistical test depends on the type of groundwater concentration limit. For health-based concentration values (e.g., an MCL or an ACL derived from health-based risk data), the tolerance interval approach is recommended (EPA 1992, page 50). A tolerance interval is constructed in such a way that it contains at least a specified proportion, P, of the population with a specified confidence coefficient, $100(1 - \alpha)\%$. The proportion of the population included, P, is referred to as the coverage. The probability, $100(1 - \alpha)\%$, with which the tolerance interval includes the proportion P% is referred to as the tolerance coefficient. If compliance data follow a normal or a log-normal distribution, an upper 95% one-sided tolerance limit with a 95% confidence is recommended to be calculated for each constituent of concern in each compliance well (EPA 1989, 1992). If the upper tolerance limit from any compliance well exceeds a MCL, it is interpreted as significant evidence that more than 5% of all compliance values exceed the fixed limit (e.g., MCL). Parametric tolerance limits (suitable for normally or log-normally distributed data) are of the form:

$$\bar{x} + ks \quad (one\text{-}sided)$$

where $\bar{x}$ is the sample mean; s is the sample standard deviation; and k is a multiplier based on the coverage, the confidence level, and sample size. Values of k can be obtained from EPA (1989). To reduce uncertainty in the estimates of the mean and standard deviation, at least 8 to 10 samples (from each compliance well) are needed.

When the normal or log-normal distribution cannot be justified, especially when a large portion of the samples are non-detects, the use of nonparametric tolerance intervals should be considered. The upper tolerance limit is usually the maximum observed observation from each compliance well for each semiannual sampling event.

Because the parametric tolerance interval approach depends heavily on the normal or log-normal assumption, the adequacy of this assumption should be assessed by probability plots and/or statistical goodness-of-fit tests, such as the Shapiro-Wilk test or Lilliefors test of normality (Gilbert 1987, Conover 1980). Unfortunately, all of the available tests for normality of data do not exhibit high degrees of power when the sample size is small (i.e., <20 to 30 observations). In a compliance monitoring program, it is impractical to obtain 30 independent samples during each semiannual sampling event. Therefore, a nonparametric tolerance interval approach should be considered for the 300 APT. One advantage is that, unless all the sample data are non-detect, the maximum value will be a detected concentration, leading to a well-defined upper tolerance. However, the nonparametric tolerance intervals require a large number of samples to provide a reasonable coverage and tolerance coefficient.

In order to have a minimum coverage of 95% with 95% confidence, 59 samples are needed. This means one would be 95% sure that at least 95% of the population measurements will fall below the maximum value based on 59 observations. When the maximum value (from four samples) is chosen as the upper tolerance limit, the average coverage (not the minimum coverage as discussed above) is 80%. That is, one would expect that on average that 80% of the population from that compliance well will be below the maximum value. More samples are needed to achieve a higher coverage. It can be shown that at least 19 samples (per compliance well per semiannual period) are necessary to achieve 95% coverage on average. For the purpose of this monitoring plan, it is assumed that a 80% average coverage is acceptable because (1) a very large amount of hydrogeologic and contaminant data have been collected from the 300 APT wells since 1987 and (2) the rate, extent, and concentrations of groundwater contaminants originating from the 300 APT are well understood.

4.6.2 Confirmation Sampling

For tolerance limits to be useful resampling has to be allowed before a decision is reached. This is because tolerance limits have a built-in failure rate of (1 - P)%. For example, one would expect 1 in every 20 samples to be outside of the upper 95% tolerance limit just by chance. To decrease the chance of a false positive decision because of either the built-in failure rate or the effects of gross errors in sampling or analysis, verification resampling is necessary. This is the best available approach to balance false positive and false negative decisions (Gibbons 1994). In case of an initial exceedance, a verification sampling is needed to determine if the exceedance is an artifact caused by an error in sampling, analysis, or statistical evaluation or natural variation in the groundwater. Recent EPA guidance (1992) encourages the use of resamples as a means to reduce the facility-wide false positive rate.

Confirmation retesting can be accomplished by taking a specific number of additional, independent samples from the well where a specific constituent triggers the initial exceedance. Because more independent data are added to the overall testing procedure, retesting of additional samples, in general, will make the statistical test more powerful and result in a more reliable determination of possible exceedance. Therefore, the objectives for the verification sampling are to ensure (1) quick identification and confirmation of contamination exceeding some standard, if any, and (2) the statistical independence of successive resamples from any well where initial exceedance occurred. The performance of the statistical retesting strategy depends substantially on the independence of the data from each well.

After considerations cited above, it is proposed to obtain two independent samples, split each sample, and send the splits to two different laboratories for independent verification. In this way, laboratory bias (if present) can be investigated. A statistically significant result will be declared only if all resamples are larger than the MCL. If all resamples are below the MCL, the compliance monitoring program will continue. If results are inconclusive, another round of verification resamples will be initiated.

Finally, if the magnitude of the initial exceedance is small (e.g., <25%), special analysis may be requested in order to achieve lower detection limits and/or improved accuracy and precision.

4.6.3 Non-detects

Non-detects will be handled per recommendations stated in the EPA guidance documents (1989 and 1992). Non-detects will not present a problem in using a nonparametric method to evaluate compliance data if the detection limit is lower than the MCL. If a parametric statistical method is used, then the handling of non-detects will depend on the percentage of detected values. Basically, a substitution method (use 1/2 of the detection limit to replace non-detects) will be used if less than 15% of all samples are non-detects. If the percent of non-detects is between 15% to 50%, either Cohen's method or Aitchison's adjustments will be used. Detailed descriptions of these methods can be found in EPA (1989 and 1992). When more than 50% of the sample values are non-detects, the Poisson model may be used to derive a Poisson tolerance limit. Steps to calculate an upper tolerance limit using the Poisson model are given in EPA (1992).

4.6.4 Outliers

An outlier is an observation that does not conform to the pattern established by other observations in the data set. Possible reasons for its occurrence include contaminated sampling equipment, inconsistent sampling or analytical procedure, data transcribing error, and true but extreme measurements. Statistical methods such as Grubbs' methods (Grubbs 1969) for testing of outliers and/or the box-and-whisker plot (Ostle and Malone 1988) may be used. Once an observation is found to be an outlier, the following action should be taken:

- If the error can be identified and the correct value can be recovered through the Request for Analytical Data Review (RADE) process (see Section 5.1), replace the outlier value with the corrected value.
- If the error can be documented but the correct value cannot be recovered, the outlier should be deleted. Describe this deletion in the statistical report.
- If no error can be documented, then assume that the value is a valid measurement. However, obtain another sample to confirm the high value, if necessary.

4.7 DETERMINING RATE AND DIRECTION OF GROUNDWATER FLOW

Depth to water will be measured in 32 300 Area wells semiannually in order to construct water table maps. These maps will be used to interpret the direction of groundwater flow and to derive the water table gradient. The gradient, in turn, will be used with estimated values of hydraulic conductivity and effective porosity to calculate flow rate by using the Darcy equation (see Section 3.2). Because the 300 Area water table is significantly affected by Columbia River level, the semiannual measurements will be coordinated with seasonal fluctuations of Columbia River stage in order to construct water table maps corresponding to high and low stages. Historically, high river stage is somewhere in the months of May or June, and low river stage occurs in September. Therefore, the semiannual measurements will be in September and in either May or June. Exact times of measurement will be adjusted to ensure that high and low stages are represented. The wells measured semiannually for water level are listed in Table 4-6 and shown in Figure 3-1. Water levels will be measured and recorded as specified in EII 10.2 (WHC 1988).

In addition to the 32 wells measured semiannually for constructing water table maps, 8 other wells will be measured semiannually to determine hydraulic head of the lower portion of the unconfined aquifer (4 wells) and upper confined aquifer (4 wells). The wells measured in the lower portion of the unconfined aquifer are 399-1-10B, 399-1-16B, 399-1-17B, and 399-1-18B. Wells measured in the uppermost confined aquifer are 399-1-9, 399-1-16C, 399-1-17C, and 399-1-18C. Figure 3-1 shows the well locations.

Table 4-6. Wells Used for Semiannual Depth-to-Water Measurements.

Wells Monitoring the Top of the Unconfined Aquifer

399-1-1	399-1-18A	399-2-2	399-4-10
-1-10A	-1-19	-2-3	-4-11
-1-11	-1-3	-3-1	-5-1
-1-12	-1-4	-3-6	-6-1
-1-14A	-1-5	-3-9	-8-1
-1-15	-1-7	-3-10	-8-2
-1-16A	-1-8	-4-1	-8-3
-1-17A	-2-1	-4-7	699-S27-E14

Wells Monitoring the Bottom of the Unconfined Aquifer

399-1-10B	399-1-16B	399-1-17B	399-1-18B

Wells Monitoring the Uppermost Confined Aquifer

399-1-9	399-1-16C	399-1-17C	399-1-18C

5.0 DATA MANAGEMENT AND REPORTING

5.1 DATA VERIFICATION AND VALIDATION

All contract analytical laboratory results are entered into the HEIS database. Data from this larger database are downloaded to smaller data sets for data validation, data reduction, and trend analysis. Data verification and validation activities should follow WHC-CM-7-8, Section 2.6, "Validation and Verification of RCRA Groundwater Data" (WHC 1992). Suspected data are submitted for formal review and resolution through the RADE process per Section 4.2, "Evaluation of Requests for Analytical Data Review" (WHC 1992). Results of data verification and validation shall be reported in the RCRA quarterly and annual reports.

5.2 REPORTING

The results of statistical evaluation will be reported to Ecology in the RCRA quarterly and annual monitoring reports. The statistical results will include a list of groundwater parameters analyzed, detection limits, and analytical results. If a statistically significant exceedance (after the confirmation resampling evaluation process) is determined at any well at the POC, the following steps will be taken per WAC 173-303-645(10)(g)(i)(ii).

- Notify Ecology in writing within 7 days of the finding with a report indicating which concentration limits have been exceeded.

- Submit an application for a permit modification to establish a corrective action program to Ecology in 90 days.

In case of a false positive claim, the following procedures will be taken per WAC 173-303-645(10)(i)].

- Notify Ecology in writing within 7 days of the finding (i.e., exceedance) that a false positive claim will be made.

- Submit a report to Ecology within 45 days. This report should demonstrate that a source other than the 300 APT caused the standard(s) to be exceeded or that the apparent noncompliance with standard(s) resulted from error in sampling, analysis, or evaluation.

- Submit an application for a permit modification to make appropriate changes to the compliance monitoring program within 45 days.

- Continue monitoring in accordance with the compliance monitoring program.

This page intentionally left blank.

6.0 CORRECTIVE ACTION PROGRAM

If, at the POC, dangerous waste constituents of concern are measured in the groundwater at concentrations that exceed the applicable groundwater concentration limit, a corrective action level monitoring program will be established. The development of a corrective action level monitoring program will be initiated by integration of RCRA/CERCLA programs. Groundwater monitoring will continue as described in Chapters 4.0 and 5.0. Implementation of the corrective action will be deferred and integrated with the remediation of the 300-FF-1 (source) and 300-FF-5 (groundwater) operable units.
A description of the groundwater monitoring plan that will be used to assess the effectiveness of the corrective/remedial action measures will be submitted when the need for corrective action is first identified.

This page intentionally left blank.

7.0 REFERENCES

Cline, C. S., J. T. Rieger, J. R. Raymond, and P. A. Eddy, 1985, *Ground-Water Monitoring at the Hanford Site, January-December 1984*, PNL-5408, Pacific Northwest Laboratory, Richland, Washington.

Conover, W. J., Practical Nonparametric Statistics, Second Edition, John Wiley and Sons, New York, New York, pp. 357-367.

Delaney, C. D., K. A. Lindsey, and S. P. Reidel, 1991, *Geology and Hydrology of the Hanford Site: A Standardized Text For Use in Westinghouse Hanford Company Documents and Reports*, WHC-SD-ER-TI-003, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

DOE, 1988, *Consultation Draft, Site Characterization Plan, Reference Repository Location, Hanford Site, Richland, Washington*, DOE/RW-0164, Volumes 1 through 9, U.S. Department of Energy, Office of Civilian Radioactive Waste Management, Washington, D.C.

DOE-RL, 1990, *Remedial Investigation/Feasibility Study Work Plan for the 300-FF-1 Operable Unit, Hanford Site, Richland, Washington*, DOE/RL-88-31, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1991, *Expedited Response Action Proposal for the 316-5 Process Trenches*, DOE/RL-91-11, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1992, *Expedited Response Action Assessment for the 316-5 Process Trenches*, DOE/RL-92-32, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1995a, *300 Area Process Trenches Closure/Postclosure Plan* (Draft), DOE/RL-93-73, Rev. 0-B, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1995b, *Annual Report for RCRA Groundwater Monitoring Projects at Hanford Site Facilities for 1994*, DOE/RL-94-136, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1995c, *Remedial Investigation/Feasibility Study Report for the 300-FF-5 Operable Unit*, DOE/RL-94-85, Draft A, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, 1986 (Amended), *Dangerous Waste Regulations*, Washington State Department of Ecology, Washington Administrative Code, Chapter 173-303, Olympia, Washington.

Ecology and EPA, 1986, *Consent Agreement and Compliance Order*, Ecology No. DE 86-113, Washington State Department of Ecology and the U.S. Environmental Protection Agency, Olympia, Washington.

Ecology, 1994, *Dangerous Waste Portion of the Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous Waste*, Permit No. WA7890008967, Effective September 28, 1994, Washington State Department of Ecology, Olympia, Washington.

EPA, 1984, *Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities*, U.S. Environmental Protection Agency, 40 CFR Part 265, U.S. Government Printing Office, Washington, D.C.

EPA, 1986, *Test Methods for Evaluating Solid Waste*, SW-846, Third Edition, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1987, *Alternate Concentration Limit Guidance: Part I, ACL Policy and Information Requirements*, EPA/530/SW-87-017, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1989, *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities - Interim Final Guidance*, PB89-151047, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1991, *Proposed Rules for National Primary Drinking Water Regulations: Radionuclides*, Federal Register 56:138, July 18, 1991, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1992, *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities - Draft Addendum to Interim Final Guidance*, EPA/530-R-93-003, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1993, *Data Quality Objectives Process for Superfund - Interim Final Guidance*, EPA/540-R-93-071, U.S. Environmental Protection Agency, Washington, D.C.

Gaylord, D. R., and E. P. Poeter, 1991, *Geology and Hydrology of the 300 Area and Vicinity, Hanford Site, South-Central Washington*, WHC-EP-0500, Westinghouse Hanford Company, Richland, Washington.

Gibbons, R. D., Statistical Methods for Groundwater Monitoring, John Wiley and Sons, New York, New York, pp. 15, 84-93.

Gilbert, R. O., 1987, Statistical Methods for Environmental Pollution Monitoring, Van Nostrand Reinhold Company, New York, New York, pp. 157-162.

Grubbs, F. E., 1969, "Procedures for Detecting Outlying Observations in Samples," *Technometrics*, 11:1-21.

Helz, R. T., 1978, *The Petrogenesis of the Ice Harbor Member, Columbia Plateau, Washington*, Ph.D. Dissertation, Pennsylvania State University, University Park, Pennsylvania.

Jackson, R. L., C. M. Einbereger, R. B. Mercer, and C. R. Wilson, 1991, *Efficiency-Based Groundwater Monitoring Network Design for Hazardous Waste Sites*, WHC-SA-1157-FP, Westinghouse Hanford Company, Richland, Washington.

Johnson, V. G. and C. J. Chou, *Some Statistical Aspects of Background Based Groundwater Standards at an Arid Hazardous Waste Site*, WHC-SA-2358-FP, Westinghouse Hanford Company, Richland, Washington.

Lindberg, J. W., and F. W. Bond, 1979, *Geohydrology and Ground-Water Quality Beneath the 300 Area, Hanford Site, Washington*, PNL-2949, Pacific Northwest Laboratory, Richland, Washington.

Lindsey, K. A., 1991, *Revised Stratigraphy for the Ringold Formation, Hanford Site, South-Central Washington*, WHC-SD-EN-EE-004, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Ostle, B. and L. C. Malone, 1988, Statistics in Research: Basic Concepts and Techniques for Research Workers, Fourth Edition, Iowa State University Press, Ames, Iowa, pp. 66-67.

PNL, 1988, *Groundwater Monitoring Compliance Projects for Hanford Site Facilities: Progress Report for the Period April to June 30, 1988*, PNL-6675, Vol. 1, Pacific Northwest Laboratory, Richland, Washington.

Schalla, R., R. L. Aaberg, D. J. Bates, J. V. M. Carlile, M. D. Freshley, T. L. Liikala, P. J. Mitchell, K. B. Olsen, and J. T. Rieger, 1988a, *Revised Ground-Water Monitoring Compliance Plan for the 300 Area Process Trenches*, PNL-6671, Pacific Northwest Laboratory, Richland, Washington.

Schalla, R., R. W. Wallace, R. L. Aaberg, S. P. Airhart, D. J. Bates, J. V. M. Carlile, C. S. Cline, D. I. Dennison, M. D. Freshley, P. R. Heller, E. J. Jensen, K. B. Olsen, R. G. Parkhurst, J. T. Rieger, and E. J. Westergard, 1988b, *Interim Characterization Report for the 300 Area Process Trenches*, PNL-6716, Pacific Northwest Laboratory, Richland, Washington.

Swanson, D. A., T. L. Wright, P. R. Hooper, and R. D. Bentley, 1979, *Revised in Stratigraphic Nomenclature of the Columbia River Basalt Group*, Bulletin 1457-G, U.S. Geological Survey, Washington, D.C.

Swanson, L. C., G. G. Kelty, K. A. Lindsey, K. R. Simpson, R. K. Price, and S. D. Consort, 1992, *Phase I Hydrogeologic Summary of the 300-FF-5 Operable Unit, 300 Area*, WHC-SD-EN-TI-052, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC, 1988, *Environmental Investigations and Site Characterization Manual*, WHC-CM-7-7, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990, *Liquid Effluent Study: Groundwater Characterization Data*, WHC-EP-0366, Westinghouse Hanford Company, Richland, Washington.

WHC, 1992, *Environmental Engineering and Geotechnology Function Procedures*, WHC-CM-7-8, Vol. 4, Westinghouse Hanford Company, Richland, Washington.

WHC, 1993, *Quality Assurance Project Plan for RCRA Groundwater Monitoring Activities*, WHC-SD-EN-QAPP-001, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A

SUMMARY OF CONSTITUENTS SAMPLED TO 1988
(Taken from Schalla et al. 1988a, Table 6)

This page intentionally left blank.

-----Constituent List-Contamination Indicators-----

CONCODE	CONNAME	ANALUNIT	DETLIMIT	SAMPLES	BELOWDL	ALLBELOW	MAXLIMIT	REGAGEN	FULLNAME
191	CONDUCT	UMHO	.	173	0		.		Conductivity
190	PH		.	172	0		.		pH
C68	TOX	PPB	100	187	160		.		Total organic halogen
C69	TOC	PPB	1000	187	106		.		Total organic carbon

-----Constituent List-Drinking Water Standards-----

CONCODE	CONNAME	ANALUNIT	DETLIMIT	SAMPLES	BELOWDL	ALLBELOW	MAXLIMIT	REGAGEN	FULLNAME
109	COLIFRM	MPN	3	211	195		1	EPA	Coliform bacteria
111	BETA	PCI/L	8	210	4		50	EPA	Gross beta
181	RADIUM	PCI/L	1	210	196		5	EPA	Radium
212	LBALPHA	PCI/L	4	210	3		15	EPA	Gross alpha
A06	BARIUM	PPB	6	216	17		1000	EPA	Barium
A07	CADMIUM	PPB	2	216	201		10	EPA	Cadmium
A08	CHROMUM	PPB	10	216	200		50	EPA	Chromium
A10	SILVER	PPB	10	216	216		50	EPA	Silver
A20	ARSENIC	PPB	5	216	190		50	EPA	Arsenic
A21	MERCURY	PPB	.1	216	197		2	EPA	Mercury
A22	SELENUM	PPB	5	216	212		10	EPA	Selenium
A33	ENDRIN	PPB	1	216	216	***	.2	EPA	Endrin
A34	METHLOR	PPB	1	216	216	***	100	EPA	Methoxychlor
A35	TOXAENE	PPB	1	216	216	***	5	EPA	Toxaphene
A36	a-BHC	PPB	1	216	216	***	4	EPA	Alpha-BHC
A37	b-BHC	PPB	1	216	216	***	4	EPA	Beta-BHC
A38	g-BHC	PPB	1	216	216	***	4	EPA	Gamma-BHC
A39	d-BHC	PPB	1	216	216	***	4	EPA	Delta-BHC
A61	LEADGF	PPB	5	216	192		50	EPA	Lead (graphite furnace)
C72	NITRATE	PPB	500	211	0		45000	EPA	Nitrate
C74	FLUORID	PPB	500	211	133		1400	EPA	Fluoride
H13	2,4-D	PPB	1	214	214	***	100	EPA	2,4-D
H14	2,4,5TP	PPB	1	214	214	***	10	EPA	2,4,5-TP silvex

-----Constituent List-Quality Characteristics-----

CONCODE	CONNAME	ANALUNIT	DETLIMIT	SAMPLES	BELOWDL	ALLBELOW	MAXLIMIT	REGAGEN	FULLNAME
A11	SODIUM	PPB	100	216	0		.		Sodium
A17	MANGESE	PPB	5	216	182		.		Manganese
A19	IRON	PPB	50	216	66		.		Iron
C57	PHENOL	PPB	10	216	216	***	.		Phenol
C73	SULFATE	PPB	500	211	1		.		Sulfate
C75	CHLORID	PPB	500	211	0		.		Chloride

Constituent List=Site Specific

CONCODE	CONNAME	ANALUNIT	DETLIMIT	SAMPLES	BELOWDL	ALLBELOW	MAXLIMIT	REGAGEN	FULLNAME
A12	NICKEL	PPB	10	210	202				Nickel
A13	COPPER	PPB	10	210	130		1300	EPAP	Copper
A15	ANTIMNY	PPB	100	210	210	***	.		Antimony
A18	ALUMNUM	PPB	150	210	189		.		Aluminum
A24	THIOURA	PPB	200	211	209		.		Thiourea
A61	TETRANE	PPB	10	210	210	***	5	EPAP	Tetrachloromethane
A62	BENZENE	PPB	10	210	210	***	5	EPAP	Benzene
A63	DIOXANE	PPB	500	210	210	***	.		Dioxane
A64	METHONE	PPB	10	210	215		.		Methyl ethyl ketone
A65	PYRIDIN	PPB	500	210	210	***	.		Pyridine
A66	TOLUENE	PPB	10	210	210	***	2000	EPAP	Toluene
A67	1,1,1-T	PPB	10	210	214		200	EPAP	1,1,1-trichloroethane
A68	1,1,2-T	PPB	10	210	214		.		1,1,2-trichloroethane
A69	TRICENE	PPB	10	210	212		5	EPAP	Trichloroethylene
A70	PERCENE	PPB	10	210	195		.		Perchloroethylene
A71	OPXYLE	PPB	10	210	210	***	440	EPAP	Xylene-o,p
B14	M-XYLE	PPB	10	210	210	***	440	EPAP	Xylene-m
B61	12-dben	PPB	10	210	210	***	.		1,2-dichlorobenzene
B62	13-dben	PPB	10	210	210	***	.		1,3-dichlorobenzene
B63	14-dben	PPB	10	210	210	***	.		1,4-dichlorobenzene
C26	PENTCHB	PPB	10	210	210	***	.		Pentachlorobenzene
C37	TETRCHB	PPB	10	210	210	***	.		1,2,4,5-tetrachlorobenzene
C43	TRICHLB	PPB	10	210	210	***	.		1,2,4-trichlorobenzene
C54	HEXACHL	PPB	10	210	210	***	.		Hexachlorophene
C56	NAPHTHA	PPB	10	210	210	***	.		Naphthalene
C66	123TRI	PPB	10	210	210	***	.		1,2,3-trichlorobenzene
C68	135TRI	PPB	10	210	210	***	.		1,3,5-trichlorobenzene
C69	1234TE	PPB	10	210	210	***	.		1,2,3,4-tetrachlorobenzene
C80	1235TE	PPB	10	210	210	***	.		1,2,3,5-tetrachlorobenzene
C70	CYANIDE	PPB	10	211	208		.		Cyanide
C71	FORMALN	PPB	500	210	210	***	.		Formalin
C76	SULFIDE	PPB	1000	211	206		.		Sulfide
C79	KEROSEN	PPB	10000	210	210	***	.		Kerosene
C80	AMMONIU	PPB	20	211	49		.		Ammonium ion
C81	ETHYGLY	PPB	10000	211	211	***	.		Ethylene glycol
C88	DIOXIN	PPB	.1	210	210	***	.		Dioxin

Constituent List=Tag-alongs

CONCODE	CONNAME	ANALUNIT	DETLIMIT	SAMPLES	BELOWDL	ALLBELOW	MAXLIMIT	REGAGEN	FULLNAME
A14	VANADUM	PPB	5	210	110		.		Vanadium
A19	POTASUM	PPB	100	210	5		.		Potassium
A80	CHLFORM	PPB	10	116	24		.		Chloroform
A93	METHYCH	PPB	10	65	14		.		Methylene chloride
B89	HEXCBEN	PPB	10	210	210	***	.		Hexachlorobenzene
C62	HEXAENE	PPB	10	164	164	***	.		Hexachloropropene
C82	CHLLATE	PPB	100	108	108	***	.		Chlorobenzilate
C76	PHOSPHA	PPB	1000	211	210		.		Phosphate
C91	STRYCHN	PPB	50	108	108	***	.		Strychnine
C92	MALHYDR	PPB	500	108	108	***	.		Maleic hydrazide
C93	NICOTIN	PPB	100	108	108	***	.		Nicotinic acid

---Constituent List=WAC 173-303-9905---

CONCODE	CONNAME	ANALUNIT	DETLIMIT	SAMPLES	BELOWDL	ALLBELOW	MANLIMIT	REGAGEN	FULLNAME
A01	BERYLAM	PPB	5	16	16	***			Beryllium
A02	OSMIUM	PPB	300	16	16	***	.		Osmium
A03	STRONUM	PPB	300	16	16	***	.		Strontium
A04	ZINC	PPB	5	16	5		.		Zinc
A05	CALCIUM	PPB	50	16	8		.		Calcium
A23	THALIUM	PPB	10	16	15		.		Thallium
A25	ACETREA	PPB	200	16	16	***	.		1-acetyl-2-thiourea
A26	CHLOREA	PPB	200	16	16	***	.		1-(o-chlorophenyl) thiourea
A27	DIETROL	PPB	200	16	16	***	.		Diethylstilbesterol
A28	ETHYREA	PPB	200	16	16	***	.		Ethylenethiourea
A29	NAPHREA	PPB	200	16	16	***	.		1-naphthyl-2-thiourea
A32	PHENREA	PPB	200	16	16	***	.		N-phenylthiourea
A40	DDD	PPB	1	16	16	***	.		DDD
A41	DDE	PPB	1	16	16	***			DDE
A42	DDT	PPB	1	16	16	***			DDT
A43	HEPTLOR	PPB	1	16	16	***	0	EPAP	Heptachlor
A44	HEPTIDE	PPB	1	16	16	***	0	EPAP	Heptchlor epoxide
A46	DIELRIN	PPB	1	16	16	***	.		Dieldrin
A47	ALDRIN	PPB	1	16	16	***	.		Aldrin
A48	CHLDANE	PPB	1	16	16	***	0	EPAP	Chlordane
A49	ENDO1	PPB	1	16	16	***	.		Endosulfan I
A62	ENDO2	PPB	1	2	2	***	.		Endosulfan II
A72	ACROLIN	PPB	10	16	16	***	.		Acrolein
A73	ACRYILE	PPB	10	16	16	***	.		Acrylonitrile
A74	BISTHER	PPB	10	16	16	***	.		Bis(chloromethyl) ether
A75	BROMONE	PPB	10	16	16	***	.		Bromoacetone
A76	METHBRO	PPB	10	16	16	***	.		Methyl bromide
A77	CARBIDE	PPB	10	16	16	***	.		Carbon disulfide
A78	CHLBENZ	PPB	10	16	16	***	.		Chlorobenzene
A79	CHLTHER	PPB	10	16	16	***	.		2-chloroethyl vinyl ether
A81	METHCHL	PPB	10	16	16	***	.		Methyl chloride
A82	CHMTHER	PPB	10	16	16	***	.		Chloromethyl methyl ether
A83	CROTONA	PPB	10	16	16	***	.		Crotonaldehyde
A84	DIBRCHL	PPB	10	16	16	***	.		1,2-dibromo-3-chloropropane
A85	DIBRETH	PPB	10	16	16	***	.		1,2-dibromoethane
A86	DIBRMET	PPB	10	16	16	***	.		Dibromomethane
A87	DIBUTEN	PPB	10	16	16	***	.		1,4-dichloro-2-butene
A88	DICDIFM	PPB	10	16	16	***	.		Dichlorodifluoromethane
A89	1,1-DIC	PPB	10	16	16	***	.		1,1-dichloroethane
A90	1,2-DIC	PPB	10	16	16	***	5	EPAP	1,2-dichloroethane
A91	TRANDCE	PPB	10	16	16	***	70	EPAP	Trans-1,2-dichloroethene
A92	DICETHY	PPB	10	16	16	***	7	EPAP	1,1-dichloroethylene
A94	DICPANE	PPB	10	16	16	***	6	EPAP	1,2-dichloropropane
A95	DICPENE	PPB	10	16	16	***	.		1,3-dichloropropene
A96	NNDIEHY	PPB	10	16	16	***	.		N,N-diethylhydrazine
A97	1,1-DIM	PPB	3000	16	16	***	.		1,1-dimethylhydrazine
A98	1,2-DIM	PPB	3000	16	16	***	.		1,2-dimethylhydrazine
A99	HYDRSUL	PPB	10	16	16	***	.		Hydrogen sulfide
B01	IODOMET	PPB	10	16	16	***	.		Iodomethane
B02	METHACR	PPB	10	16	16	***	.		Methacrylonitrile

---Constituent List=WAC 173-303-9905---

CONCODE	CONNAME	ANALUNIT	DETLIMIT	SAMPLES	BELOWDL	ALLBELOW	MAXLIMIT	REGAGEN	FULLNAME
B03	METHTHI	PPB	10	16	16	***	.		Methanethiol
B04	PENTACH	PPB	10	16	16	***	.		Pentachloroethane
B05	1112-tc	PPB	10	16	16	***	.		1,1,1,2-tetrachlorethane
B06	1122-tc	PPB	10	16	16	***	.		1,1,2,2-tetrachlorethane
B08	BROMORM	PPB	10	16	16	***	.		Bromoform
B09	TRCMEOL	PPB	10	16	16	***	.		Trichloromethanethiol
B10	TRCMFLM	PPB	10	16	16	***	.		Trichloromonofluoromethane
B11	TRCPANE	PPB	10	16	16	***	.		Trichloropropane
B12	123-trp	PPB	10	16	16	***	.		1,2,3-trichloropropane
B13	VINYIDE	PPB	10	16	16	***	1	EPAP	Vinyl chloride
B16	DIETHY	PPB	10	16	16	***	.		Diethylarsine
B19	ACETILE	PPB	10	16	16	***	.		Acetonitrile
B20	ACETONE	PPB	10	16	16	***	.		Acetophenone
B21	WARFRIN	PPB	10	16	16	***	.		Warfarin
B22	ACEFENE	PPB	10	16	16	***	.		2-acetylaminofluorene
B23	AMINOYL	PPB	10	16	16	***	.		4-aminobyphenyl
B24	AMIISOX	PPB	10	16	16	***	.		5-(aminomethyl)-3-isoxazolol
B25	AMITROL	PPB	10	16	16	***	.		Amitrole
B26	ANILINE	PPB	10	16	16	***	.		Aniline
B27	ARAMITE	PPB	10	16	16	***	.		Aramite
B28	AURAMIN	PPB	10	16	16	***	.		Auramine
B29	BENZCAC	PPB	10	16	16	***	.		Benz[c]acridine
B30	BENZAAN	PPB	10	16	16	***	.		Benz[a]anthracene
B31	BENDICM	PPB	10	16	16	***	.		Benzene, dichloromethyl
B32	BENTHOL	PPB	10	16	16	***	.		Benzenethiol
B33	BENDINE	PPB	10	16	16	***	.		Benzidine
B34	BENZBFL	PPB	10	16	16	***	.		Benzo[b]fluoranthene
B35	BENZJFL	PPB	10	16	16	***	.		Benzo[j]fluoranthene
B36	PBENZQU	PPB	10	16	16	***	.		P benzoquinone
B37	BENZCHL	PPB	10	16	16	***	.		Benzyl chloride
B38	BIS2CHM	PPB	10	16	16	***	.		Bis(2-chloroethoxy) methane
B39	BIS2CHE	PPB	10	16	16	***	.		Bis(2-chloroethyl) ether
B40	BIS2EPH	PPB	10	26	16		.		Bis(2-ethylhexyl) phthalate
B41	BROPHEN	PPB	10	16	16	***	.		4-bromophenyl phenyl ether
B42	BUTBENP	PPB	10	16	16	***	.		Butyl benzyl phthalate
B43	BUTDINP	PPB	10	16	16	***	.		2-sec-butyl-4,6-dinitrophenol
B44	CHALETH	PPB	10	16	16	***	.		Chloroalkyl ethers
B45	CHLANIL	PPB	10	16	16	***	.		P-chloroaniline
B46	CHLCRES	PPB	10	16	16	***	.		P-chloro-m-cresol
B47	CHLEPOX	PPB	10	16	16	***	.		1-chloro-2,3-epoxypropane
B48	CHLNAPH	PPB	10	16	16	***	.		2-chloronaphthalene
B49	CHLPHEN	PPB	10	16	16	***	.		2-chlorophenol
B50	CHRYSEN	PPB	10	16	16	***	.		Chrysene
B51	CRESOLS	PPB	10	16	16	***	.		Cresols
B52	CYCHDIN	PPB	10	16	16	***	.		2-cyclohexyl-4,6-dinitrophenol
B53	DIBAHAC	PPB	10	16	16	***	.		Dibenz[a,h]acridine
B54	DIBAJAC	PPB	10	16	16	***	.		Dibenz[a,j]acridine
B55	DIBAHAN	PPB	10	16	16	***	.		Dibenz[a,h]anthracene
B56	DIBCGCA	PPB	10	16	16	***	.		7H-dibenzo[c,g]carbazole
B57	DIBAEPY	PPB	10	16	16	***	.		Dibenzo[a,e]pyrene

--Constituent List=WAC 173-303-9906--

CONCODE	CONNAME	ANALUNIT	DETLIMIT	SAMPLES	BELOWDL	ALLBELOW	MAXLINIT	REGADEN	FULLNAME
B58	DIBAHPY	PPB	10	16	16	***		.	Dibenzo[a,h]pyrene
B59	DIBAIPY	PPB	10	16	16	***		.	Dibenzo[a,i]pyrene
B60	DIBPHTH	PPB	10	16	16	***		.	Di-n-butyl phthalate
B64	DICHBEN	PPB	10	16	16	***		.	3,3'-dichlorobenzidine
B65	24-dchp	PPB	10	16	16	***		.	2,4-dichlorophenol
B66	26-dchp	PPB	10	16	16	***		.	2,6-dichlorophenol
B67	DIEPHTH	PPB	10	16	16	***		.	Diethyl phthalate
B68	DIHYSAF	PPB	10	16	16	***		.	Dihydrosafrole
B69	DIMETHB	PPB	10	16	16	***		.	3,3'-dimethoxybenzidine
B70	DIMEAMB	PPB	10	16	16	***		.	P-dimethylaminoazobenzene
B71	DIMBENZ	PPB	10	16	16	***		.	7,12-dimethylbenz[a]anthracene
B72	DIMEYLB	PPB	10	16	16	***		.	3,3'-dimethylbenzidine
B73	THIONOX	PPB	10	16	16	***		.	Thiofanox
B74	DIMPHAM	PPB	10	16	16	***		.	Alpha,alpha-dimethylphenethylamine
B75	DIMPHEN	PPB	10	16	16	***		.	2,4-dimethylphenol
B76	DIMPHTH	PPB	10	16	16	***		.	Dimethyl phthalate
B77	DINBENZ	PPB	10	16	16	***		.	Dinitrobenzene
B78	DINCRES	PPB	10	16	16	***		.	4,6-dinitro-o-cresol and salts
B79	DINPHEN	PPB	10	16	16	***		.	2,4-dinitrophenol
B80	24-dint	PPB	10	16	16	***		.	2,4-dinitrotoluene
B81	26-dint	PPB	10	16	16	***		.	2,6-dinitrotoluene
B82	DIOPHTH	PPB	10	16	16	***		.	Di-n-octyl phthalate
B83	DIPHAMI	PPB	10	16	16	***		.	Diphenylamine
B84	DIPHHYD	PPB	10	16	16	***		.	1,2-diphenylhydrazine
B85	DIPRNIT	PPB	10	16	16	***		.	Di-n-propylnitrosamine
B86	ETHMINE	PPB	10	16	16	***		.	Ethyleneimine
B87	ETHMETH	PPB	10	16	16	***		.	Ethyl methanesulfonate
B88	FLUORAN	PPB	10	16	16	***		.	Fluoranthene
B90	HEXCBUT	PPB	10	16	16	***		.	Hexachlorobutadiene
B91	HEXCCYC	PPB	10	16	16	***		.	Hexachlorocyclopentadiene
B92	HEXCETH	PPB	10	16	16	***		.	Hexachloroethane
B93	INDENOP	PPB	10	16	16	***		.	Indeno(1,2,3-cd)pyrene
B94	ISOSOLE	PPB	10	16	16	***		.	Isosafrole
B95	MALOILE	PPB	10	16	16	***		.	Malononitrile
B96	MELPHAL	PPB	10	16	16	***		.	Melphalan
B97	METHAPY	PPB	10	16	16	***		.	Methapyrilene
B98	METHNYL	PPB	10	16	16	***		.	Methomyl
B99	METAZIR	PPB	10	16	16	***		.	2-methylaziridine
C01	METCHAN	PPB	10	16	16	***		.	3-methylcholanthrene
C02	METBISC	PPB	10	16	16	***		.	4,4'-methylenebis(2-chloroaniline)
C03	METACTN	PPB	10	16	16	***		.	2-methyllactonitrile
C04	METACRY	PPB	10	16	16	***		.	Methyl methacrylate
C05	METMSUL	PPB	10	16	16	***		.	Methyl methanesulfonate
C06	METPROP	PPB	10	16	16	***		.	2-methyl-2-(methylthio) propionaldehyde-o-
C07	METHTOU	PPB	10	16	16	***		.	Methylthiouracil
C08	NAPHQUI	PPB	10	16	16	***		.	1,4-naphthoquinone
C09	1-napha	PPB	10	16	16	***		.	1-naphthylamine
C10	2-napha	PPB	10	16	16	***		.	2-naphthylamine
C11	NITRANI	PPB	10	16	16	***		.	P-nitroaniline
C12	NITBENZ	PPB	10	16	16	***		.	Nitrobenzene

---Constituent List=WAC 173-303-9906---

CONCODE	CONNAME	ANALUNIT	DETLIMIT	SAMPLES	BELOWDL	ALLBELOW	MAXLIMIT	REGAGEN	FULLNAME
C13	NITPHEN	PPB	10	16	16	***	.		4-nitrophenol
C14	NNIBUTY	PPB	10	16	16	***	.		N-nitrosodi-n-butylamine
C15	NNIDIEA	PPB	10	16	16	***	.		N-nitrosodiethanolamine
C16	NNIDIET	PPB	10	16	16	***	.		N-nitrosodiethylamine
C17	NNIDIME	PPB	10	16	16	***	.		N-nitrosodimethylamine
C18	NNIMETH	PPB	10	16	16	***	.		N-nitrosomethylethylamine
C19	NNIURET	PPB	10	16	16	***	.		N-nitroso-N-methylurethane
C20	NNIVINY	PPB	10	16	16	***	.		N-nitrosomethylvinylamine
C21	NNIMORP	PPB	10	16	16	***	.		N-nitrosomorpholine
C22	NNINICO	PPB	10	16	16	***	.		N-nitrosonornicotine
C23	NNIPIPE	PPB	10	16	16	***	.		N-nitrosopiperidine
C24	NITRPYR	PPB	10	16	16	***	.		Nitrosopyrrolidine
C26	NITRTOL	PPB	10	16	16	***	.		5-nitro-o-toluidine
C27	PENTCHN	PPB	10	16	16	***	.		Pentachloronitrobenzene
C28	PENTCHP	PPB	10	16	16	***	220	EPAP	Pentachlorophenol
C29	PHENTIN	PPB	10	16	16	***	220	EPAP	Phenacetin
C30	PHENINE	PPB	10	16	16	***	.		Phenylenediamine
C31	PHTHEST	PPB	10	16	16	***	.		Phthalic acid esters
C32	PICOLIN	PPB	10	16	16	***	.		2-picoline
C33	PRONIDE	PPB	10	16	16	***	.		Pronamide
C34	RESERPI	PPB	10	16	16	***	.		Reserpine
C35	RESORCI	PPB	10	16	16	***	.		Resorcinol
C38	SAFROL	PPB	10	16	16	***	.		Safrol
C39	TETRCHP	PPB	10	16	16	***	.		2,3,4,6-tetrachlorophenol
C40	THIURAM	PPB	10	16	16	***	.		Thiuram
C41	TOLUDIA	PPB	10	16	16	***	.		Toluenediamine
C42	OTOLHYD	PPB	10	16	16	***	.		O-toluidine hydrochloride
C44	245-trp	PPB	10	16	16	***	.		2,4,5-trichlorophenol
C46	246-trp	PPB	10	16	16	***	.		2,4,6-trichlorophenol
C46	TRIPHOS	PPB	10	16	16	***	.		O,O,O-triethyl phosphorothioate
C47	SYMTRIN	PPB	10	16	16	***	.		Sym-trinitrobenzene
C48	TRIPHOS	PPB	10	16	16	***	.		Tris(2,3-dibromopropyl) phosphate
C49	BENZOPY	PPB	10	16	16	***	.		Benzo[a]pyrene
C50	CHLNAPH	PPB	10	16	16	***	.		Chlornaphazine
C51	BISZETH	PPB	10	16	16	***	.		Bis(2-chloroisopropyl)ether
C59	HYDRAZI	PPB	3000	16	16	***	.		Hydrazine
C81	TETEPYR	PPB	2	16	16	***	.		Tetraethylpyrophosphate
C83	CARBPHT	PPB	2	16	16	***	.		Carbophenothion
C84	DISULFO	PPB	2	16	16	***	.		Disulfoton
C85	DIMETHO	PPB	6	16	16	***	.		Dimethoate
C86	METHPAR	PPB	2	16	16	***	.		Methyl parathion
C87	PARATHI	PPB	2	16	16	***	.		Parathion
C87	CITRUSR	PPB	1000	16	16	***	.		Citrus red
C88	CYANBRM	PPB	3000	16	16	***	.		Cyanogen bromide
C89	CYANCHL	PPB	3000	16	16	***	.		Cyanogen chloride
C90	PARALDE	PPB	3000	16	16	***	.		Paraldehyde
C94	ACRYIDE	PPB	3000	16	16	***	8	EPAP	Acrylamide
C95	ALLYLAL	PPB	3000	16	16	***	.		Allyl alcohol
C96	CHLORAL	PPB	3000	16	16	***	.		Chloral
C97	CHLACET	PPB	3000	16	16	***	.		Chloroacetaldehyde

Constituent List=WAC 173-303-9905

CONCODE	CONNAME	ANALUNIT	DETLIMIT	SAMPLES	BELOWDL	ALLBELOW	MAXLIMIT	REGAGEN	FULLNAME
C98	CHLPROP	PPB	3000	18	18	***		.	3-chloropropionitrile
C99	CYANOGN	PPB	3000	18	18	***		.	Cyanogen
H01	DICPROP	PPB	3000	18	18	***		.	Dichloropropanol
H03	ETHCARB	PPB	3000	18	18	***		.	Ethyl carbamate
H04	ETHCYAN	PPB	3000	18	18	***		.	Ethyl cyanide
H05	ETHOXID	PPB	3000	18	18	***		.	Ethylene oxide
H06	ETHMETH	PPB	3000	18	18	***		.	Ethyl methacrylate
H07	FLUOROA	PPB	3000	18	18	***		.	Fluoroacetic acid
H08	GLYCIDY	PPB	3000	18	18	***		.	Glycidylaldehyde
H09	ISOBUTY	PPB	3000	18	18	***		.	Isobutyl alcohol
H10	METZINE	PPB	3000	18	18	***		.	Methyl hydrazine
H11	PROPYLA	PPB	3000	18	18	***		.	N-propylamine
H12	PROPYNO	PPB	3000	18	18	***		.	2-propyn-1-ol
H16	2,4,5-T	PPB	1	14	14	***		.	2,4,5-T
I01	ACETONE	PPB	.	2	0			.	
I02	HEXANE	PPB	0	2	0			.	
I03	MECYPEN	PPB	0	1	0			.	
I04	MEBUPHT	PPB	0	1	0			.	
I20	TAF	PPB	0	2	0			.	
I63	BHT	PPB	.	1	0			.	
I99	UNKNOWN	PPB	0	4	0			.	

This page intentionally left blank.

APPENDIX B

ANALYTICAL DATA, MAY 1986 - JUNE 1988
(Taken from Schalla et al. 1988a, Table 7)

This page intentionally left blank.

--Constituent List=Contamination Indicators--

CONSTIT			SAMPLES	DETLIMIT	BELOWDL	MAXLIMIT	MEAN	MEDIAN	STDDEV	COEFFVAR	MINIMUM	MAXIMUM
191	CONDUCT	UMHO	173	.	0	.	282	287	86.7	30.7	146	586
199	PH		172	.	0	.	7.03	7.1	0.646	9.2	3.9	8.8
C68	TOX	PPB	187	100	158	.	246	30.3	1010	410.6	2.3	9180
C69	TOC	PPB	187	1000	188	.	1100	933	938	85.0	1	4030

--Constituent List=Drinking Water Standards--

CONSTIT			SAMPLES	DETLIMIT	BELOWDL	MAXLIMIT	MEAN	MEDIAN	STDDEV	COEFFVAR	MINIMUM	MAXIMUM
109	COLIFRM	MPN	211	3	195	1	9.82	3	76.4	783.6	0	1100
111	BETA	PCI/L	210	8	4	50	14.7	12	9.16	62.4	0.719	68
181	RADIUM	PCI/L	210	1	198	5	0.0669	0.0462	0.129	192.4	-0.121	0.875
212	LOALPHA	PCI/L	210	4	3	15	15.6	13.9	11.5	73.8	1.31	67.1
A06	BARIUM	PPB	216	6	17	1000	40.6	53.6	54.4	134.0	6	719
A07	CADMIUM	PPB	216	2	201	10	2.13	2	0.616	29.0	2	7
A08	CHROMUM	PPB	216	10	200	60	11.7	10	17	145.6	10	257
A18	SILVER	PPB	216	10	216	60	10	10	0.612	6.1	10	18
A20	ARSENIC	PPB	216	5	199	50	5.26	5	1.56	29.6	5	23
A21	MERCURY	PPB	216	0.1	197	2	0.627	0.1	1.8	287.3	0.1	9.9
A22	SELENUM	PPB	216	5	212	10	5.14	5	1.09	21.1	5	17
A61	LEADGF	PPB	216	6	192	50	6.69	5	4.66	70.0	5	48
C72	NITRATE	PPB	211	500	8	45000	18900	19000	5778	30.6	2000	86000
C74	FLUORID	PPB	211	500	133	1400	578	500	178	30.8	500	1070

-----Constituent List-Quality Characteristics-----

CONSTIT	SAMPLES	DETLIMIT	BELOWDL	MAXLIMIT	MEAN	MEDIAN	STDDEV	COEFFVAR	MINIMUM	MAXIMUM
A11 SODIUM PPB	216	100	0	.	16300	14700	5100	33.4	1220	29800
A17 MANGESE PPB	216	5	182	.	8.67	5	25.8	298.5	5	367
A19 IRON PPB	216	50	66	.	258	81	1090	423.2	0	14900
C78 SULFATE PPB	211	500	0	.	21700	18200	9770	45.1	6700	53600
C75 CHLORID PPB	211	500	0	.	14400	11800	10800	75.4	880	72200

-----Constituent List-Site Specific-----

CONSTIT	SAMPLES	DETLIMIT	BELOWDL	MAXLIMIT	MEAN	MEDIAN	STDDEV	COEFFVAR	MINIMUM	MAXIMUM
A12 NICKEL PPB	216	10	202	.	11	10	8.98	83.1	10	96
A13 COPPER PPB	216	10	130	1300	22.2	10	39.6	178.8	10	516
A16 ALUMNUM PPB	216	150	189	.	221	150	486	219.6	150	7000
A24 THIOURA PPB	211	200	209		208	200	80.6	38.8	200	1090
A64 METHONE PPB	216	10	215	.	9.98	10	0.436	4.4	3.7	11
A67 1,1,1-T PPB	216	10	214	200	10.4	10	4.81	46.1	10	72
A68 1,1,2-T PPB	216	10	214	.	10.1	10	1	10.0	10	23
A69 TRICENE PPB	216	10	212	5	9.73	10	1.43	14.7	2.4	14
A70 PERCENE PPB	216	10	195	.	10.4	10	4.73	45.5	2	55
C70 CYANIDE PPB	211	10	209	.	10	10	0.314	3.1	10	14
C78 SULFIDE PPB	211	1000	208	.	1020	1000	107	10.4	1000	3000
C80 AMMONIU PPB	211	50	89	.	120	118	79.2	66.0	30	360

Constituent List=Tag-alongs

	CONSTIT	SAMPLES	DETLIMIT	BELOWDL	MAXLIMIT	MEAN	MEDIAN	STDDEV	COEFFVAR	MINIMUM	MAXIMUM
A14	VANADUM PPB	218	5	110	.	9.05	5	6.46	67.7	5	38
A18	POTASUM PPB	216	100	3	.	3860	3630	1600	38.8	100	8810
A80	CHLFORM PPB	116	10	24	.	16.3	18	8.02	49.1	4.1	42
A93	METHYCH PPB	66	10	14	.	787	115	3306	420.9	3	27600
C76	PHOSPHA PPB	211	1000	210	.	1010	1000	164	16.3	1000	3240

Constituent List=WAC 173-303-9906

	CONSTIT	SAMPLES	DETLIMIT	BELOWDL	MAXLIMIT	MEAN	MEDIAN	STDDEV	COEFFVAR	MINIMUM	MAXIMUM
A04	ZINC PPB	16	5	5	.	31.5	14	44.4	141.0	5	178
A06	CALCIUM PPB	16	50	0	.	31900	29500	12700	39.8	17000	61700
A23	THALIUM PPB	16	10	15	.	10	10	0	0.0	10	10
B40	BIS2EPH PPB	26	10	16	.	14.9	10	12.3	82.5	10	60
J01	ACETONE PPB	2	.	0	.	20	20	8.49	42.4	14	26
J02	HEXANE PPB	2	0	0	.	60	60	0	0.0	60	60
J03	MECYPEN PPB	1	0	0	.	16	16	.	.	16	16
J04	MEBUPHT PPB	1	0	0	.	9	9	.	.	9	9
J20	TAF PPB	2	0	0	.	61.5	61.5	41.7	67.8	32	91
J63	BHT PPB	1	.	0	.	3.2	3.2	.	.	3.2	3.2
J90	UNKNOWN PPB	4	0	0	.	17.8	13	11.7	65.9	10	35

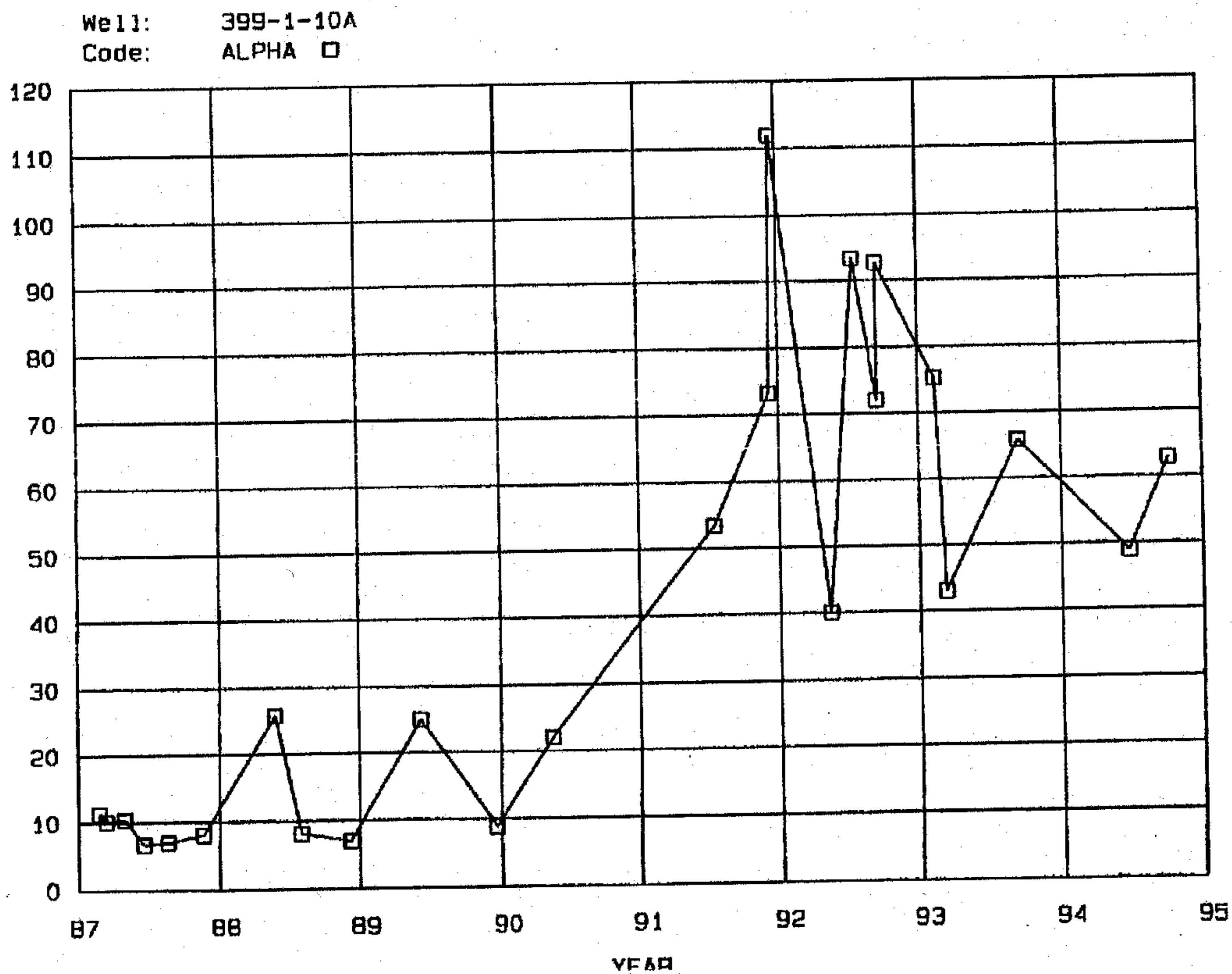
This page intentionally left blank.

APPENDIX C

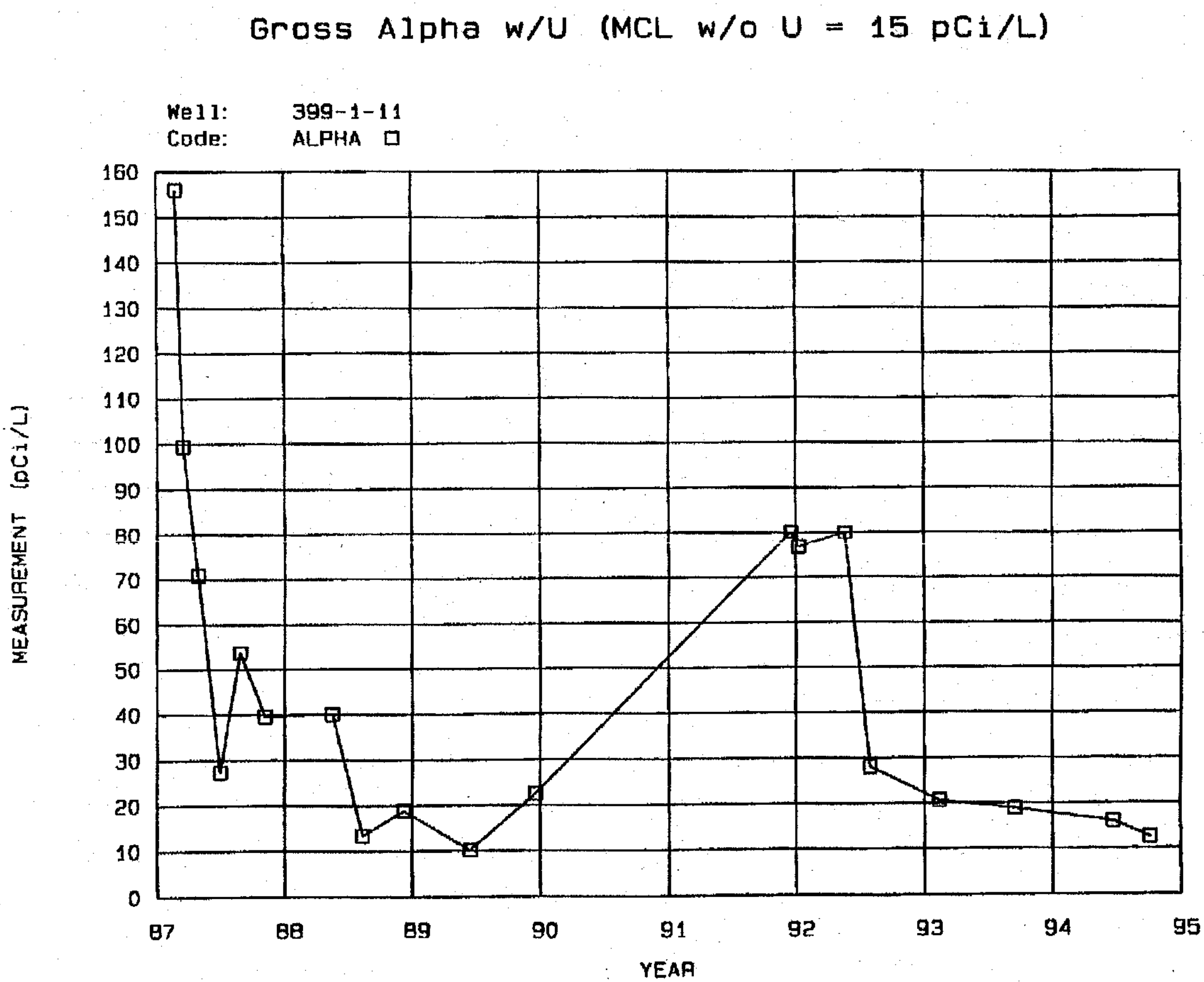
CONCENTRATION VS. TIME PLOTS FOR DETECTED CONSTITUENTS AND CONSTITUENTS EXCEEDING MCLs

This page intentionally left blank.

Gross Alpha w/U (MCL w/o U = 15 pCi/L)



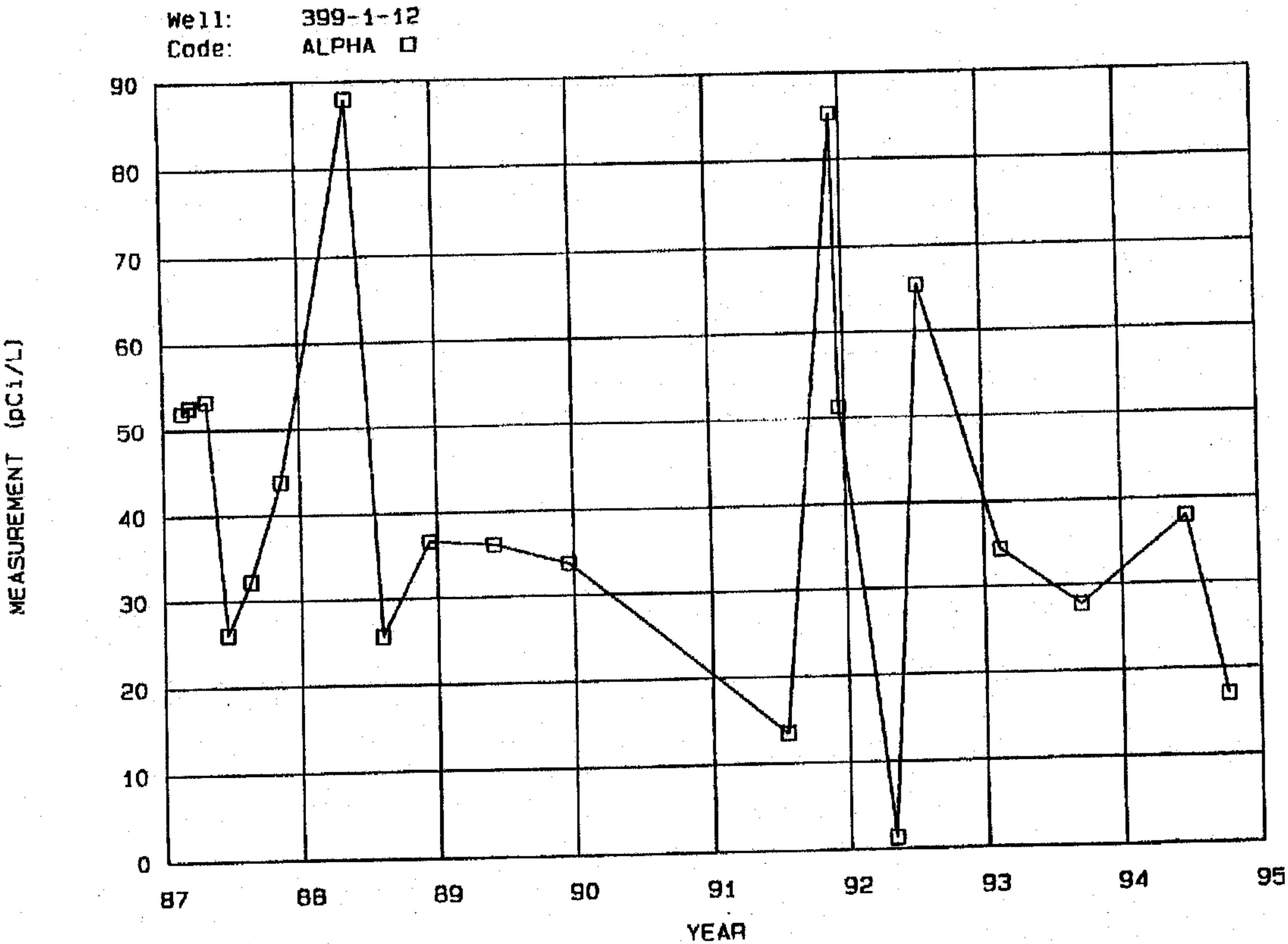
E-3



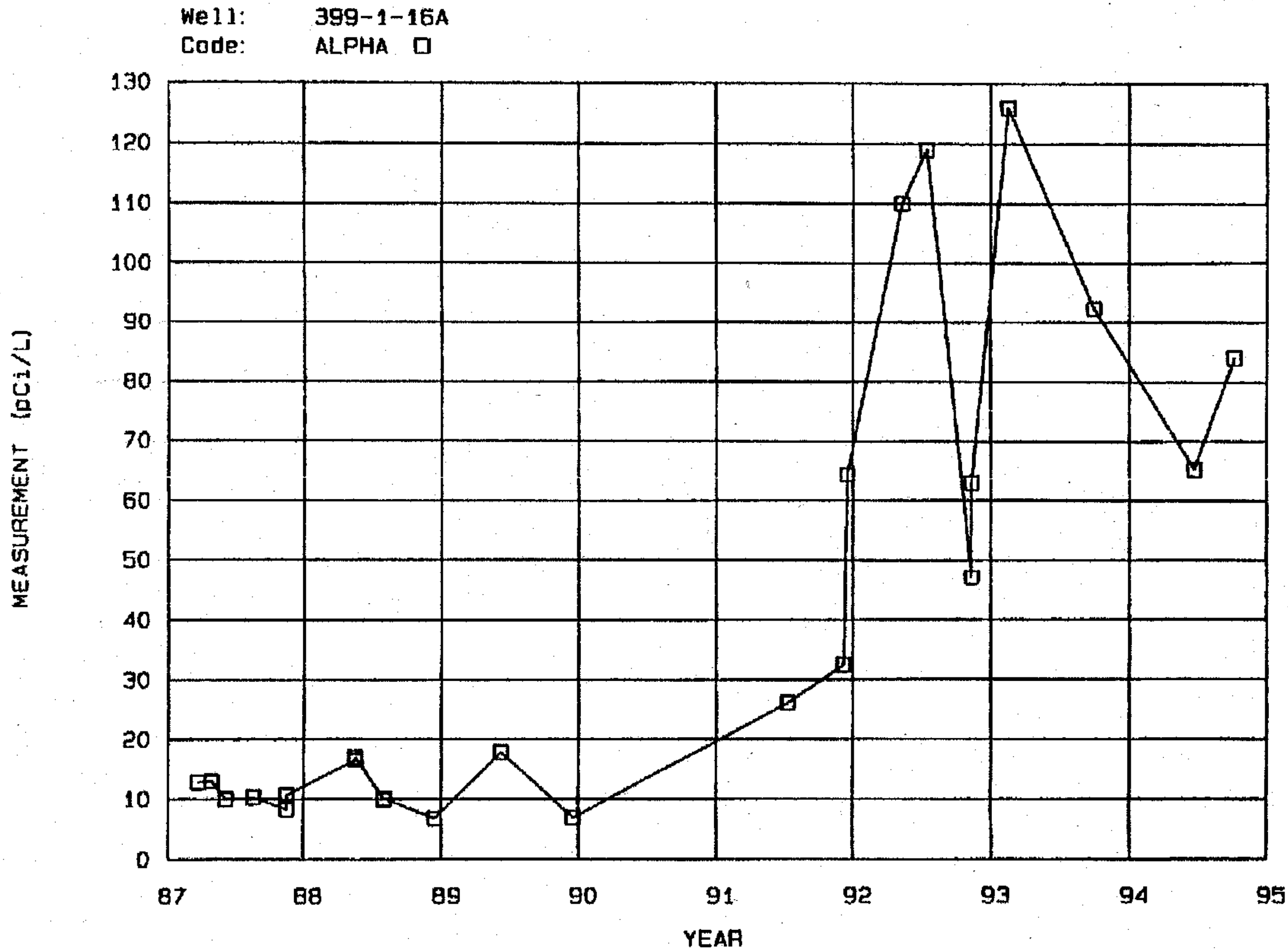
Gross Alpha w/U (MCL w/o U = 15 pCi/L)
Well: 399-1-11
Code: ALPHA
MEASUREMENT (pCi/L)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
87
88
89
90
91
92
93
94
95
YEAR

C-4

Gross Alpha w/U (MCL w/o U = 15 pCi/L)

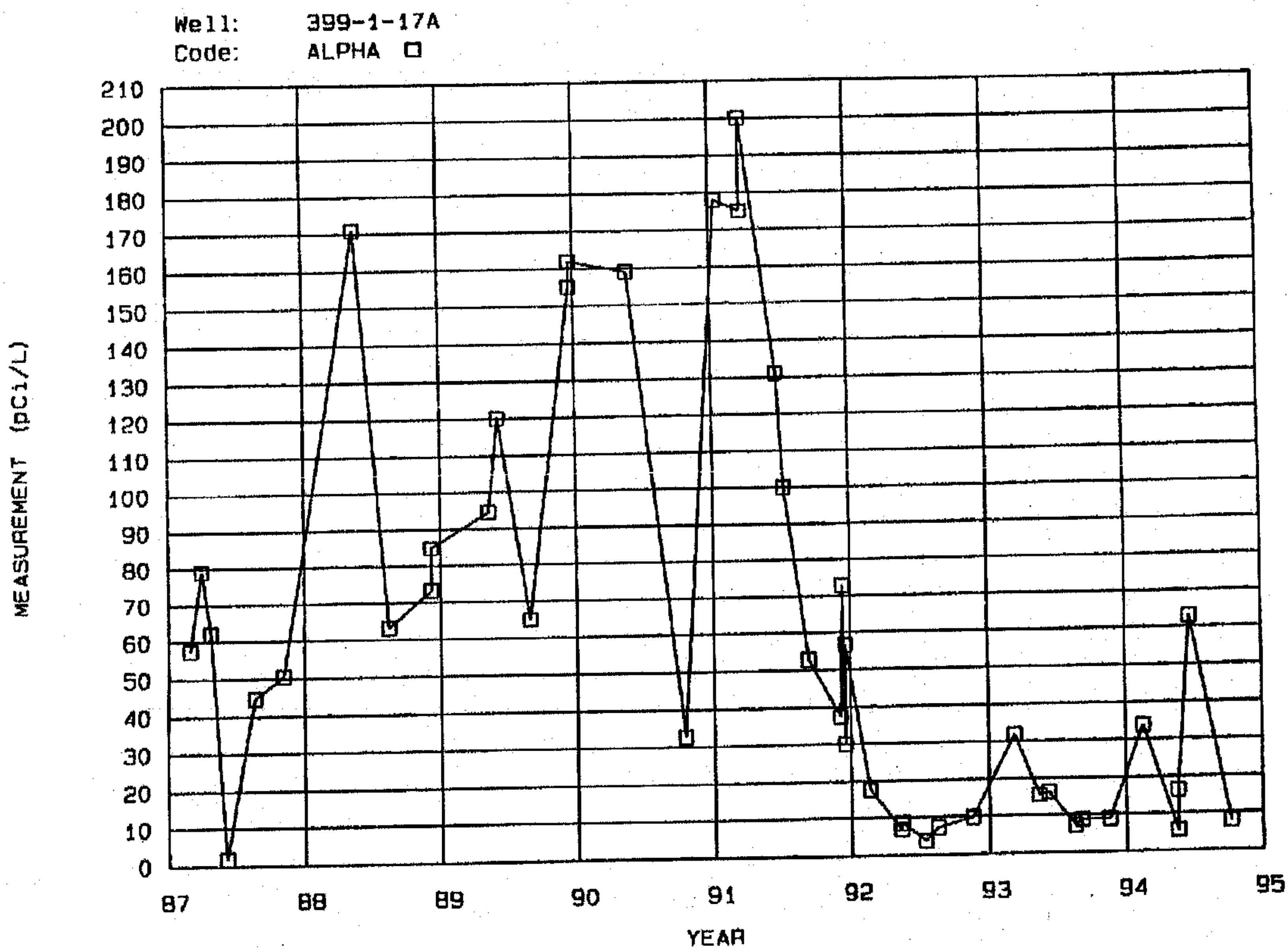


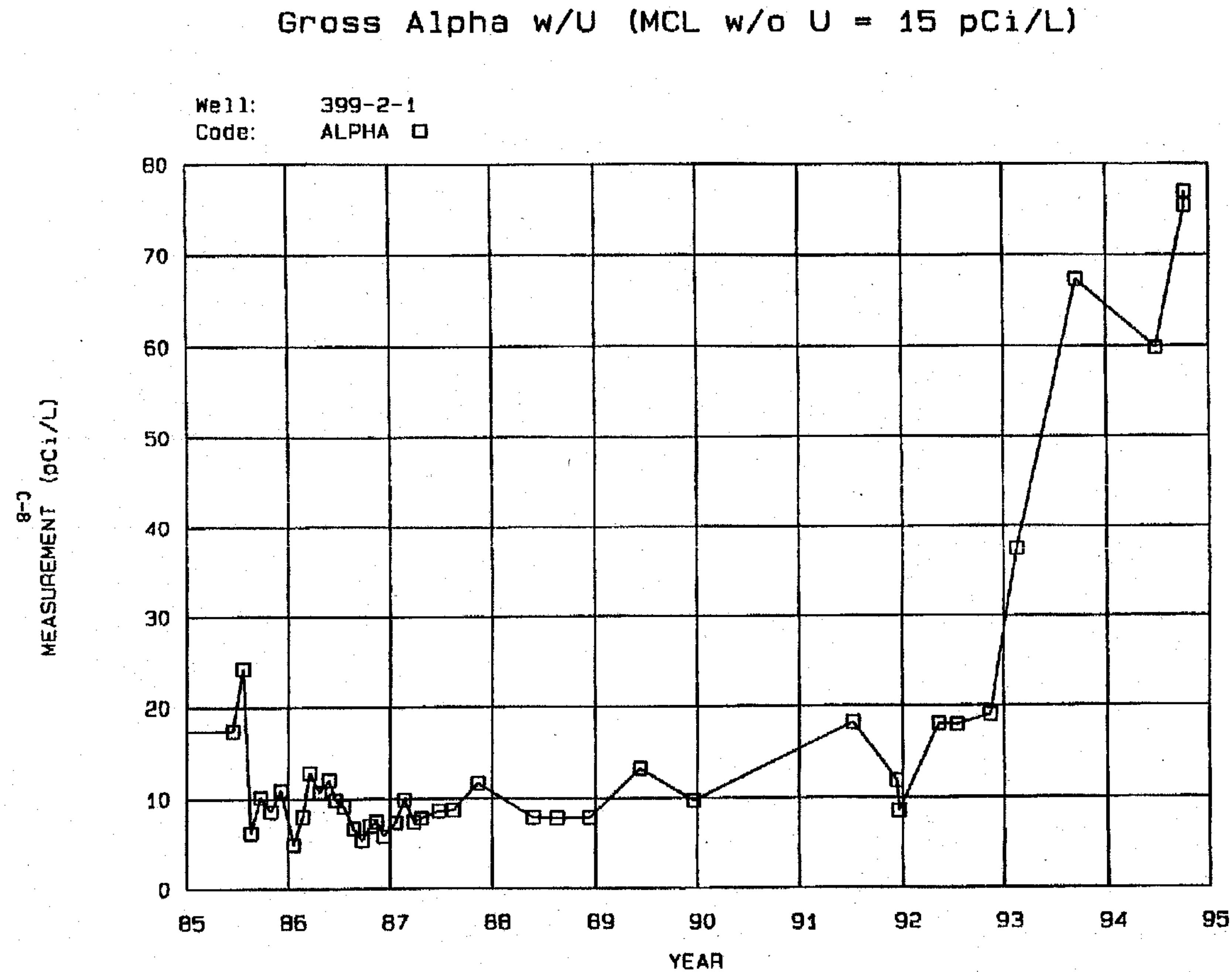
Gross Alpha w/U (MCL w/o U = 15 pCi/L)



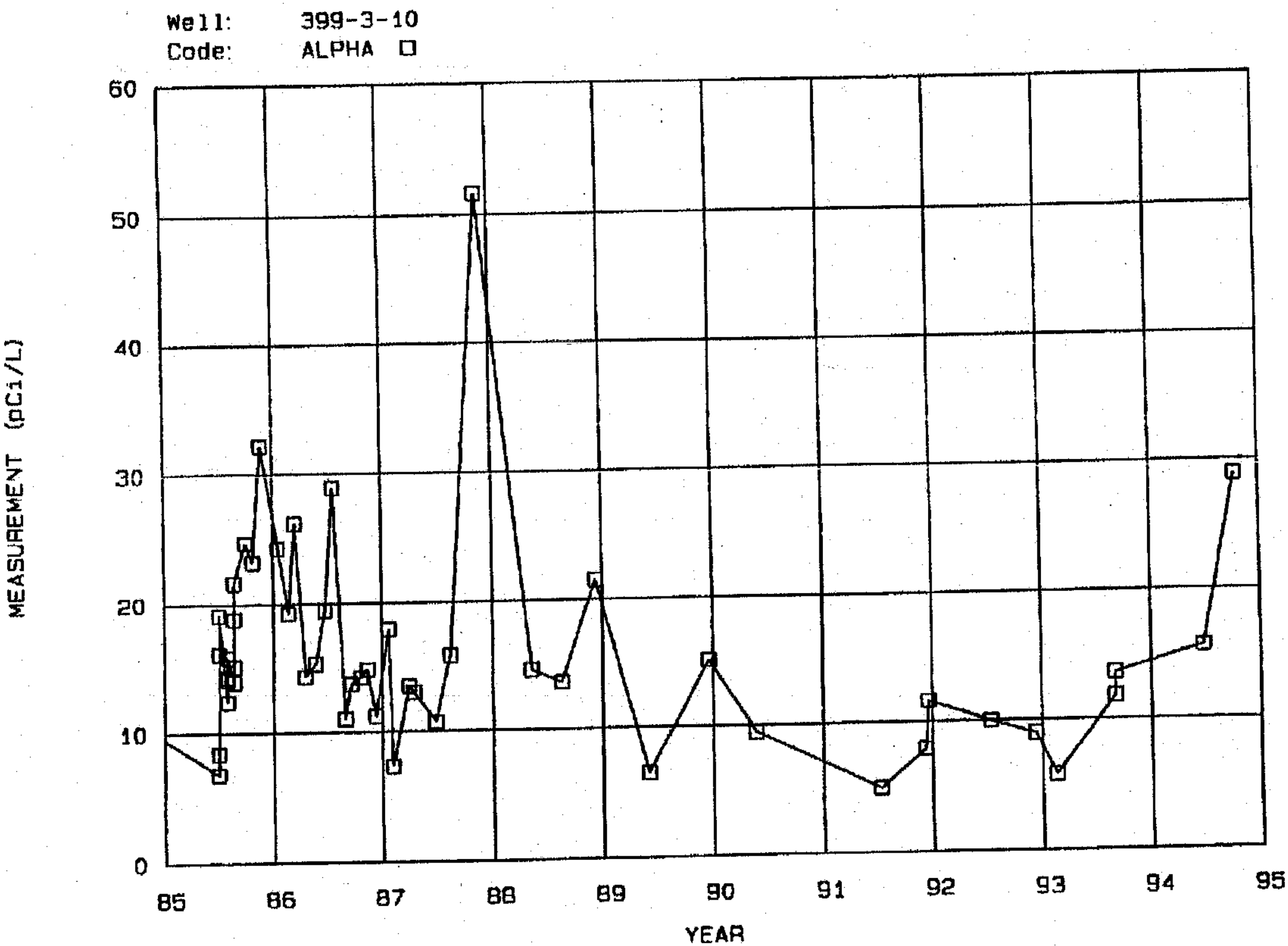
C-6

Gross Alpha w/U (MCL w/o U = 15 pCi/L)

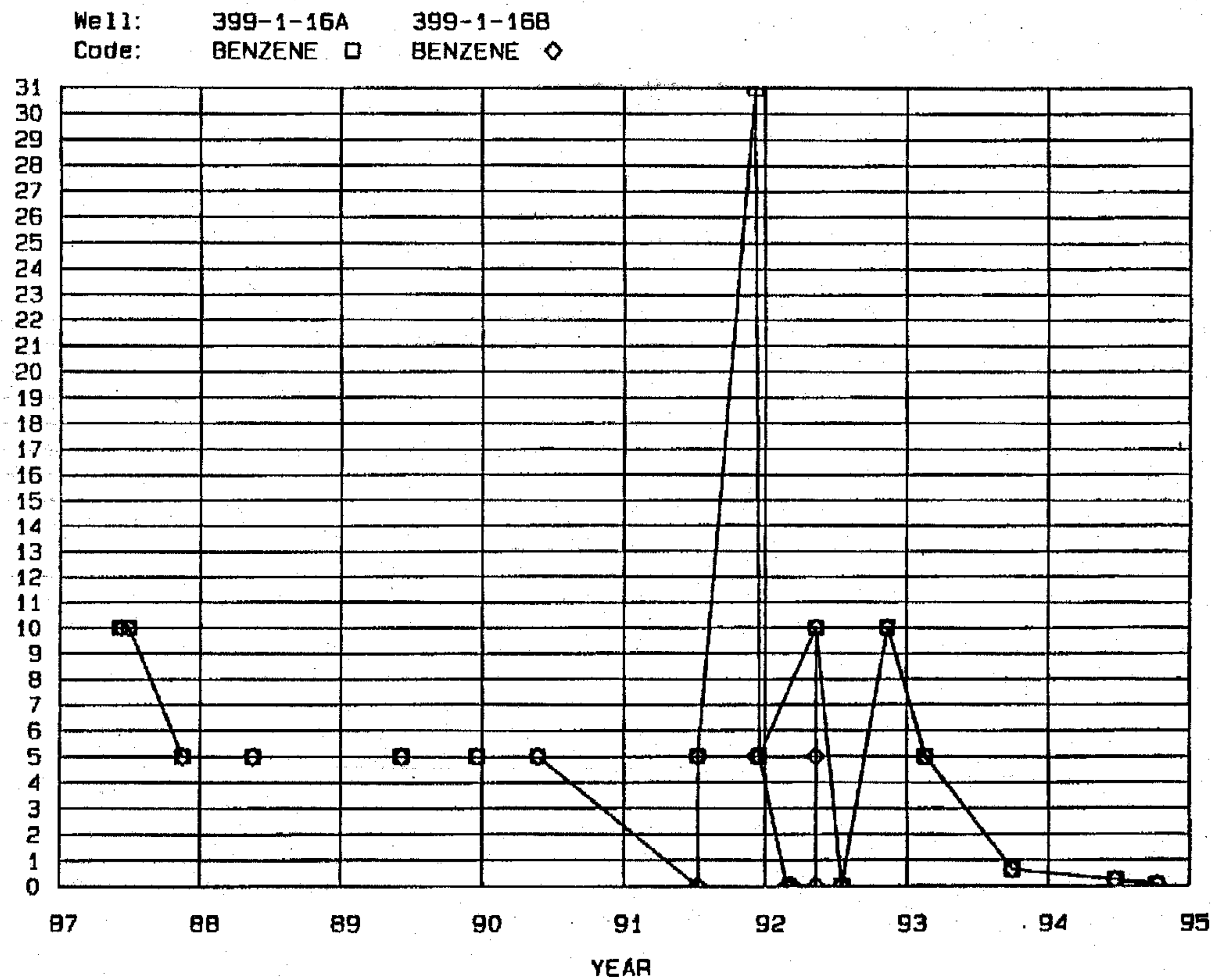



Gross Alpha w/U (MCL w/o U = 15 pCi/L)
Well: 399-2-1
Code: ALPHA □
80
70
60
50
40
30
20
10
0
85
86
87
88
89
90
91
92
93
94
95
YEAR
C-8
MEASUREMENT (pCi/L)

Gross Alpha w/U (MCL w/o U = 15 pCi/L)

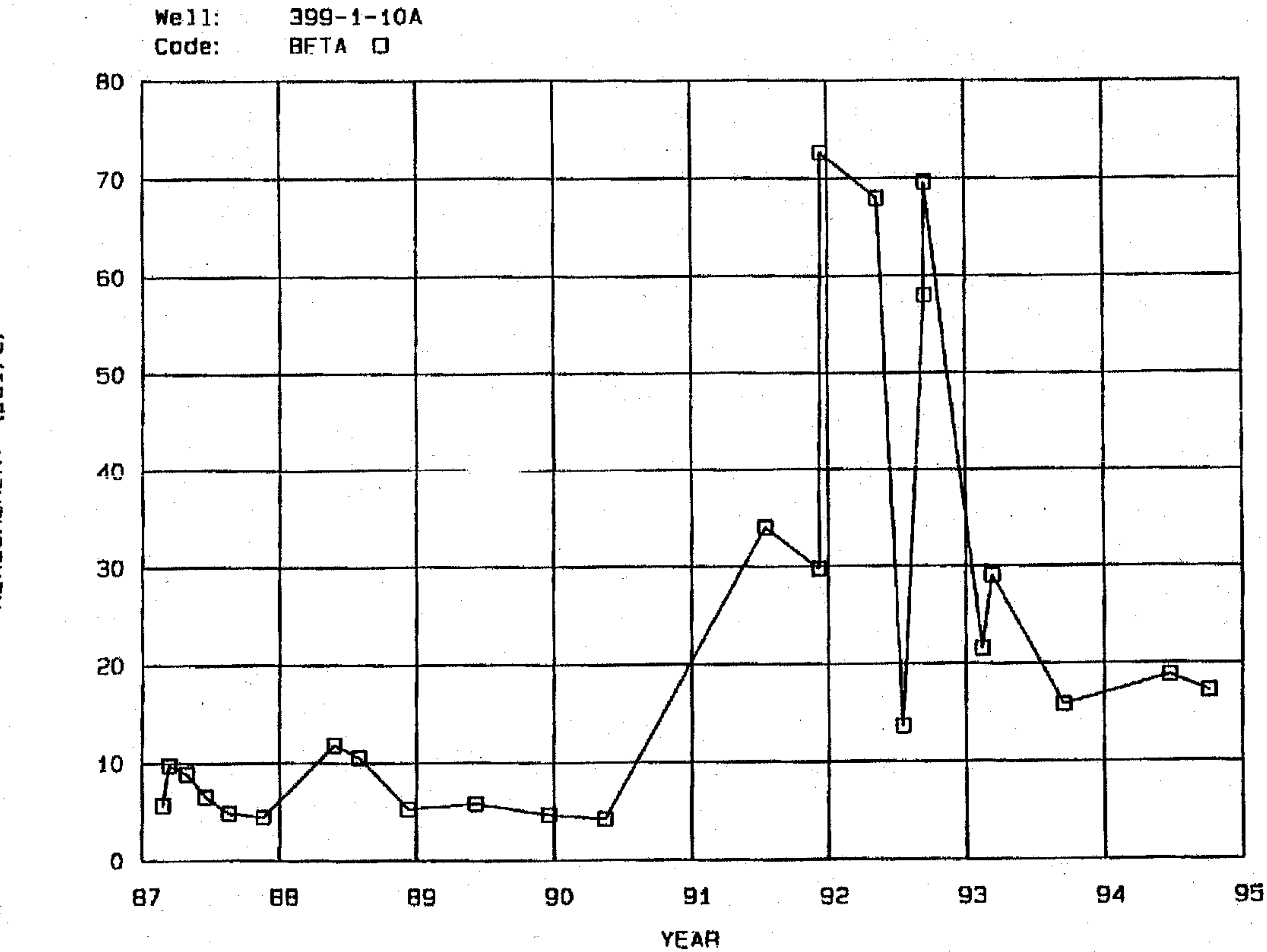


Benzene (MCL = 5 ppb)

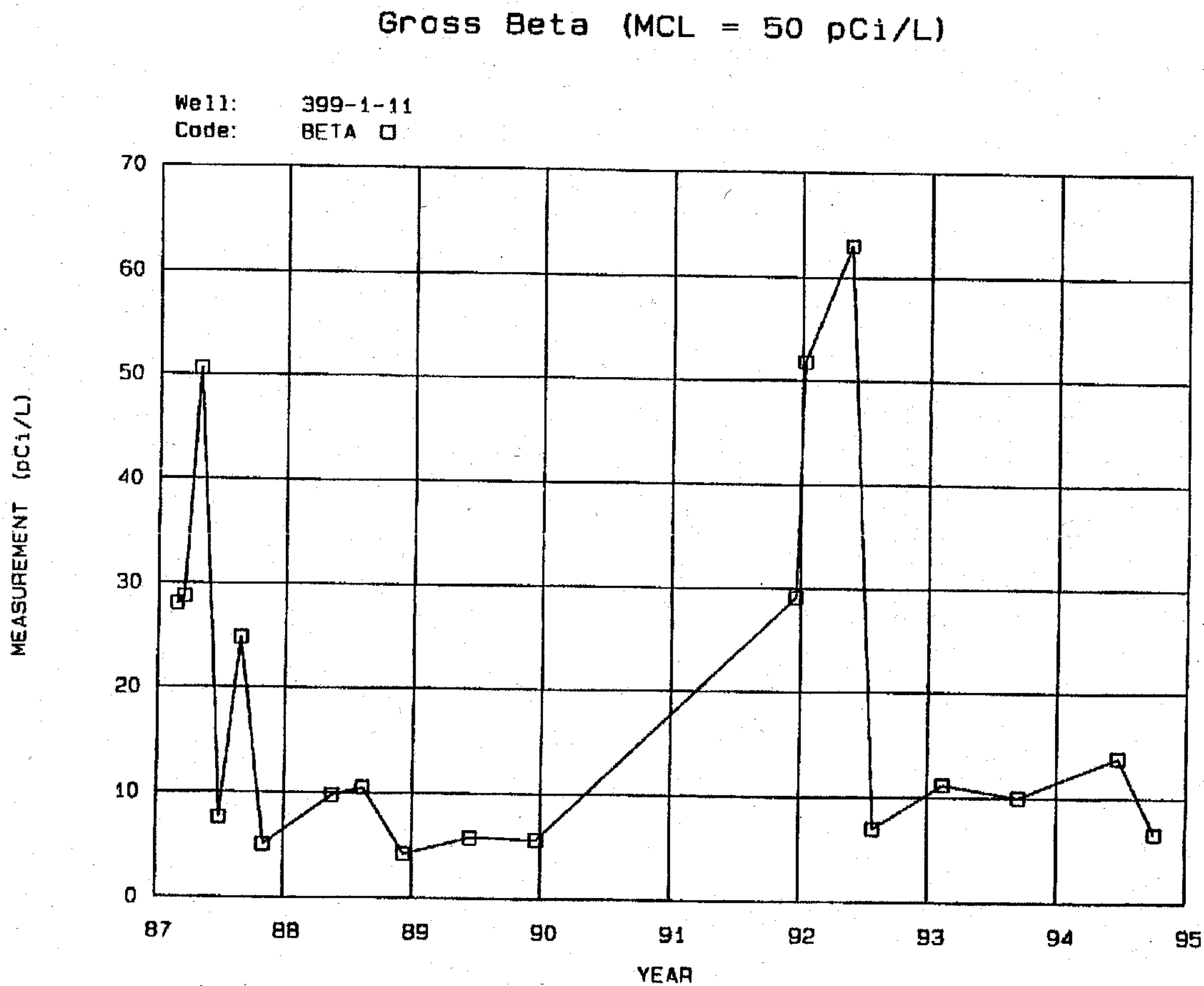


C-10

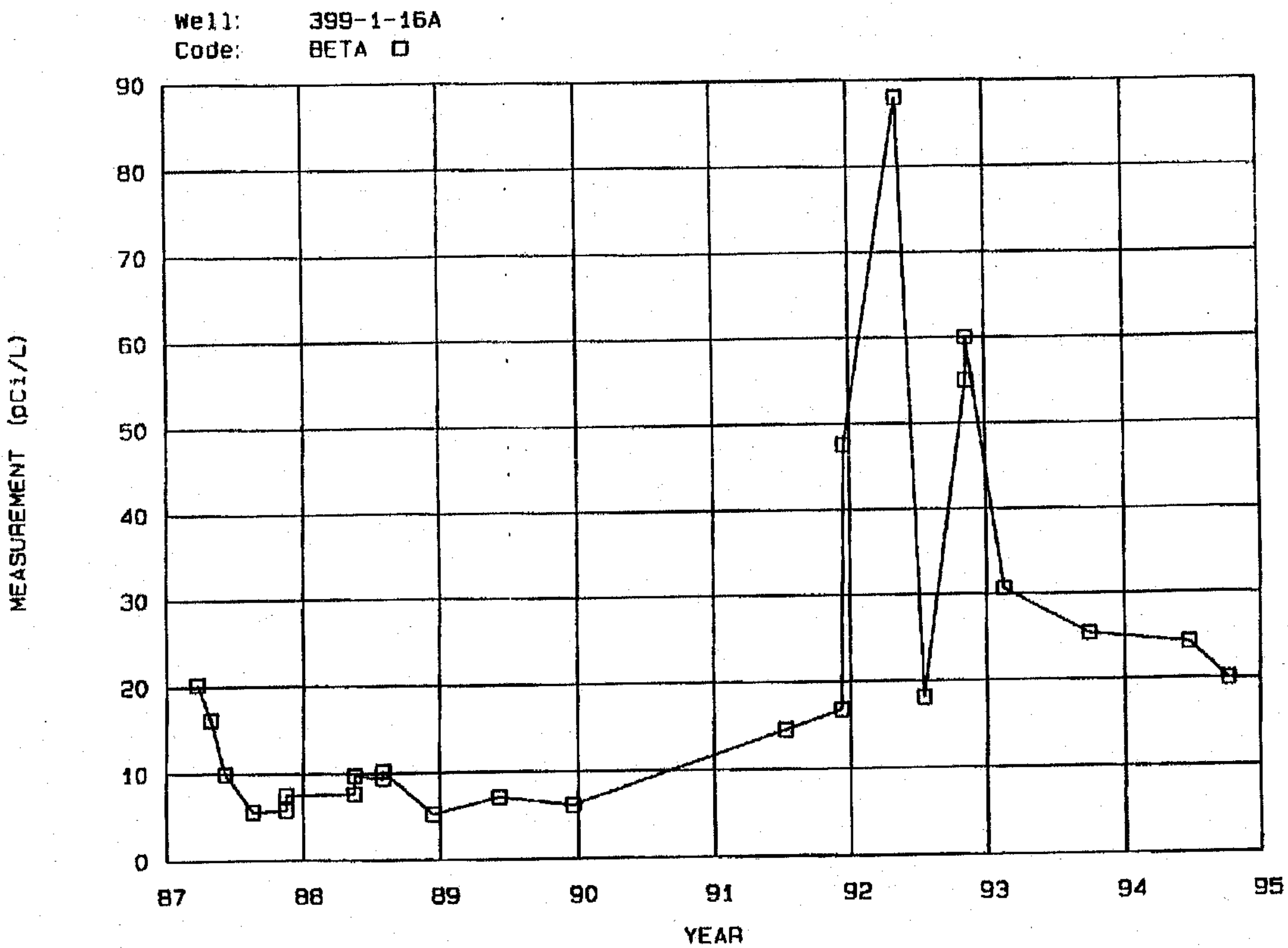
Gross Beta (MCL = 50 pCi/L)

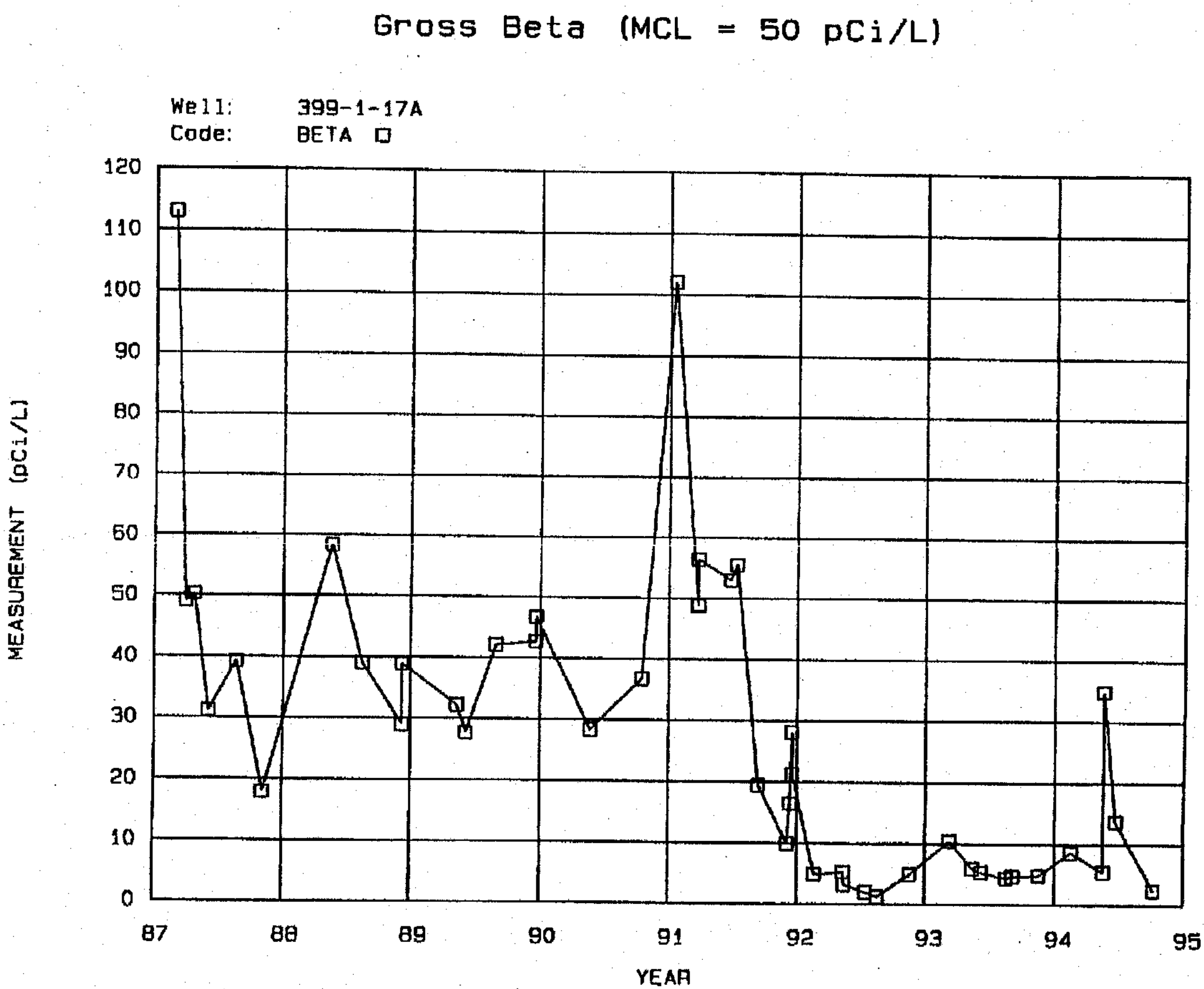


C-11


Gross Beta (MCL = 50 pCi/L)
Well: 399-1-11
Code: BETA
MEASUREMENT (pCi/L)
0
10
20
30
40
50
60
70
87
88
89
90
91
92
93
94
95
YEAR

Gross Beta (MCL = 50 pCi/L)

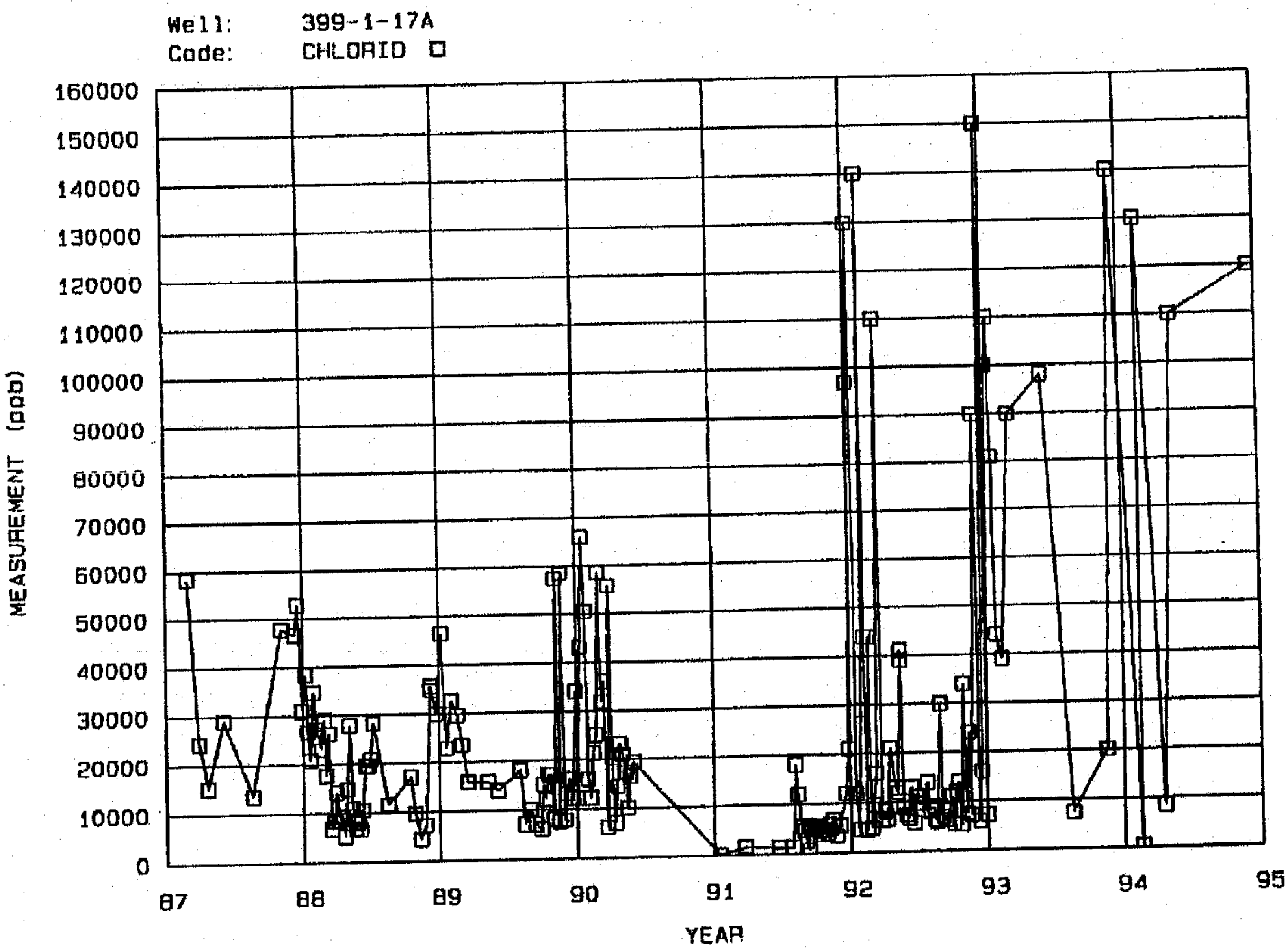


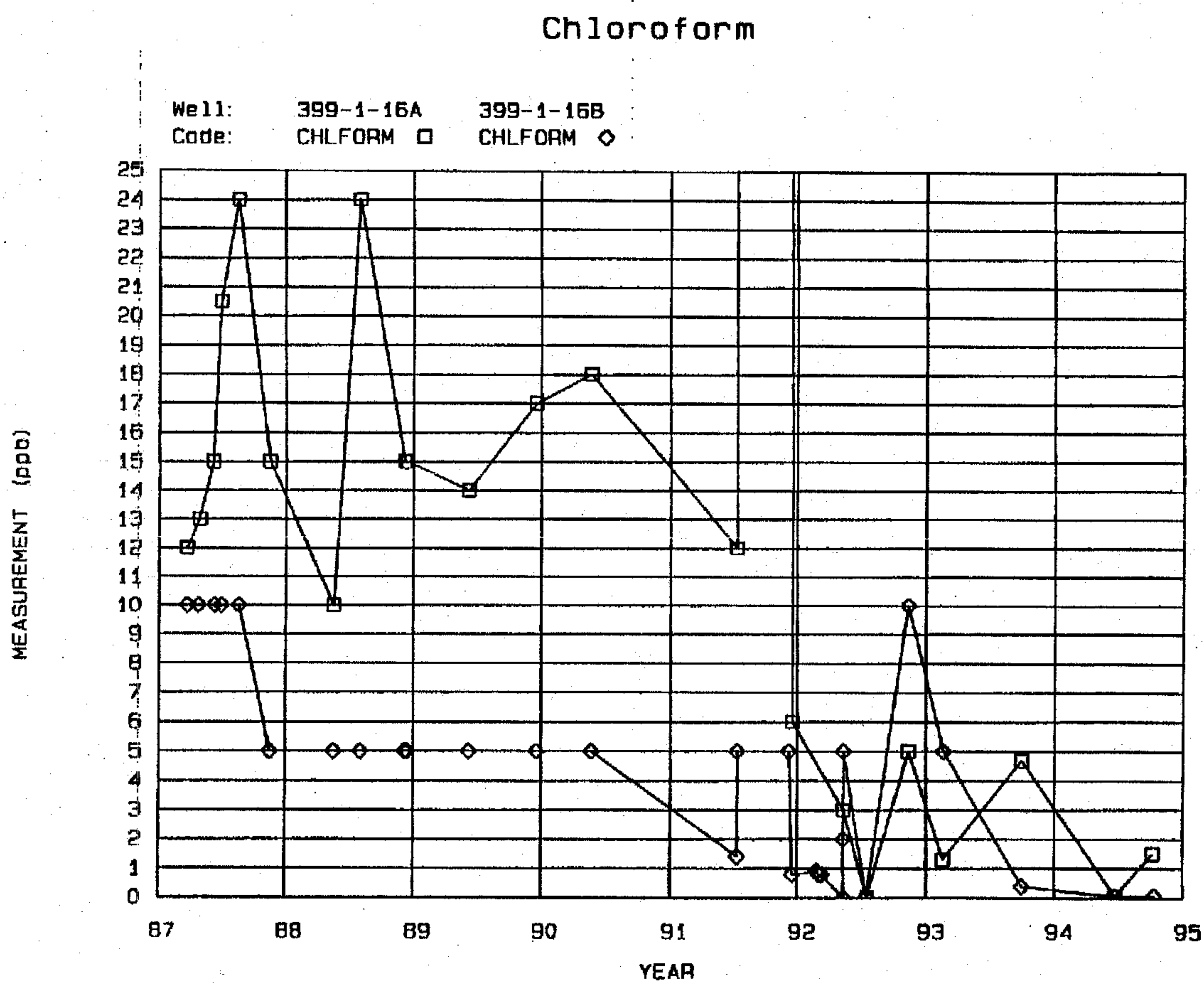


Gross Beta (MCL = 50 pCi/L)
Well: 399-1-17A
Code: BETA
120
110
100
90
80
70
60
50
40
30
20
10
0
MEASUREMENT (pCi/L)
87
88
89
90
91
92
93
94
95
YEAR

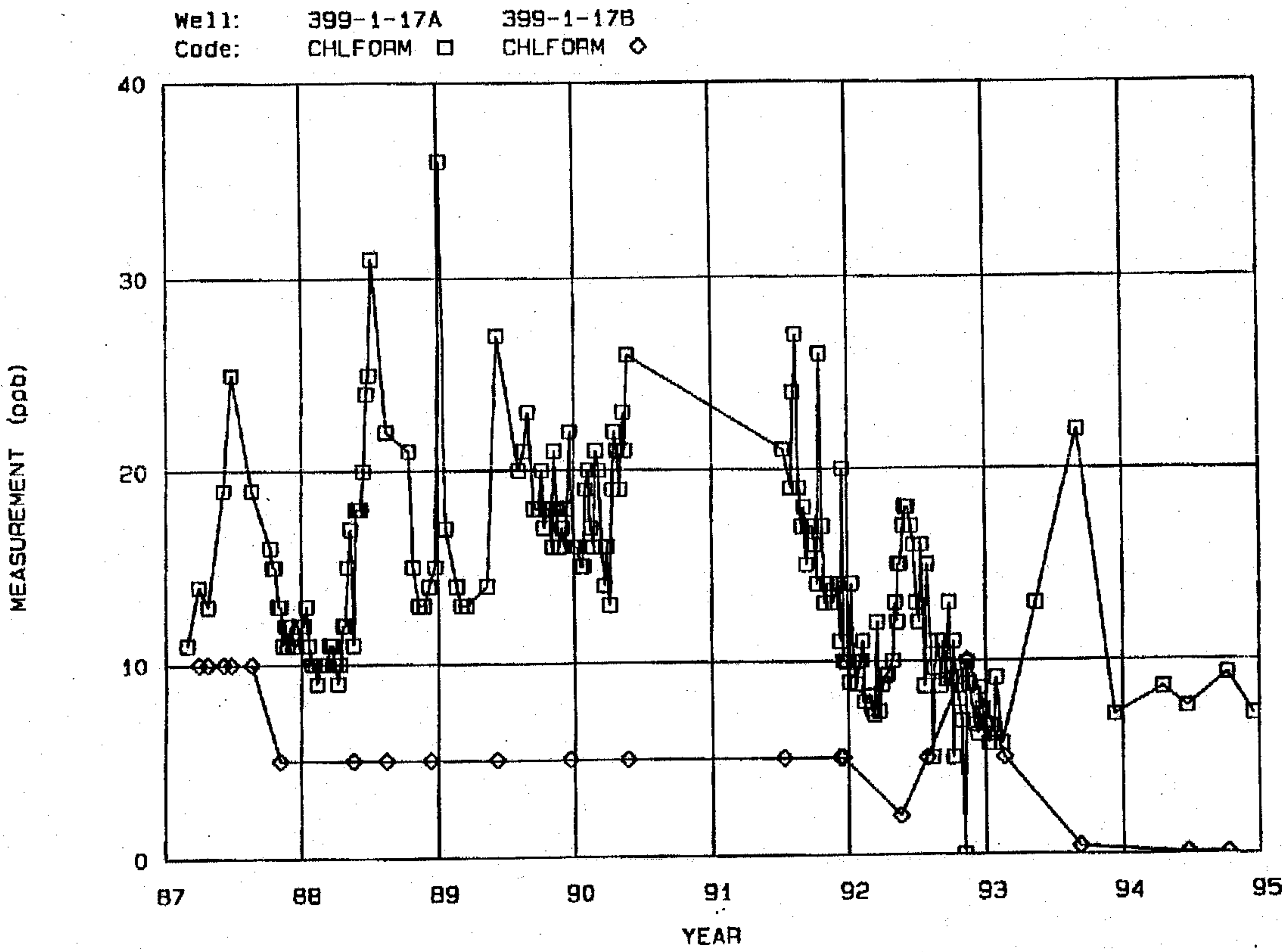
C-14

Chloride (MCL = 250000 ppb)

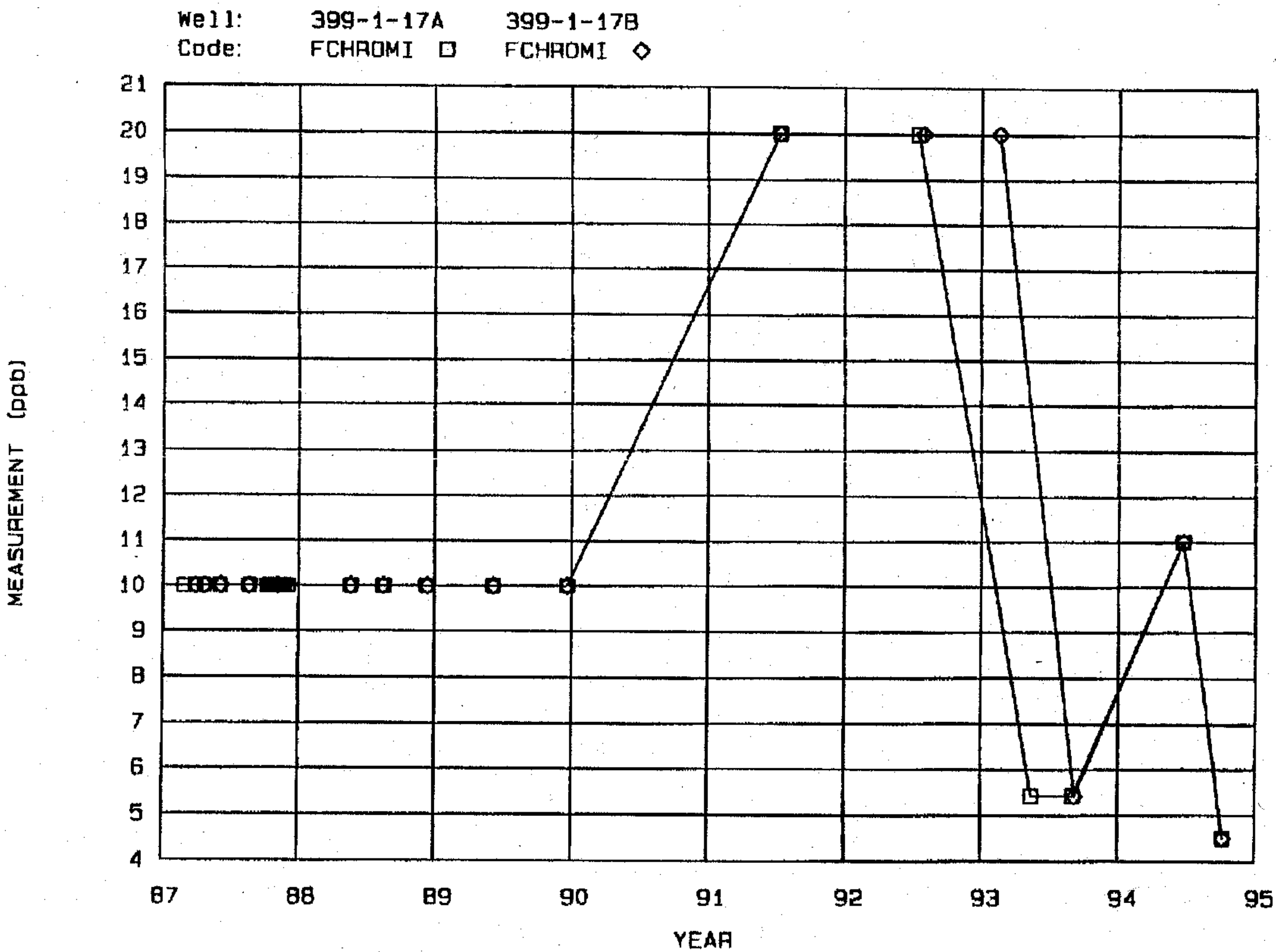



Chloroform
Well: 399-1-16A 399-1-16B
Code: CHLFORM □ CHLFORM ◇
MEASUREMENT (ppb)
YEAR
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
87
88
89
90
91
92
93
94
95

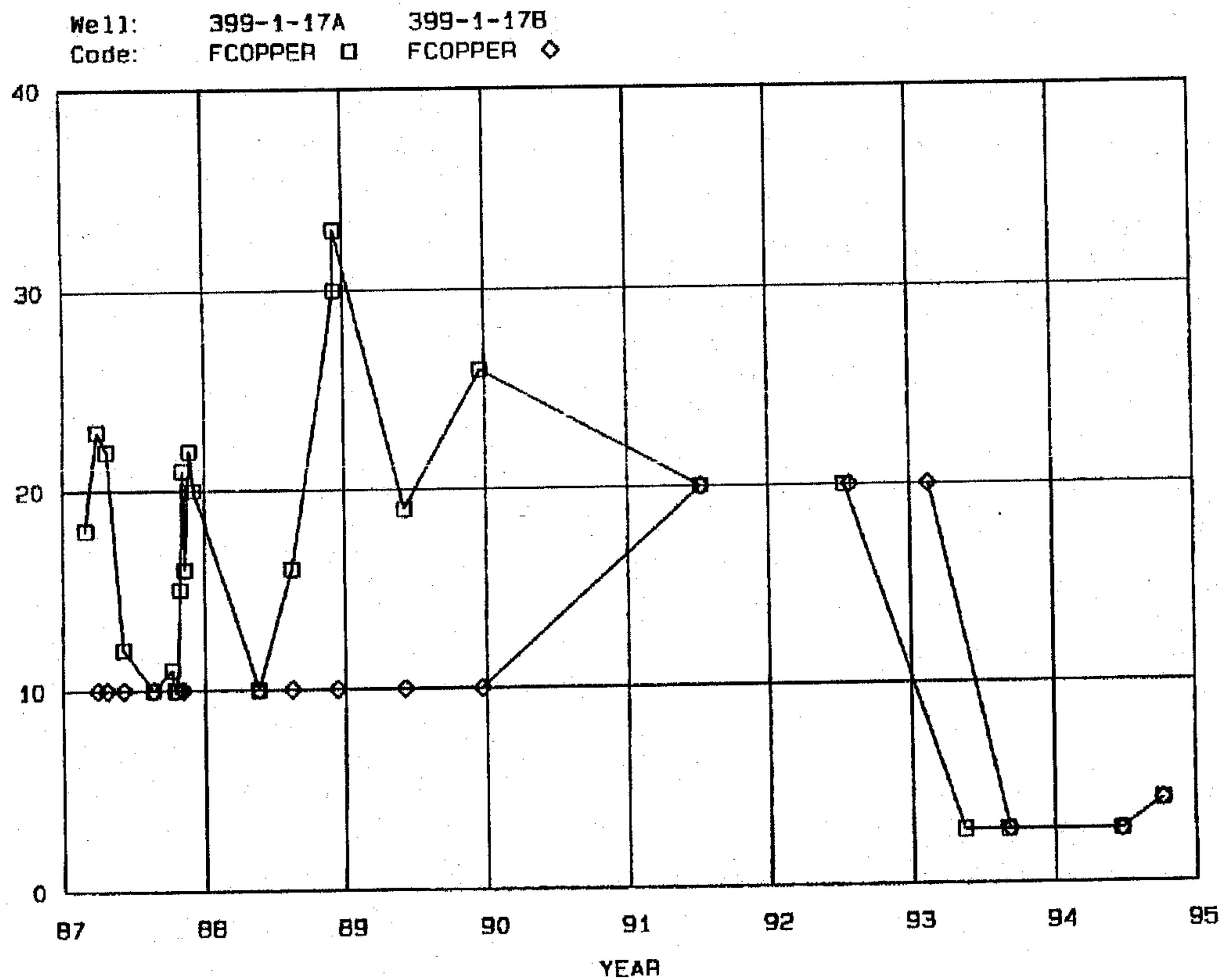
Chloroform

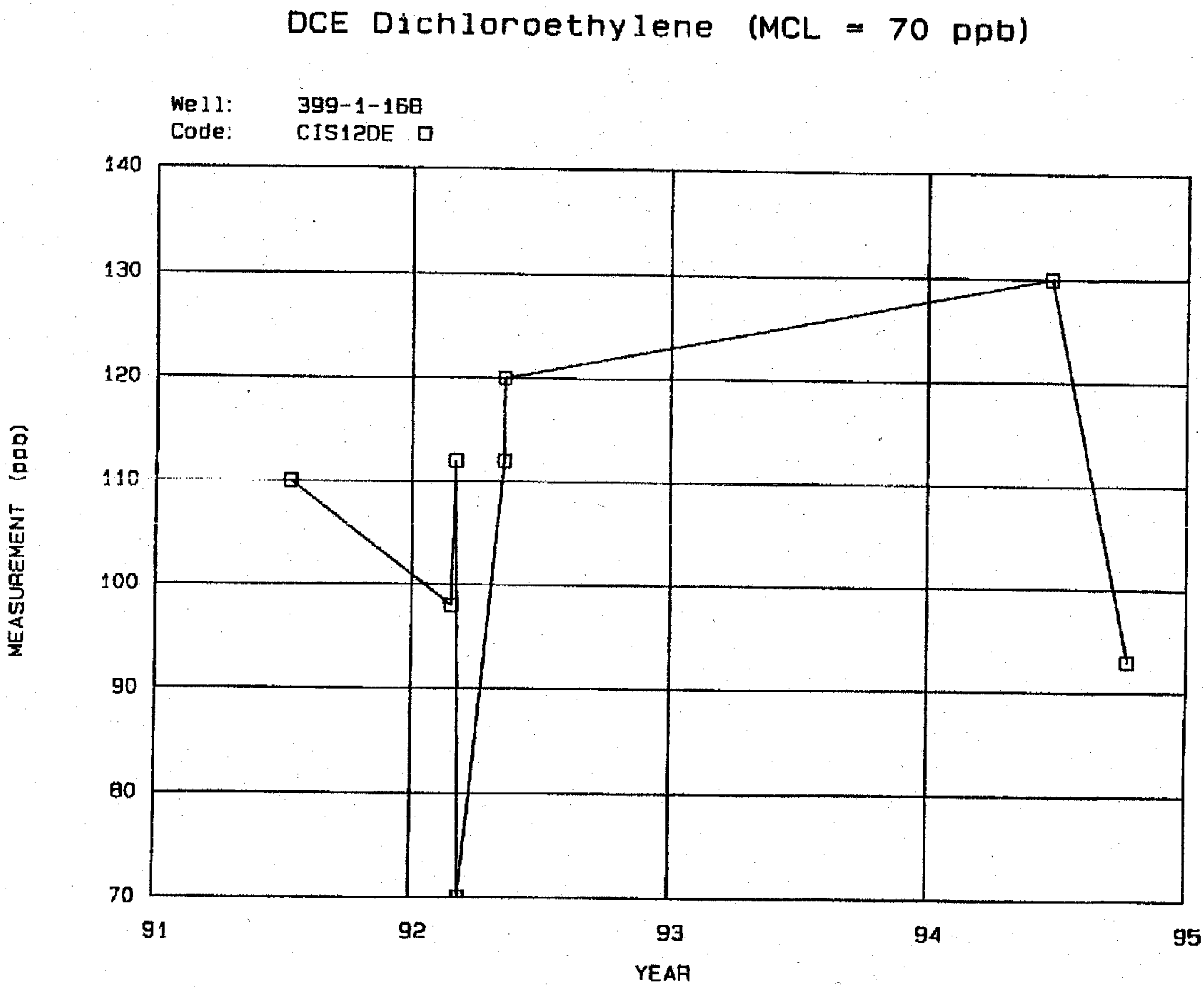

Well: 399-1-17A 399-1-17B
Code: CHLFORM □ CHLFORM ◇
MEASUREMENT (ppb)
0
10
20
30
40
87
88
89
90
91
92
93
94
95
YEAR

Chromium (MCL = 100 ppb)

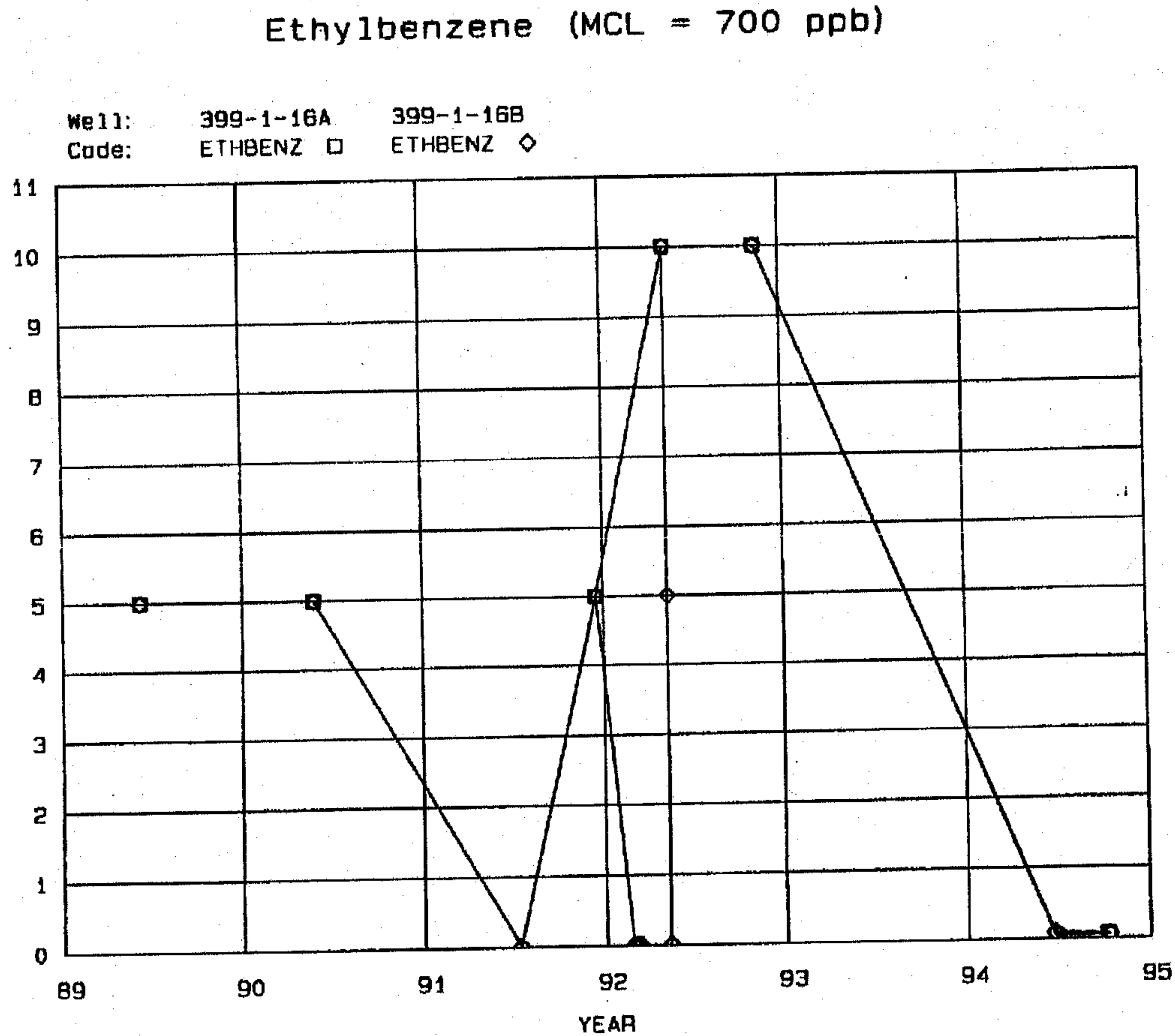


Copper (MCL = 1000 ppb)

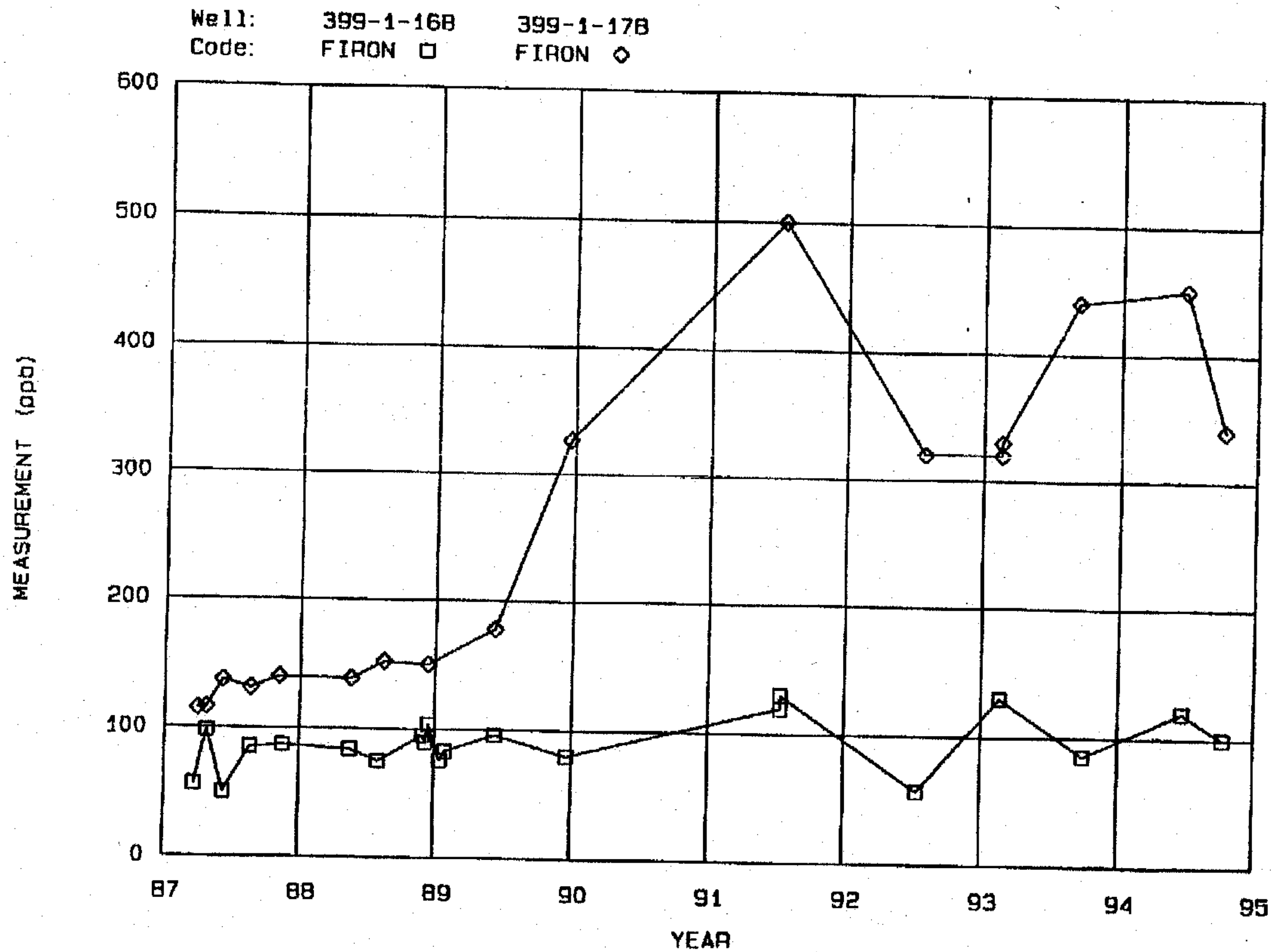




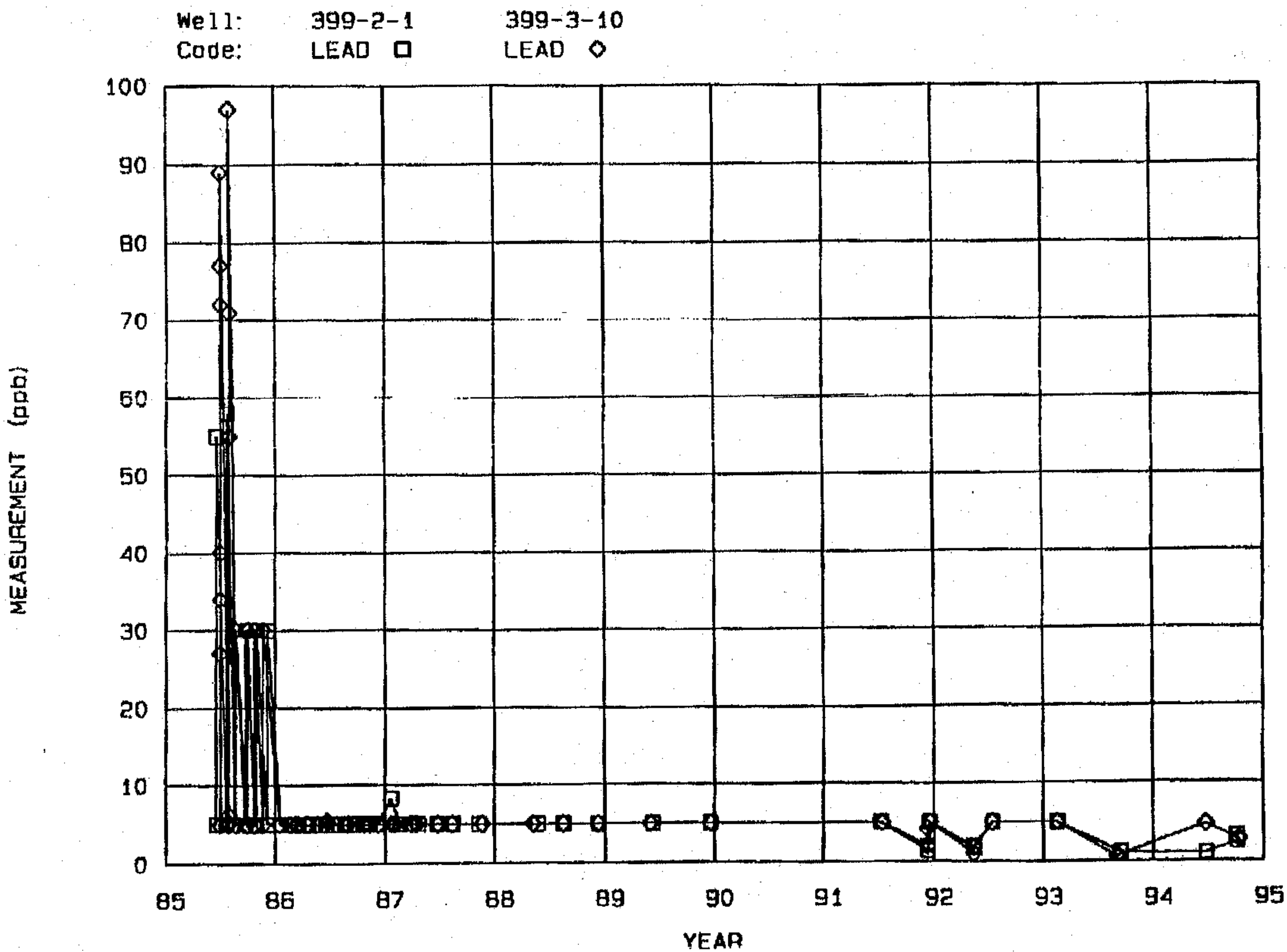
DCE Dichloroethylene (MCL = 70 ppb)
Well: 399-1-16B
Code: CIS12DE
MEASUREMENT (ppb)
140
130
120
110
100
90
80
70
91
92
93
94
95
YEAR


Ethylbenzene (MCL = 700 ppb)
Well: 399-1-16A 399-1-16B
Code: ETHBENZ □ ETHBENZ ◇
MEASUREMENT (ppb)
0
1
2
3
4
5
6
7
8
9
10
11
89
90
91
92
93
94
95
YEAR

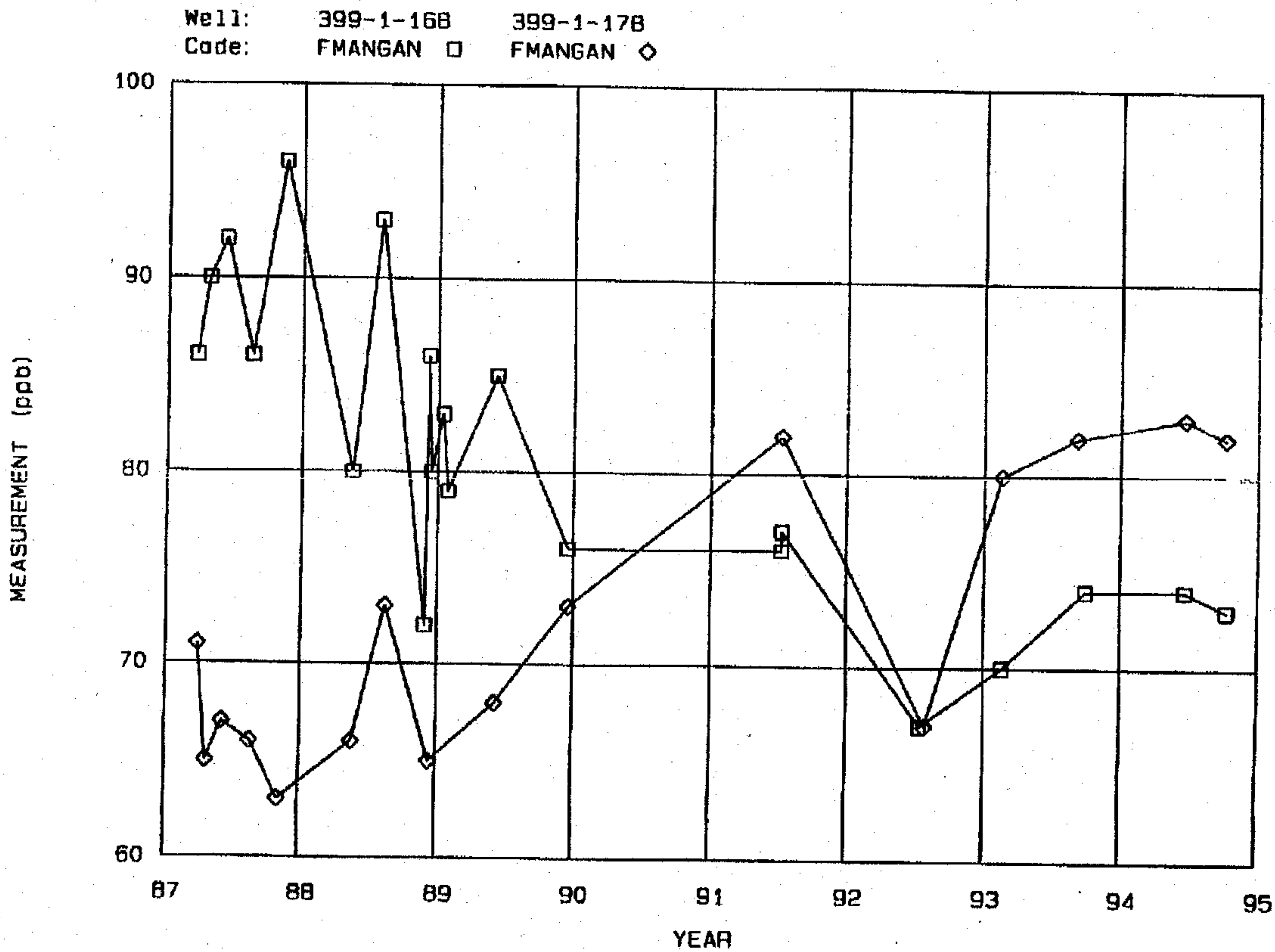
Iron (MCL = 300 ppb)



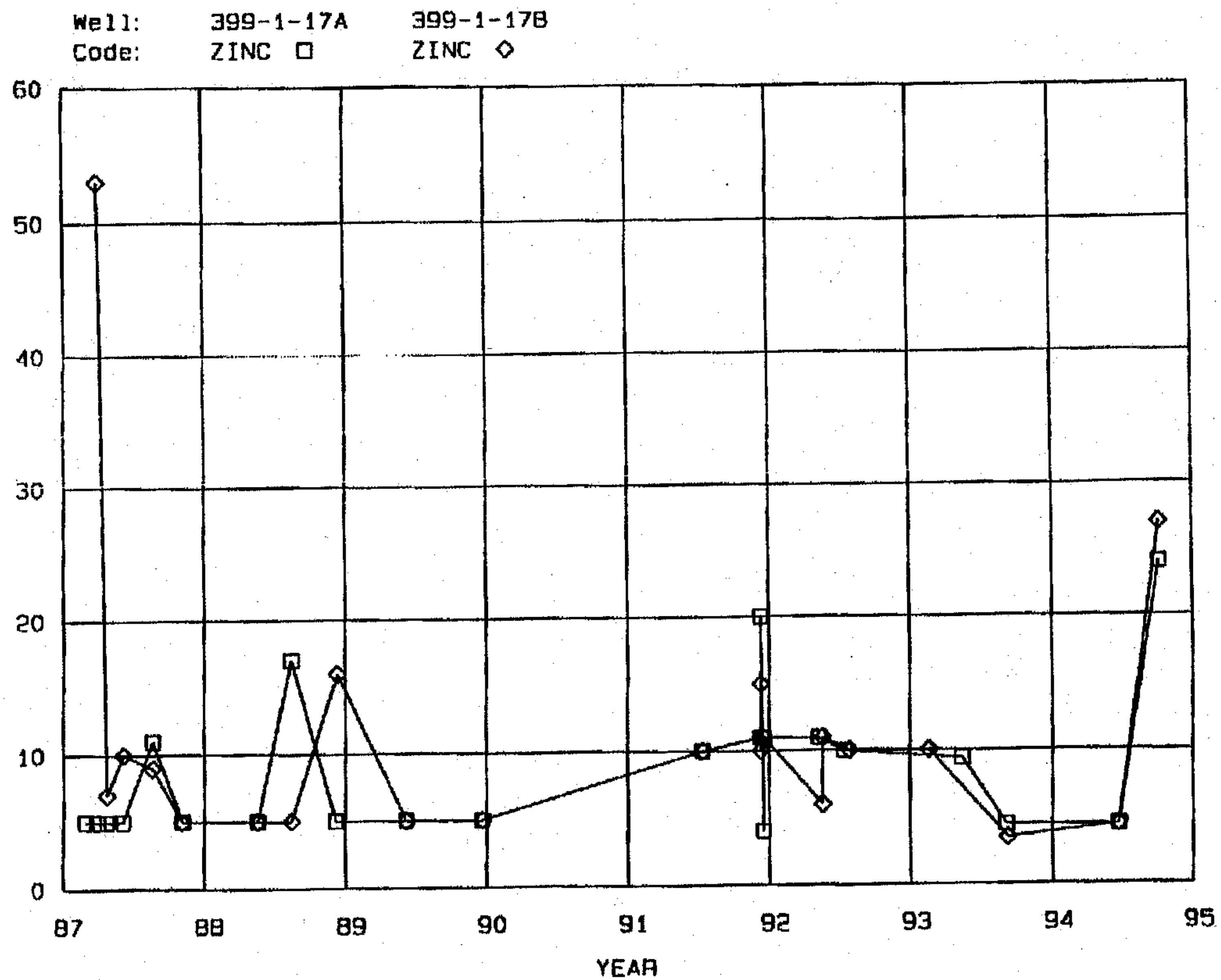
Lead (MCL = 50 ppb)

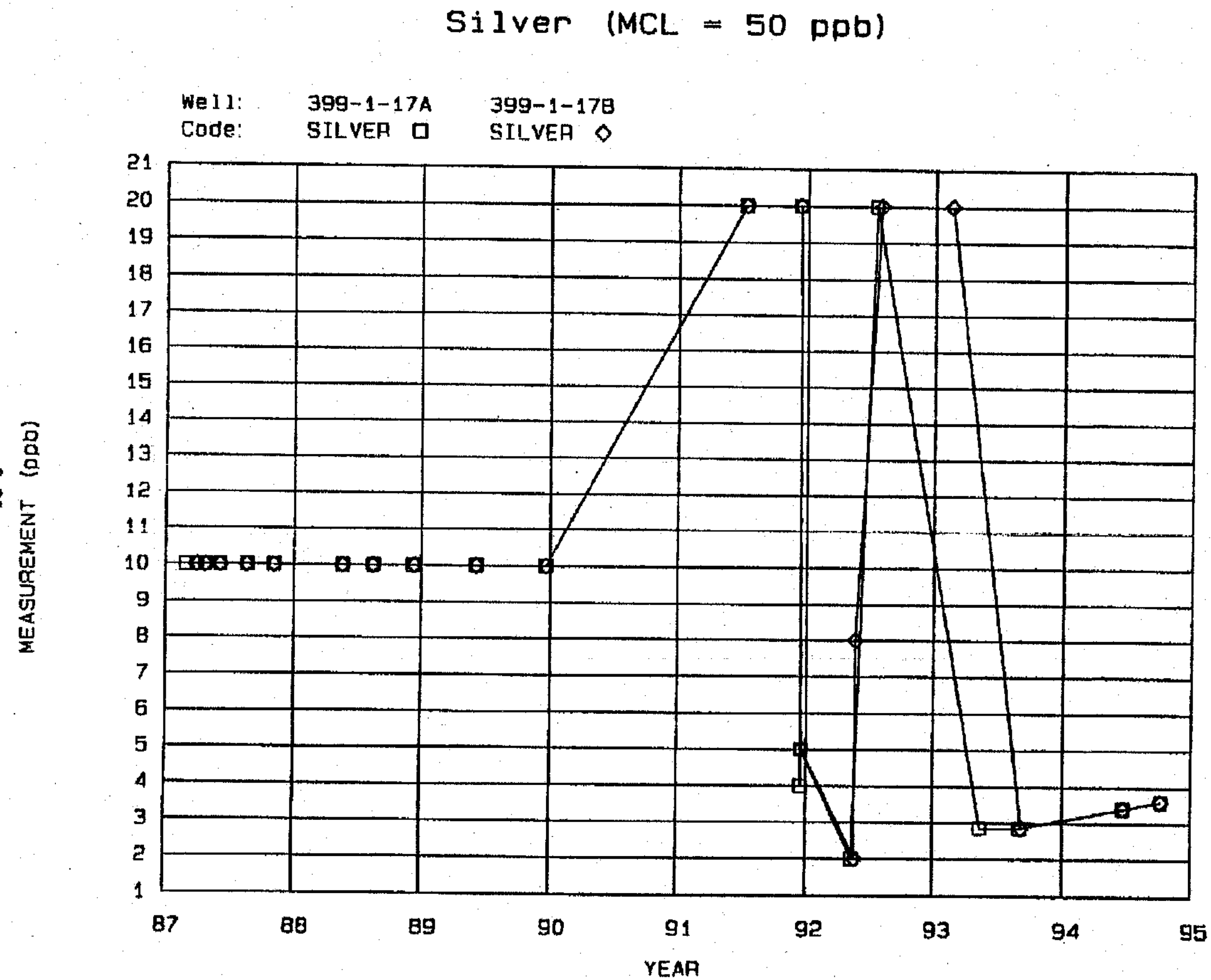


Manganese (MCL = 50 ppb)



Zinc (MCL = 5000 ppb)

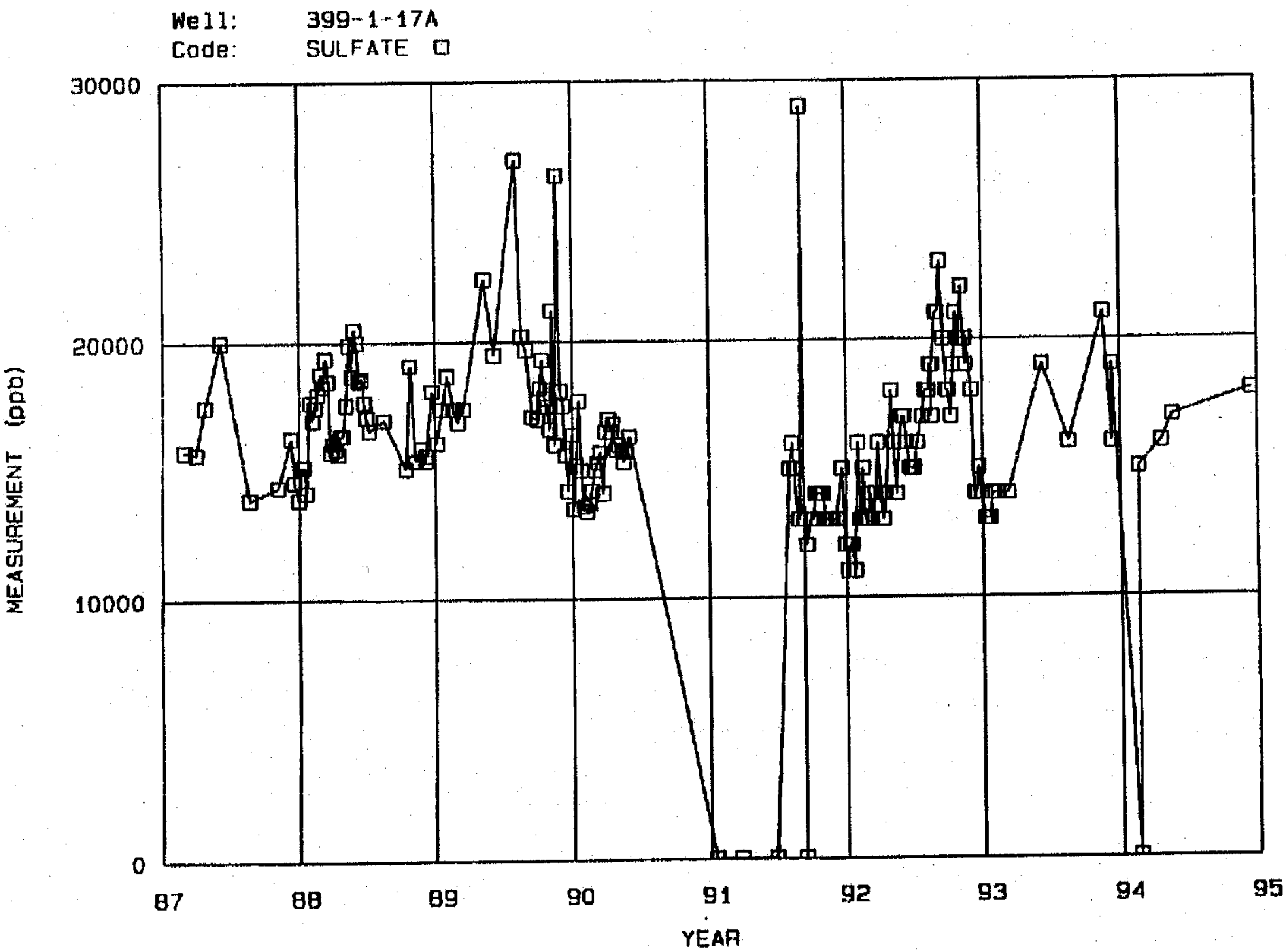




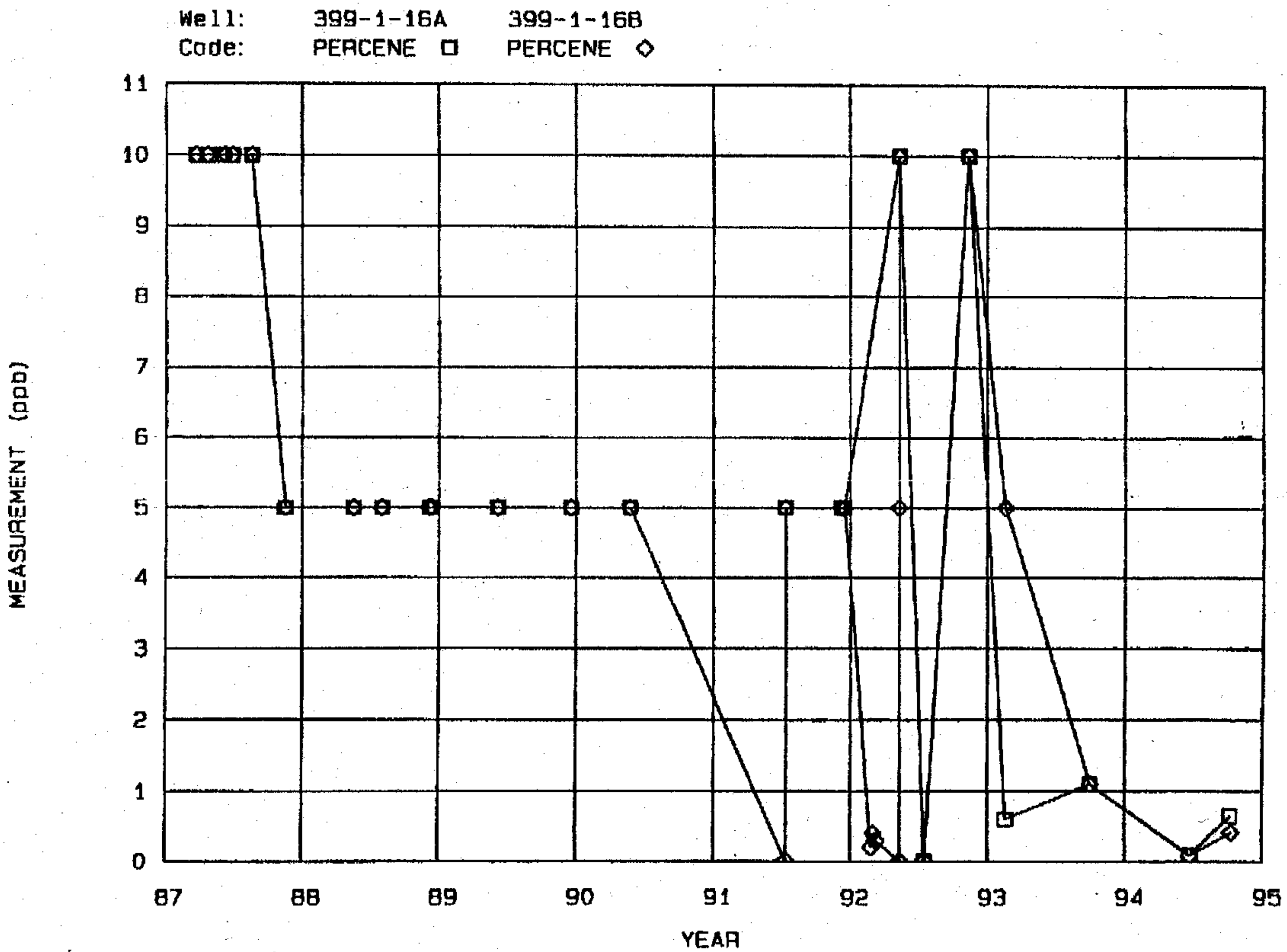
C-26

WHC-SD-EN-AP-185, Rev. 0

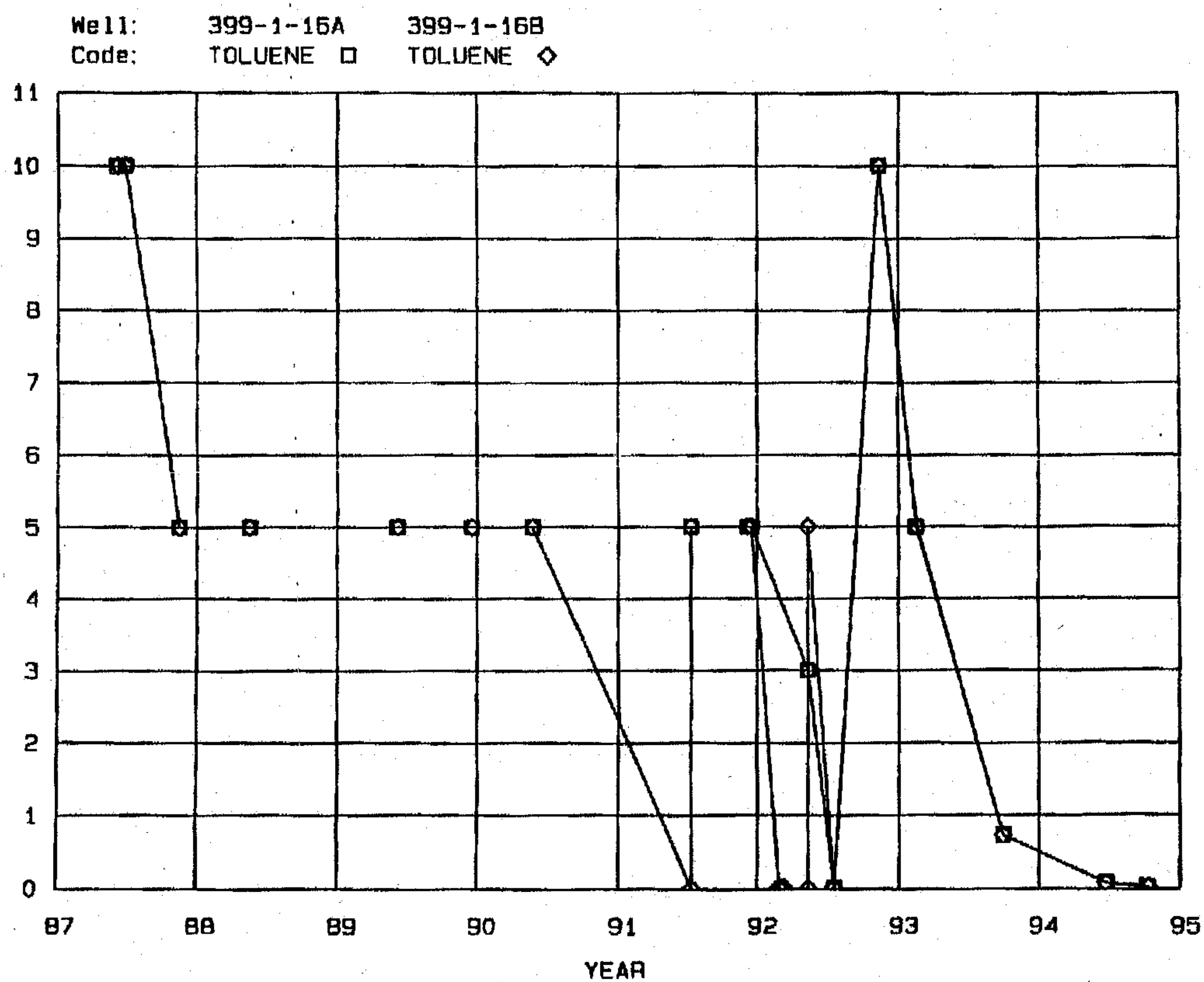
Sulfate (MCL = 250000 ppb)



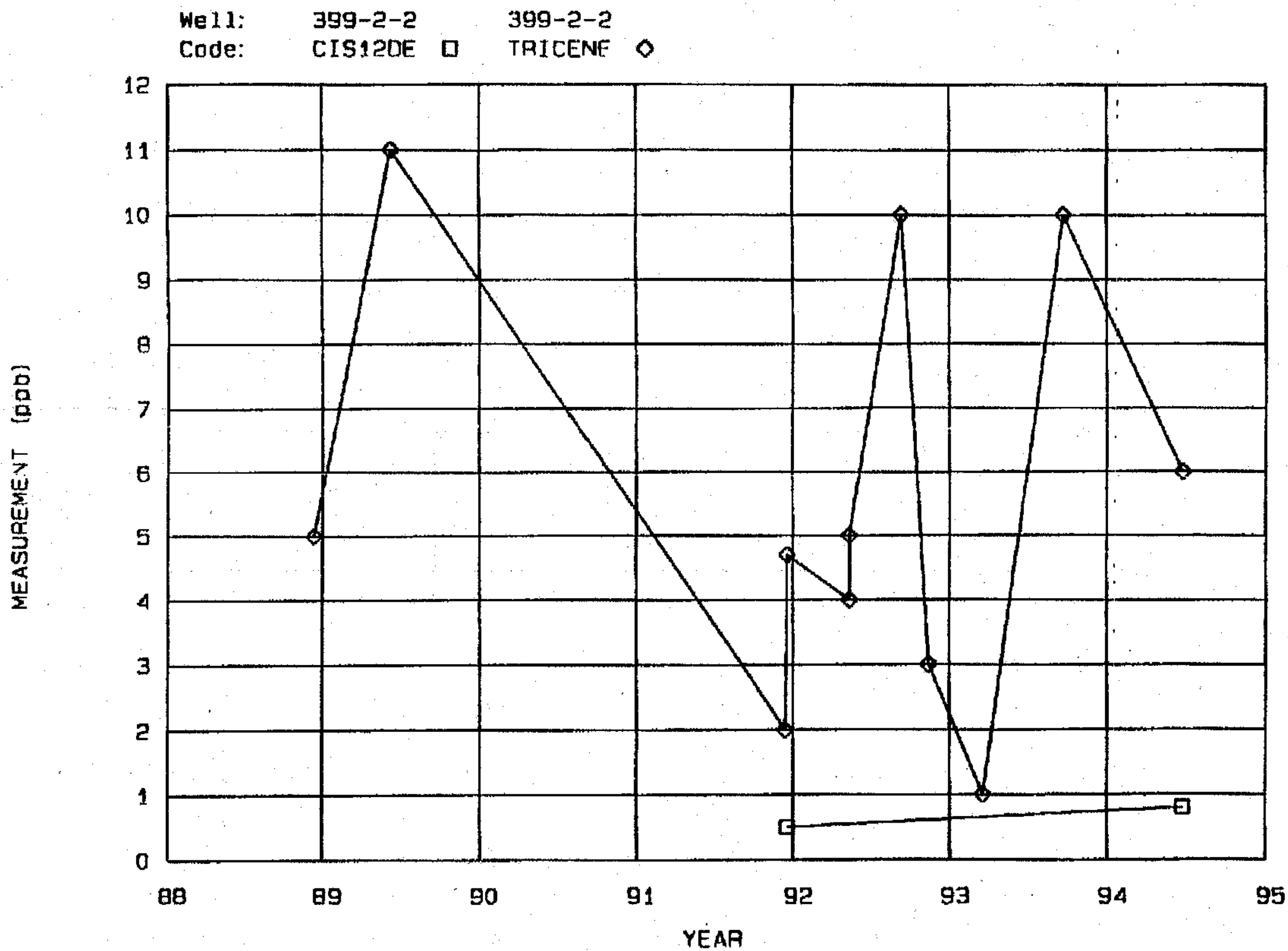
Tetrachloroethene (MCL = 5 ppb)



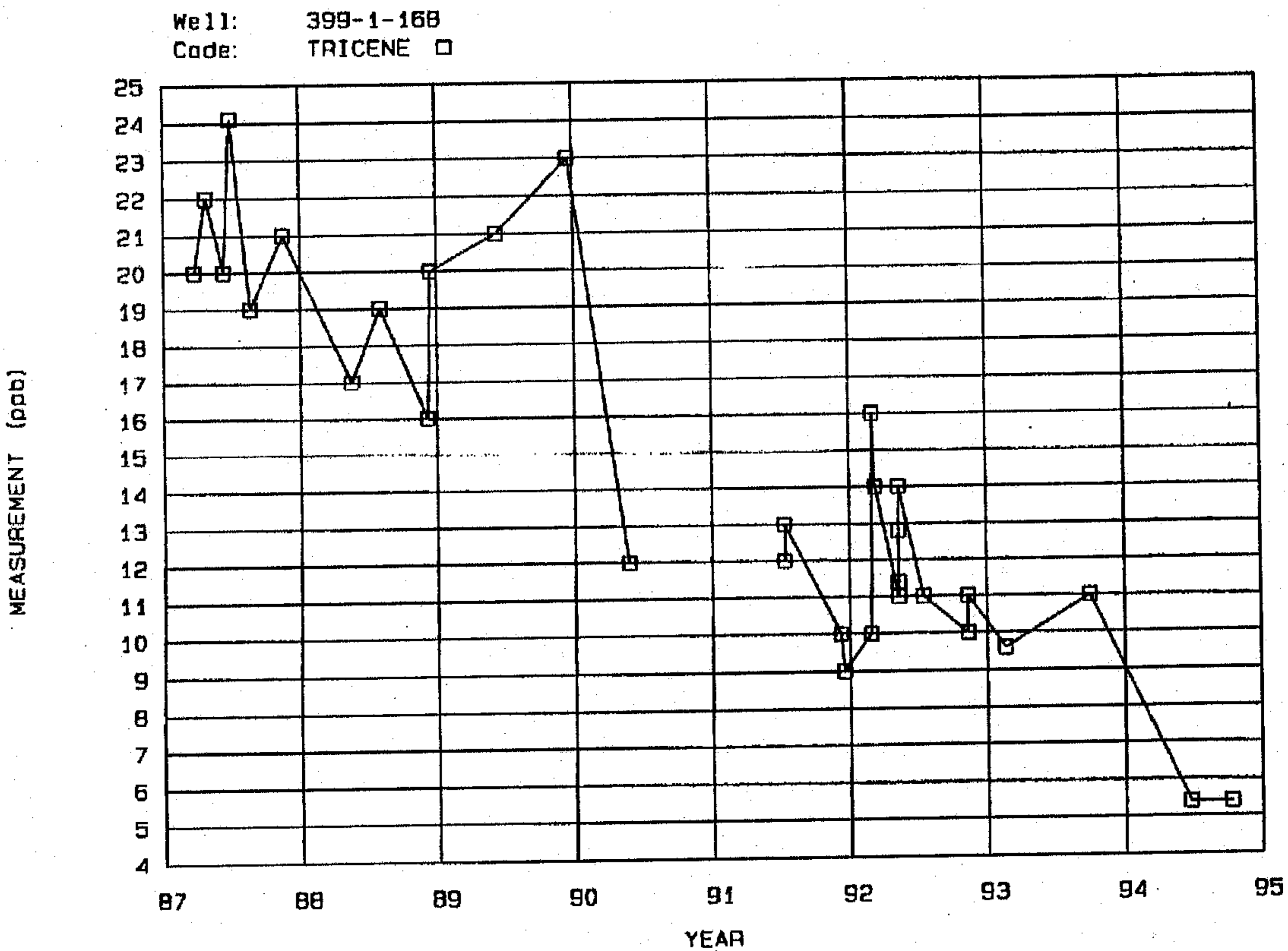
Toluene (MCL = 1000 ppb)



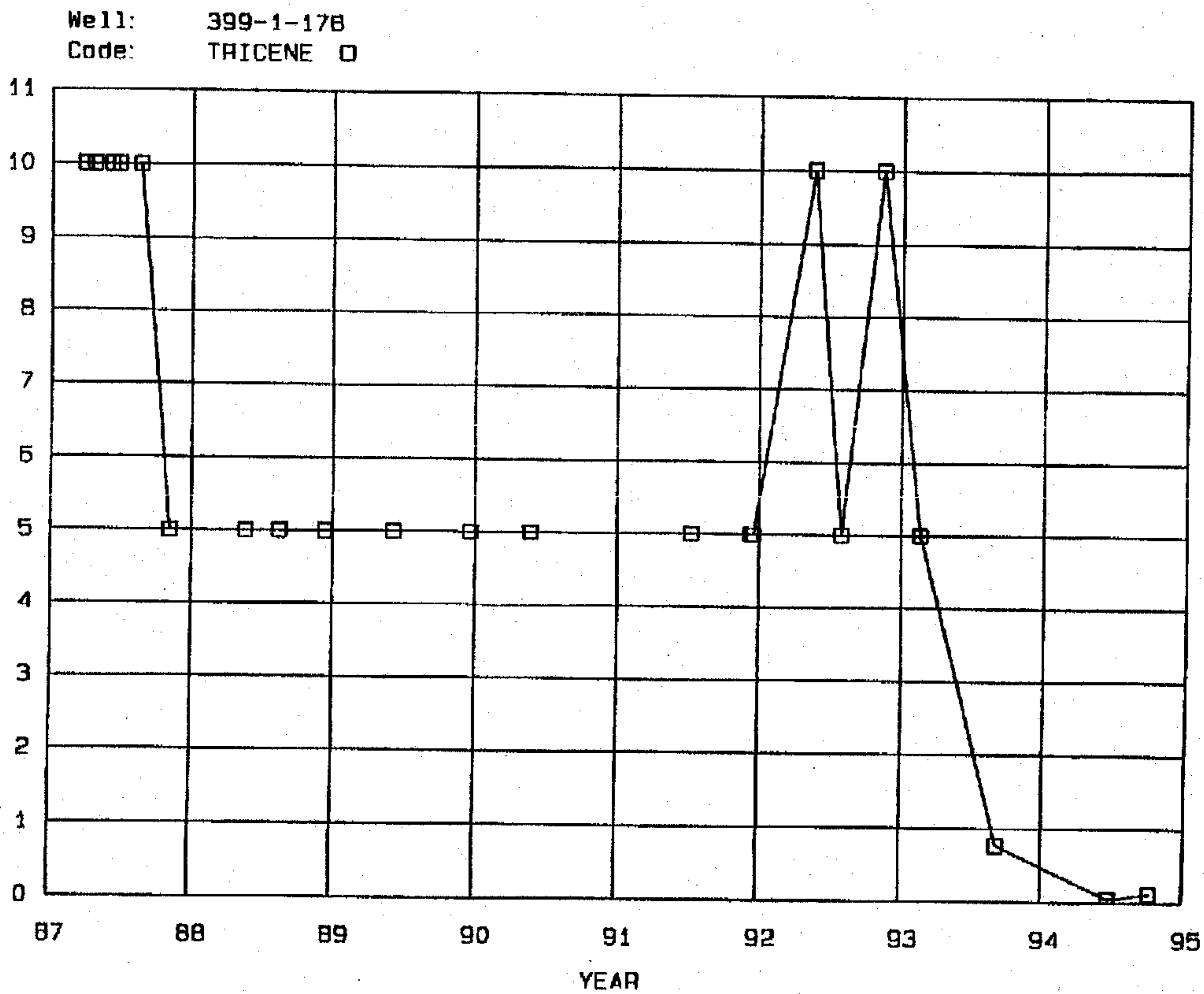
TCE (MCL 5 ppb) DCE (MCL 70 ppb)



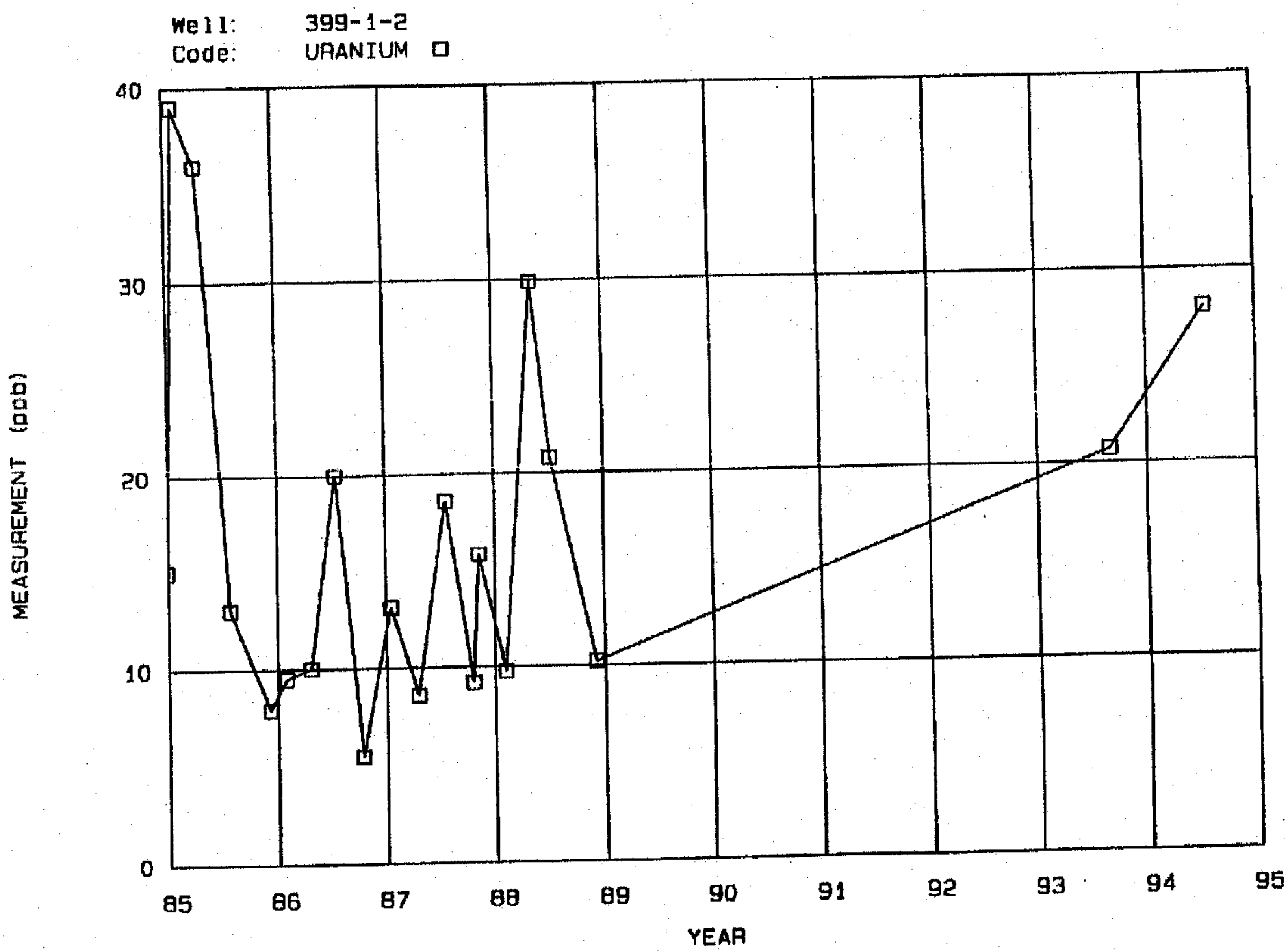
Trichloroethene MCL = 5 ppb



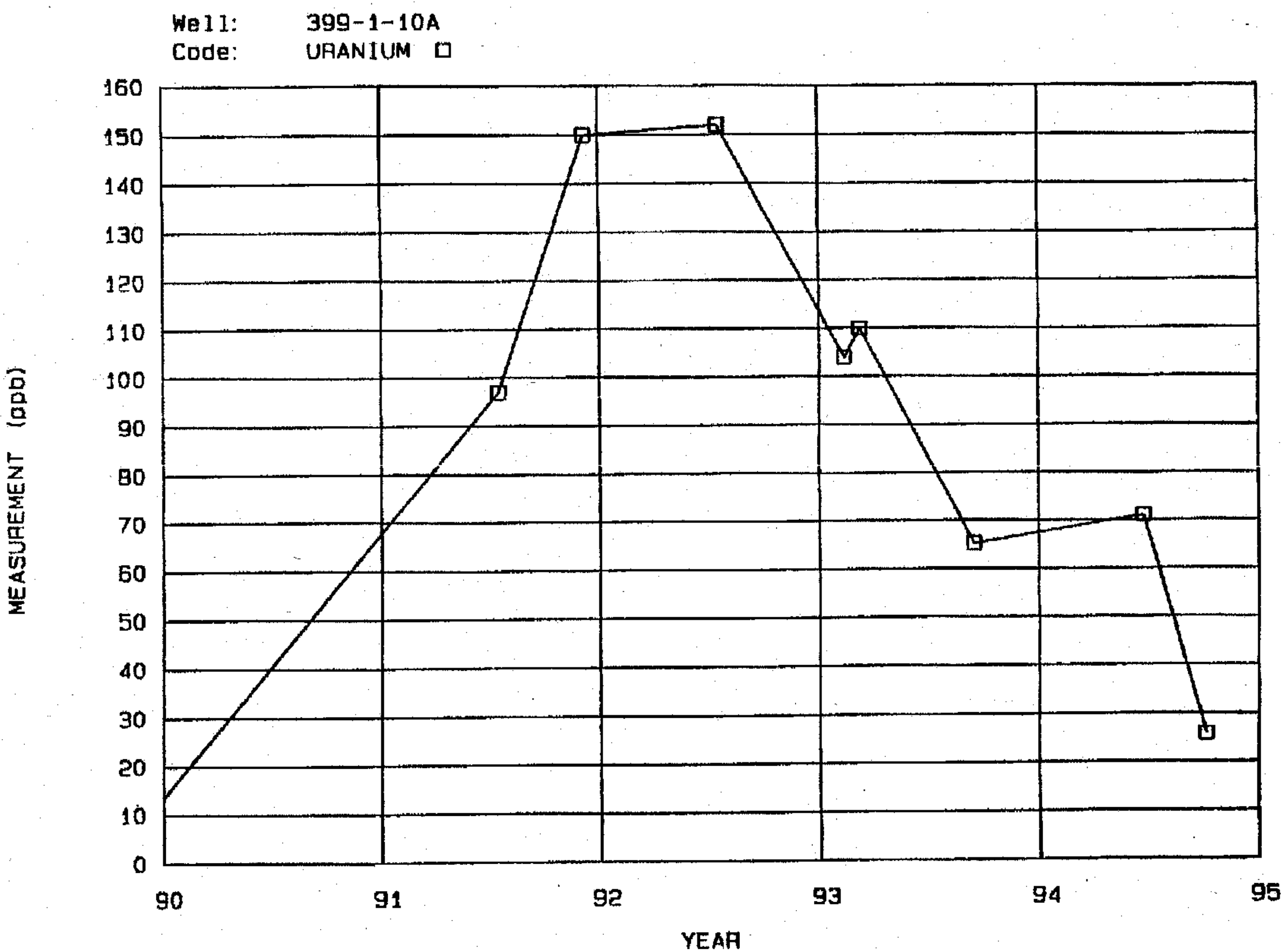
Trichloroethene (MCL = 5 ppb)



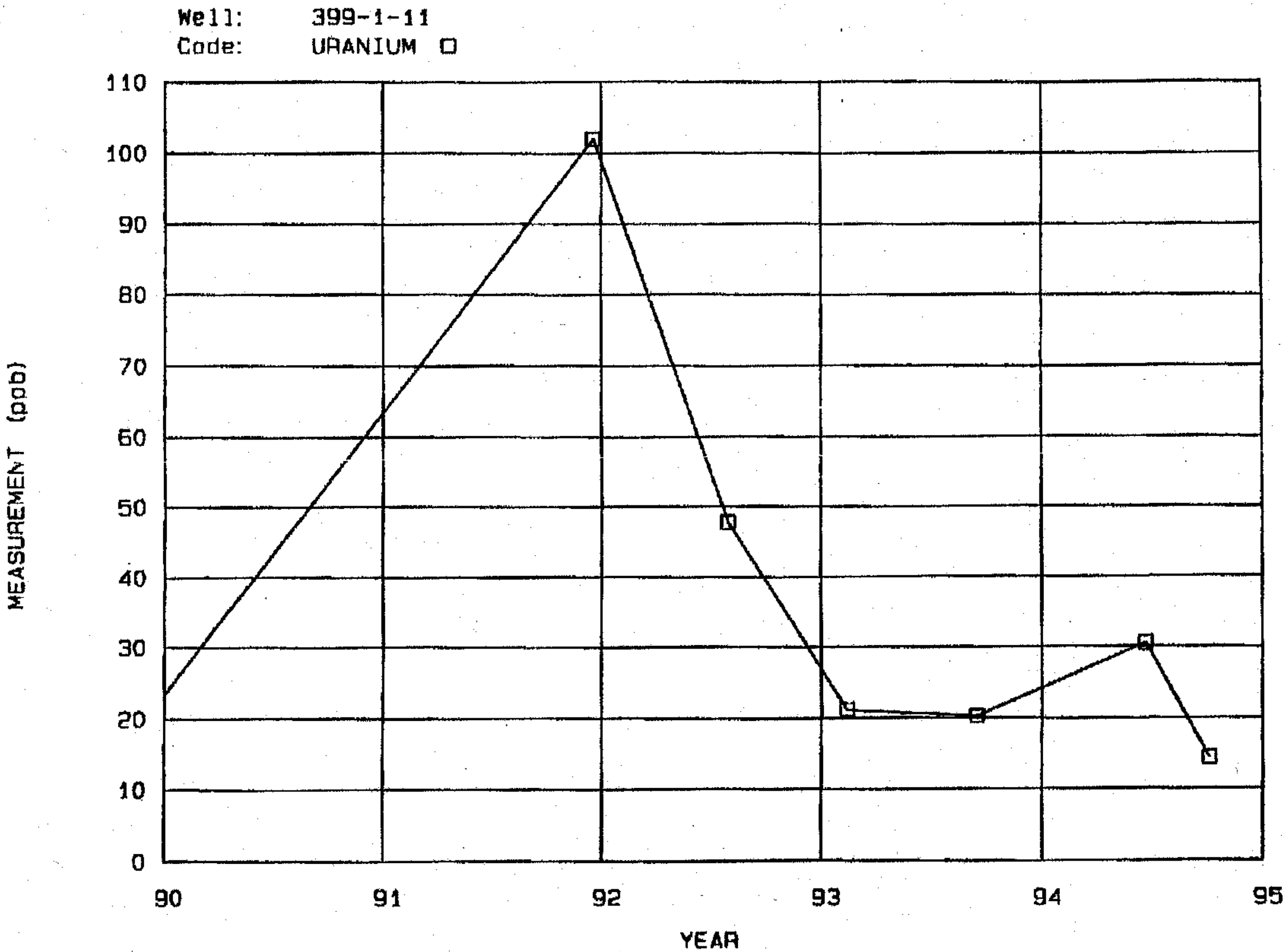
Uranium


Well: 399-1-2
Code: URANIUM
40
30
20
10
0
85
86
87
88
89
90
91
92
93
94
95
YEAR
MEASUREMENT (ppb)

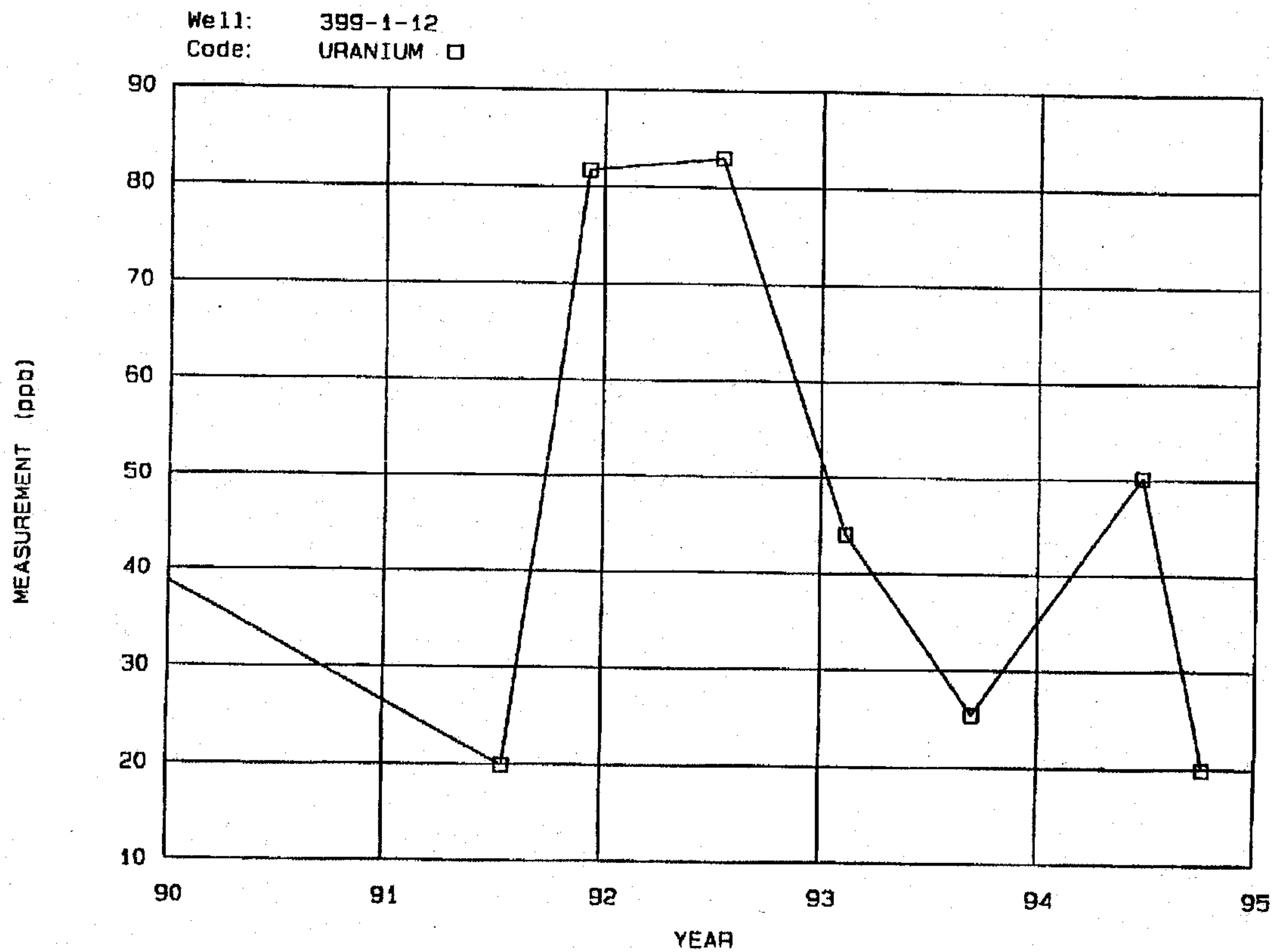
Uranium MCL = 20 ppb



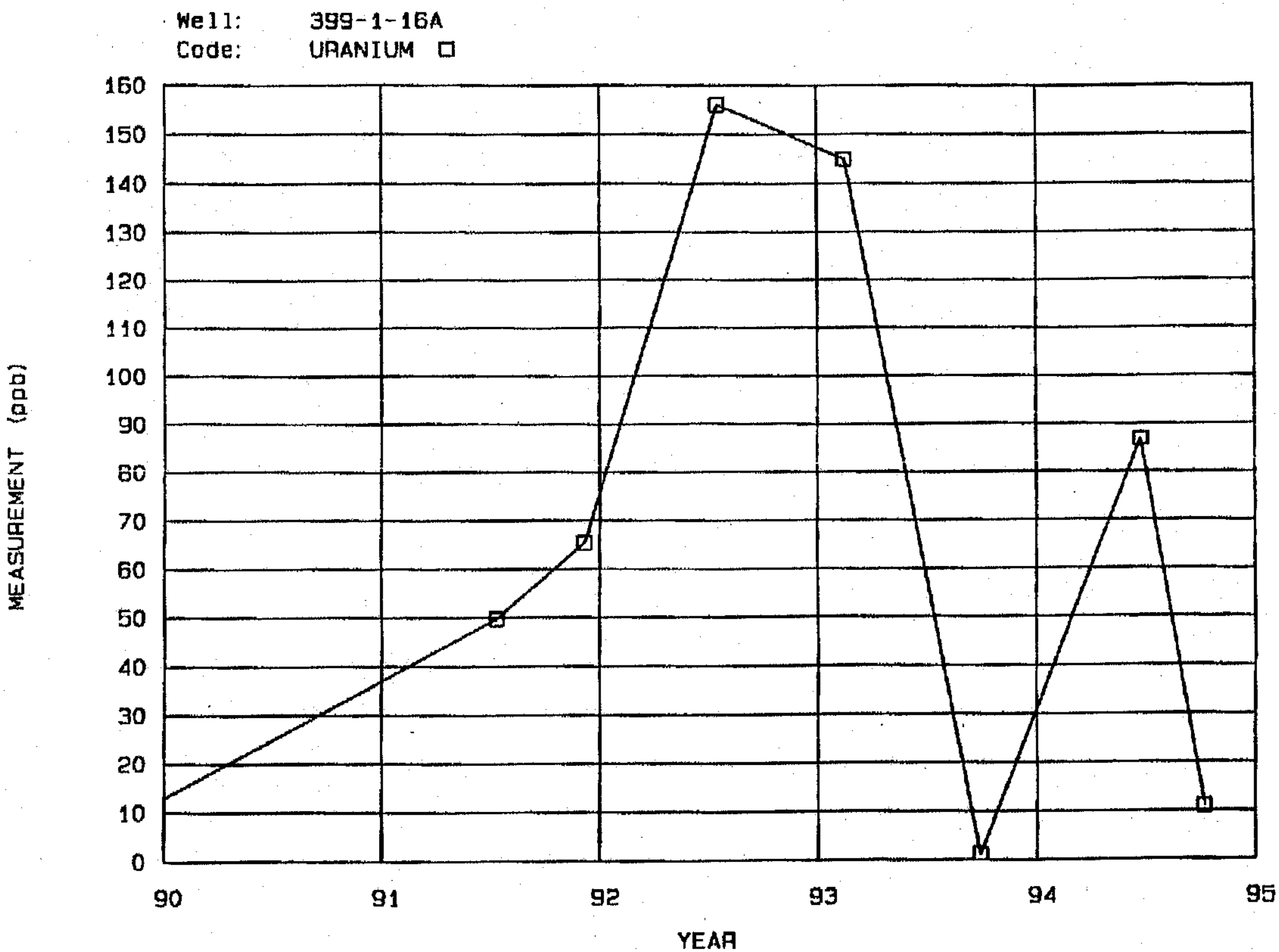
Uranium

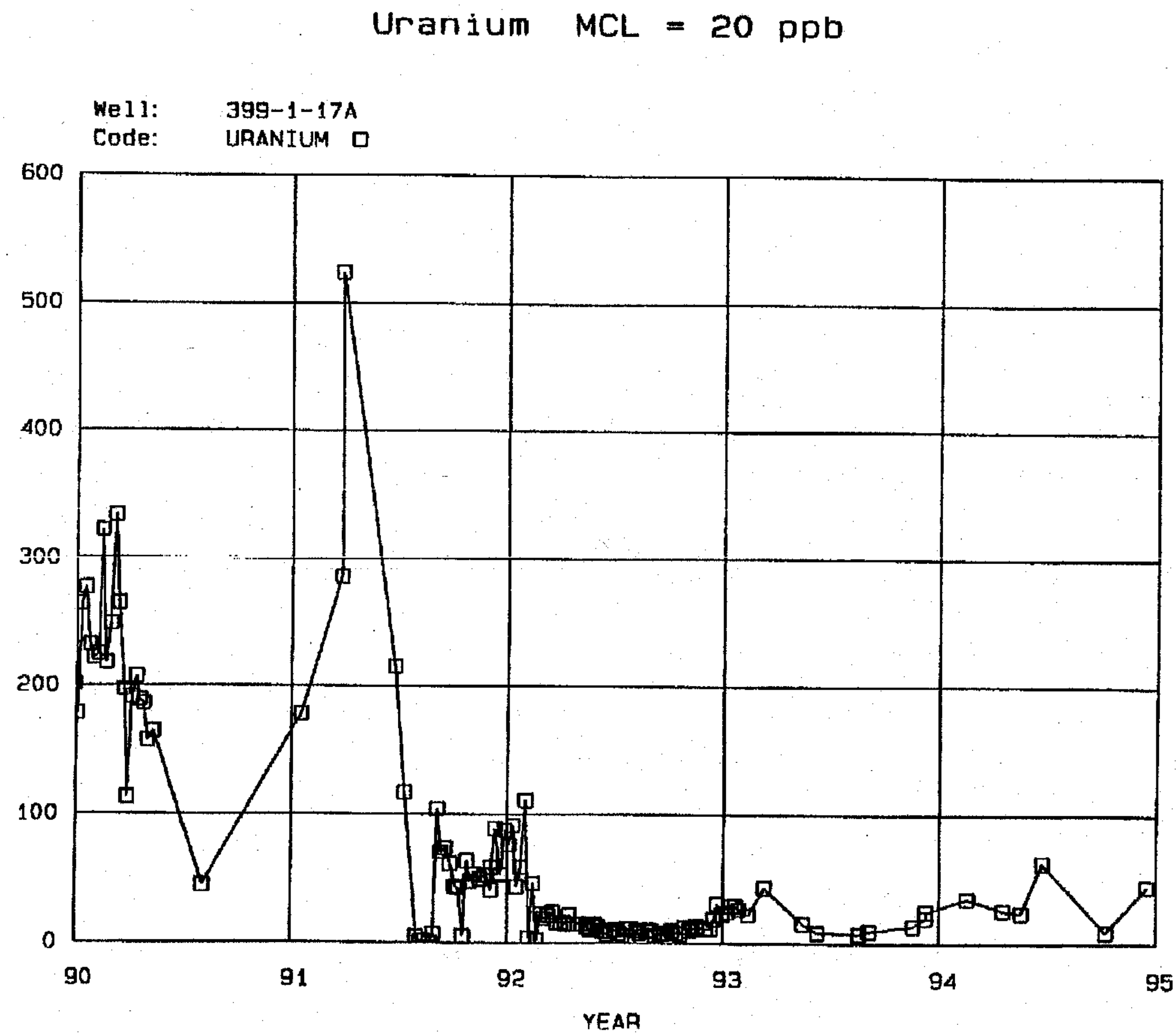

Well: 399-1-11
Code: URANIUM
MEASUREMENT (ppb)
110
100
90
80
70
60
50
40
30
20
10
0
90
91
92
93
94
95
YEAR

Uranium MCL = 20 ppb

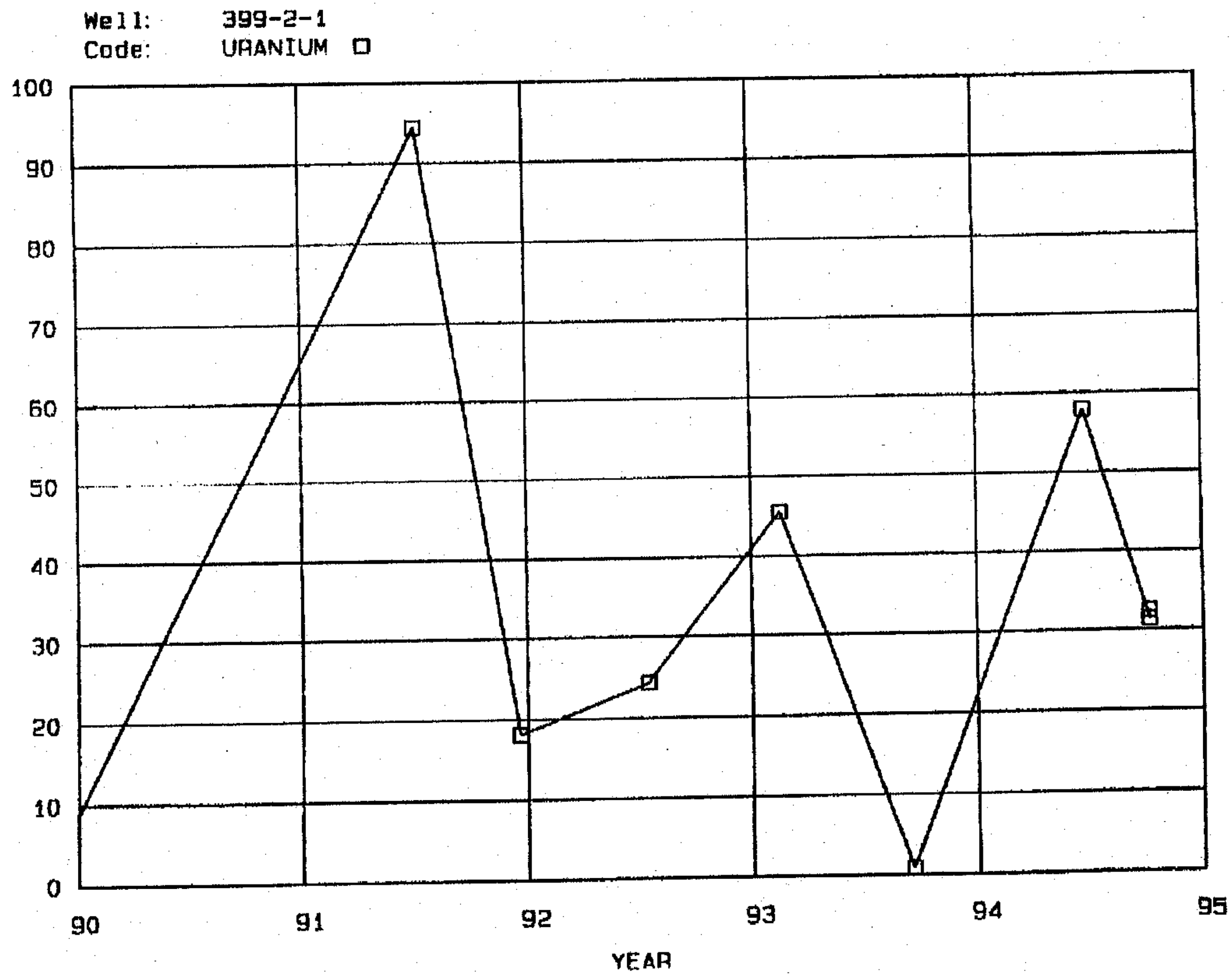


Uranium MCL = 20 ppb

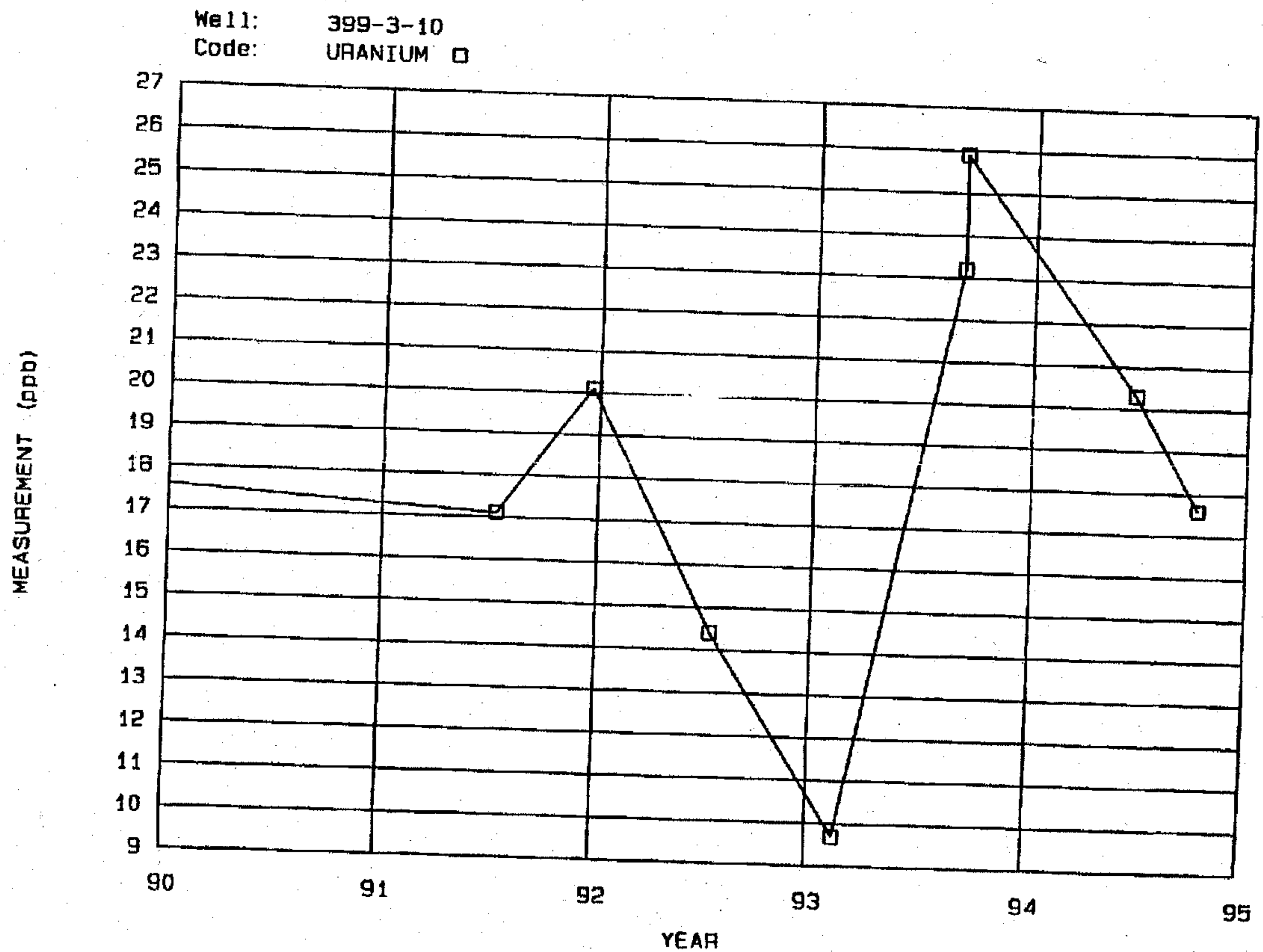



Uranium MCL = 20 ppb
Well: 399-1-17A
Code: URANIUM
600
500
400
300
200
100
0
MEASUREMENT (ppb)
90
91
92
93
94
95
YEAR

Uranium MCL = 20 ppb



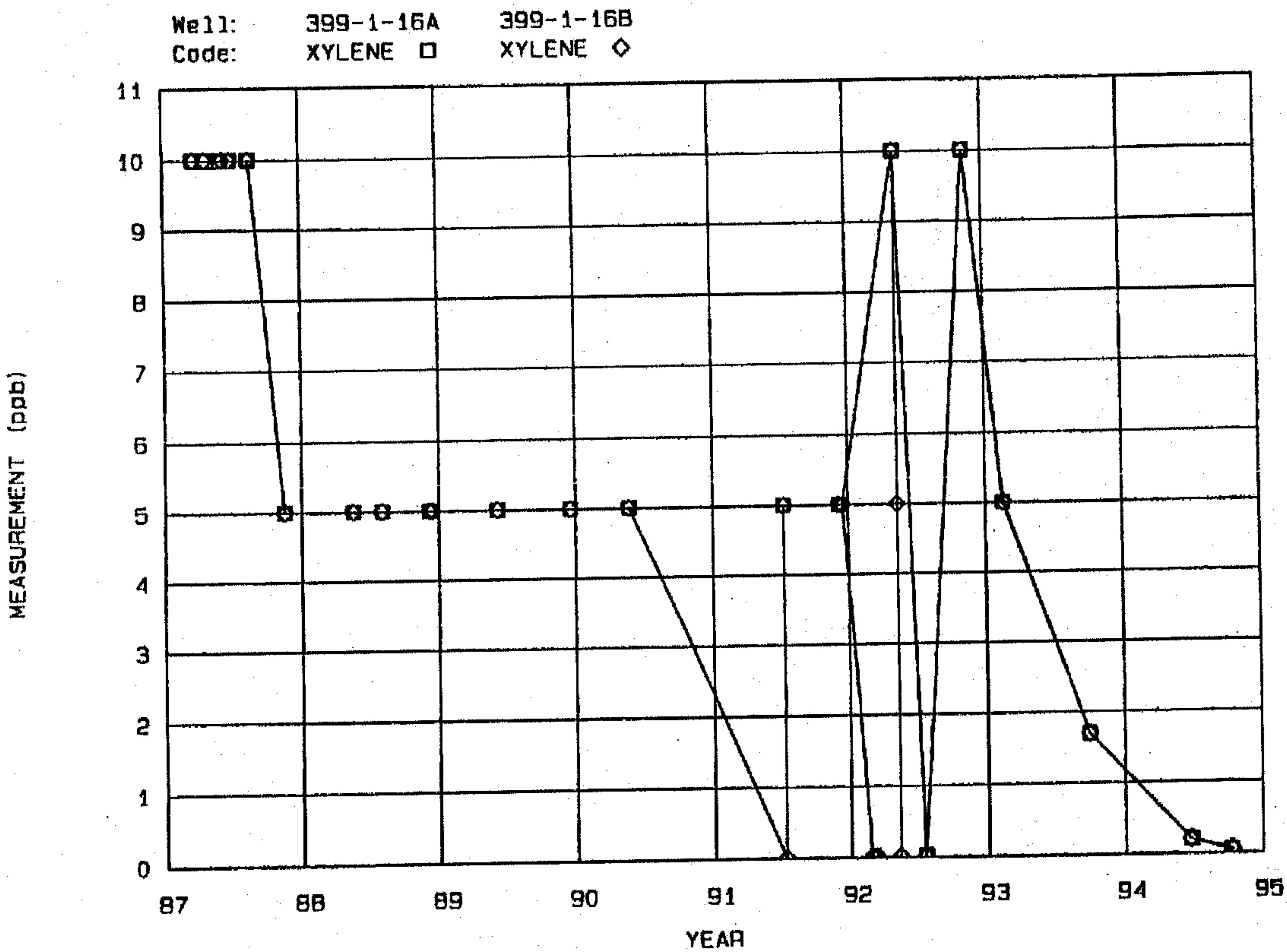
Uranium MCL = 20 ppb



C-40

WHC-SD-EN-AP-185, Rev. 0

Xylene (MCL = 10000 ppb)



This page intentionally left blank.

APPENDIX D

WELL CONSTRUCTION AND COMPLETION SUMMARIES

This page intentionally left blank.

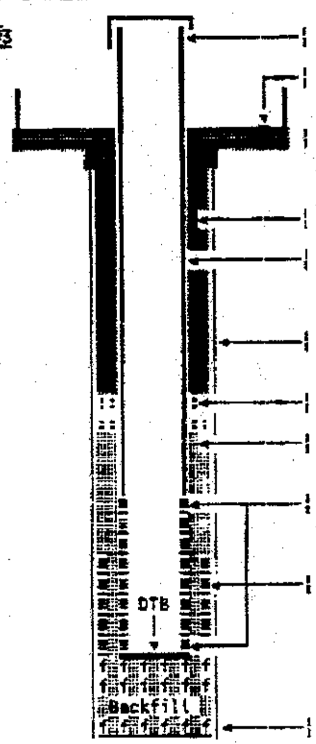
WELL CONSTRUCTION AND COMPLETION SUMMARY

Drilling Method: Cable tool	Sample Method: Drive barrel	WELL NUMBER: 399-1-10A; TEMPORARY WELL NO: S-3
Drilling Fluid Used: 300 Area Water Supply	Additives Used: Not documented	Hanford Coordinates: N/S S 22,293; E/W E 14,413
Driller's Name: Gordon	WA State Lic Nr: 0079	State Coordinates: RN 57,083.8; RE 16,018.6 / N Not documented E Not doc
Drilling Company: Associated Drillers	Company Location:	Start Card #: Not documented T___ R___ S___
Date Started: 13Nov86	Date Complete: 22Nov86	Elevation Ground surface: 371.94-ft Brass cap

Depth to water: 29.0-ft Nov86
(Ground surface) 29.4-ft 17Dec93

GENERALIZED STRATIGRAPHY | Geologist's Log

0-10: Coarse to medium SAND
10-20: Sandy GRAVEL
20-30: Silty, sandy GRAVEL
30-35: Silty, sandy PEBBLES



- Elevation of reference point: [373.65-ft] (top of casing)
- Height of reference point above ground surface [1.71-ft]
- Depth of surface seal [0-13.5-ft]
- Type of surface seal: Portland cement 4-ft x 4-ft x 6-in(nom) extending 3-ft into annulus.
- Bentonite crumbles to 13.5-ft
- 6-in ID stainless steel casing, +1.7-24.5-ft
- Hole diameter, 0-45.0-ft, 11-in nominal
- Volclay bentonite pellets, 13.5-18.5-ft
- Silica sand pack, 18.5-39.5-ft, 8-12-mesh
- 6-in stainless steel screen 24.5-39.5-ft, #40-slot
- 10-in telescoping screen, 29.5-39.5-ft
- DTB=Depth to bottom, 39.1-ft, 12Feb92
- Borehole drilled depth: [45.0-ft]

Drawing By: RKL/3-01-10A.ASB
Date : 12Jan94
Reference : HANFORD WELLS WHC-SD-EN-DP-071

WELL CONSTRUCTION AND COMPLETION SUMMARY

Drilling Method: Cable tool
Drilling Fluid Used: Raw water
Driller's Name: D Rossman
Drilling Company: Kaiser Engineers
Date Started: 06Sep91

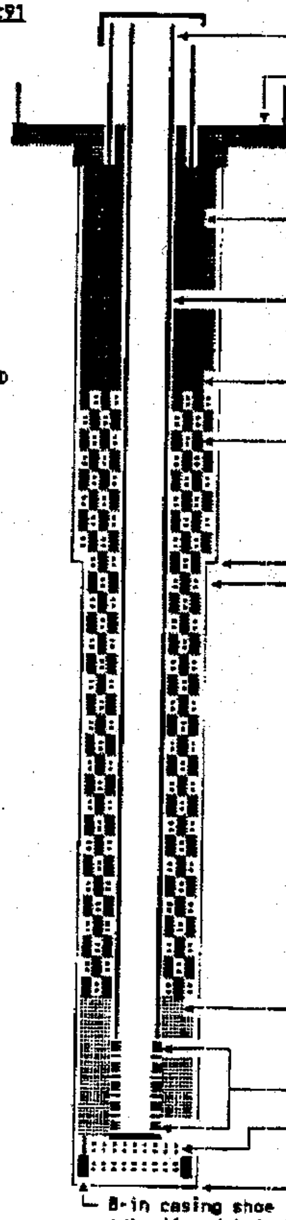
Sample Method: Drive barrel
Additives Used: Not documented
WA State Lic Nr: Not documented
Company Location: Hanford
Date Complete: 08Oct91

WELL NUMBER: 399-1-10B
TEMPORARY WELL NO: 1-10B
Hanford Coordinates: N/S Not documented E/W Not doc
State NAD83 Coordinates: RN 57,067.3 RE 16,033.3
N 116,729.06m E 594,351.09m
Start Card #: Not documented T___ R___ S___
Elevation Ground surface: 372.47-ft Brass cap

Depth to water: 37.7-ft 08Oct91
(Ground surface)

GENERALIZED STRATIGRAPHY
Geologist's Log

0-8: SAND
8-10: Silty SAND
10-35: Gravelly silty SAND
35-39.4: Sandy GRAVEL
39.4-49.6: Gravelly SAND
49.6-54.7: Sandy GRAVEL
54.7-72: Gravelly SAND
72-73: SILT
73-79.8: Gravelly SAND
79.8-80.1: Gravelly SILT
80.1-98: Gravelly SAND
98-109.8: Slightly gravelly SAND
109.8-113: Gravelly SAND
113-119: SILT



Elevation of reference point: [375.58-ft]
(top of inner casing)
Height of reference point above ground surface [3.11-ft]

Depth of surface seal [0-20.3-ft]
Type of surface seal:
4-ft x 4-ft concrete surface pad extends 2.5-ft into annulus
Portland cement grout to 20.3-ft

4-in ID T304 stainless steel casing, +1.5-104.5-ft

Bentonite crumbles, 20.3-28.2-ft

Bentonite slurry, 28.2-99.0-ft

Hole diameter,
0-53.0-ft, 10.95-in
53.0-119.0-ft, 8.8-in

Silica sand pack,
99.0-100.8-ft, 40-100-mesh
100.8-114.4-ft, 20-40-mesh

4-in T304 stainless steel screen, 104.5-114.5-ft, #10-slot

Bentonite hole plug, 115.3-119.0-ft

Borehole drilled depth: [119.0-ft]

8-in casing shoe cut off and left in hole, ~117.0-119.0-ft

Drawing By: RKL/3-01-10B.ASB
Date: 31Jan94
Reference: HANFORD WELLS WHC-SD-EN-TI-052

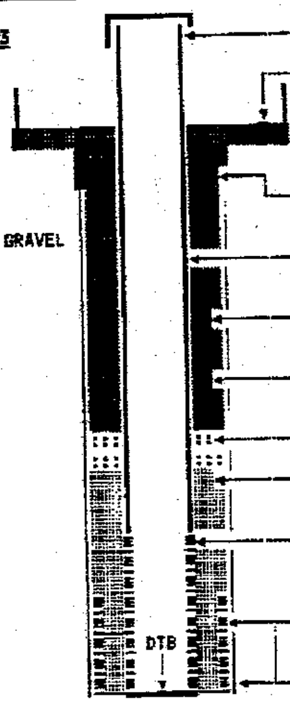
WELL CONSTRUCTION AND COMPLETION SUMMARY

Drilling Method: Cable tool	Sample Method: Drive barrel	WELL NUMBER: 399-1-16A TEMPORARY WELL NO: C-1A
Drilling Fluid Used: 300 Area Water Supply	Additives Used: Not documented	Hanford Coordinates: N/S S 23,341 E/W E 14,304
Driller's Name: Amos	WA State Lic Nr: 1224	State Coordinates: RN 56,035.6 RE 15,910.1
Drilling Company: Associated Drillers	Company Location:	Coordinates: N Not documented E Not documented
Date Started: 01Dec86	Date Complete: 04Dec86	Start Card #: Not documented T___ R___ S___
		Elevation Ground surface: 380.21-ft Brass cap

Depth to water: 40.0-ft Dec86
(Ground surface) 38.1-ft 17Dec93

GENERALIZED STRATIGRAPHY   Geologist's Log

0-15: Silty, sandy GRAVEL
15-20: Clayey, sandy GRAVEL
20-30: Silty, sandy GRAVEL
30-35: Silty, gravelly SAND
35-45: Silty SAND with CLAY and GRAVEL
45-TD: Silty, gravelly SAND



Elevation of reference point: [381.51-ft]
(top of casing)
Height of reference point above [1.30-ft]
ground surface

Depth of surface seal [0-5.0-ft]
Type of surface seal:
4-ft x 4-ft concrete surface pad
Cement to 5.0-ft

6-in ID stainless steel casing,
+1.3-32.5-ft

Bentonite crumbles,
5.0-21.0-ft

Hole diameter,
0-47.5-ft, 11-in nominal

Bentonite pellets,
21.0-24.8-ft

Silica sand pack,
24.8-47.5-ft, 10-20-mesh

6-in stainless steel screen,
32.5-47.5-ft, #20-slot

10-in telescoping screen,
37.5-47.5-ft, #40-slot

Borehole drilled depth: [47.5-ft]

DTB=Depth to bottom,
47.8-ft, 04Dec90

Drawing By: RKL/3-01-16A.ASB
Date : 12Jan94
Reference : HANFORD WELLS
WHC-SD-EN-DP-071

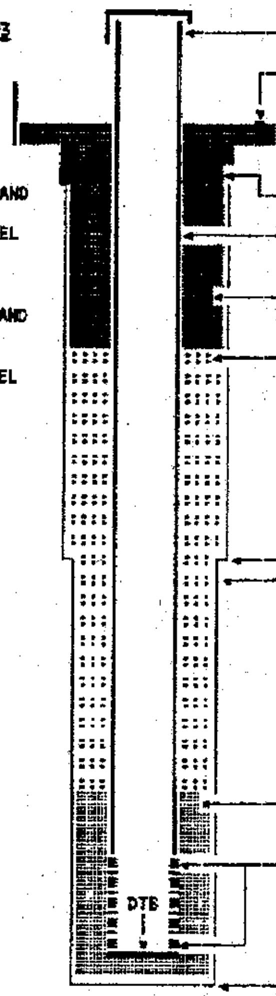
WELL CONSTRUCTION AND COMPLETION SUMMARY

Drilling Method: Cable tool	Sample Method: Drive barrel	WELL NUMBER: 399-1-16B TEMPORARY WELL NO: C-10
Drilling Fluid Used: 300 Area Water Supply	Additives Used: Not documented	Hanford Coordinates: N/S S 23,350 E/W E 14,326
Driller's Name: Gordon/Amos	WA State Lic Nr: 1517/1224	State Coordinates: N RN 56,026.9 Not documented E RE 15,931.6 Not doc
Drilling Company: Associated Drillers	Company Location:	Start Card #: Not documented T___ R___ S___
Date Started: 29Jan87	Date Complete: 10Feb87	Elevation Ground surface: 380.03-ft Brass cap

Depth to water: 37.5-ft Feb87
(Ground surface) 37.8-ft 17Dec93

GENERALIZED STRATIGRAPHY   Geologist's Log

0-10: Sandy GRAVEL
10-35: Silty, sandy GRAVEL
35-45: Gravelly, silty, clayey SAND
45-60: Silty, sandy GRAVEL
60-65: Clayey, silty, sandy GRAVEL
65-75: Silty, gravelly SAND
75-80: Silty, sandy GRAVEL
80-85: Clayey, sandy GRAVEL
85-90: Gravelly, silty, clayey SAND
90-95: Sandy GRAVEL
95-110: Silty, sandy GRAVEL
110-TD: Clayey, silty sandy GRAVEL



Elevation of reference point: (top of casing) [381.14-ft]
Height of reference point above ground surface [1.11-ft]
Depth of surface seal [0-5.0-ft]
Type of surface seal: 4-ft x 4-ft surface pad
Cement to 5.0-ft
6-in ID stainless steel casing, +1.1-105.0-ft
Bentonite crumbles, 5.0-26.0-ft
Volclay tablets, 26.0-99.7-ft
Hole diameter, 0-60.0-ft, 13-in nominal
60.0-118.0-ft, 11-in nominal
Silica sand pack, 99.7-118.0-ft, 8-12-mesh
6-in stainless steel screen, 105.0-115.0-ft, #20-slot
Borehole drilled depth: [118.0-ft]

DTB=Depth to bottom, 115.5-ft, 03Dec90

Drawing By: RKL/3-01-16B.ASB
Date : 12Jan94
Reference : HANFORD WELLS
WHC-SD-EN-DP-071

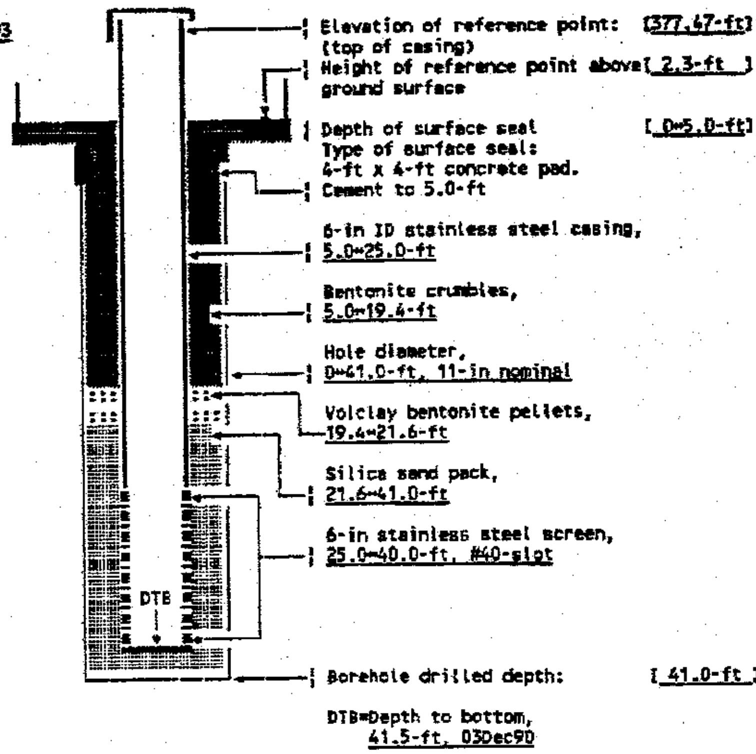
WELL CONSTRUCTION AND COMPLETION SUMMARY

Drilling Method: Cable tool Drilling Fluid Used: 300 Area Water Supply Driller's Name: Cordon Drilling Company: Associated Drillers Date Started: 08Nov86	Sample Method: Drive barrel Additives Used: Not documented WA State Lic Nr: 0079 Company Location: Date Complete: 13Nov86	WELL NUMBER: 399-1-17A TEMPORARY WELL NO: C-2A Hanford Coordinates: N/S S 23,331 E/W E 13,630 State Coordinates: N Not documented E Not doc RN 56,045.7 RE 15,236.2 Start Card #: Not documented T___ R___ S___ Elevation Ground surface: 375.13-ft Brass cap

Depth to water: 32.3-ft Nov86
(Ground surface) 33.2-ft 17Dec93

GENERALIZED STRATIGRAPHY / Geologist's Log

0-10: Sandy GRAVEL
10-25: Silty, sandy GRAVEL
25-35: Silty, gravelly SAND
35-40: Silty SAND



Drawing By: RKL/3-01-17A.ASB
Date : 12Jan94
Reference : HANFORD WELLS WHC-SD-EN-DP-071

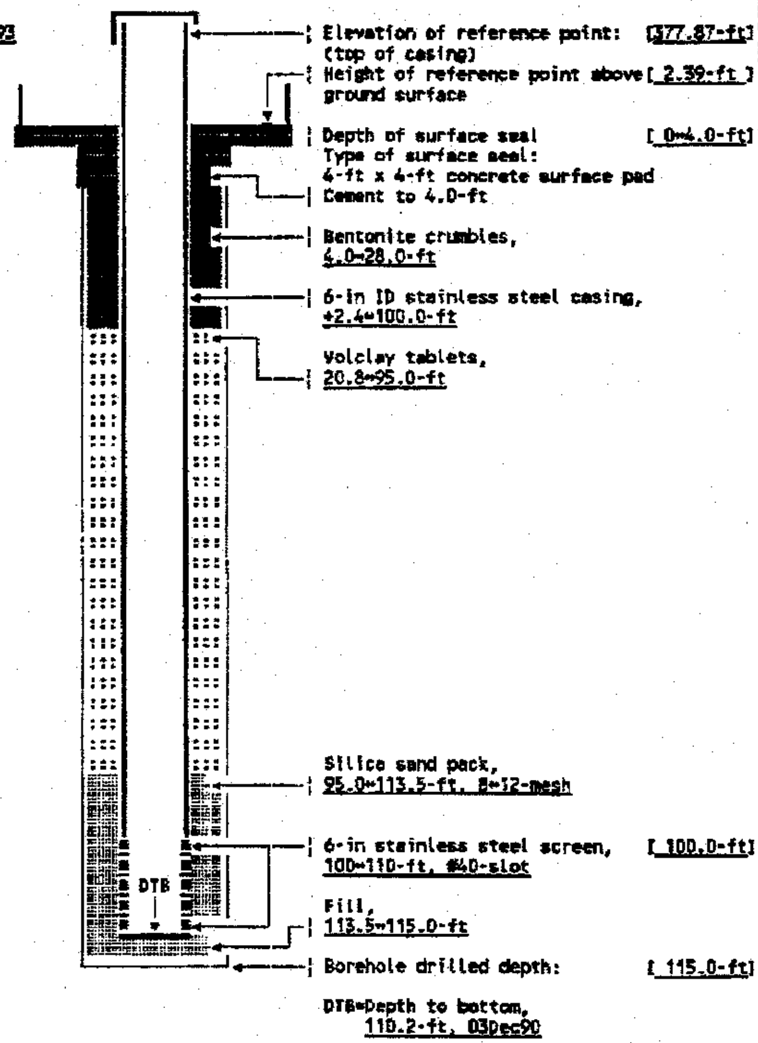
WELL CONSTRUCTION AND COMPLETION SUMMARY

Drilling Method: Cable tool	Sample Method: Drive barrel	WELL NUMBER: 399-1-17B TEMPORARY WELL NO: C-2B
Drilling Fluid Used: 300 Area Water Supply	Additives Used: Not documented	Hanford Coordinates: N/S S 23,317 E/W E 13,604
Driller's Name: Cordon	WA State Lic Nr: 1517	State Coordinates: N Not documented E Not doc (RN 56,059.5, RE 15,210.3)
Drilling Company: Associated Drillers	Company Location:	Start Card #: Not documented T___ R___ S___
Date Started: 01Dec86	Date Complete: 19Dec86	Elevation Ground surface: 375.48-ft Brass cap

Depth to water: 32.9-ft Dec86
(Ground surface) 33.3-ft 17Dec93

GENERALIZED Geologist's STRATIGRAPHY Log

0-5: Silty SAND
5-15: Silty, sandy PEBBLES
15-25: Sandy PEBBLES
25-30: Gravelly SAND
30-35: Sandy GRAVEL
35-40: Sandy PEBBLES
40-55: Sandy GRAVEL
55-70: Silty, sandy GRAVEL
70-85: Sandy GRAVEL
85-90: Silty, sandy GRAVEL
90-95: Sandy GRAVEL
95-105: Silty, sandy GRAVEL
105-110: Silty, gravelly SAND
110-115: Sandy, gravelly CLAY



Drawing By: RKL/3-01-17B.ASB
Date : 12Jan94
Reference : HANFORD WELLS
WHC-SD-EN-DP-071

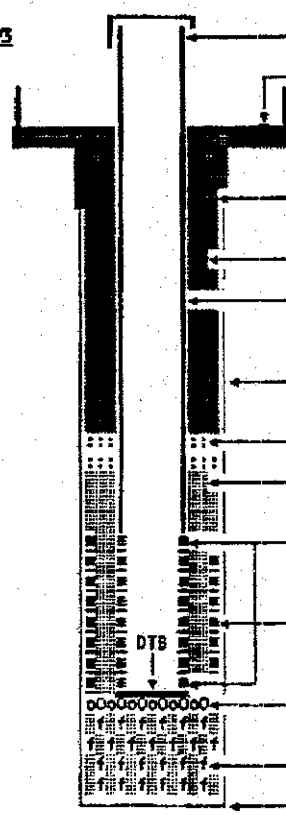
WELL CONSTRUCTION AND COMPLETION SUMMARY

Drilling Method: Cable tool	Sample Method: Drive barrel	WELL NUMBER: 399-1-18A TEMPORARY WELL NO: C-3A
Drilling Fluid Used: 300 Area Water Supply	Additives Used: Not documented	Hanford Coordinates: N/S N 20,407 E/W E 12,877
Driller's Name: Cordon	WA State Lic Nr: 0079	State Coordinates: N 384,928 (RN 58,970.1) E 2,308,254 (RE 14,483.3)
Drilling Company: Associated Drillers	Company Location:	Start Card #: Not documented T___ R___ S___
Date Started: 06Nov86	Date Complete: 12Nov86	Elevation Ground surface: 387.77-ft Brass cap

Depth to water: 47.0-ft Nov86
(Ground surface) 44.9-ft 17Dec93

GENERALIZED STRATIGRAPHY   Geologist's Log

0–5: No record
5–15: Silty SAND
15–35: Gravelly SAND
35–45: Silty, gravelly SAND
45–60: Gravelly SAND with trace of SILT
60–TD: Sandy GRAVEL with trace of SILT and CLAY



Elevation of reference point: [390.83-ft]
(top of casing)

Height of reference point above ground surface [3.06-ft]

Depth of surface seal [0–5.5-ft]
Type of surface seal:
4-ft x 4-ft concrete surface pad

Cement to 5.5-ft

Bentonite crumbles,
5.5–31.8-ft

6-in ID stainless steel casing,
+3.1–39.0-ft

Hole diameter,
0–63.0-ft, 11-in nominal

Volclay bentonite pellets,
31.8–34.0-ft

Silica sand pack,
34.0–54.0-ft, 8–12-mesh

6-in stainless steel screen,
39.0–54.0-ft, #40-slot

10-in telescoping screen,
39.0–54.0-ft

Gravel pack to 54.4-ft

Fill,
54.4–63.0-ft

Borehole drilled depth: [63.0-ft]

DTB=Depth to bottom,
53.8-ft, 06Nov90

Drawing By: RKL/3-01-18A.ASB
Date : 12Jan94
Reference : HANFORD WELLS WHC-SD-EN-DP-071

WELL CONSTRUCTION AND COMPLETION SUMMARY

Drilling Method: Cable tool
Drilling Fluid Used: 300 Area Water Supply
Driller's Name: Cordon
Drilling Company: Associated Drillers
Date Started: 13Nov86

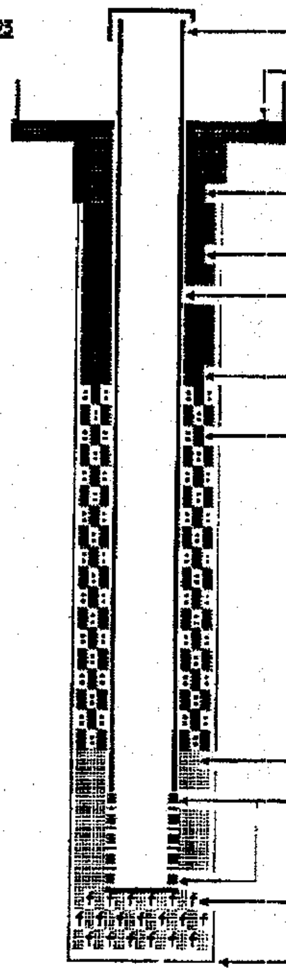
Sample Method: Drive barrel
Additives Used: Not documented
WA State Lic Nr: 0079
Company Location:
Date Complete: 20Jan87

WELL NUMBER: 399-1-18B
TEMPORARY WELL NO: C-38
Hanford Coordinates: N/S S 20,420 E/W E 12,865
State Coordinates: N Not documented E Not doc
RN 58,956.5 RE 14,470.8
Start Card #: Not documented T___ R___ S___
Elevation Ground surface: 387.24-ft Brass cap

Depth to water: 42.5-ft Jan87
(Ground surface) 44.0-ft 17Dec93

GENERALIZED STRATIGRAPHY Geologist's Log

0-5: Not documented
5-11: SAND
11-15: SAND and GRAVEL
15-25: Sandy GRAVEL
25-30: Silty, sandy GRAVEL
30-40: Sandy GRAVEL with trace of SILT
40-50: Silty, sandy GRAVEL
50-55: Pebbly SAND
55-60: Sandy, silty GRAVEL
60-65: Pebbly SAND
65-85: Silty, sandy GRAVEL
85-90: Sandy SILT
90-95: Silty, sandy GRAVEL
95-115: Sandy, silty GRAVEL
115-120: Silty, sandy GRAVEL
120-125: Sandy, clayey GRAVEL
125 : Sandy, gravelly CLAY



Drawing By: RKL/3-01-18B.ASB
Date : 12Jan94
Reference : HANFORD WELLS
WHC-SD-EN-DP-071

Contents

8.0 POSTCLOSURE PLAN Att.31.8.1

8.1 INSPECTION PLAN Att.31.8.1
8.1.1 Security Control Devices Att.31.8.1
8.1.2 Well Condition Att.31.8.1

8.2 MAINTENANCE PLAN Att.31.8.1
8.2.1 Repair of Security Control Devices Att.31.8.1
8.2.2 Well Replacement Att.31.8.1

8.3 PERSONNEL TRAINING Att.31.8.2
8.3.1 Outline of the Training Program Att.31.8.2
8.3.2 Job Description Att.31.8.2
8.3.3 Training Content, Frequency, and Techniques Att.31.8.2
8.3.4 Training for Emergency Response Att.31.8.3
8.3.5 Implementation of Training Program Att.31.8.3

Table

Table 8.1. Inspection Schedule for the 300 Area Process Trenches Att.31.8.3

This page intentionally left blank.

8.0 POSTCLOSURE PLAN

8.1 INSPECTION PLAN

This section describes compliance monitoring activities, security equipment, and inspections for well conditions during a period of modified closure compliance monitoring. Table 8.1 lists the inspection items and the inspection frequency for the postclosure care period. These inspections may be implemented in checklist form. Such a checklist could specify entering checklist performance and results in the appropriate inspection logbook.

8.1.1 Security Control Devices

Each of the groundwater monitoring wells has a locked cap to prevent unauthorized access and is surrounded by four steel guard posts for visibility to prevent damage from vehicles. The overall well condition, locks, guard posts, and pumps will be inspected during each sampling event. Problems and/or damage will be noted on well inspection forms for tracking of repairs.

8.1.2 Well Condition

Inspection of groundwater monitoring wells will be conducted pursuant to Permit Condition II.F and carried out under internal procedure BHI-EE-01 (BHI 1995) or equivalent guidance. This procedure calls for a surface inspection of a well at each sampling event. The procedure also calls for a subsurface inspection of the well at a minimum of every 3 to 5 years. This routine subsurface inspection may consist of pulling and inspecting the pump, brushing the inner walls of the casing and screen, and conducting a down-hole television survey.

8.2 MAINTENANCE PLAN

This section provides a plan for maintenance of the unit during the compliance monitoring period required for modified closure. Elements of this maintenance plan include repair of security devices, and well replacement. The maintenance plan is based on observations made and recorded in the well inspection form during site inspections. Except where immediate action is required, maintenance action will be initiated within 90 days of inspection and discovery.

8.2.1 Repair of Security Control Devices

The responsible maintenance organization will be notified of any problems to the well locks or guard posts and/or problems noted in the well inspection form during inspections and/or well monitoring activities. Well repairs will be made as soon as possible after notification of damage. Repairs to the four steel guard posts at each monitoring well will be made before the following inspection period and tracked on well inspection forms to completion.

8.2.2 Well Replacement

Maintenance of groundwater monitoring wells will be carried out under internal procedure BHI-EE-01 (BHI 1995) or equivalent guidance. This procedure covers correction of problems found during routine inspection or that manifest themselves at other times. If field maintenance procedures are inadequate to solve problems identified during site inspection, management will decide whether to repair or replace the well.

Where monitoring well damage requires modification of the groundwater monitoring program, the monitoring plan will be amended in accordance with WAC 173-303-610 (8)(d).

8.3 PERSONNEL TRAINING

This section describes the training of personnel required to maintain the 300 APT in a safe and secure manner during postclosure care as required by 40 CFR 265.16, WAC 173-303-330, and Permit Condition II.C of the Hanford Facility Dangerous Waste Permit.

8.3.1 Outline of the Training Program

This section outlines the introductory and continuing training programs necessary to conduct the postclosure activities at the 300 APT in a safe manner. This section also includes a brief description of how training will be designed to meet job tasks as required in 40 CFR 265.16(a).

Surveillance Personnel: The following outline provides information on classroom and on-the-job training that surveillance personnel will complete before conducting independent site surveillance at the 300 APT:

- Security inspections
- Location, integrity, and inspection of groundwater wells.

8.3.2 Job Description

This section provides the job description(s) for postclosure activities at 300 APT as required by 40 CFR 265.16(d)(1) and WAC 173-303-330(2)(a).

Site Surveillance: Personnel with training in the following areas will conduct the inspections:

- Control devices
- Damage

8.3.3 Training Content, Frequency, and Techniques

The training of personnel requires the following job-specific training areas, as appropriate.

- **Emergency Preparedness Training:** This training will include a review of emergency procedures that consists of listening to standard emergency signals, and reporting procedures.

- **The RCRA Groundwater Monitoring Scope, Organization, and Quality Assurance Plan:** This training will include the documentation requirements included in the chain of custody to the laboratory, how to correct mistakes made on field data sheets, and any applicable manifests or shipping orders required for shipping samples to the laboratory.

- **Groundwater Field Sampling Procedures:** This training will include pump description and operation of the three types of pumps (used by the field personnel), operational procedures for the generators and the pumps used to gather groundwater samples, and special requirements for collecting and packaging samples containing volatile organic materials that require acid preservatives or special filtering. Training also will be given in the areas of field data record preparation and chain of custody to the laboratory.

- **Site Security Inspections:** Personnel will be instructed on how to inspect for obvious signs of a security breach. Signs may include downed barricades.

- **Location, Integrity, and Inspection of Groundwater Wells:** Personnel will be shown the locations of the groundwater wells and instructed on how to inspect the cap and casing of each well to ensure that it is locked.

8.3.4 Training for Emergency Response

This section will demonstrate that personnel conducting postclosure activities at the 300 APT have been fully trained to respond effectively to emergencies and are familiar with emergency procedures and equipment. In addition, hazardous waste site operation training will be provided in accordance with 29 CFR 1910.120.

- **Response to Fires:** The 300 APT will have no existing structures and may be covered with a soil cover. As such, there is no need for fire equipment. However, if personnel are at the unit when a brushfire breaks out, they will notify the Hanford Fire Department.

- **Response to Groundwater Contamination:** Based on the current groundwater monitoring program, groundwater contamination beneath the 300 APT does not constitute an emergency situation, nor will it become so as a result of closure. Therefore, emergency response training in this regard is not warranted at this time.

8.3.5 Implementation of Training Program

Surveillance personnel will undergo the required training programs outlined in Section 8.5.1 as they pertain to monitoring requirements. Surveillance personnel will not be allowed to perform inspections at the 300 APT until the required training programs have been completed.

Table 8.1. Inspection Schedule for the 300 Area Process Trenches.

Inspection item	Inspection frequency
Security control devices: well caps, and locks	Quarterly
Well condition	Semiannually
Subsurface well condition	3 to 5 years

This page intentionally left blank.

Contents

FOREWORD....Foreword.i
CHECKLIST....Checklist.1
1.0 PART A [A]....1.i
2.0 FACILITY DESCRIPTION AND GENERAL PROVISIONS [B AND E]....2.i
3.0 WASTE ANALYSIS [C]....3.i
4.0 PROCESS INFORMATION [D]....4.i
5.0 GROUNDWATER MONITORING FOR LAND-BASED UNITS [D-10]....5.i
6.0 PROCEDURES TO PREVENT HAZARDS [F]....6.i
7.0 CONTINGENCY PLAN [G]....7.i
8.0 PERSONNEL TRAINING [H]....8.i
9.0 EXPOSURE INFORMATION REPORT....9.i
10.0 WASTE MINIMIZATION [D-9]....10.i
11.0 CLOSURE AND FINANCIAL ASSURANCE [I]....11.i
12.0 REPORTING AND RECORDKEEPING....12.i
13.0 OTHER FEDERAL AND STATE LAWS [J]....13.i
14.0 CERTIFICATION [K]....14.i
15.0 REFERENCES....15.i

Appendices

2A LOCATION MAP....Appendix.2A
2B GLOSSARY....Appendix.2B
2C HANFORD FACILITY LEGAL DESCRIPTION....Appendix.2C
2D SOLID WASTE MANAGEMENT UNITS....Appendix.2D

This page intentionally left blank.

HANFORD FACILITY
DANGEROUS WASTE PERMIT APPLICATION, GENERAL INFORMATION PORTION

FOREWORD

The Hanford Facility, located in southeastern Washington State, is owned by the U.S. Government and operated by the U.S. Department of Energy, Richland Operations Office. Dangerous waste and mixed waste (containing both dangerous and radioactive components) are generated and managed on the Hanford Facility. Waste components are regulated in accordance with the *Resource Conservation and Recovery Act of 1976*, the *Hazardous and Solid Waste Amendments of 1984*, and/or the *State of Washington Hazardous Waste Management Act of 1976* (as administered through the Washington State Department of Ecology *Dangerous Waste Regulations*, Washington Administrative Code 173-303); or the *Atomic Energy Act of 1954*.

The permitting framework for the Hanford Facility was established by the original 1989 *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1996). The original document addressed the Hanford Facility as a single *Resource Conservation and Recovery Act* facility (U.S. Environmental Protection Agency/State Identification Number WA7890008967) consisting of approximately 70, storage, and/or disposal units. Approximately 25 percent of these units are, or are anticipated to be, 'operating'; approximately 50 percent are 'undergoing closure'; and approximately 25 percent are, or are anticipated to be, 'dispositioned through other options' under the *Hanford Federal Facility Agreement and Consent Order*.

The original Hanford Federal Facility Agreement and Consent Order also established a stepwise permitting process that provided for the issuance of an initial Resource Conservation and Recovery Act permit for less than the entire Hanford Facility. Any treatment, storage, and/or disposal units not included in the initial permit were to be incorporated through a permit modification. Treatment, storage, and/or disposal units not yet incorporated into the Resource Conservation and Recovery Act permit were to continue to operate under interim status. Subsequent amendments of the Hanford Federal Facility Agreement and Consent Order have retained the Resource Conservation and Recovery Act permitting framework established by the original 1989 document

The initial *Hanford Facility Resource Conservation and Recovery Act Permit* became effective in September 1994, and is comprised of two portions, a Dangerous Waste Portion, issued by Ecology, and a Hazardous and Solid Waste Amendments Portion, issued by the U.S. Environmental Protection Agency, Region 10. The Dangerous Waste Portion is issued to five Permittees: the U.S. Department of Energy, Richland Operations Office, as the owner/operator, and to four of its contractors, as co-operators. The Hazardous and Solid Waste Amendments Portion, and Part IV, "Corrective Action" of the Dangerous Waste Portion is issued to the U.S. Department of Energy, Richland Operations Office, as the owner/operator and contractors.

For purposes of the *Hanford Facility Dangerous Waste Permit Application*, the U.S. Department of Energy's contractors are identified as 'co-operators' and sign in that capacity (refer to Condition I.A.2. of the Dangerous Waste Portion of the Hanford Facility Resource Conservation and Recovery Act Permit). Any identification of these contractors as an 'operator' elsewhere in the application is not meant to conflict with the contractors' designation as co-operators but rather is based on the contractors' contractual status with the U.S. Department of Energy, Richland Operations Office.

The *Hanford Facility Dangerous Waste Permit Application* is considered to be a single application organized into a General Information Portion (this document, DOE/RL-91-28) and a Unit-Specific Portion. The scope of the Unit-Specific Portion is limited to individual 'operating' treatment, storage, and/or disposal units for which Part B permit application documentation has been, or is anticipated to be, submitted. Documentation for treatment, storage, and/or disposal units 'undergoing closure', or for units that are, or are anticipated to be, 'dispositioned through other options', will continue to be submitted by the Permittees in accordance with the provisions of the *Hanford Federal Facility Agreement and Consent Order*. However, the scope of the General Information Portion includes information that could be used to discuss 'operating' units, units 'undergoing closure', or units being 'dispositioned through other options'.

The permit modification process is used to incorporate treatment, storage, and/or disposal units as permitting documentation for these units is finalized. The units to be included in annual modifications are specified in a schedule contained in the Dangerous Waste Portion of the *Hanford Facility Resource Conservation and Recovery Act Permit*. Treatment, storage, and/or disposal units will remain in interim status until incorporated into the Permit or dispositioned through other options.

Both the General Information and Unit-Specific portions of the *Hanford Facility Dangerous Waste Permit Application* address the contents of the Part B permit application guidance documentation prepared by the Washington State Department of Ecology (Ecology 1987 and 1996) and the U.S. Environmental Protection Agency (40 Code of Federal Regulations 270), with additional information needs defined by revisions of Washington Administrative Code 173-303 and by the *Hazardous and Solid Waste Amendments*. For ease of reference, the alpha-numeric section identifiers from the Washington State Department of Ecology's permit application guidance documentation follow, in brackets, the chapter headings and subheadings. Documentation contained in the General Information Portion is broader in nature and could be used by multiple treatment, storage, and/or disposal units (i.e., either 'operating' units, units 'undergoing closure', or units being 'dispositioned through other options'). A checklist indicating where information is contained in the General Information Portion, in relation to the Washington State Department of Ecology guidance documentation, is located in the Contents Section.

The intent of the General Information Portion is: (1) to provide an overview of the Hanford Facility; and (2) to assist in streamlining efforts associated with treatment, storage, and/or disposal unit-specific Part B permit application, preclosure work plan, closure work plan, closure plan, closure/postclosure plan, or postclosure permit application documentation development, and the *Hanford Facility Resource Conservation and Recovery Act Permit* modification process. Wherever appropriate, the Unit-Specific Portion of the application, as well as preclosure work plan, closure work plan, closure plan, closure/postclosure plan, or postclosure permit application documentation, will make cross-reference to the General Information Portion, rather than duplicating text. Thus, *Hanford Facility Resource Conservation and Recovery Act Permit* modifications involving general information will require updating only the General Information Portion instead of each unit-specific document.

'Dangerous Waste', as used in the title of the *Hanford Facility Dangerous Waste Permit Application*, refers to waste subject to Washington Administrative Code 173-303 requirements and to requirements of the *Hazardous and Solid Waste Amendments*, including those for which the state of Washington has not yet been granted authority by the U.S. Environmental Protection Agency. Throughout the *Hanford Facility Dangerous Waste Permit Application*, 'mixed waste' refers to waste containing both dangerous and radioactive components. The radioactive component of mixed waste is interpreted by the U.S. Department of Energy to be regulated under the *Atomic Energy Act*; the nonradioactive dangerous component of mixed waste is interpreted to be regulated under the *Resource Conservation and Recovery Act* and Washington Administrative Code 173-303. It is the position of the U.S. Department of Energy that any procedures, methods, data, or information contained in the *Hanford Facility Dangerous Waste Permit Application* that relate solely to the radioactive component of mixed waste are outside the scope of the permit application and the *Hanford Facility Resource Conservation and Recovery Act Permit*, but are included for the sake of completeness. It is the position of the Washington State Department of Ecology that the radioactive component influences safe management of mixed waste and therefore information about this component is necessary to ensure compliance with Washington Administrative Code 173-303 and the *Hanford Facility Resource Conservation and Recovery Act Permit*. Both agencies acknowledge the other's position, but to avoid a conflict on the issue, the U.S. Department of Energy, Richland

Operations Office has agreed to provide information on radioactive constituents without agreeing with the Washington State Department of Ecology's position. The Washington State Department of Ecology has agreed to accept the information in this context without giving up its position.

The General Information Portion of the *Hanford Facility Dangerous Waste Permit Application* contains information current of May 1, 2000.

This page intentionally left blank.

Application Checklist

In accordance with the Washington State Department of Ecology's Dangerous Waste Permit Application Requirements (Ecology 1996), an application checklist has been completed by providing the facility name and indicating where the listed material has been placed in the General Information Portion. This is particularly important when the General Information Portion does not closely follow the outline of the checklist and guidance or to designate where information is more appropriately placed in the Unit-Specific Portion. The completed checklist is contained within this section of this Dangerous Waste Permit application documentation.

As noted in the Introduction of the Washington State Department of Ecology's 1996 guidance document, this document only includes a detailed discussion of requirements for treatment and storage in tanks and containers. Requirements for land-based and incinerator units are in a document entitled *Dangerous Waste Management Facility Permit Application: Additional Requirements for Facilities Which Dispose of Dangerous Wastes or Manage Them in Land-based Units* (Ecology 1987). The 1996 guidance document advises that when preparing an application for land-based units use both guidance documents in conjunction. To provide continuity in numbering, the major outline headings for land-based and incinerator units have been provided by the Washington State Department of Ecology in the application checklist included in its 1996 guidance document.

The application checklist provided by the Washington State Department of Ecology has been modified to include citations for Chapter 173-303 Washington Administrative Code and for 40 Code of Federal Regulations Parts 264 and 270. In addition, the title of the checklist has been modified to indicate that the checklist contents do not just refer to "Treatment and Storage in Tanks and Containers".

Facility Name Hanford Facility Dangerous Waste Permit Application, General Information Portion

Date Application Received______________________

State of Washington
Part B Permit Application Review Checklist

		Technically Adequate?	Location in Application
Citations for the Chapter 173-303 Washington Administrative Code (WAC) are followed by those for 40 Code of Federal Regulations (CFR) Parts 264 and 270. The federal citations are always in brackets. For example: "806(2)[270.10(d)]" refers to WAC 173-303-806(2) and 40 CFR 270.10(d).			
A.	**Part A Form** 806(2), 810(12)(a), 810(13) [270.10(d), 270.11(a) and (d), 270.13]		Chapter 1.0
B.	**Facility Description and General Provisions** 806(4)(a)(i),(x),(xi),(xviii) [270.14(b)(1),(10),(19)]		Chapter 2.0
B-1	General Description 806(4)(a)(i) [270.14(b)(1)]		2.1
B-1(a)	Facility Description		2.1.1
B-1(b)	Construction Schedule		2.1.2
B-2	Topographic Map		2.2
B-2a	General Requirements 806(4)(a)(xviii) [270.14(b)(19)]		2.2.1
B-2b	Additional Requirements for Land Disposal Facilities		2.2.2
B-3	Seismic Consideration 806(4)(a)(xi) [270.14(b)(11)(i) and (ii), 264.18(a)]		2.3
B-4	Traffic Information 806(4)(a)(x) [270.14(b)(10)]		2.4
C.	**Waste Analysis** 806(4)(a)(ii) and (iii), 300 [270.14(3), 264.13(b) and (c)]		Chapter 3.0
C-1	Chemical, Biological and Physical Analyses 806(4)(a)(ii), 806(4)(b)(ii) and (v); 806(4)(c)(x); 140; 300; 395; 630(7)(c) and (9); 640(1)(b), (2)(c), (3)(a), and (10) [270.14(b)(2), 264.13(a), 268.7, 268.9]		3.1
C-1a C-1b C-1c	Waste In Piles Landfilled Wastes Wastes Incinerated and Wastes Used in Performance Tests		3.1.3 3.1.4 3.1.5
C-2	Waste Analysis Plan 806(4)(a)(iii), 140, 300(5) and (6) [270.14(b)(3), 264.13(b) and (c), 268.7 and 268.9]		3.2
C-2a	Detailed Chemical, Physical, and/or Biological Analysis		3.2

State of Washington
Part B Permit Application Review Checklist

		Technically Adequate?	Location in Application
C-2a(1)	Parameters and Rationale 806(4)(b)(ii)(A); 140 (LDR); 300(2), (5)(a), and (5)(f); 395(1) and (2); 630(7)(c); 640(1)(b), (2)(c) and (3)(a) [270.15(b)(1), 270.24, 270.25, 264.13(b)(1) and (8), 264.17, 264.191(b)(2), 264.192(a)(2), 264.1034(d), 264.1064(d), 268.7]		3.2
C-2a(2)	Analytical Methods 110, 300(5)(b) [264.13(b)(2) and (8), Part 264 Subparts AA, BB, and CC] - Washington State has not adopted the CC requirements yet.		3.2
C-2a(3)	Generator-Supplied Analyses 300(3), (5)(g), and (e) [264.13(b)(5)]		3.2
C-2b	Additional Requirements for Wastes Generated Off-site 806(4)(a)(iii), 300(6) [264.13(c)]		3.2
C-2b(1)	Parameters and Rationale to Confirm Identity of Off-site Waste 300(3), (5)(a), and 5(g) [264.13(a)(4) and (b)(1)]		3.2
C-2b(2)	Analytical Methods to Confirm Identity of Off-site Waste 300(3) and (5)(b) [264.13(b)(2)]		3.2
C-2b(3)	Representative Sampling of Incoming Off-site Wastes 300(3) and (5)(c), 110(2) [264.13(b)(3), Part 261, Appendix I]		3.2
C-2c	Methods for Collecting Samples for Detailed and Confirming Analyses 300(5)(c), 110(2) [264.13(b)(3), 264.1034(d), Part 261, Appendix I]		3.2
C-2d	Frequency of Analyses 300(4),(5)(d) [264.13(b)(4)]		3.2
C-3	Manifest System 370 [264.71, 264.72]		3.3
C-3a	Procedures for Receiving Shipments 370(2),(3),(4) [264.71]		3.3.1
C-3b	Response to Significant Discrepancies 370(4) [264.72]		3.3.2
C-3c	Provisions for Non-acceptance of Shipment 370(5)		3.3.3
C-3c(1)	Non-acceptance of Undamaged Shipment 370(5)(b)		3.3.3.1

State of Washington
Part B Permit Application Review Checklist

		Technically Adequate?	Location in Application
C-3c(2)	Activation of Contingency Plan for Damaged Shipment 370(5)(c)		3.3.3.2
C-4	Tracking System 380		3.4
D.	**Process Information** 806(4)(b) - (c), 630 through 670 [270.15 - 270.26, 264 Subparts I - BB]		Chapter 4.0
D-1	Containers 806(4)(b), 630 [270.15, 264 Subpart I]		4.2
D-1a	Description of Containers 630(4) [264.172]		Unit-Specific Portion
D-1b	Container Management Practices 630(5) and (8); 340(3) [264.35, 264.173]		Unit-Specific Portion
D-1c	Container Labelling 806(4)(b)(iii), 395(6), 630(3)		Unit-Specific Portion
D-1d	Containment Requirements for Storing Containers		Unit-Specific Portion
D-1d(1)	Secondary Containment System Design 806(4)(b)(i) and (iv), 630(7) [270.15(a); 264.175(a), (b), and (d)]		Unit-Specific Portion
D-1d(1)(a)	System Design 806(4)(b)(i), 630(7) (a) and (d) [270.15(a), 264.175(b)]		Unit-Specific Portion
D-1d(1)(b)	Structural Integrity of Base 806(4)(b)(i), 630(7)(a) [270.15(a), 264.175(b)]		Unit-Specific Portion
D-1d(1)(c)	Containment System Capacity 806(4)(b)(i)(A) and (C), 630(7)(a) [270.15(a)(3), 264.175(b)(3)]		Unit-Specific Portion
D-1d(1)(d)	Control of Run-on 806(4)(b)(i)(D), 630(7)(b) [270.15(a)(4), 264.175(b)(4)]		Unit-Specific Portion
D-1d(2)	Removal of Liquids from Containment System 806(4)(b)(i)(E), 630(7)(a)(ii) [270.15(a)(5), 264.175(b)(5)]		Unit-Specific Portion
D-1e	Demonstration that Containment Is Not Required Because Containers Do Not Contain Free Liquids, Wastes That Exhibit Ignitability or Reactivity, or Wastes Designated F020 - 023, F026, or F027 806(4)(b)(ii), 630(7)(c) [270.15(b)(2), 264.175(c)]		Unit-Specific Portion

State of Washington
Part B Permit Application Review Checklist

		Technically Adequate?	Location in Application
D-1f	Prevention of Reaction of Ignitable, Reactive, and Incompatible Wastes in Containers		Unit-Specific Portion
D-1f(1)	Management of Certain Reactive Wastes in Containers 806(4)(b)(iv), 630(8)(a) [270.15(c), 264.176]		Unit-Specific Portion
D-1f(2)	Management of Ignitable and Certain Other Reactive Wastes in Containers 806(4)(b)(iv), 630(8)(b) [270.15(c), 264.176]		Unit-Specific Portion
D-1f(3)	Design of Areas to Manage Incompatible Wastes 806(4)(b) (iv), 630(9)(c) [270.15(c), 264.177]		Unit-Specific Portion
D-2	Tank Systems 806(4)(c), 640, 395(6) [270.16, 264.190 through 264.199, 264.1030 through 264.1065]		4.3
D-2a	Design, Installation and Assessment of Tanks Systems 806(4)(c)(i),(ii),(v), and (vi), 640(2) and (3) [270.16(a), (b), (e), and (f), 264.191, 264.192]		Unit-Specific Portion
D-2a(1)	Design Requirements 640(2)(c), (3)(a) [264.191(b), 264.192(a)]		Unit-Specific Portion
D-2a(2)	Integrity Assessments 640(2)(a),(c) and (e); (3)(a),(b) and (g) [264.191(a) and (b) 264.192(a),(b), and (g)]		Unit-Specific Portion
D-2a(3)	Additional Requirements for Existing Tanks 640(2)(a) and (c)(v) [264.191(a) and (b)(5)]		Unit-Specific Portion
D-2a(4)	Additional Requirements for New Tanks 640(3)(c), (e), (f) and (g) [264.192(b),(d), and (e)]		Unit-Specific Portion
D-2a(5)	Additional Requirements for New On-ground or Underground Tanks 640(3)(a)(iii), (iv), and (v); 640(3)(d) [264.192(a)(3),(4), and (5), and (c)]		Unit-Specific Portion
D-2b	Secondary Containment and Release Detection for Tank Systems 640(4), 806(4)(c)(vii) [270.16(g), 264.193]		Unit-Specific Portion
D-2b(1)	Requirements for All Tank Systems		Unit-Specific Portion
D-2b(2)	Additional Requirements for Specific Types of Systems		Unit-Specific Portion
D-2b(2)(a)	Vault Systems 640(4)(e)(ii) [264.193(e)(2)]		Unit-Specific Portion

State of Washington
Part B Permit Application Review Checklist

		Technically Adequate?	Location in Application
D-2b(2)(b)	Double-walled Tanks 640(4)(e)(iii) [264.193(e)(3)]		Unit-Specific Portion
D-2b(2)(c)	Ancillary Equipment 640(4)(f) [264.193(f)]		Unit-Specific Portion
D-2c	Variances from Secondary Containment Requirements 640(4)(g) and (h), 640(1)(b) and 806(c)(viii) [270.16(h), 264.193(g) and (h), 264.190(a)]		Unit-Specific Portion
D-2d	Tank Management Practices 806(4)(c)(iii),(iv),(ix); 640(5)(a) and (b) [270.16(c),(d), and (i), 264.194(a) and (b)]		Unit-Specific Portion
D-2e	Labels or Signs 806(4)(c)(xi), 395(6), 640(5)(d)		Unit-Specific Portion
D-2f	Air Emissions 806(4)(c)(xii), 640(5)(e)		Unit-Specific Portion
D-2g	Management of Ignitable or Reactive Wastes in Tank Systems 806(4)(c)(x), 640(9) [270.16(f), 264.198]		Unit-Specific Portion
D-2h	Management of Incompatible Wastes in Tank Systems 806(4)(c)(x), 640(10) [270.16(f), 264.199]		Unit-Specific Portion
D-3 D-4 D-5 D-6 D-7	Waste Piles Surface Impoundments Incinerators Landfills Land Treatment		4.4 4.5 4.6 4.7 4.8
D-8	Air Emissions Control 806(4)(j) and (k), 110 (test methods), 690, 691 [270.24, 270.25, Part 264 Subparts AA, BB, and CC] - Washington State has not adopted the CC requirements yet.		4.10
D-8a	Process Vents 806(4)(j), 110, 690 [270.24, 264.1030 - 264.1035 (Subpart AA)]		4.10.1
D-8a(1)	Applicability of Subpart AA Standards 690 [270.24(b), 264.1030, 264.1034(d), 264.1035(b)(2)]		4.10.1

State of Washington
Part B Permit Application Review Checklist

		Technically Adequate?	Location in Application
D-8a(1)(a)	Process Vents Subject to Subpart AA Standards		4.10.1
D-8a(1)(b)	Process Vents Not Subject to Subpart AA Standards		4.10.1
D-8a(1)(c)	Re-evaluating Applicability of Subpart AA Standards 690 [270.24(b)(3), 264.1030]		4.10.1
D-8a(2)	Process Vents - Demonstrating Compliance 806(4)(j), 110, 690 [270.24, 264.1030 - 264.1035]		4.10.1
D-8a(2)(a)	The Basis for Meeting Limits/ Reductions 806(4)(j)(ii), 110, 690 [270.24(b), 264.1032, 264.1034(c), 264.1035(b)(2) and (b)(3)]		4.10.1
D-8a(2)(b)	Demonstrating Compliance via Selected Method 806(4)(j)(ii), 110, 690 [270.24(b), 264.1032, 264.1034(c), 264.1035(b)(2) and (b)(3)]		4.10.1
D-8a(2)(c)	Design Information and Operating Parameters for Closed Vent Systems and Control Devices 806(4)(j)(iv), 110, 690 [270.24(d), 264.1032(b), 264.1033, 264.1034, 264.1035(b)(3) and (b)(4), 264.1035(c)]		4.10.1
D-8a(2)(d)	Re-evaluating Compliance with Subpart AA Standards 806(4)(j)(ii), 690 [270.24(b), 264.1030, 264.1035(b)(2)]		4.10.1
D-8b	Equipment Leaks 806(4)(k), 110, 691 [270.25, 264.1050 - 264.1064, 264.1033, 264.1034(c), 264.1035(b) and (c)]		4.10.2
D-8b(1)	Applicability of Subpart BB Standards 806(4)(k), 110, 691 [270.25, 264.1050, 264.1063]		4.10.2
D-8b(1)(a)	Equipment Subject to Subpart BB		4.10.2
D-8b(1)(b)	Re-evaluating Applicability of Subpart BB Standards 110, 691(1) [264.1063(d) - (g), 264.1064(k)]		4.10.2
D-8b(2)	Equipment Leaks - Demonstrating Compliance		4.10.2

State of Washington
Part B Permit Application Review Checklist

		Technically Adequate?	Location in Application
D-8b(2)(a)	Procedures for Identifying Equipment Location and Method of Compliance, Marking Equipment, and Ensuring Records are Up-to-date 806(4)(k), 691 [270.25, 264.1050 - 264.1064]		4.10.2
D-8b(2)(b)	Demonstrating Compliance with D-8b(1)(a) and (2)(a) Procedures 806(4)(k), 691 [270.25, 264.1050 - 264.1059]		4.10.2
D-8b(2)(c)	Closed Vent Systems or Control Devices: Showing Compliance with Emission Reduction Standards 806(4)(k), 110, 690, 691 [270.25, 264.1033 - 264.1035, 264.1052 - 264.1055, 264.1059, 264.1060, 264.1063]		4.10.2
D-8c	Tanks and Containers [270.27, 270.15, 270.16, Part 264 Subpart CC]		4.10.3
D-8c(1)	Applicability of Subpart CC Standards [264.1080, 264.1082]		4.10.3
D-8c(2)	Tank Systems and Container Areas - Demonstrating Compliance Provide the documentation required by 270.27(a)(1) - (a)(3) and (a)(5) - (a)(6).		4.10.3
D-9	Waste Minimization [264.73(b)(9), 264.75(h) and (i)]		Chapter 10.0
D-10	Groundwater Monitoring for Land-based Units		Chapter 5.0
E.	**Releases from Solid Waste Management Units** 806(4)(a)(xxiii) and (xxiv), 645, 646 [270.14(d)]		Chapter 2.0
E-1	Solid Waste Management Units and Known and Suspected Releases of Dangerous Wastes or Constituents		2.5
E-1a	Solid Waste Management Units		2.5
E-1b	Releases		2.5
E-2	Corrective Actions Implemented (If you have been conducting corrective action under a RCRA Section 3008(h), 7003, or 3013 order; under a Model Toxics Control Act (MTCA) order; as an independent MTCA cleanup; or under another authority.)		2.5

State of Washington
Part B Permit Application Review Checklist

		Technically Adequate?	Location in Application
F.	**Procedures to Prevent Hazards** 806(4)(a)(iv),(v),(vi),(viii),(ix), 310, 320, 340 [270.14(b)(4),(5),(6),(8); 264.14, 264.15, 264.17, 264.30 - 264.35]		Chapter 6.0
F-1	Security 806(4)(a)(iv), 310(1) and (2) [270.14(b)(4), 264.14]		6.1
F-1a	Security Procedures and Equipment 806(4)(a)(iv), 310(2) [270.14(b)(4), 264.14]		6.1.1
F-1b	Waiver 310(1) [264.14(a)]		6.1.2
F-2	Inspection Plan 806(4)(a)(v), 320, 340 [270.14(b)(5), 264.15]		6.2
F-2a	General Inspection Requirements 806(4)(a)(v), 320(1), 320(2)(a),(b) and (c), 340(1)(d) [270.14(b)(5), 264.15(a) and (b), 264.33, 264.34, 264.35]		6.2.1
F-2b	Inspection Log 320(2)(d) [264.15(d)]		6.2.2
F-2c	Schedule for Remedial Action for Problems Revealed 320(3) [264.15(c)]		6.2.3
F-2d	Specific Process or Waste Type Inspection Requirements		6.2.4
F-2d(1)	Container Inspections 806(4)(a)(v), 630(3) and (6), 320(2)(c) and (3) [270.14(b)(5), 264.15(c), 264.174]		Unit-Specific Portion
F-2d(2)	Tank System Inspections and Corrective Actions 640(6) and (7) [270.14(b)(5), 264.195]		Unit-Specific Portion
F-2d(2)(a)	Tank System Inspections 806(4)(a)(v), 640(6) [264.195]		Unit-Specific Portion
F-2d(2)(b)	Tank Systems - Corrective Actions 640(7) [264.196]		Unit-Specific Portion
F-2d(3)	Storage of Ignitable or Reactive Wastes 806(4)(a)(v), 395(1)(d) [no equivalent federal requirement]		Unit-Specific Portion
F-2d(4)	Air Emissions Control and Detection - Inspections, Monitoring, and Corrective Actions (806(4)(a)(v) [270.14(b)(5), 264.1033 (e) - (k); 264.1035; 264.1052; 264.1053; 264.1058; 264.1064; 264.1067, 264.1088, 264.1091]		Unit-Specific Portion

State of Washington
Part B Permit Application Review Checklist

		Technically Adequate?	Location in Application
F-2d(4)(a)	Process Vents 806(4)(a)(v) [264.1033; 264.1034(b) and (c); 264.1035(b)(3), (b)(4), and (c)]		Unit-Specific Portion
F-2d(4)(b)	Equipment Leaks 806(4)(a)(v) [264.1052 - 264.1064]		Unit-Specific Portion
F-2d(4)(c)	Tanks and Containers [270.14(b)(5), 270.27((a)(6), 264.1088, 264.1091] Department of Ecology has not yet adopted the CC requirements.		Unit-Specific Portion
F-2d(5) F-2d(6) F-2d(7) F-2d(8) F-2d(9)	Waste Pile Inspection Surface Impoundment Inspection Incinerator Inspection Landfill Inspection Land Treatment Facility Inspection		Unit-Specific Portion
F-3	Preparedness and Prevention Requirements 806(4)(a)(vi), 340 [270.14(b)(6), Part 264 Subpart C]		6.3
F-3a	Equipment Requirements 340(1) and (2) [264.32, 264.34]		6.3.1 and Unit-Specific Portion
F-3b	Aisle Space Requirement 340(3) [264.35]		6.3.2
F-4	Preventive Procedures, Structures, and Equipment 806(4)(a)(viii) [270.14(b)(8)]		6.4
F-5	Prevention of Reaction of Ignitable, Reactive, and/or Incompatible Wastes 806(4)(a)(ix),(b)(v), and (c)(x); 395(1)(a),(b) and (c); 630(9)(a) and (b); 640(9)(10) [270.14(b)(9), 264.17(a) and (b), 264.177(a) and (b)]		6.5 and Unit-Specific Portion
F-5a	Precautions to Prevent Ignition or Reaction of Ignitable or Reactive Waste 806(4)(a)(ix), 395(1)(a) and (c) [270.14(b)(9), 264.17(a)]		Unit-Specific Portion
F-5b	Precautions for Handling Ignitable or Reactive Waste and Mixing Incompatible Wastes 806(4)(a)(ix), (b)(v), and (c)(x); 395(1)(b) and (c); 630(9)(a) and (b); 640(9) and (10) [270.14(b)(9), 264.17(b), 264.177(a) and (b)]		Unit-Specific Portion
F-5b(1)	Ignitable or Reactive Wastes In Tanks 806(4)(c)(x), 640(9) [270.16(j), 264.198]		Unit-Specific Portion

State of Washington
Part B Permit Application Review Checklist

		Technically Adequate?	Location in Application
F-5b(2)	Incompatible Wastes In Containers or Tanks 806(4)(b)(v) and (4)(c)(x), 630(9) (a) and (b), 640(10) [270.15(d), 270.16(j) 264.17(b) and (c), 264.177(a) and (b), 264.199]		Unit-Specific Portion
G.	**Contingency Plan** 806(4)(a)(vii), 340, 350, 360, 640(7), 650(5), 660(6) [270.14(b)(7), 264.50 through 264.56]		Chapter 7.0
G-1	General Information		Attachment 4 of HF RCRA Permit (DW Portion)
G-2	Emergency Coordinators 350(3)(d), 360(1) [264.52(d), 264.55]		Attachment 4 of HF RCRA Permit (DW Portion) and Unit-Specific Portion
G-3	Circumstances Prompting Implementation 350(1) and (2), 360(2) [264.51, 264.52(a), 264.56(a) and (b)]		Attachment 4 of HF RCRA Permit (DW Portion) and Unit-Specific Portion
G-4	Emergency Response Procedures 350(3)(a) and (b), 360(2)(a),(b), and (c) [264.52(a), 264.56]		Attachment 4 of HF RCRA Permit (DW Portion) and Unit-specific Portion
G-4a	Notification 360(2)(a) [264.56(a)] Note that the facility must also notify under WAC 173-303-145.		Attachment 4 of HF RCRA Permit (DW Portion) and Unit-Specific Portion
G-4b	Identification of Dangerous Materials 360(2)(b) [264.56(b)]		Attachment 4 of HF RCRA Permit (DW Portion) and Unit-Specific Portion
G-4c	Hazard Assessment and Report 360(2)(c),(d), and (e) [264.56(c) and (d)]		Attachment 4 of HF RCRA Permit (DW Portion) and Unit-Specific Portion
G-4d	Prevention of Recurrence or Spread of Fires, Explosions, or Releases 360(2)(f) and (g), 630(2), 640(7) [264.56(e) and (f), 264.171, 264.196]		Attachment 4 of HF RCRA Permit (DW Portion) and Unit-Specific Portion
G-4f	Post-Emergency Actions 360(2)(h),(i),(j), and (k); 640(7) [264.56(g) and (h)]		Attachment 4 of HF RCRA Permit (DW Portion) and Unit-Specific Portion
G-5	Emergency Equipment 350(3)(e) [264.52(e)]		Attachment 4 of HF RCRA Permit (DW Portion) and Unit-specific Portion
G-6	Coordination Agreements 350(3)(c), 340(4) [264.52(c), 264.37]		Attachment 4 of HF RCRA Permit (DW Portion)
G-7	Evacuation Plan 350(3)(f), 355 [264.52(f)]		Attachment 4 of HF RCRA Permit (DW Portion) and Unit-Specific Portion

State of Washington
Part B Permit Application Review Checklist

		Technically Adequate?	Location in Application
G-8	Required Reports, Recordkeeping, and Certifications 360(2)(k), 640(7)(d)(iii), 640(7)(f) [264.56(j)]		Attachment 4 of HF RCRA Permit (DW Portion) and Unit-Specific Portion
G-8(1)	General Requirements		Attachment 4 of HF RCRA Permit (DW Portion) and Unit-Specific Portion
G-8(2)	Requirements for Tank Systems		Attachment 4 of HF RCRA Permit (DW Portion) and Unit-Specific Portion
H.	**Personnel Training** 806(4)(a)(xii), 330 [270.14(b)(12), 264.16]		Chapter 8.0
H-1	Job Title/Job Description 330(2)(a) [264.16(d)(1) and (2)]		Unit-Specific Portion
H-2	Outline of Training Program 806(4)(a)(xii), 330(1) and (2)(b) [270.14(b)(12); 264.16(a)(1),(c), and (d)(3)]		Unit-Specific Portion
H-3	Implementation of Training Program 330(1)(c), 330(2)(c), 330(3) [264.16(b)]		Unit-Specific Portion
I.	**Closure and Financial Assurance** 806(4)(a)(xiii), 610, 620 [270.14(b)(15), 264.142, 264.143, 264.151]		Chapter 11.0
I-1	Closure Plan/Financial Assurance for Closure 806(4)(a)(xiii), 610(2) - (6) [270.14(b)(13), 264.111, 264.112]		11.1
I-1a	Closure Performance Standard 610(2)(b) [264.111]		11.1.1
I-1b	Closure Activities 610(3)(a)(i) through (vi); 610(5); 630(10); 640(5) [264.112(b)(1), 264.112(b)(4), 264.114, 264.178, 264.197]		11.1.2
I-1b(1)	Maximum Extent of Operation		11.1.2.1
I-1b(2)	Removing Dangerous Wastes		11.1.2.2
I-1b(3)	Decontaminating Structures, Equipment, and Soil		11.1.2.3
I-1b(4)	Sampling and Analysis to Identify Extent of Decontamination/ Removal and to Verify Achievement of Closure Standard		11.1.2.4
I-1b(4)(a)	Sampling to Confirm Decontamination of Structures and Soils		11.1.2.4
I-1b(5)	Other Activities 610(3)(vi)		Unit-Specific Portion
I-1c	Maximum Waste Inventory 610(3)(a)(iii) [264.112(b)(3)]		11.1.3

State of Washington
Part B Permit Application Review Checklist

		Technically Adequate?	Location in Application
I-1d	Closure of Waste Piles, Surface Impoundments, Incinerators, Land Treatment, and Miscellaneous Units		11.1.4
I-1e	Closure of Landfill Units		11.1.5
I-1f	Schedule for Closure 610(3)(a)(vii) [264.112(b)(6)]		11.1.6
I-1g	Extension for Closure Time 610(4)(a), 610(4)(b) [264.113(a), 264.113(b)]		11.1.7
I-1h	Closure Cost Estimate 806(4)(a)(xv), 620(3) [270.14(b)(15), 264.142]		11.1.8
I-1i	Financial Assurance Mechanism for Closure 806(4)(a)(xv), 620(4) and (10) [270.14(b)(15), 264.143, 264.151]		11.1.9
I-2	Notice in Deed of Already Closed Disposal Units 806(4)(a)(xiv), 610(10) [270.14(b)(14), 264.120, 264.117(c), 264.119]		11.2
I-3	Post-Closure Plan		11.3
I-4	Liability Requirements 806(4)(a)(xvii), 620(8), 620(10) [270.14(b)(17), 264.147, 264.151]		11.4
I-4a	Coverage for Sudden Accidental Occurrences 620(8)(a) [264.147(a),(f)]		11.4
I-4b	Coverage for Nonsudden Accidental Occurrences		11.4
I-4c	Request for Variance 620(8)(c) [264.147(c)]		11.4
J.	**Other Federal and State Laws** 806(4)(a)(xix) [270.14(b)(20), 270.3]		Chapter 13.0
K.	**Part B Certification** 806(4)(a), 810(12) and (13) [270.11]		Chapter 14.0

This page intentionally left blank.