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004416

SHLWS T/S
September 13, 1989
Rev. 4

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CLOSURE PLAN

SIMULATED HIGH LEVEL WASTE SLURRY TREATMENT AND STORAGE (SHLWS T/S) UNIT

September 13, 1989

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1.0 PART A APPLICATION

1.1 INTRODUCTION

The Simulated High-Level Waste Slurry (SHLWS) Treatment/Storage (T/S) unit is an open, fenced-in area which was used to store containerized simulated high-level waste slurry. The unit was also used to treat this waste in a grout/stabilization process. The untreated slurry was originally considered to be a radioactive mixed waste because, in addition to being designated as a dangerous waste, it contained elevated levels of natural radioactivity. Analysis of the waste later indicated that the radioactivity of the waste is low enough to be classified as nonradioactive waste. The slurry was designated as a dangerous waste because it contained toxic constituents, was corrosive, was ignitable, and contained dissolved metals above the limits given in the Extraction Procedure (EP) Toxicity test. The treated slurry is not dangerous waste. The levels of radioactivity in the treated waste are low enough for the waste to be managed at the Hanford Site as nonradioactive solid waste.

The SHLWS was procured for a research demonstration program which was subsequently cancelled. While some of the slurry was used in other programs, the remaining material was declared surplus and thereby became a solid waste requiring management in compliance with the Washington Dangerous Waste Regulations (WAC 173-303). A Part A permit application was submitted for the SHLWS T/S unit for treatment of the SHLWS, as well as for storage of the containerized slurry prior to treatment. The permit application included only the inventory of wastes in storage at the time the permit was submitted; no other wastes were or will be stored or treated. The Part A Permit Application for this unit was submitted by May 23, 1988, by the U.S. Department of Energy-Richland Operations Office (DOE-RL) to the Washington State Department of

Ecology (Ecology) and to Region X of the U.S. Environmental Protection Agency (EPA).

1.2 PART A APPLICATION

The following Dangerous Waste Permit Application, Form 3, contains a description of waste treatment and storage conditions and designation codes for the wastes at the SHLWS T/S unit.

9 0 1 1 7 7 1 1 0 9

PART A
DANGEROUS WASTE PERMIT APPLICATION
(FORM 3)

FORM 3

DANGEROUS WASTE PERMIT APPLICATION

I. EPA/STATE I.D. NUMBER: W A 7 8 9 0 0 0 8 9 6 7

FOR OFFICIAL USE ONLY

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

II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below (mark one box only) to indicate whether this is the first application you are submitting for your facility or a 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. 06 DAY __ YR. 87 — FOR EXISTING FACILITIES, PROVIDE THE DATE (mo., day, & yr.) OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED (use the boxes to the left)

☐ 2. NEW FACILITY (Complete item below.)

MO. __ DAY __ YR. __ — FOR NEW FACILITIES, PROVIDE THE DATE (mo., day, & yr.) OPERATION BEGAN OR IS EXPECTED TO BEGIN

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

☒ 1. FACILITY HAS AN INTERIM STATUS PERMIT

☐ 2. FACILITY HAS A FINAL PERMIT

III. PROCESSES — CODES AND 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 code(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
GALLONS	G
LITERS	L
CUBIC YARDS	Y
CUBIC METERS	C
GALLONS PER DAY	U
LITERS PER DAY	V
TONS PER HOUR	D
METRIC TONS PER HOUR	W
GALLONS PER HOUR	E
LITERS PER HOUR	H
ACRE-FEET	A
HECTARE-METER	F
ACRES	B
HECTARES	Q

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

LINE NUMBER	A. PROCESS CODE (from list above)	B.1. AMOUNT (specify)	B.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	S 0 1	20,000	G	
2	T 0 4	550	U	
3				
4				
5				
6				
7				
8				
9				
10				

Continued from the front.

III. PROCESSES (continued)

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

T04, S01

This permit covers a one-time proposal to immobilize approximately 200 55-gallon drums of a simulated high level waste slurry that contains enough natural radioactivety to designate a: RMW. The program that originally procured this specialty chemical was eliminated before the material was used for R&D purposes. Although the material has been used intermittently, al remaining material with no future use will be treated.

The RMW will be neutralized and mixed with grout in a "Littleford" mixer and poured into 55-gallon, DOT 17H containers to solidify, eliminating the characteristics of ignitability and EP Toxicity; a photograph of the mixer and controls can be found under the "Physical/Chemica Treatment Technologies." The treatment design capacity is 550 gallons per day.

The grouted slurry will be stored in drums at the site of generation and treatment (1100 Area, see attached drawing) until tests (e.g., EP Toxicity) are completed to verify the wastes can be disposed as non-hazardous waste.

This "Simulated High Level Waste Slurry" was formerly known as "PW-0" and "PW7/7A Material."

IV. DESCRIPTION OF DANGEROUS WASTES

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

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

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

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

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account 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. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

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

Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

I.D. NUMBER (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 1	150,000	P	S 0 1 T 0 4	Storage/Treatment
2	D 0 0 2	included in above			
3	D 0 0 5	"			
4	D 0 0 6	"			
5	D 0 0 7	"			
6	D 0 1 1	"			
7					
8					
9					
10					
11					
12					
13					
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16					
17					
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21					
22					
23					
24					
25					
26					

Continued from the front

IV. DESCRIPTION OF DANGEROUS WASTES (continued)

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

Material to be treated is designated as ignitable (D001), corrosive (D002) due to pH ≤ 2.0 and EP Toxic due to barium (D005), cadmium (D006), chromium (D007) and silver (D011) and is also radioactive due to naturally-occuring elements present.

V. FACILITY DRAWING

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

*This information appears on the attached drawing and photographs.

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

VII. FACILITY GEOGRAPHIC LOCATION

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

VIII. FACILITY OWNER

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

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

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

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

IX. OWNER CERTIFICATION

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

NAME (print or type)	SIGNATURE	DATE SIGNED
Michael J. Lawrence, Manager U.S. DOE, Richland Operations	Michael J. Lawrence	5-19-88

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

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.

Michael J. Lawrence, Manager
Department of Energy
Richland Operations Office

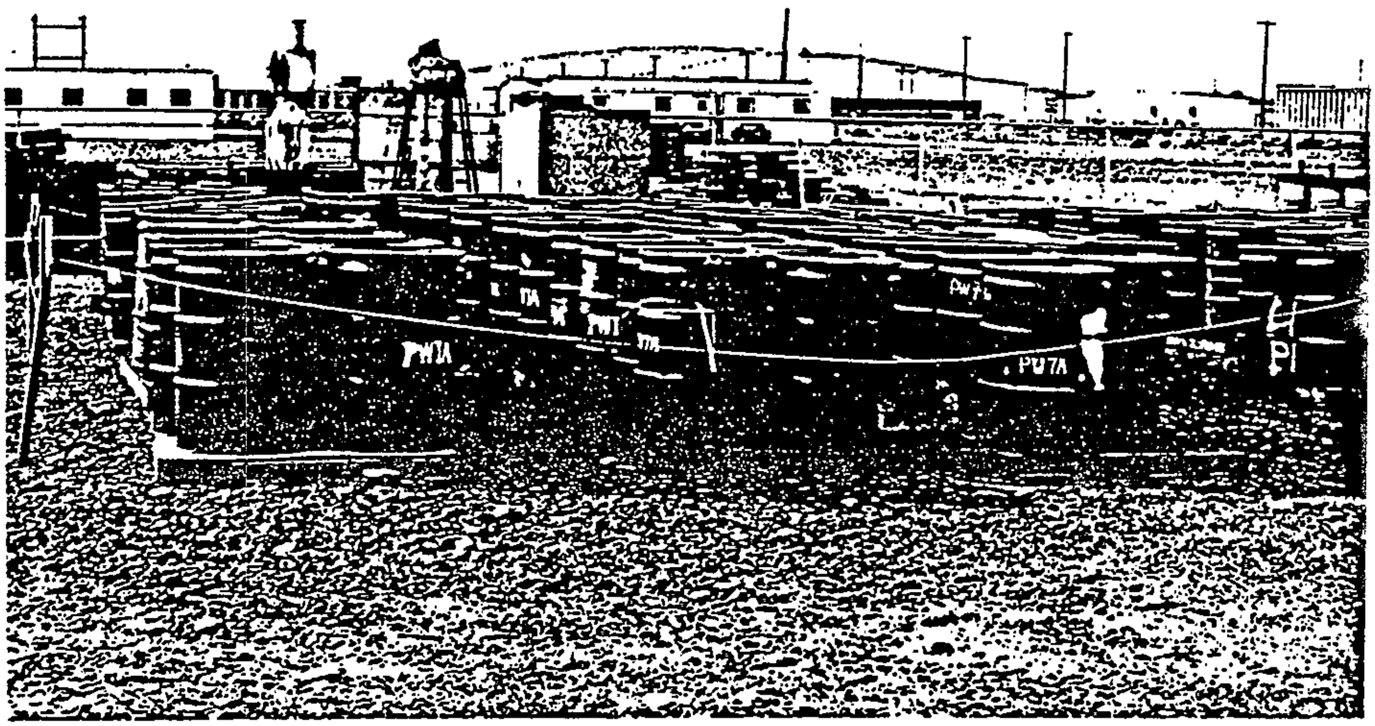
5-19-88
Date

William R. Wiley, Director
Pacific Northwest Laboratory

5/19/88
Date

WA7890008967

Simulated High-Level Waste Slurry Treatment/Storage

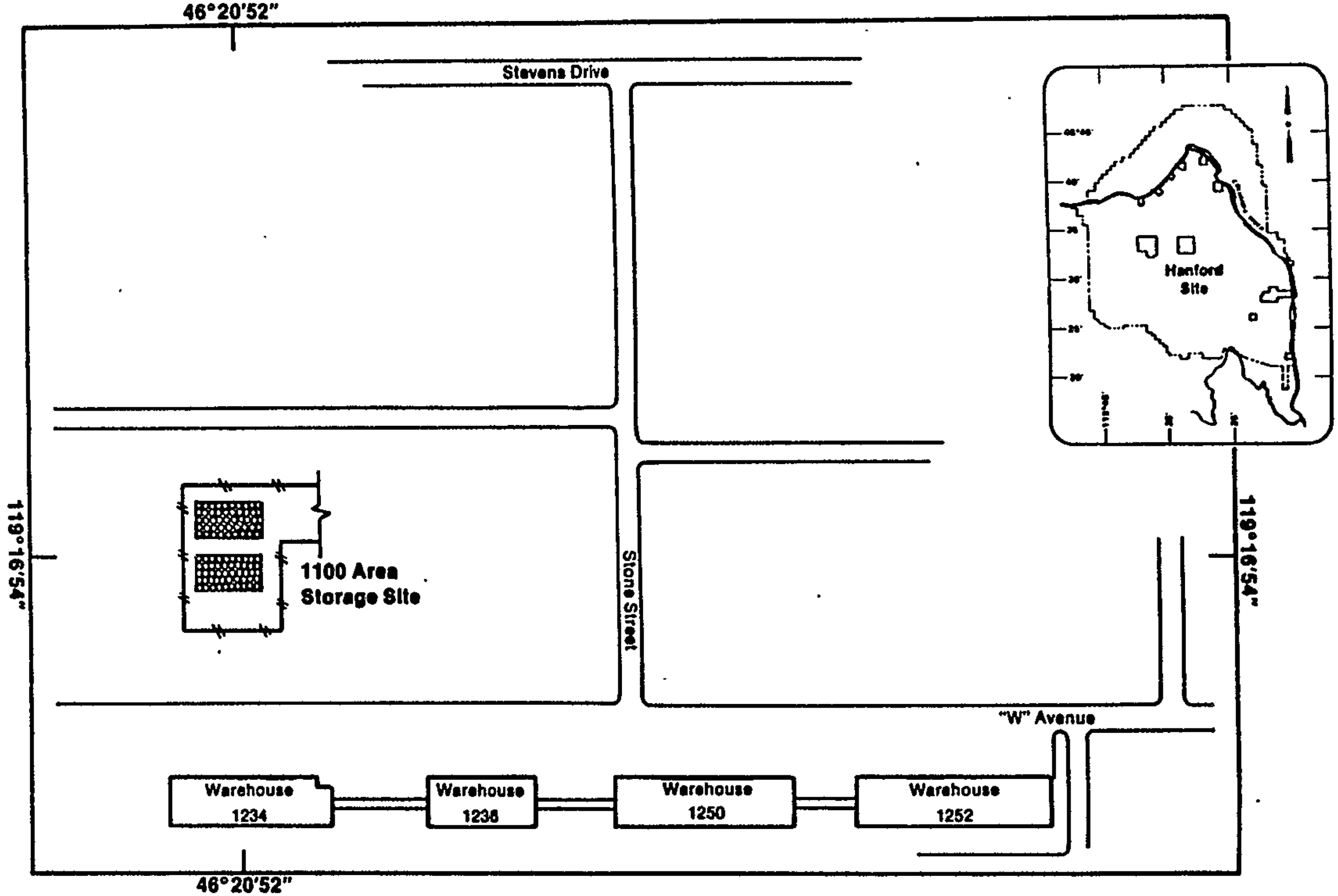


Longitude 119°16'54"
Latitude 46°20'52"

8801374-2CN
Photo Taken 1988

Simulated High-Level Waste Slurry Treatment/Storage

Site Plan



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2.0 FACILITY DESCRIPTION

This Section provides a general description of the DOE Hanford Site and the dangerous waste management unit discussed in this Closure Plan, and is intended to provide the permit application reviewer/permit writer with an overview of the operation.

2.1 GENERAL DESCRIPTION

The DOE Hanford Site consists of approximately 560 square mi (1,450 square km) of semiarid land that is owned and operated by the DOE. This site is located northwest of the City of Richland, Washington, along the Columbia River. The City of Richland lies approximately 3 mi (4.8 km) from the southernmost portion of the Hanford Site boundary and is the nearest population center (Figure 2-1). In early 1943, the U.S. Army Corps of Engineers selected the Hanford Site as the location for reactor, chemical separation, and related facilities for the production and purification of plutonium. A total of eight graphite-moderated reactors using Columbia River water for once-through cooling were built along the Columbia River. These reactors were operated from 1944 to 1971.

N Reactor, a dual-purpose reactor for production of plutonium and generation of steam for production of electricity, uses recirculating water coolant. N Reactor began operating in 1963 and is in the process of being put in a cold standby status.

Activities are centralized in numerically designated areas on the Hanford Site. The reactor facilities (active and decommissioned) are located along the Columbia River in the 100 Areas. The reactor fuel processing and waste management facilities are located in the 200 Areas, situated on a plateau about 7 mi (11.2 km) from the river. The 300 Area, located north of

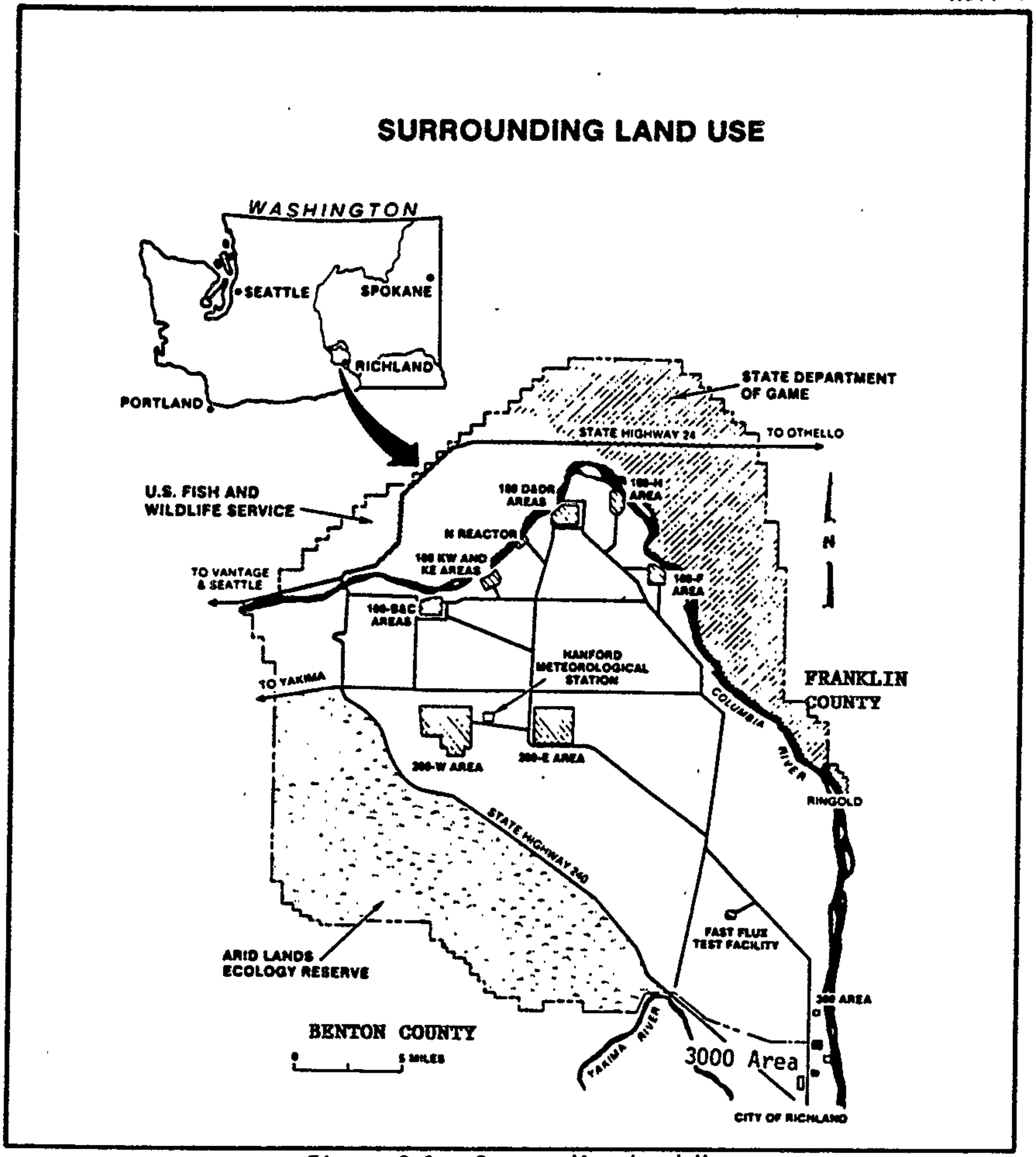

Figure 2-1. Surrounding Land Use

Richland, contains the reactor fuel manufacturing facilities and the research and development laboratories. The 400 Area, 5 mi (8 km) northwest of the 300 Area, contains the Fast Flux Test Facility. The 1100 Area, north of Richland, contains buildings associated with maintenance and transportation functions for the Hanford Site. Administrative buildings and other research and development laboratories are found in the 3000 Area, also north of Richland.

2.2 SHLWS T/S UNIT

The SHLWS T/S unit is an open, fenced-in area located in the 3000 Area of the Hanford Site at approximately 46°20'52" latitude and 119°16'54" longitude. The general location of the SHLWS T/S unit is shown in Figure 2-2. The location of the SHLWS T/S unit within the 3000 Area is shown in Figure 2-3.

The SHLWS T/S unit encompasses approximately 93,000 square ft (8,600 square m) in the shape of two joined rectangles. The larger rectangle is aligned north-south and has a length of 449.5 ft (137 m) and width of 187.5 ft (57 m), while the smaller joins the larger on the southeast corner and is aligned east-west with a length of 114.0 ft (35 m) and a width of 77.5 ft (24 m). The unit is surrounded by a 6-ft chain-link fence. The fence is topped with barbed wire on the western side, which is the only boundary with public access. Access is gained through a single 6-ft locked gate, located on the eastern edge of the unit. Keys to the locked gate are controlled by Mr. H. Wayne Slater (509-376-0575), who is the PNL SHLWS T/S Project Manager.

The interior of the unit is divided among roped-off areas, including one area used for storage of SHLWS in drums, another area used for SHLWS treatment, and one area used for less-than-90-day storage of containerized dangerous wastes, as shown in Figure 2-4. Other areas of the unit are used for nonregulated activities including storage of raw materials and

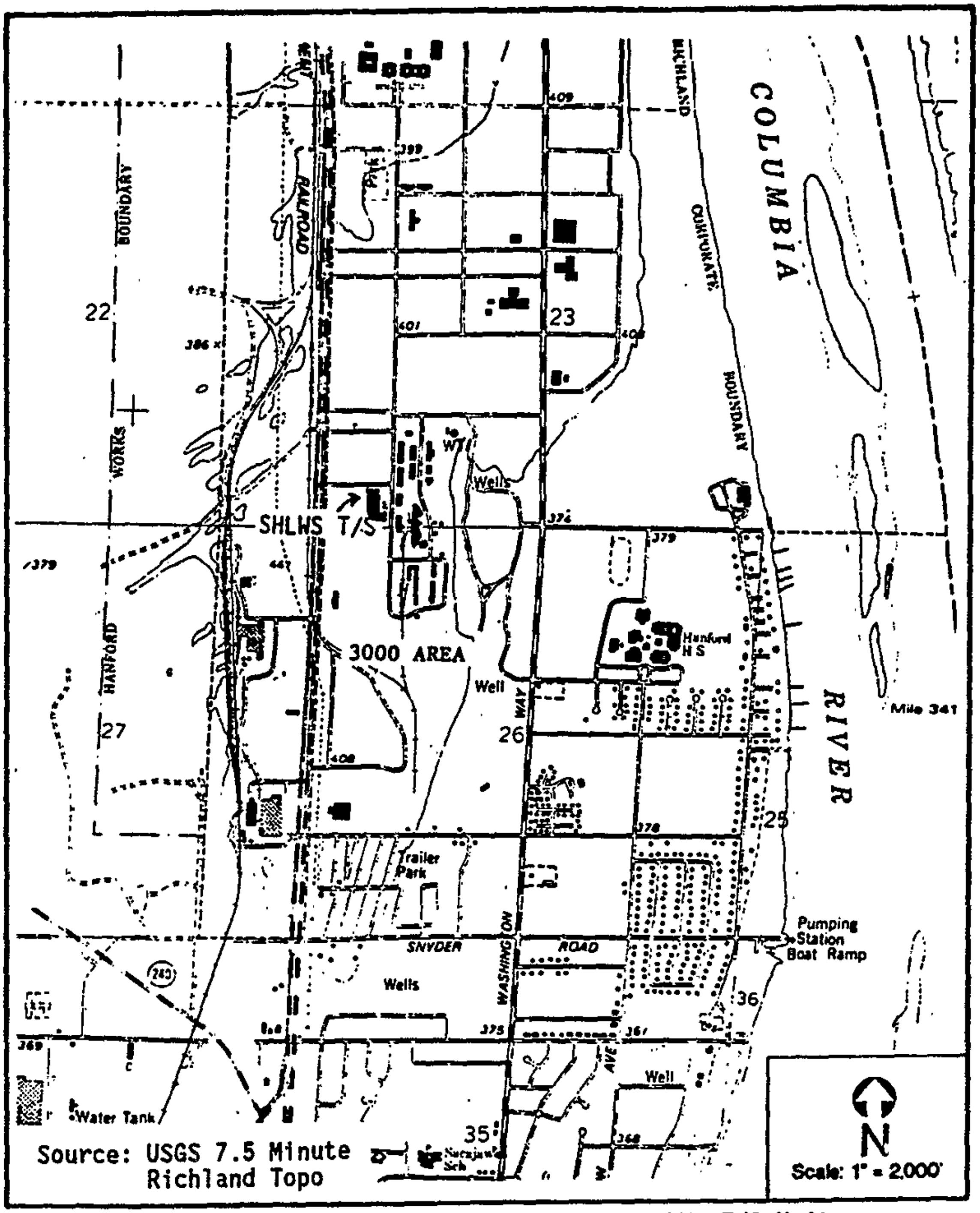

Figure 2-2. General Location of SHLWS T/S Unit

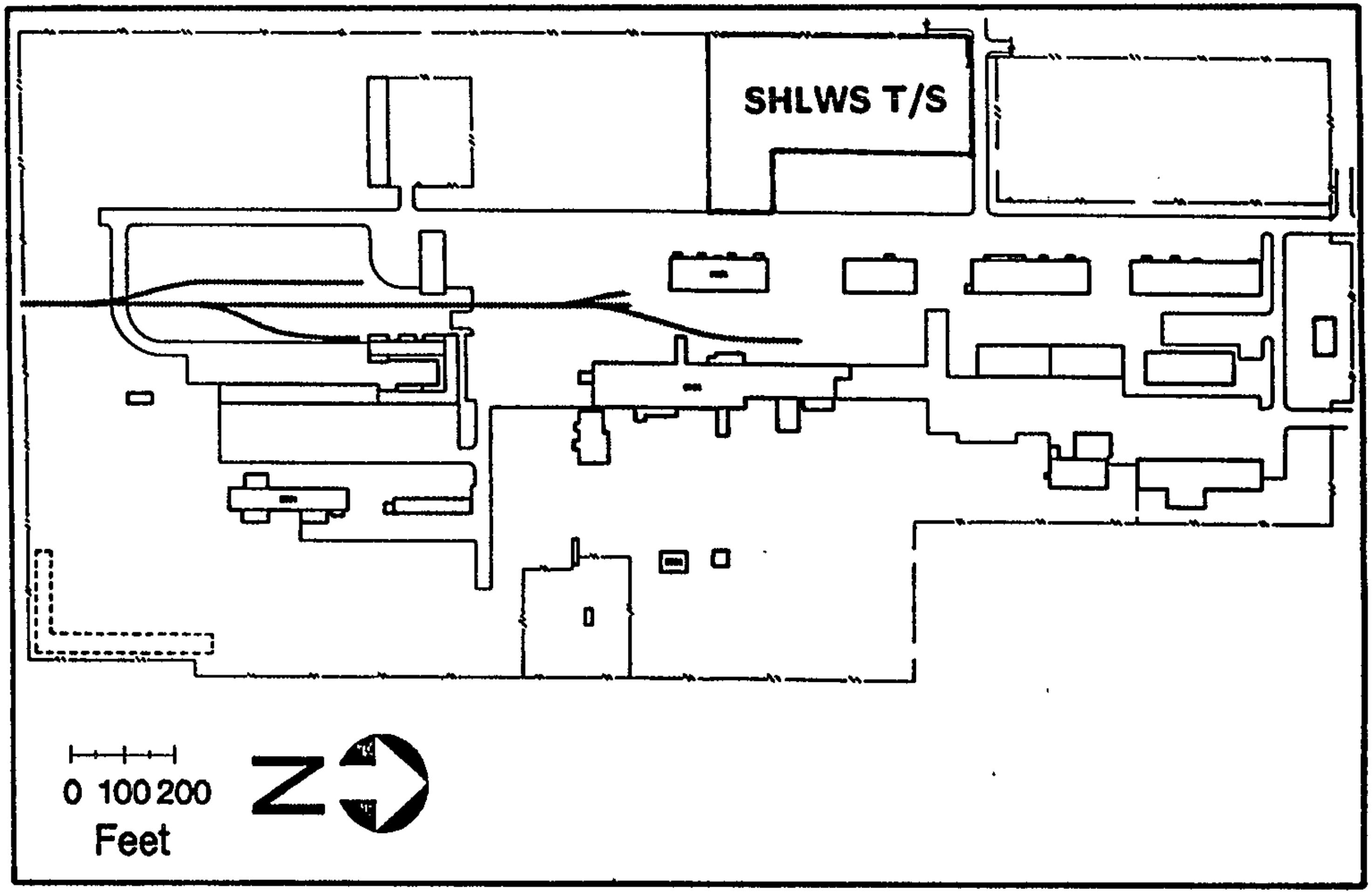

Figure 2-3. Location of SHLWS T/S Unit Within 3000 Area

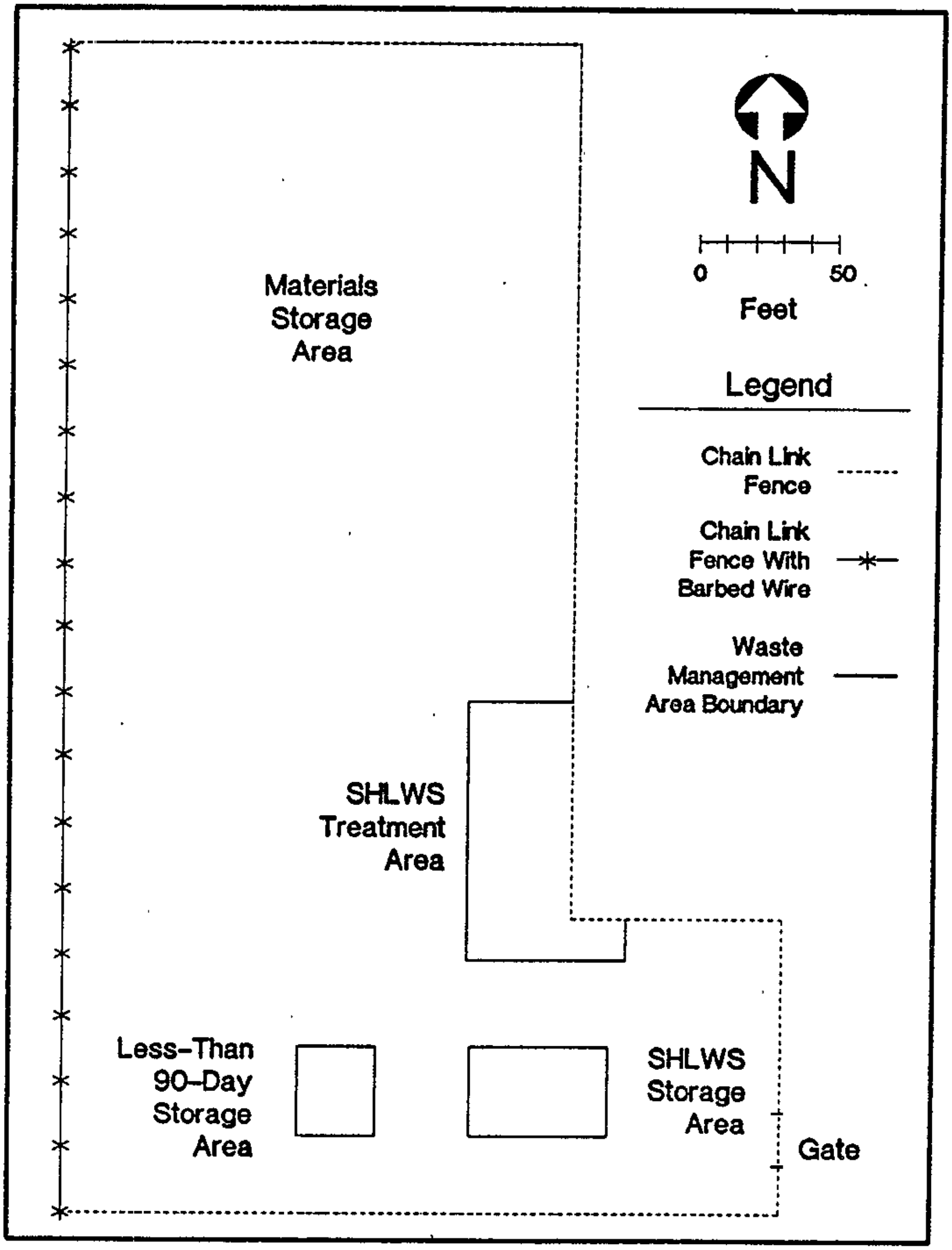

Figure 2-4. Layout of SHLWS T/S Unit

structural materials. Raw materials stored in the unit included the grout-forming chemicals used for treatment (fly ash, blast furnace slag, and portland cement).

2.3 PHYSIOGRAPHY

Figure 2-1 is a general overview map of the entire Hanford Site property and the surrounding countryside. It provides information on major features and illustrates the facility boundary and surrounding land use including the U.S. Fish and Wildlife Service Saddle Mountain National Wildlife Refuge and the Washington State Game Reserve to the north and the Arid Lands Ecological Reserve located to the west. Land east of the Hanford Site across the Columbia River is primarily farmland or a part of the Washington State Game Reserve.

A topographic map of the area around the SHLWS T/S unit is shown in Figure 2-5. As shown in this figure, the topography at the site is very flat. The general topographic slope in the general vicinity is to the east toward the Columbia River.

A more detailed presentation of nearby buildings is provided in Figures 2-2 and 2-3. Figure 2-6 provides the wind roses for various locations on the Hanford Site based on information from the meteorological stations operated by PNL. The wind roses show the relative proportion of time that winds blow from various directions and indicate that winds on the Hanford Site are predominately from the west.

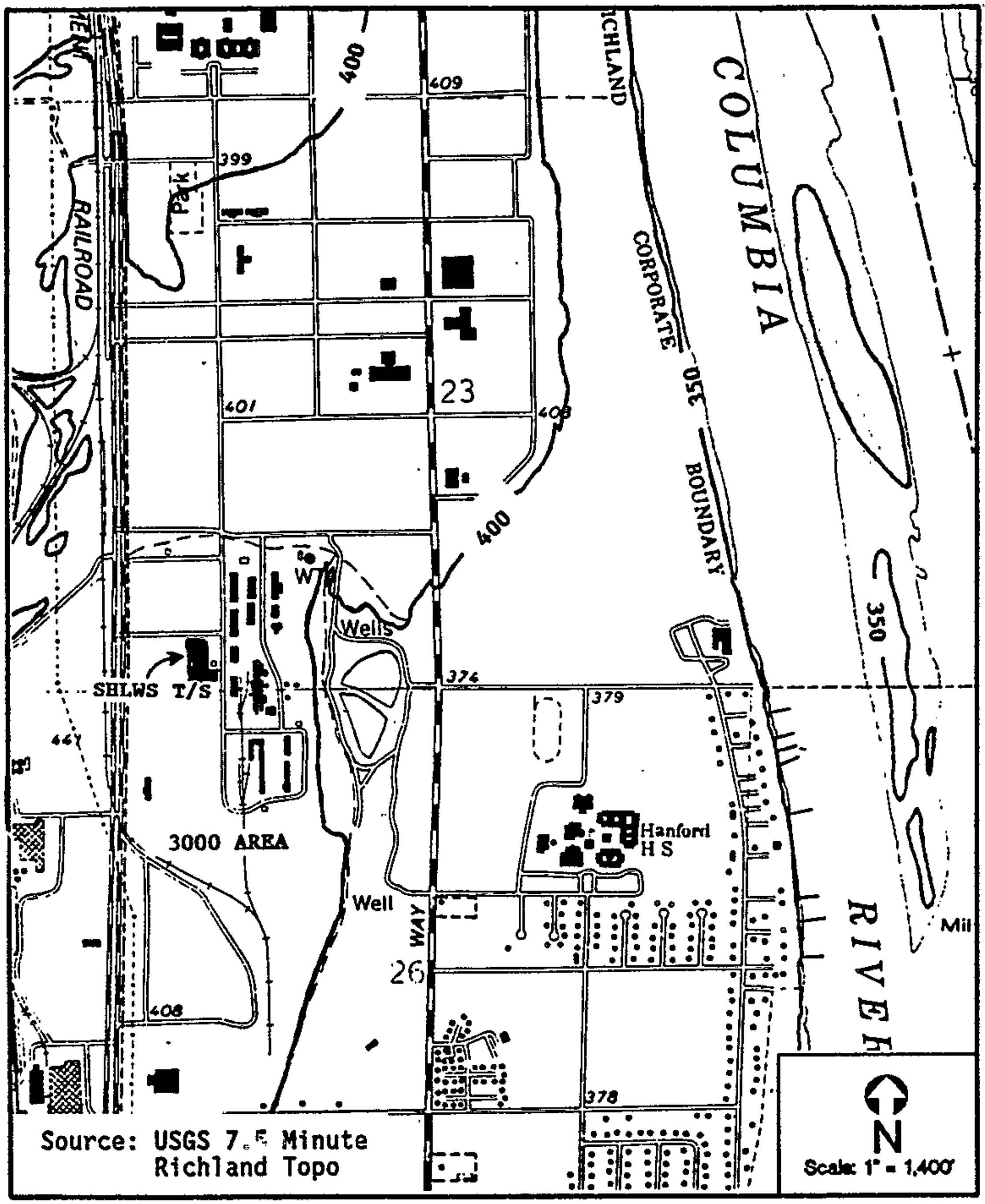

Figure 2-5. Topographic Map for Area Near SHLWS T/S Unit

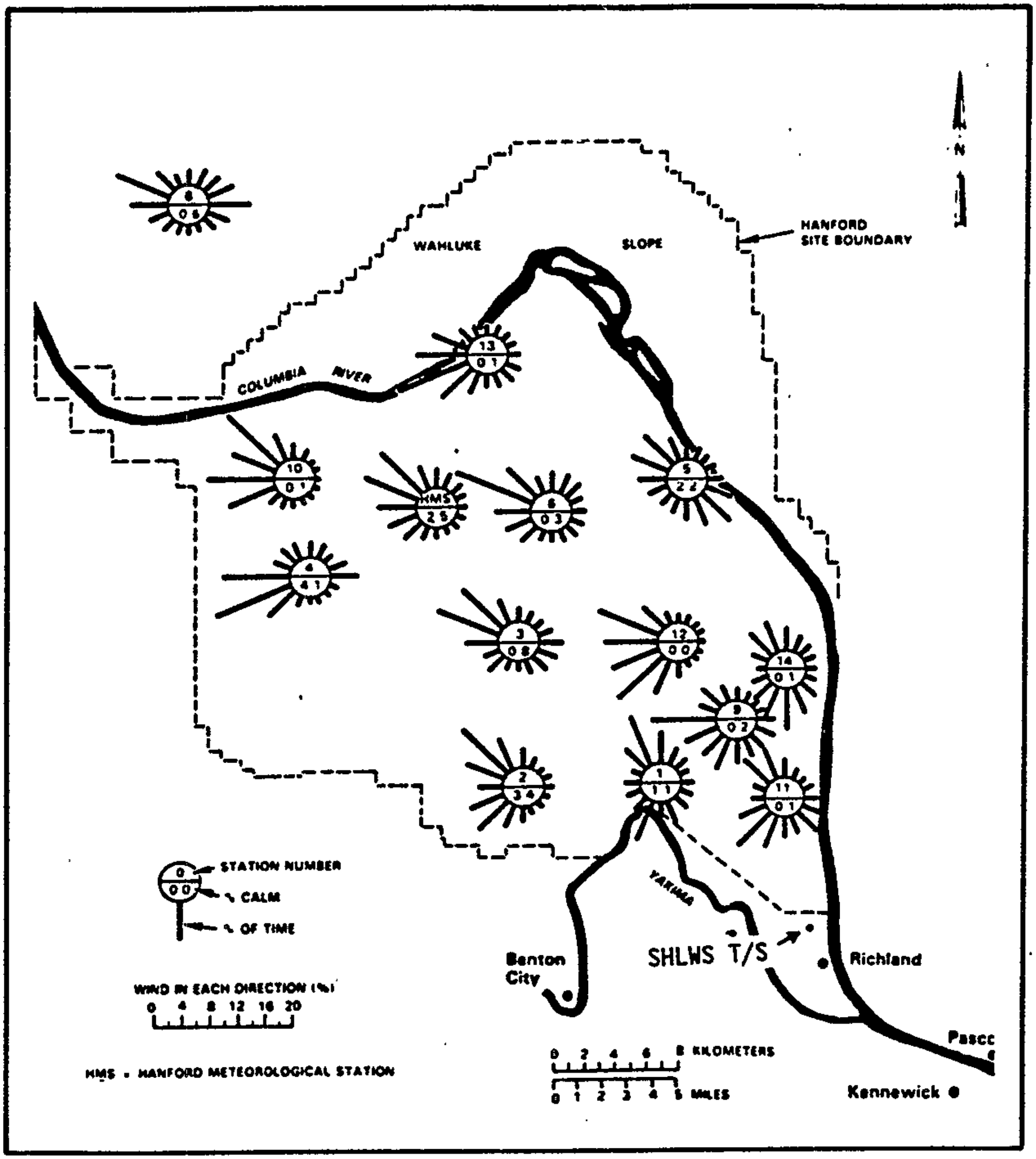

Figure 2-6. Wind Roses for the Hanford Site

2.4 LOCATION INFORMATION

2.4.1 Seismic Consideration

The Hanford Site is not located within any of the counties identified in Appendix VI of 40 CFR 264 and WAC 173-303- 420(3)(c) that are considered to be seismically active.

2.4.2 Floodplain Standard

The U.S. Army Corps of Engineers has calculated the probable maximum flood based on the upper limit of precipitation falling on a drainage area and other hydrologic factors such as antecedent moisture conditions, snowmelt, and tributary conditions that could lead to maximum runoff (USCOE, 1969). The probable maximum flood for the Columbia River below Priest Rapids Dam has been calculated to be 1.4 million cubic ft/s (40,000 cubic m/s). This flow would result in estimated flood elevations of 423 ft (129 m) at the 100-N Area and 384 ft (117 m) at the 300 Area. The area near the 3000 Area estimated to be inundated by this flood is shown in Figure 2-7. The elevation of the SHLWS T/S unit is approximately 400 ft (122 m); the unit would not be inundated by this flood. It is noted that area which would be inundated by this maximum probable flood is greater than that which would be inundated during a 100-yr flood event.

2.5 TRAFFIC INFORMATION

The SHLWS T/S unit is located in the 3000 Area, which is south of the Controlled Access Area of the Hanford Site. The roadways in this area are owned by the U.S. DOE and public use is generally allowed by the DOE. The roadways providing access to the 3000 Area largely receive Hanford employee

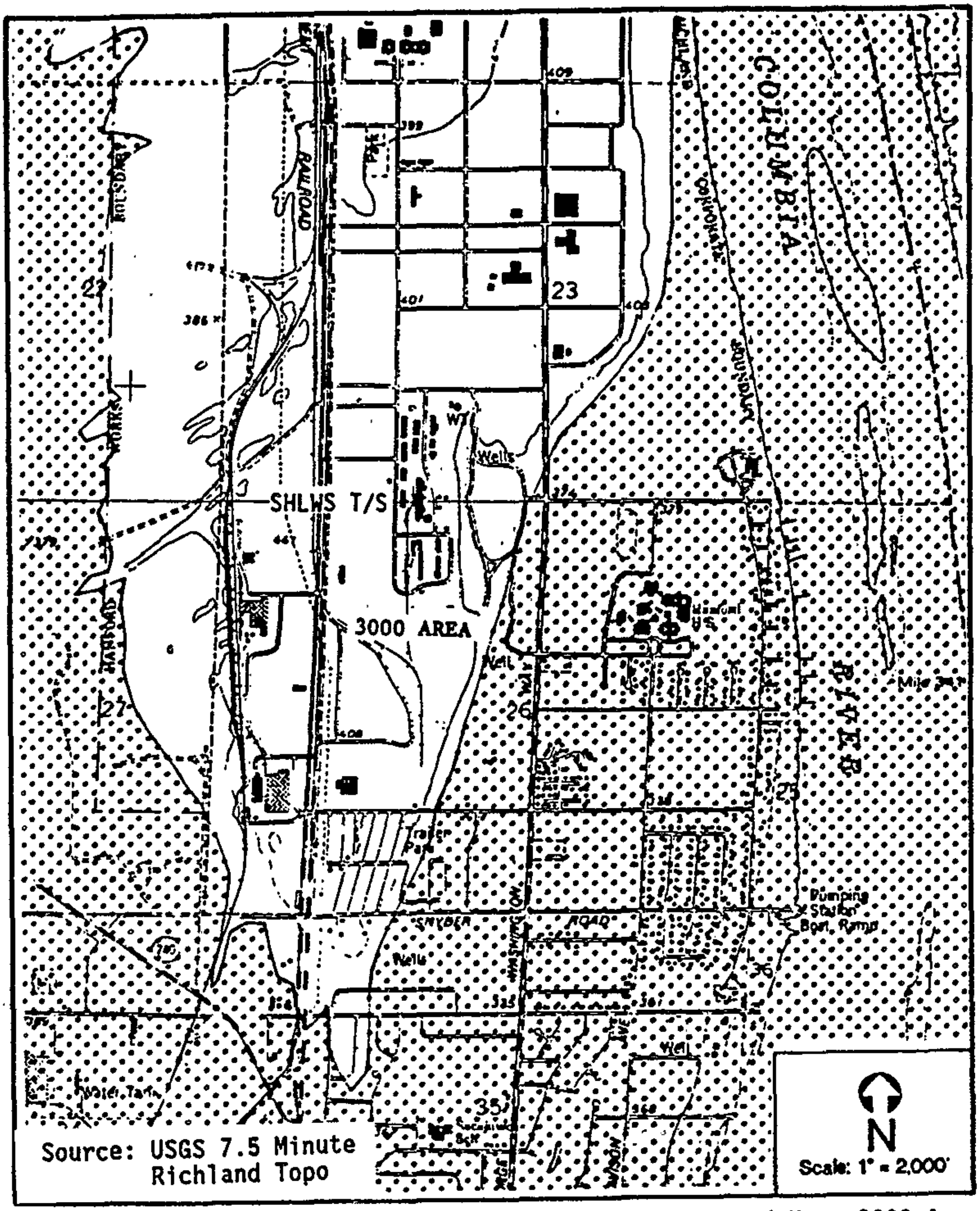

Figure 2-7. Estimated Extent of Maximum Probable Flood Near 3000 Area

traffic because of the lack of non-Hanford-related facilities in the zone between the 3000 Area and the Controlled Access Area. As a consequence, traffic consists of light-duty vehicles and employee buses. The unit itself lies within the fenced-in area managed for DOE by Kaiser Engineers Hanford (KEH) on a dead-end access road (Stone Street). Access to the KEH-managed area is not controlled during normal working hours, but is limited to authorized personnel during off-hours. The SHLWS T/S unit is removed from the major thoroughfare in the vicinity (primarily Route 4S) and does not border on general public traffic lanes. Stone Street and Stevens Drive (Route 4S) are constructed of bituminous asphalt (usually 2 in. [5 cm] thick) with an underlying aggregate base. The aggregate base consists of various types and sizes of rock found on the Hanford Site.

2.6 REFERENCES

U. S. Corps of Engineers. 1969. Memorandum Report - Lower Columbia River Standard Flood Project and Probable Maximum Flood. U.S Army Engineer Division, Portland, Oregon.

3.0 WASTE CHARACTERISTICS

This Section describes the characteristics of the SHLWS stored and treated at the SHLWS T/S unit.

3.1 UNTREATED WASTE CHARACTERISTICS

The SHLWS was created by blending together virgin chemical products to simulate high level wastes for use in experimental waste treatment programs. Two separate compositions of material were created by a chemical supplier, Research Chemical, P.O. Box 14588, Phoenix, Arizona, 85031. These compositions are designated as PW-0 and PW-7A. In addition, a third composition consisting of 50% PW-0 and 50% PW-7A was created after receipt of the SHLWS from the supplier. The compositions of the three mixtures are given in Table 3-1. The compositions shown in Table 3-1 for PW-0 and PW-7A are the specifications which the manufacturer was required to meet. Random samples of the PW-0 and PW-7A supplied by the manufacturer were collected and analyzed by Inductively Coupled Plasma spectroscopy (ICP) and Atomic Absorption (AA) spectroscopy. Analytical results are shown in Table 3-2. The results in Table 3-2 identify several elements which are not included in Table 3-1. These elements reflect impurities in the chemicals used to form the mixtures. The rare earth mixture used consisted of a naturally occurring mineral containing a variety of impurities. The pH of all three compositions was below 1.

The SHLWS met several of the criteria and characteristics for designation of dangerous wastes, as defined by Ecology. The slurries were dangerous waste mixtures (WAC 173-303-084) because of the toxicity and concentrations of the chemical compounds used to prepare the simulated wastes. The wastes also met dangerous waste characteristics (WAC 173-303-090). The

Table 3-1. Composition of SHLWS as Procured

Compound	Concentration (g/L)		
	PW-0	PW-7A	50/50
$AgNO_3$	1.80	0	0.90
$BaNO_3$	37.28	0	18.64
$Cd(NO_3)_2 \cdot 4H_2O$	3.26	0	1.63
$Co(NO_3)_2 \cdot 6H_2O$	15.38	0	7.69
$Cr(NO_3)_3 \cdot 9H_2O$	25.37	0	12.69
$Fe(NO_3)_3 \cdot 9H_2O$	232.66	106.72	169.69
KNO_3	34.18	0	17.09
$NaNO_3$	0	263.15	131.58
$Ni(NO_3)_2 \cdot 6H_2O$	56.85	0	28.43
$Sr(NO_3)_2$	30.19	0	15.10
$ZrO(NO_3)_2 \cdot 2H_2O$	149.68	0	74.84
MoO_3	88.95	0	44.48
Ce	45.90	73.29	61.10
Rare Earths	301.53	279.47	290.50
HNO_3	39	120	77

Note: Compositions of PW-0 and PW-7A are as specified by supplier. Composition of 50/50 mixture is as mixed after receipt from supplier.

Table 3-2. Analyzed Composition of SHLWS

	Concentration (mg/L)	
Constituent	PW-0	PW-7A
Al	3300	6300
Ag	530	<10[a]
As	<0.2	<10
B	(70)[b]	(70)
Ba	4700	210
Ca	2200	2800
Cd	900	<10
Ce	40000	67000
Co	2390	90
Cr	2600	190
Cu	150	160
Dy	9500	12200
Eu	200	190
Fe	24000	13900
Gd	4000	3300
Hg	0.4	0.4
K	14000	5700
La	27000	26000
Mg	340	870
Mn	80	67
Mo	44000	80
Na	900	59500
Nd	21400	26800
Ni	8500	100
Pb	(560)	(600)
Sb	(240)	(200)
Se	<0.022	<10
Si	780	450
Sr	9000	50
Te	(500)	(600)
Ti	120	80
Y	4400	5600
Zr	36800	2000

[a] "Less than" values represent analytical detection limits.
[b] Values in parentheses are near the detection limits.

wastes were ignitable because the high concentration of nitrates caused them to be classified as oxidizers. The wastes were corrosive because their pH was less than 2. The wastes were toxic on the basis of the EP because of the concentration of silver, barium, cadmium, and chromium. The SHLWS also met the federal criteria for land disposal restrictions [RCRA Section 3004(d)(2)] because of pH and concentrations of cadmium and nickel.

The SHLWS was also slightly radioactive because of naturally occurring radioactivity in the rare earth minerals used to prepare the mixtures. At the time that the SHLWS became a waste, it was considered to be a radioactive mixed waste since radiological surveys of the wastes identified levels of radioactivity above background. The exact nature of the radioactivity was not determined until the waste was sampled. Waste sampling and analysis, as described below, determined that the radioactivity was due to naturally occurring radionuclides and that the total specific activity was less than 2,000 pCi/g. Wastes at Hanford which contain naturally occurring radionuclides whose specific activity is less than 2,000 pCi/g are not considered to be radioactive wastes. As a result of the waste analysis, the SHLWS was considered to be dangerous waste rather than mixed waste.

Samples of the mixtures were analyzed for gross alpha activity, gross beta activity, and gamma emitting radionuclides. The gross beta activity was calculated assuming energies similar to ^{90}Sr-^{90}Y. The gross alpha activity was calculated by spiking replicate samples with a known amount of ^{242}Pu to determine absorption effects from residual salts. Results of this analysis are given in Table 3-3. The sample used to determine the radioactive constituents for the 50:50 mixture consisted primarily of sludge which accounts for the higher values. Individual samples of PW-0 and PW-7A were homogenous samples.

Table 3-3. Radiation Resulting from Radioactive Constituents in Untreated SHLWS

Constituent	Concentration (pCi/g)		
	PW-0	PW-7A	50/50
Gross Beta	82.9	66.9	129
Gross Alpha	389	150	600
Gross Gamma[1]			
^{228}Ac[2]	7.21	1.85	13.1
^{214}Bi[3]	2.21	0.70	8.23
^{232}Ra[4]	33.8	40.8	71.1
^{40}K	14.8	<0.81	6.85
Total	529.92	<261.01	828.28

(1) Gamma radiation resulting from other radioisotopes within the chains noted was below background.

(2) Thorium-232 decay chain, parent is radium-228.

(3) Uranium-238 decay chain.

(4) Uranium-235 decay chain, parent is actinium-227

3.2 TREATED WASTE CHARACTERISTICS

Samples of treated SHLWS were collected during treatment and tested following completion of the curing period. The samples were analyzed for unconfined compressive strength, EP toxicity, corrosivity, and acute fish toxicity. Testing of the treated SHLWS was documented in response to Ecology requests for information concerning the treatment. Sampling and testing are described in detail in the document provided Ecology (Lokken, 1989). Results of this testing are summarized below.

Table 3-4. EP Toxicity Results for Solidified SHLWS

Sample ID	Concentration, mg/L							
	As	Ba	Cd	Cr	Pb	Hg	Se	Ag
PW-0 7-3	<0.06	2.1	0.13	0.01	<0.03	<0.005	0.05	<0.02
PW-0 42-3	<0.06	2.7	0.21	0.01	<0.03	<0.005	0.04	<0.02
PW-0 75-3	<0.06	1.9	<0.005	0.02	<0.03	<0.005	0.08	<0.02
PW-0 87-3	<0.06	1.5	<0.005	0.02	<0.03	<0.005	0.08	<0.02
PW-0 104-3	<0.06	1.3	<0.005	0.02	<0.03	<0.005	0.06	<0.02
PW-0 144-3	<0.06	2.4	0.20	0.02	<0.03	<0.005	0.04	<0.02
PW-7A 171-2	<0.06	1.7	<0.005	<0.01	<0.03	<0.005	0.05	<0.02
PW-7A 191-2	<0.06	2.4	<0.005	0.01	<0.03	<0.005	0.06	<0.02
PW-7A 220-2	<0.06	1.6	<0.005	<0.01	<0.03	<0.005	0.05	<0.02
PW-7A 231-2	<0.06	1.3	<0.005	<0.01	<0.03	<0.005	0.04	<0.02
PW-7A 273-2	<0.06	2.5	<0.005	<0.01	0.04	<0.005	<0.03	<0.02
PW-7A 276-2	<0.06	2.1	<0.005	<0.01	0.04	<0.005	<0.03	<0.02
EP Toxicity Limits	5	100	1	5	5	0.2	1	5

given in Table 3-5. All results are within the allowable pH range of 2 to 12.5. These results indicate that the treated SHLWS is not dangerous because of the corrosivity characteristic.

3.2.4 Acute Fish Toxicity

Acute fish toxicity (Biological Testing Method No. WDOE 80-12) was determined for a composite sample of solidified PW-0. The lethal concentration (LC_{50}) for this material was greater than 1,000 mg/L.

Table 3-5. Corrosivity Test Results for Solidified SHLWS

Sample ID	pH
PW-0 7-2	11.6, 11.6, 11.6
PW-0 42-2	11.5, 11.5, 11.5
PW-0 75-2	11.5, 11.6, 11.5
PW-0 87-2	11.5, 11.5, 11.5
PW-0 104-2	11.3, 11.3, 11.3
PW-0 144-2	11.3, 11.3, 11.3
PW-7A 171-1	11.5, 11.5, 11.5
PW-7A 191-1	11.4, 11.3, 11.3
PW-7A 220-1	11.5, 11.5, 11.5
PW-7A 231-1	11.6, 11.6, 11.6
PW-7A 272-1	11.5, 11.5, 11.5
PW-7A 276-1	11.5, 11.5, 11.5

3.2.5 Radioactivity

The radioactivity (gross gamma) of the treated PW-0 and PW-7A was calculated to be 35 pCi/g and 18 pCi/g, respectively. This is significantly less than the gross gamma of the untreated slurry (see Table 3-3) because of dilution provided by addition of the grout-formers and neutralizing material. In addition, the effective radiation dose from alpha and beta emitters within the waste is reduced significantly by treatment because of the self-shielding effect of the grout. As shown in Table 3-3, radiation from naturally occurring radionuclides in the untreated SHLWS is well below 2,000 pCi/g. Due to dilution, the concentrations of radionuclides in the treated waste are less than those in the untreated waste. Wastes containing naturally occurring radionuclides below the 2,000 pCi/g threshold may be disposed of at the Hanford Site as nonradioactive solid waste.

3.3 REFERENCES

ASTM. 1985. "C-39-84, Standard Test Methods for Compressive Strength of Cylindrical Concrete Specimens," 1985 Annual Book of ASTM Standards, Volume 04.02 Concrete and Mineral Aggregates, American Society for Testing and Materials, Philadelphia, PA.

Lokken, R. O. 1989. Treatment of Excess Process Chemicals (Simulated High-Level Waste Slurry, PNL-6915. Pacific Northwest Laboratory, Richland, Washington.

4.0 PROCESS INFORMATION

The SHLWS T/S area was used for storage of containers of waste and for treatment of this waste by solidification/stabilization. The area is now used for storage of drums of treated SHLWS. The waste storage and treatment areas are separate, as shown in Figure 4-1. Details of the SHLWS storage area, less-than-90-day waste storage area, and treatment area are provided in Figures 4-2 through 4-4, respectively. The untreated SHLWS containers consisted of 55-gallon (208-liter), polyethylene-lined, carbon steel drums, which were stored on pallets. The palletized drums were stored in two vinyl-lined storage areas having 4-inch spill containment curbs, as shown in Figure 4-2. Because of the corrosive nature of the SHLWS, some of the drums had corroded. Secondary containment was provided for these corroded drums by wrapping them with polyethylene and placing them in "Spil-Tainer" polyethylene containers. Each "Spil-Tainer" contained one drum; these were stored in a separate unlined area as shown in Figure 4-2.

The SHLWS treatment was conducted in a separate area which is roped-off and identified by warning signs. The SHLWS treatment process is summarized as follows.

1) A full pallet of four (4) SHLWS drums was transferred by fork-lift truck from the storage area to the treatment area and placed in a stainless steel spill containment pan.

2) The lids of the drums were removed and the contents homogenized by mixing with an air-driven drum mixer. The contents of each drum were adjusted to approximately 34 gallons (130 liters) by pumping excess homogenized mixture into empty or partially-filled polyethylene-lined drums.

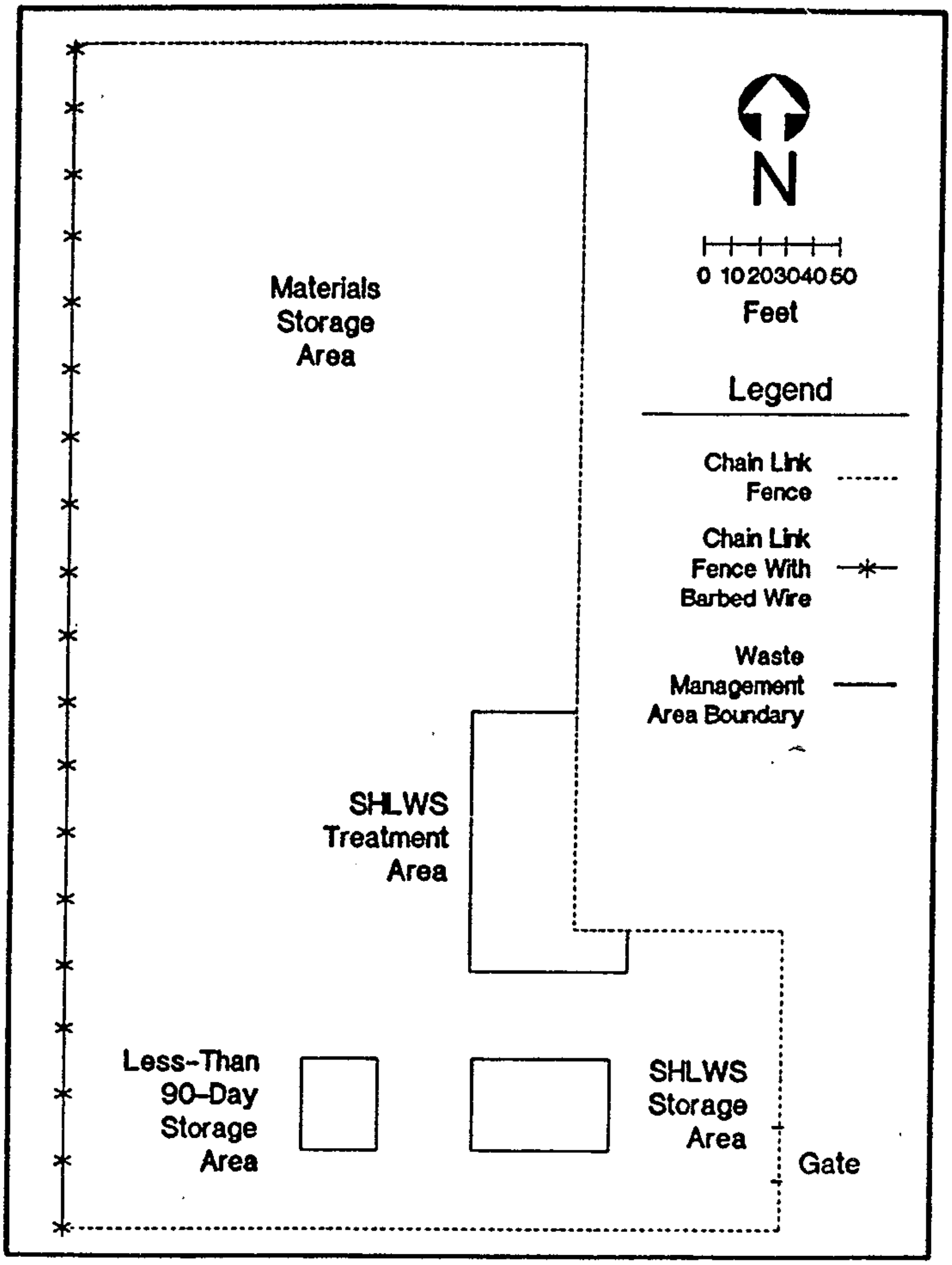

Figure 4-1. Layout of SHLWS Storage and Treatment Areas

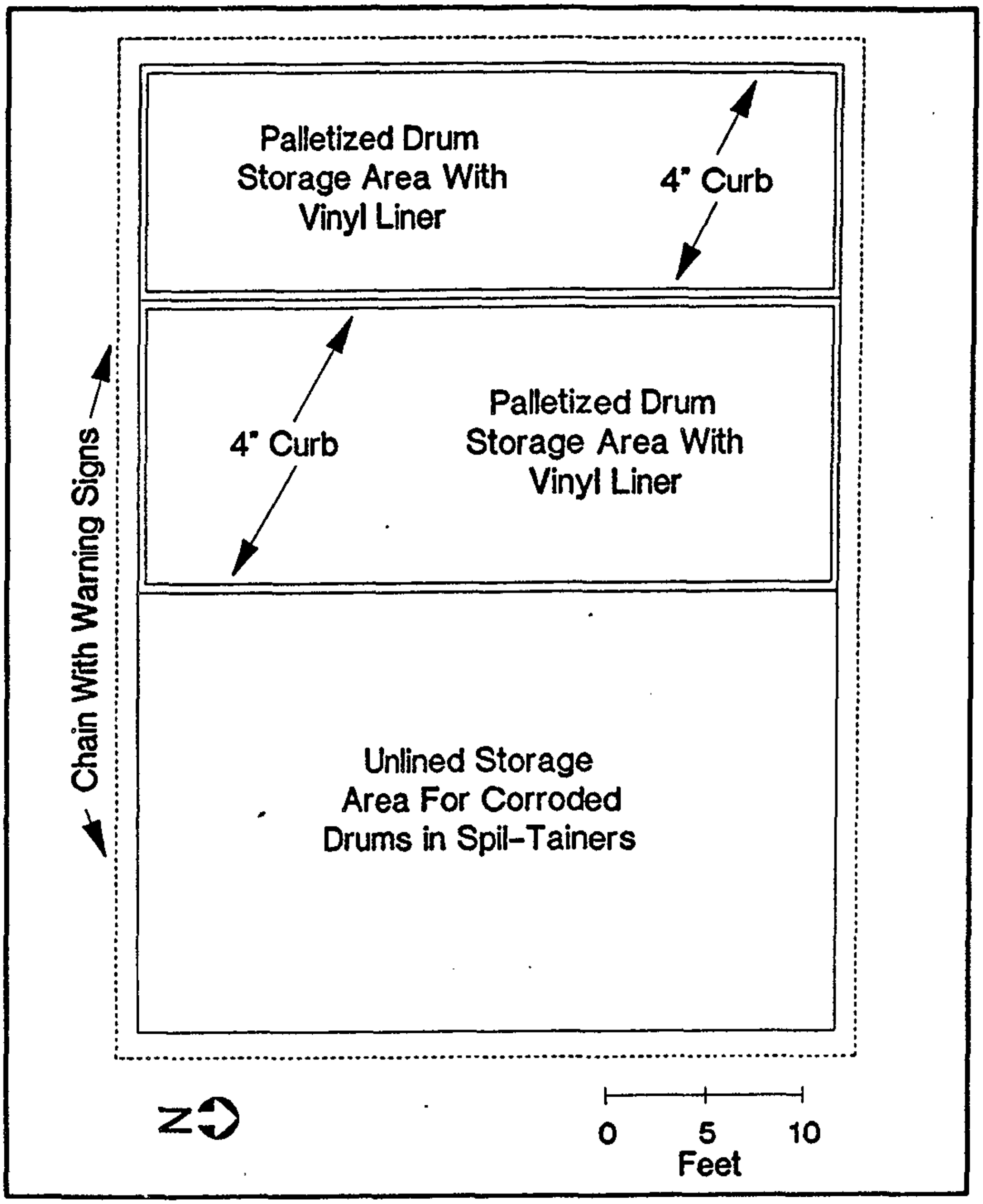

Figure 4-2. Details of the SHLWS Storage Area

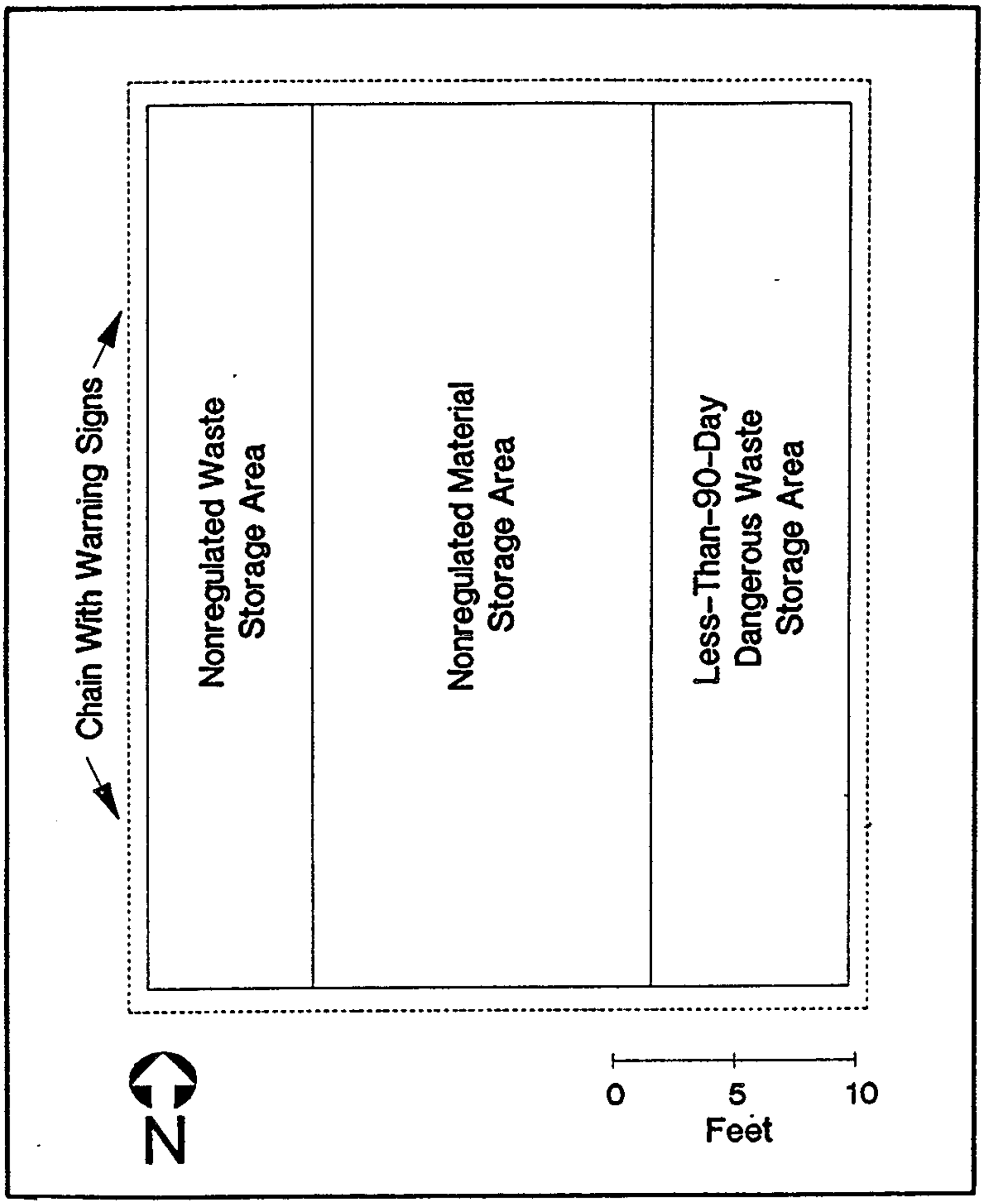

Figure 4-3. Details of the Less-Than-90-Day Waste Storage Area

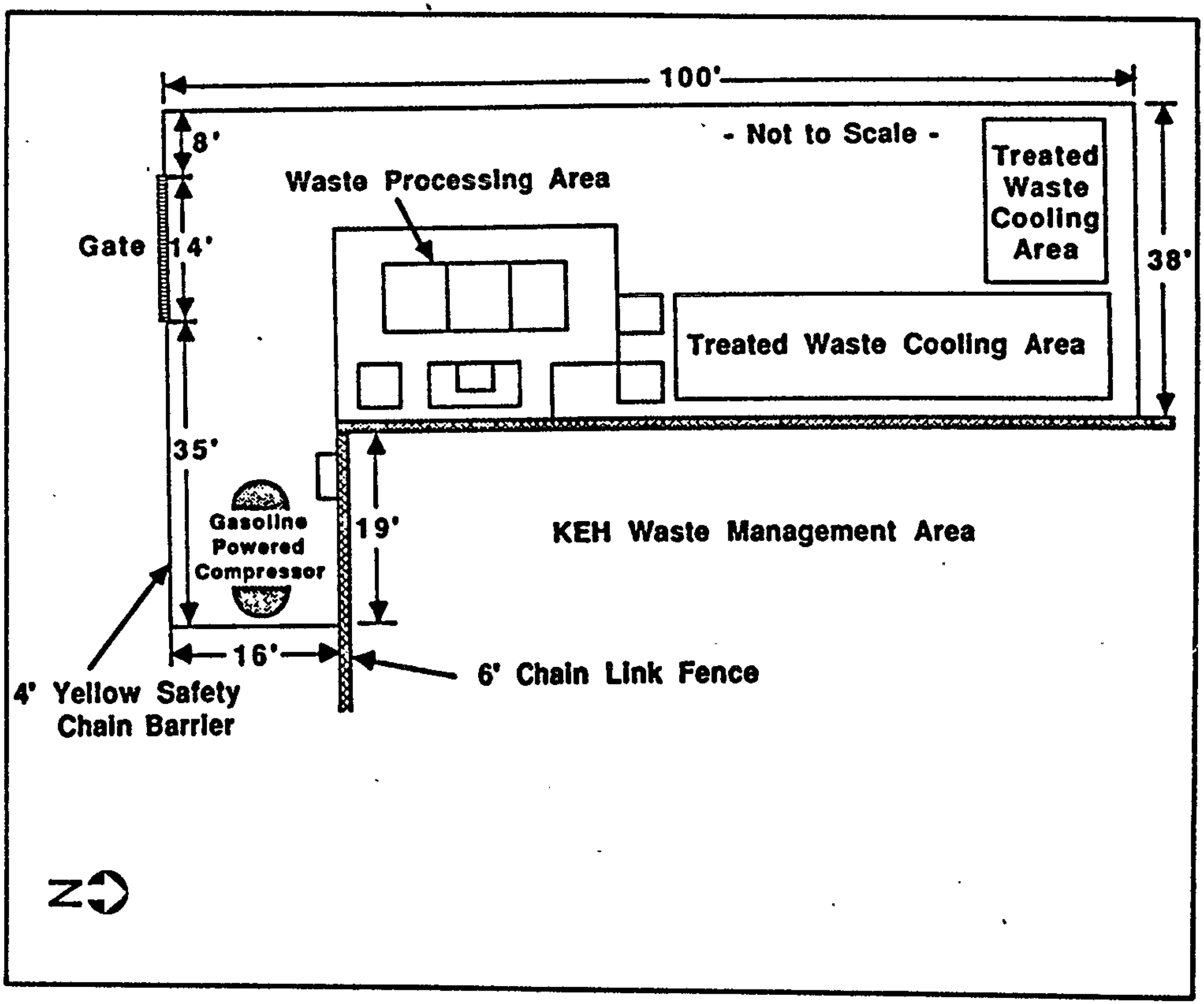

Figure 4-4. Details of the SHLWS Treatment Area

3) The pH of the waste mixture was adjusted to pH 6±0.5 by addition of 50% NaOH (19M). The caustic was added at a rate of approximately 0.5 gal/min (2 L/min) while mixing the slurry with an air-driven drum mixer. During caustic addition, the temperature of the slurry was monitored and caustic addition stopped if the temperature reached 85°C.

4) Following neutralization, the lid of the drum was replaced. When a pallet of drums had been neutralized, the pallet was transferred to a temporary storage area to allow the drums to cool to below 45°C (approximately 24 hours). The temporary storage area is adjacent to the mixing area and is lined with a 30-mil (0.076 cm) polyvinyl chloride (PVC) liner which is curbed to provide spill containment and to control runon and runoff.

5) Once the drums had cooled, the pallet was transferred back to the mixing area and placed in the spill pan. The drum lid was removed and the contents of the drum mixed with the air-driven drum mixer. The grout was formed by addition of one 80-pound (36-kg) bag of fly ash, one 90-pound (41 kg) bag of blast furnace slag, and one 94-pound (43-kg) bag of portland cement.

6) A sample of grout was obtained at random from approximately one of every 12 drums of grout. The sampling frequency was selected based on a statistical analysis of sample rates necessary to provide 95% confidence that 99.5% of the treated drum contents would have the same characteristics as the analyzed samples. Samples were collected using a composite liquid waste sampler (COLIWASA). After sampling, the slurry samples were poured into plastic bottles for curing prior to testing. These samples were tested for EP toxicity, corrosivity, and acute fish toxicity to verify that stabilization of the wastes had occurred and

that hazardous constituents were not leachable from the treated wastes at levels of concern.

7) Following addition of the grout-forming chemicals, the drums were resealed and transferred to the temporary storage area for curing. The lids were temporarily left unsealed to eliminate the potential for pressure buildup caused by volume changes during curing.

8) Once the treated slurry was hardened, the drum lids were secured and the pallet of drums transferred back to the SHLWS storage area.

Additional information describing the waste treatment process and related activities is contained in the "RCRA Plans 'Compliance Notebook' for Simulated High-Level Waste Treatment/Storage." This document contains plans for the SHLWS T/S unit required under WAC 173-303 including a waste analysis plan, security plan, general inspection plan, training plan, preparedness and prevention plan, contingency plan, emergency plan, facility record keeping plan, and facility reporting plan. A copy of this document is maintained at the SHLWS T/S unit and is available for review through the PNL Project Manager, Mr. H. W. Slater.

5.0 GROUNDWATER MONITORING

Groundwater monitoring is not presently applicable to the SHLWS T/S unit. 40 CFR 265 Subpart F requires groundwater monitoring for landfills, impoundments, and land treatment sites only. As a container storage unit and treatment unit, the SHLWS T/S unit does not meet any of the three designations.

The need for groundwater monitoring at the SHLWS T/S unit will be determined as part of the closure activities described in Section 6.0 of this Plan. A soil sampling and analysis program will be implemented to verify removal of any contamination above the closure performance standard. The results of this sampling and analysis program will be used to determine the potential for contamination of groundwater at the site. If vertical contaminant profiles indicate significant potential for downward migration of contaminants, a groundwater monitoring program will be implemented to assess the impacts to groundwater.

6.0 CLOSURE AND POST-CLOSURE REQUIREMENTS

The SHLWS T/S unit currently contains drums of SHLWS which have undergone treatment by solidification/stabilization. Because the untreated SHLWS was originally designated as a radioactive mixed waste and later as a dangerous waste, a Part A permit application was submitted and the unit operated under interim status standards. As an interim status unit, the SHLWS T/S unit will be closed according to Section 6.3 of the Hanford Federal Facility Agreement and Consent Order Action Plan, which references applicable requirements under Federal and State hazardous waste regulations. The treated wastes will be removed from the unit for disposal and the unit will not be used for any additional dangerous or radioactive mixed waste management activities.

The purpose of this Section is to demonstrate that the DOE-RL and PNL have developed a plan to assure safe closure of the unit and adequate post-closure care in accordance with applicable regulations.

To aid in the evaluation of this Closure Plan, it is organized corresponding to the headings of the closure/post-closure checklist given in <u>Protocol for Evaluating Interim Status Closure/Post-Closure Plans</u>, U.S. EPA, Office of Solid Waste. Reference is made to applicable sections of WAC 173-303 and 40 CFR 265.

6.1 GENERAL CLOSURE REQUIREMENTS

6.1.1 Partial and/or Final Closure Activities [40 CFR 265.111 and 265.112, WAC 173-303-610(2),(3)]

This Plan presents the activities required for final closure of the SHLWS T/S unit at its maximum extent of operation. Partial closure will not be conducted. Closure activities are presented in sufficient detail such that the closure process is understandable and a closure schedule can be developed.

6.1.1.1 Closure Performance Standard [40 CFR 265.111, WAC 173-303-610(2)]

The SHLWS T/S unit will be closed in a manner that will minimize the need for further maintenance and minimize or eliminate post-closure release of dangerous/mixed wastes or dangerous/mixed waste constituents which could pose a risk to human health or the environment. This standard will be met by removal of all dangerous/mixed wastes and dangerous/mixed waste residuals from the site. All SHLWS stored at the unit has been treated using the process described in Section 4.0 of this Plan, and the treated waste will be removed from the unit for final disposition prior to beginning closure. All equipment at the unit will be decontaminated using the procedures described in Sections 6.3.2 and 6.11.2 of this Plan or removed from the unit for final disposition. All residuals resulting from decontamination will be removed from the unit for final disposition. Contaminated soils will be removed from the unit so that dangerous waste residuals in soils remaining on site are below the levels given in WAC 173-303-610(2)(b). The requirements of WAC 173-303-610(2)(b) dictate that residuals in soil do not exceed:

(i) Background environmental levels, for any dangerous waste, managed at the facility, which either is listed under WAC 173-303-081 or 173-303-082 or is designated by the characteristics of WAC 173-303-090; and

(ii) At least the designation limits of WAC 173-303-084, or 173-303-101 through 173-303-103 for any dangerous waste, managed at the facility, which is not listed under WAC 173-303-081 or 173-

303-082 and is not designated by the characteristics of WAC 173-303-090.

If it is determined to be impractical to remove all such contaminated soils or other dangerous/mixed waste residuals, they will be stabilized on-site such that they will not pose a risk to human health or the environment. The soils will be graded so that the unit is returned to the appearance and use of surrounding land areas.

6.1.1.2 Contents of Plan [40 CFR 265.112(b), WAC 173-303-610(3)(a)]

This Plan identifies the steps necessary to perform final closure of the unit. The Plan identifies how the SHLWS T/S unit will be closed in order to meet the closure performance standard given in Section 6.1.1.1. Section 6.1 addresses general regulatory requirements for closure of treatment, storage, and disposal (TSD) units. Section 6.2 addresses general post-closure requirements, which are not currently applicable because it is not planned to close the SHLWS T/S unit as a unit requiring post-closure care. Section 6.3 describes the procedures which will be undertaken to close the container storage areas at the SHLWS T/S unit, including removal of containers, decontamination of equipment, and removal of any contaminated soils. Section 6.11 describes the procedures which will be undertaken to close the treatment area at the SHLWS T/S unit, including decontamination of equipment and disposal of decontamination wastes. Sections 6.4 through 6.10 are not applicable because they address closure requirements of other types of TSD units.

6.1.1.2.1 Maximum Inventory of Wastes, Removal of Wastes [40 CFR 265.112(b)(3), WAC 173-303-610(3)(a)(iii),(iv)]

Prior to commencing treatment operations, the SHLWS T/S unit contained 100 drums of PW-0 waste, 98 drums of PW-7A waste, 1 drum of 50% PW-0 and 50% PW-7A waste, and 11 drums of secondary waste, including drum liners, absorbent, and soil. Because of the volume addition associated with treatment, the 199 drums of SHLWS resulted in a total of 306 drums of treated waste. No additional wastes will be added to this inventory. This inventory represents the maximum inventory of dangerous/mixed wastes on-site in the SHLWS container storage area during the active life of the unit. The SHLWS T/S unit also contains a less-than-90-day dangerous waste storage area which was used to accumulate drummed dangerous wastes. The maximum inventory of wastes stored in this area at any one time was 79 drums. All wastes accumulated in this area have been removed to the 305-B Storage Building which is permitted under interim status for storage of dangerous and mixed wastes. The SHLWS storage area, SHLWS treatment area, and less-than-90-day waste storage area (see Figure 2-4) represent the maximum extent of the unit (used for dangerous/mixed waste management) operational during the active life.

The process used to treat the SHLWS is described in Section 4.0. Methods to be used for removing, transporting, storing, or disposing of all dangerous/mixed wastes at the time of closure are described in Sections 6.3 and 6.11 for the container storage areas and treatment area, respectively.

6.1.1.2.2 Removal and Decontamination Procedures [40 CFR 265.112(b)(4)), WAC 173-303-610(3)(a)(v)]

Steps for removing or decontaminating all dangerous/mixed waste residues and contaminated equipment are described Sections 6.3 and 6.11 for the container storage areas and treatment area, respectively.

6.1.1.2.3 Other Activities During Closure Period [40 CFR 265.112(b)(5); WAC 173-303-610(3)(a)(vi)]

This Closure Plan for the SHLWS T/S unit is based upon removal of all dangerous/mixed wastes and dangerous/mixed waste residues. Control of run-on and run-off will be accomplished by performing closure activities (e.g., equipment decontamination) within bermed collection areas. All liquids collected in the bermed collection areas will be managed as liquid decontamination wastes, as described in Section 6.3.2.2. Other activities such as groundwater monitoring and leachate collection are currently deemed unnecessary. Groundwater monitoring and leachate collection are not required for container storage areas under WAC 173-303-645 and WAC 173-303-630, respectively. If, during implementation of this Closure Plan, it becomes evident that all dangerous/mixed waste residuals cannot be practicably removed, other closure activities will be identified and the Closure Plan will be amended.

6.1.1.2.4 Closure Schedule [40 CFR 265.112(b)(6),(7), WAC 173-303-610(3)(a)(vii)]

Closure of the SHLWS T/S unit is scheduled to begin in 1990. A detailed schedule of closure activities is presented in Sections 6.3.1.8 and 6.11.1.8 for the container storage areas and treatment area, respectively.

6.1.1.3 Amendment of Closure Plan [40 CFR 265.112(c), WAC 173-303-610(3)(b)]

No changes in unit design or year of closure are expected that would require amendment to the Closure Plan. Unexpected events (e.g., discovery of dangerous/mixed waste residuals that cannot be removed) could be encountered during implementation of closure activities. If so, the Closure Plan will be amended and resubmitted to EPA and Ecology within 30 days of encountering such an unexpected event. The PNL Project Manager, Mr. H. W. Slater, will be responsible for amendment of the Plan. The amended plan will be resubmitted to EPA and Ecology by PNL and DOE-RL.

6.1.1.4 Notification of Closure [40 CFR 265.112(d), WAC 173-303-610(3)(c)]

This Closure Plan will be submitted to EPA and Ecology by September 1989. This deadline for submission corresponds to Interim Milestone M-20-19 of the Action Plan for Implementation of the Hanford Consent Order and Compliance Agreement (Action Plan).

6.1.1.5. Closure Activities Performed Prior to Notification of Closure [40 CFR 265.112(e), WAC 173-303-610(3)(c)(iv)]

No closure activities described in this Plan will be undertaken prior to approval of the Closure Plan and notification of EPA and Ecology. The only activity at the unit which may be performed prior to initiation of final closure is removal and disposal of treated SHLWS wastes which are no longer dangerous wastes. These wastes will be removed from the unit for disposal at the Hanford Central Landfill. Information concerning treatment of the SHLWS and the characteristics of the treated wastes was submitted by PNL and DOE-RL to Ecology in June 1989. Disposal of the treated wastes is being withheld pending approval by Ecology after review of this information.

6.1.2 Time Allowed For Closure [40 CFR 265.113, WAC 173-303-610(4)]

6.1.2.1 Extension of Closure Timeframe [40 CFR 265.113(a),(b), WAC 173-303-610(4)(a)(b)]

All dangerous wastes have been treated and rendered nondangerous or removed from the unit. There are, therefore, no dangerous or mixed wastes requiring treatment or removal within 90 days after approval of this Plan by Ecology. The closure activities described in this Plan will be completed within 180 days of approval of the Plan by Ecology. No extension to the timeframe for initiation and completion of closure is currently expected to be necessary.

6.1.2.2 Timeframes for Demonstrations for Extensions [40 CFR 265.113(c), WAC 173-303-610(4)(c)]

Extensions to the timeframes for closure would only be necessary if unexpected conditions were encountered during closure of the unit. If it becomes apparent that closure cannot be completed within 180 days after approval of this Plan, EPA and Ecology will be so notified at least 30 days prior to expiration of the 180 day period. This notification will demonstrate why more than 180 days is required for closure and will demonstrate that steps have been taken to prevent threats to human health and the environment and that the unit is in compliance with applicable interim status standards. The PNL Project Manager, Mr. H. W. Slater, will be responsible for preparing the notification which will be submitted by PNL and DOE-RL.

6.1.3 Disposal or Decontamination of Equipment, Structures, and Soils [40 CFR 265.114, WAC 173-303-610(5)]

Steps for disposing of or decontaminating all contaminated equipment, structures, and soils are described in Sections 6.3.2 and 6.11.2 for the container storage areas and treatment area, respectively.

6.1.4 Certification of Closure [40 CFR 265.115, WAC 173-303-610(6)]

Within 60 days of completion of the final closure activities described in this Plan, a certification of closure will be submitted to EPA and Ecology. This certification will indicate that the SHLWS T/S unit has been closed as described in this Plan and that the closure performance standards given in Section 6.1.1.1 have been met. The certification will be submitted by registered mail and will be signed by the Manager of DOE-RL (or his authorized representative) and an independent professional engineer registered in the State of Washington.

6.1.4.1 Owner/Operator Closure Certification

The DOE-RL will self-certify with the following document or a document similar to it:

> I, (name), an authorized representative of the U.S. Department of Energy-Richland Operations Office located at the Federal Building, 825 Jadwin Avenue, Richland, Washington, hereby state and certify that the Simulated High Level Waste Slurry Treatment and Storage Unit at the 3000 Area, to the best of my knowledge and belief, has been closed in accordance with the attached approved Closure Plan, and that the closure was completed on (date).
> (Signature and date).

6.1.4.2 Professional Engineer Closure Certification

The DOE-RL will engage an independent Professional Engineer registered in the State of Washington to certify that the SHLWS T/S unit has been closed in accordance with this Closure Plan. The DOE-RL will require the engineer to sign the following document or a document similar to it:

> I, (name), a certified Professional Engineer, hereby certify, to the best of my knowledge and belief, that I have made visual inspection(s) of the Simulated High Level Waste Slurry Treatment and Storage Unit at the 3000 Area and that closure of the aforementioned unit has been performed in accordance with the attached approved Closure Plan. (Signature, date, state Professional Engineer license number, business address, and phone number).

6.1.5 Survey Plat [40 CFR 265.116, WAC 173-303-610(9)]

This Closure Plan does not presently call for the SHLWS T/S unit to be closed as a dangerous/mixed waste disposal unit. As a result, submission of a survey plat indicating the location of disposal areas is not required. If, during closure, it is determined that it is necessary to close any areas as dangerous/mixed waste disposal units, the Closure Plan would be amended. The amended Plan would include surveying all areas to be closed as disposal units and submitting a survey plat indicating the location of these units to Ecology, EPA, the City of Richland, and Benton County.

The survey plat will indicate the locations and dimensions of the disposal units with respect to permanently surveyed benchmarks. This plat will be prepared by a certified professional land surveyor. The following notice is to accompany the survey plat:

"This plat describes real property in which hazardous wastes have been disposed in accordance with the requirements of 40 CFR Parts 265.116 and 265.119. Although this hazardous waste disposal unit is now closed, regulations issued by EPA in 40 CFR 265.119 require that the post-closure use of the property never be allowed to disturb the integrity of the final cover unless it can be demonstrated that any proposed disturbance will not increase the risk to human health or the environment."

6.1.6 Post-Closure Notices [40 CFR 265.119, WAC 173-303-610(10)]

6.1.6.1 Record of Wastes [40 CFR 265.119(a), WAC 173-303-610(10)(a)]

This Closure Plan does not presently call for the SHLWS T/S unit to be closed as a dangerous/mixed waste disposal unit. As a result, submission of records of the types, locations, and quantities of dangerous/mixed wastes disposed of is not required. If, during closure, it is determined that it is necessary to close any areas as dangerous/mixed waste disposal units, the Closure Plan would be amended. Under the amended Plan, the PNL Project Manager, Mr. H. W. Slater, would be responsible for assembling and maintaining such records. These records would be submitted by PNL and DOE-RL to Ecology, EPA, the City of Richland, and Benton County.

6.1.6.2 Notice in Deed [40 CFR 265.119(b), WAC 173-303-610(10)(b)]

This Closure Plan does not presently call for the SHLWS T/S unit to be closed as a dangerous/mixed waste disposal unit. As a result, submission of notice to be placed in the deed of the property describing use of the land for disposal of dangerous/mixed wastes is not required. If, during closure, it is determined that it is necessary to close any areas as dangerous/mixed waste disposal units, the Closure Plan would be amended. The amended Plan would include preparation of an appropriate notice for the property deed to ensure that future land uses are compatible with the maintenance of the integrity of the closed disposal units. This notice will be similar to the survey plat notice previously identified in Section 6.1.5.

6.1.6.3 Certification of Notice [40 CFR 265.119(b)(2), WAC 173-303-610(10)(b)(ii)]

If a notice to the property deed is required under an amended Closure Plan, as described in Section 6.1.6.2, a certification will be made upon preparation of this notice. This certification will include a copy of the property deed containing the notice. The certification will be signed by the DOE-RL and submitted to Ecology and EPA.

6.1.7 Closure Cost Estimate [40 CFR 265.142, WAC 173-303-620(3)]

A closure cost estimate is not required because federal facilities are exempt from this requirement per 40 CFR 265.140(c).

6.1.8 Financial Assurance for Closure [40 CFR 265.143, WAC 173-303-620(4)]

Financial assurance mechanisms are not required because federal facilities are exempt from this requirement per 40 CFR 265.140(c).

6.1.9 Liability Requirements [40 CFR 265.147, WAC 173-303-620(8)]

Liability coverage is not required because federal facilities are exempt from this requirement per 40 CFR 265.140(c).

6.2 GENERAL POST-CLOSURE CARE REQUIREMENTS [40 CFR 265.117 - 265.120, 265.144, 265.145; WAC 173-303-610(7),(8),(11), -620(5),(6)]

As currently described in this Closure Plan, the SHLWS T/S unit will not be closed as a dangerous/mixed waste disposal unit. As a result, post-closure care requirements are not applicable per 40 CFR 265.110(b) and WAC 173-303-610(1)(b). If, during closure, it is determined that all dangerous/mixed waste residues cannot practicably be removed, the Closure Plan will be amended and additional procedures developed for meeting the closure performance standard given in Section 6.1.1.1. These additional procedures may require post-closure care. If so, a post-closure plan will be prepared that addresses the applicable requirements of 40 CFR 265.117 through 40 CFR 265.120 and WAC 173-303-610(7) through WAC 173-303-610(11). The post-closure plan will be prepared and submitted to EPA and Ecology within 90 days of determination of the need for such a plan. Preparation of the plan will be the responsibility of the PNL Waste Technology Center.

It is noted that if a post-closure plan is necessary, a post-closure cost estimate (40 CFR 265.144) and a financial assurance mechanism for post-closure care (40 CFR 265.145) will not be required because federal facilities are exempted from those requirements per 40 CFR 265.140(c).

6.3 CLOSURE OF CONTAINER STORAGE AREAS

6.3.1 Contents Of Plan [40 CFR 265.112(b), WAC 173-303-610(3)(a)]

This Plan addresses closure activities for the SHLWS container storage area and the less-than-90-day waste accumulation area at the SHLWS T/S unit. It is noted that a closure plan is not strictly required for the less-than-90-day waste accumulation area. This accumulation area does, however, constitute a solid waste management unit (SWMU) under RCRA Section 3004(u). This Plan, therefore, will address removal of dangerous/mixed wastes and dangerous/mixed waste residuals from both of these container storage areas.

6.3.1.1 Description Of How Each Unit Will Be Closed [40 CFR 265.112(b)(1), WAC 173-303-610(3)(a)(i)]

The container storage areas at the SHLWS T/S unit will be closed by removal of all dangerous/mixed wastes and dangerous/mixed waste residues. All SHLWS were treated and the treated wastes removed for disposal prior to beginning closure. The vinyl liner beneath the drum storage area will be removed and disposed of as either dangerous waste or radioactive mixed waste, depending on the level of radioactive contamination present.

All dangerous waste containers at the less-than-90-day storage area were removed from the SHLWS T/S unit prior to beginning closure.

All soils beneath the SHLWS drum storage area or less-than-90-day storage area having visual appearance of contamination by past waste leakage or spillage will be removed and disposed of as dangerous waste or mixed waste. Removal of all contaminated soils will be verified by sampling and analysis, as described in the Sampling and Analysis Plan (SAP, Appendix A). If, during closure, it is determined that all dangerous/mixed waste residues cannot practicably be removed, the Closure Plan will be amended and additional procedures will be developed for meeting the closure performance standard given in Section 6.1.1.1.

Performance of these closure activities will be the responsibility of the PNL Waste Technology Center and will be performed by staff having 40 hour hazardous waste health and safety training meeting the requirements of 29 CFR 1910.120.

6.3.1.2 Description Of How Final Closure Will Be Conducted [40 CFR 265.112(b)(2), WAC 173-303-610(3)(a)(ii)]

The liner at the SHLWS storage area has several minor tears and is not suitable for reuse. Because of its condition and the difficulty associated with decontamination, the vinyl liner at the SHLWS storage area will be disposed of rather than decontaminated. Any free liquid present on the liner at the time of disposal will be neutralized and absorbed according to the spill response procedures in the Contingency Plan for the SHLWS T/S unit (the Contingency Plan is contained in the "RCRA Plans 'Compliance Notebook' for Simulated High Level Waste Treatment/Storage," which is maintained at the SHLWS T/S unit). For disposal, the liner will be cut into strips approximately 30-in (76-cm) wide. Each strip will be rolled to fit into an open-top 55-gallon (208-liter) drum. Prior to placement in the drums, the liner material will be given a radiological survey to determine if it will be managed as dangerous waste or RMW. Each drum will be filled with liner material, sealed, labeled, manifested, and transported to a permitted TSD unit. These activities will be conducted according to the requirements of WHC-CM-5-16, Nonradioactive Dangerous Waste Packaging and Disposal Requirements.

Removal of contaminated soils is described in Section 6.3.1.6.

Following completion of all closure activities, closure will be certified as described in Section 6.1.4.

6.3.1.3 Identification Of The Maximum Extent Of Operation [40 CFR 265.112(b)(2), WAC 173-303-610(3)(a)(ii)]

The SHLWS storage area and less-than-90-day waste storage area (see Figure 2-4) represent the maximum extent of the unit used for storage of dangerous and mixed waste containers. These two areas occupy approximately 1,800 and 1,100 square ft (160 and 100 square m), respectively.

6.3.1.4 Estimate Of The Maximum Inventory Of Dangerous Wastes [40 CFR 265.112(b)(3), WAC 173-303-610(3)(a)(iii)]

Prior to beginning treatment, the SHLWS container storage area contained 100 drums of PW-0, 98 drums of PW-7A, 1 drum of 50% PW-0 and 50% PW-7A, and 11 drums of secondary waste (drum liners, absorbent, soil). The 199 drums of SHLWS have been solidified within 306 drums. The characteristics of these wastes are described in Section 3.0. These characteristics indicate that solidified wastes are not dangerous. No additional wastes are to be added to this inventory prior to closure. This inventory represents the maximum inventory of dangerous/mixed wastes stored at the SHLWS container storage area during the active life of the unit. The maximum inventory of dangerous wastes stored in the less-than-90-day storage area was 79 drums. All wastes have been removed from the less-than-90-day area.

6.3.1.5 Detailed Description Of Removal Of Waste Inventory [40 CFR 265.112(b)(3), WAC 173-303-610(3)(a)(iv)]

Drums of treated SHLWS will be removed from the storage area prior to beginning final closure. The treated wastes will be loaded onto a truck and transported to the Hanford Central Landfill for disposal as nonradioactive solid waste.

All drums at the less-than-90-day storage area have been transferred to the 305-B Building, which is permitted under interim status for storage of dangerous and mixed wastes. These drums were sealed and labeled according to the requirements of WHC-CM-5-16, Nonradioactive Dangerous Waste Packaging and Disposal Requirements and were transported by truck to 305-B.

During closure activities, drums of liquid decontamination wastes and other wastes (e.g., protective clothing, contaminated soil) will be generated. Removal and management of these wastes is described in Section 6.3.2.2.

6.3.1.6 Detailed Description Of Removal Of Waste Residues [40 CFR 265.112(b)(4), 265.114, WAC 173-303-610(3)(a)(v)]

Dangerous/mixed waste residues at the SHLWS container storage areas are expected to consist of soils contaminated by past leakage from containers. Identification of soils to be removed will be based on visual inspection for evidence of contamination. All soils which are visibly contaminated will be removed. A statistical sampling program, as described in the SAP, will be used to determine whether the remaining soils (i.e., those without visible contamination) meet the closure performance standard given in Section 6.1.1.1. It is currently expected, based on observations of the areas, that any significant contamination will be limited to surface soils. Shallow contaminated soils will be excavated by hand or using a backhoe, depending on extent, and soils transferred to 55-gallon (208-liter) open-top drums. Drum loading operations will be conducted over reinforced polyethylene tarps to contain any soil that may be spilled and to avoid further soil contamination. After all drums are loaded, the tarps and any soil residuals on them will be drummed. All drums will be sealed, labeled, manifested according to the requirements of WHC-CM-5-16, Nonradioactive Dangerous Waste Packaging and Disposal Requirements, and transferred to a permitted TSD unit. Prior to excavation, the soils will be given a radiological survey to determine whether they will be managed as dangerous wastes or RMW. Radiation surveys will be conducted in accordance with PNL-MA-6, Radiation Protection and PNL-MA-507, Procedures for Radiation Protection Technologists. Removal of contaminated soil sufficient to meet the closure performance standard will be verified through the sampling and analysis program described in Appendix A. Sampling and analysis will be conducted according to a Quality Assurance Project Plan

(QAPjP) prepared in accordance with "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans," QAM-005/80.

Exhumed soil will be replaced with clean fill and the site graded to return it to its original state.

If the analyses indicate that the closure performance standard has not been met, the Closure Plan will be amended. The amended Plan will include methods for further characterizing the extent of soil contamination and for removal or stabilization of the contaminated soil to meet the closure performance standard given in Section 6.1.1.1. If sampling and analysis results are suggestive of the potential for deep soil contamination, the amended plan will also address characterization of possible groundwater contamination, and will include a groundwater monitoring plan to assess groundwater contamination.

6.3.1.7 Detailed Description Of Other Necessary Activities [40 CFR 265.112(b)(5), WAC 173-303-610(3)(a)(vi)]

The closure of the container storage areas is based upon removal of all dangerous/mixed wastes and dangerous/mixed waste residues. Other activities such as groundwater monitoring, leachate collection, and run-on and run-off control are not expected to be necessary based on current knowledge. If, during implementation of the Closure Plan, it becomes evident that all dangerous/mixed waste residuals cannot be practicably removed, the Closure Plan will be amended and other closure activities will be identified.

6.3.1.8 Schedule For Closure Of Each Unit [40 CFR 265.112(b)(6), WAC 173-303-610(a)(vii)]

A detailed schedule for closure presented in Figure 6-1.

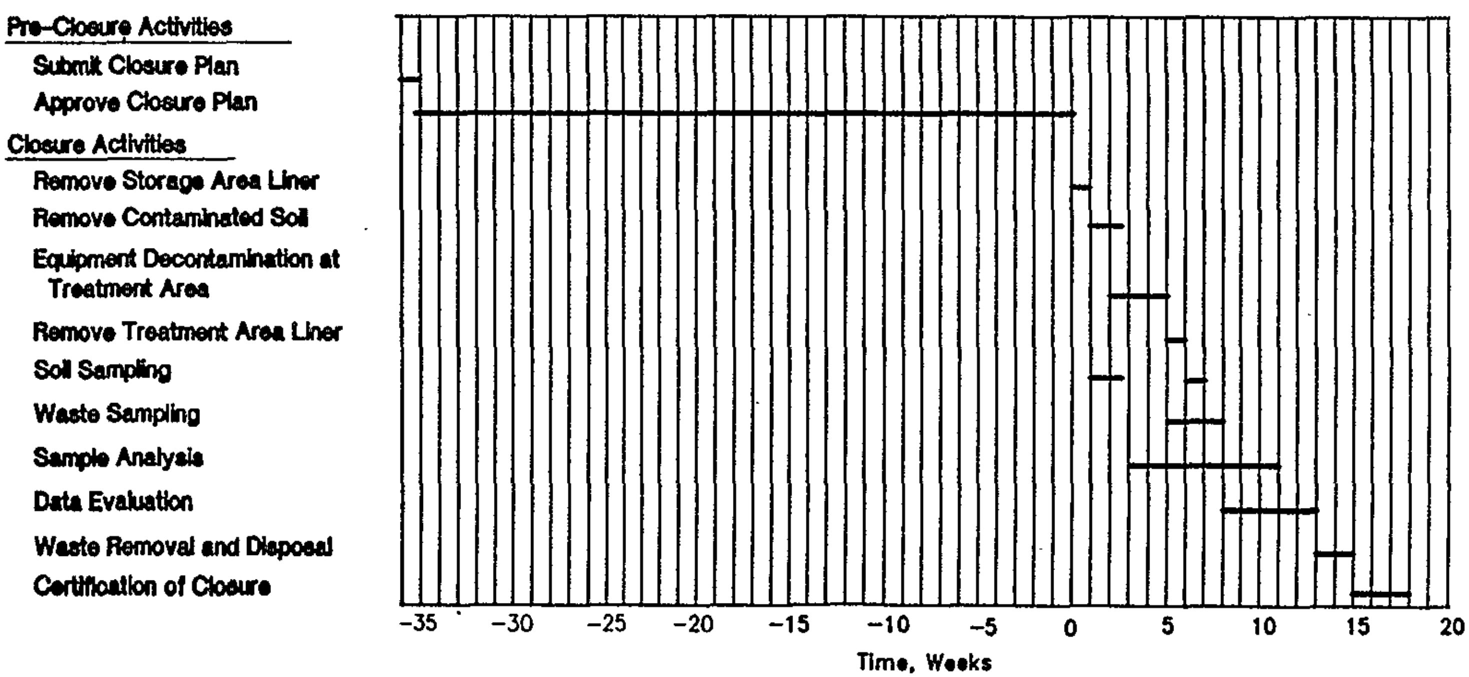

Figure 6-1. Closure Schedule

6.3.2 Decontamination Procedures [40 CFR 265.112(b)(4), 265.114, WAC 173-303-610(3)(a)(v), (5)]

Decontamination efforts during closure of the container storage areas will involve decontamination of sampling equipment and soil excavation equipment. Removal of contaminated soil was previously described in Section 6.3.1.6.

6.3.2.1 Procedures For Cleaning Equipment And Removing Contaminated Soils [40 CFR 265.112(b)(4), WAC 173-303-610(3)(a)(v)]

Sampling equipment, and any other small equipment which comes into contact with dangerous/mixed wastes, will be decontaminated at the container storage areas immediately after use. Decontamination will be performed as follows:

1) Equipment will be given a radiological survey to determine whether it is radioactively contaminated. Radiological surveys will be performed using procedures specified in PNL-MA-507, Procedures for Radiation Protection Technologists. Separate decontamination lines will be used for radioactively contaminated equipment and nonradioactively equipment, and decontamination wastes from these two lines will be segregated. The two lines will use identical decontamination procedures.

2) Equipment will be thoroughly scrubbed using a solution of trisodium phosphate (TSP) at a strength of 1/4 pound TSP per gallon of clean water (30 grams per liter). All visible signs of contamination will be removed.

3) Equipment will be thoroughly rinsed with clean tap water, being certain that no TSP is left on the equipment.

4) Equipment will be thoroughly rinsed with reagent grade acetone followed by rinsing with deionized water.

5) Equipment will be thoroughly rinsed with 0.1N nitric acid followed by thorough rinsing with deionized water. Samples of rinse water will be periodically collected for equipment blanks to verify decontamination, as explained in the SAP.

6) If the equipment is not to be used immediately, it will be allowed to air dry and will be wrapped with aluminum foil, with the dull side of the foil toward the equipment.

7) All equipment will be surveyed by a radiation protection technologist (RPT) to confirm radiologic decontamination.

All decontamination wastes will be collected in polyethylene-lined drums. Polyethylene is compatible with the dilute detergent, acetone, and nitric acid which will be present in the decontamination wastes. Prior to decontamination, equipment will be radiologically surveyed to determine if radioactive contamination is present. Decontamination wastes from radioactively-contaminated equipment will be kept separate from wastes from nonradioactively-contaminated equipment.

Large contaminated equipment from the container storage areas (e.g., excavation equipment) will be decontaminated at the SHLWS treatment area within the bermed temporary drum storage area. These activities are described in Section 6.11.2.1.

Removal of contaminated soils was described previously in Section 6.3.1.6.

6.3.2.2 Management Of Generated Wastes [40 CFR 265.114, WAC 173-303-610(5)]

Wastes which may be generated during closure of the container storage areas include personnel protective clothing, the liner from the SHLWS storage area, soil contaminated with dangerous/mixed waste constituents, and liquid decontamination wastes. All wastes will be sampled according to the Sampling and Analysis Plan (Appendix A) to determine whether they are dangerous wastes. Wastes which are designated as dangerous wastes will be drummed, properly labeled and manifested, and shipped to a permitted storage area (i.e., 616 Building or 305-B Building). All wastes which are determined to be RMW will be drummed and labeled, manifested, and shipped to an appropriate storage area. Container management procedures for dangerous and mixed wastes will be according to the requirements of WHC-CM-5-16, Nonradioactive Dangerous Waste Packaging and Disposal Requirements, which complies with 40 CFR 262 and WAC 173-303-170 through -190. Solid wastes which are determined to be only contaminated with radioactivity will be managed as low-level radioactive wastes and shipped to the 200 Area Burial Grounds. Liquid wastes which are nondangerous but radioactively contaminated will be drummed and transferred to an appropriate liquid low-level waste (LLLW) management unit in the 200 Area or 300 Area. Solid wastes which are nondangerous and nonradioactive will be disposed of at the Hanford Central Landfill. Liquid wastes which are nondangerous and nonradioactive may be disposed of to the City of Richland sewer system with prior approval of the City. A request for such disposal, including an analysis of the wastes, will be made to the City. If such approval is not granted, the wastes will be disposed of to the 300 Area process sewer.

Personnel protective clothing will be collected in drums. Prior to placement in drums, the clothing will be radiologically surveyed to determine if it is radioactively contaminated. Radioactive and nonradioactive clothing will be segregated. All waste protective clothing will be handled as dangerous waste or RMW.

Disposal of the liner from the drum storage area was previously described in Section 6.3.1.2.

Soils contaminated with dangerous waste residues will be drummed and disposed of as dangerous waste, RMW, or solid waste, depending on the waste designation. The designation of soil wastes will be based on the results of the soil sampling and analysis described in Appendix A.

Liquid decontamination wastes will be sampled and analyzed as described in Appendix A to determine the proper method of management. These wastes may be managed as dangerous, RMW, LLLW, or nondangerous-nonradioactive. All liquid wastes from decontamination of radioactively-contaminated equipment will be disposed of as RMW or LLLW.

6.3.2.3 Methods For Sampling And Testing To Demonstrate Success Of Decontamination [40 CFR 265.112(b)(4), WAC 173-303-610(3)(a)(v)]

Decontaminated equipment will not be sampled to determine the effectiveness of chemical decontamination. Rather, effectiveness will be based on knowledge of the contaminants present, known effectiveness of the decontamination agents used, and removal of all visual evidence of contamination. Decontamination of sampling equipment will also be verified by analysis of the final decontamination rinse water, as described in Appendix A. All equipment will be radiologically surveyed following decontamination to verify that all radioactivity is below release limits given in PNL-MA-6, Radiation Protection.

The effectiveness of the removal of contaminated soils will be based on sampling and analysis, as described in Appendix A.

6.3.2.4 Criteria For Determining The Extent Of Decontamination Necessary [40 CFR 265.112(b)(4), WAC 173-303-610(3)(a)(v)]

Criteria for decontamination will depend on the type of material being decontaminated. All sampling equipment will be decontaminated following use, primarily to avoid cross-contamination of samples. All other equipment which comes into contact with dangerous/mixed wastes will be decontaminated. Soils beneath the drum storage areas having visual evidence of contamination will be removed.

6.4 CLOSURE OF TANKS

These requirements are not applicable to the SHLWS T/S unit.

6.5 CLOSURE OF SURFACE IMPOUNDMENTS

These requirements are not applicable to the SHLWS T/S unit.

6.6 CLOSURE OF WASTE PILES

These requirements are not applicable to the SHLWS T/S unit.

6.7 CLOSURE OF LAND TREATMENT UNITS

These requirements are not applicable to the SHLWS T/S unit.

6.8 CLOSURE OF LANDFILLS

These requirements are not applicable to the SHLWS T/S unit.

6.9 CLOSURE OF INCINERATORS

These requirements are not applicable to the SHLWS T/S unit.

6.10 CLOSURE OF THERMAL TREATMENT UNITS

These requirements are not applicable to the SHLWS T/S unit.

6.11 CLOSURE OF CHEMICAL, PHYSICAL, AND BIOLOGICAL TREATMENT UNITS [40 CFR 265.404]

6.11.1 Contents of Plan [40 CFR 265.112(b)]

This Plan addresses closure activities for the SHLWS treatment area at the SHLWS T/S unit.

6.11.1.1 Description Of How Each Unit Will Be Closed [40 CFR 265.112(b)(1)]

The treatment area at the SHLWS T/S unit will be closed by removal of all dangerous/mixed wastes and dangerous/mixed waste residues. All equipment in the treatment area will be decontaminated to remove dangerous/mixed waste residuals. All dangerous/mixed wastes resulting from decontamination activities will be removed from the unit.

All soils beneath the SHLWS treatment area having visual appearance of contamination by past waste leakage or spillage will be removed and disposed of as dangerous waste or mixed waste. Removal of all contaminated soils will be verified by sampling and analysis, as described in the SAP. If, during closure, it is determined that all dangerous/mixed waste residues cannot practicably be removed, the Closure Plan will be amended and additional procedures will be developed for meeting the closure performance standard given in Section 6.1.1.1.

6.11.1.2 Description Of How Final Closure Will Be Conducted [40 CFR 265.112(b)(2)]

Closure of the treatment area will be performed in concert with closure of the container storage areas. Closure activities will primarily involve decontamination of equipment. Decontamination activities at the treatment area will be conducted in the bermed temporary drum storage area as described in Section 6.11.2.1. Following completion of all decontamination activities, all decontamination wastes will be removed from the site and transported to an appropriate unit, depending on the regulatory designation of the wastes.

The final closure activity will be removal and disposal of the liner of the decontamination area. This liner will be removed and disposed of as dangerous waste or RMW. For disposal, the liner will be cut into strips approximately 30-in (76-cm) wide. Each strip will be rolled to fit into an open-top 55-gallon (208-liter) drum. Prior to placement in the drums, the liner material will be given a radiological survey to determine if it will be managed as dangerous waste or RMW. Each drum will be filled with liner material, sealed, labeled, manifested, and transported to a permitted treatment, storage, or disposal facility (TSDF).

All visibly contaminated soils at the treatment area will removed and soils will be sampled, as described in Section 6.11.1.6, to meet the closure performance standards given in Section 6.1.1.1.

Following completion of all closure activities, closure will be certified as described in Section 6.1.4.

6.11.1.3 Identification Of The Maximum Extent Of Operation [40 CFR 265.112(b)(2)]

The SHLWS treatment area (see Figure 2-4) represents the maximum extent of the unit used for dangerous/mixed waste treatment. This area occupies approximately 4,100 square ft (380 square m). All SHLWS has been treated and the treatment area will not be used for additional waste treatment. The treatment area will be used during closure for decontamination of equipment used in closure of the storage areas. For this reason, closure of the treatment area (i.e., removal of liners) will follow closure of the storage areas, as shown in Figure 6-1.

6.11.1.4 Estimate Of The Maximum Inventory Of Dangerous Wastes 40 CFR 265.112(b)(3)]

The SHLWS treatment area was used to treat 199 55-gallon (208-liter) drums of SHLWS whose characteristics are described in Section 3.0. These wastes constitute the only wastes treated at this area during its active life.

6.11.1.5 Detailed Description Of Removal Of Waste Inventory [40 CFR 265.112(b)(3), 265.404]

Most of the treated SHLWS was removed from the temporary storage area following solidification and transferred back to the SHLWS storage area. Some treated SHLWS was stored at the treatment area. The drums of treated waste will be removed from the unit and taken to the Hanford Central Landfill for disposal as nonradioactive solid waste prior to closure. This waste removal will occur prior to beginning closure and is not considered to be a closure activity (see Section 6.1.1.5).

During closure activities, drums of liquid decontamination wastes and other wastes (e.g., protective clothing) will be generated. Removal and management of these wastes is described in Section 6.11.2.2.

6.11.1.6 Detailed Description Of Removal Of Waste Residues [40 CFR 265.112(b)(4), 265.114, 265.404]

Dangerous/mixed waste residues at the SHLWS treatment area are expected to be present in the treatment equipment following completion of treatment. These residues will be removed through decontamination, as described in Section 6.11.2.1. If residues cannot be removed from equipment through decontamination, the equipment will be disposed of as dangerous waste or RMW, depending on whether radioactive contamination is present. The only pieces of equipment likely to be extensively contaminated are the air-driven drum mixers. If these mixers cannot be decontaminated, they will be dismantled and placed in polyethylene-lined drums for disposal.

Dangerous/mixed waste residues in the form of contaminated soil are not expected to be found at this area. The treatment area was designed to contain spills without contamination of soil. If, after removal of the liner, it becomes evident that spills have not been properly contained and that soil contamination has occurred, visibly contaminated soils will be removed. Soils at the treatment area will be sampled as described in Appendix A to verify removal of contamination.

6.11.1.7 Detailed Description Of Other Necessary Activities [40 CFR 265.112(b)(5)]

The closure of the SHLWS treatment area is based upon removal of all dangerous/mixed wastes and dangerous/mixed waste residues. Other activities such as groundwater monitoring, leachate collection, and run-on and run-off control are not expected to be necessary based on current knowledge. If, during implementation of the Closure Plan, it becomes evident that all dangerous/mixed waste residuals cannot be practicably removed, the Closure Plan will be amended and other closure activities will be identified.

6.11.1.8 Schedule For Closure Of Each Unit [40 CFR 265.112(b)(6)]

A detailed schedule for closure is presented in Figure 6-1.

6.11.2 Decontamination Procedures [40 CFR 265.112(b)(4) 265.114, 265.404]

Decontamination efforts during closure of the SHLWS treatment area will involved decontamination of treatment equipment, spill pans, and large equipment contaminated during closure of the container storage areas. Contaminated soil is not expected to be encountered at this area but will be removed if discovered.

6.11.2.1 Procedures For Cleaning Equipment And Removing Contaminated Soils [40 CFR 265.112(b)(4), 265.404]

Equipment will be decontaminated at the bermed temporary container storage area with the liner and berms used to contain and collect decontamination wastes. Prior to beginning decontamination, the condition of the liner at the temporary storage area will be evaluated to determine if it is in suitable condition. The liner will be inspected for tears, holes, and integrity of seams. If the liner is judged to be unsatisfactory condition, a new liner will be installed.

Prior to decontamination, all equipment will be radiologically surveyed to determine if the equipment is radioactively contaminated. Liquid wastes from decontamination of radioactively-contaminated equipment will be kept separate from those from nonradioactively contaminated equipment.

The drum mixers are expected to be contaminated with waste residuals, including treated wastes. Each mixer will be soaked in a polyethylene-lined drum containing a TSP solution and then scrubbed to removed all visible contamination. Next, each mixer will be rinsed with 0.1N nitric acid, followed by three rinses in clean tap water.

The drums of liquid decontamination waste will be sampled as described in Appendix A.

Stainless steel spill containment pans will be decontaminated by scrubbing with a TSP solution until all visible contamination has been removed. The pans will then be rinsed with a mild acid solution (i.e., 0.1N HNO_3). The pans will then be rinsed thoroughly with clean tap water. All liquid wastes will be collected in polyethylene-lined drums and sampled and managed as described in Section 6.3.2.2.

If used, large equipment (e.g., the backhoe used to excavate contaminated soil) will be decontaminated by steam cleaning using a TSP solution. This equipment will be steam cleaned until all visible contamination is removed and then rinsed with clean tap water. This activity will be conducted in the PVC-lined bermed temporary drum storage area. The liner and berms will be used to collect liquid decontamination wastes. These wastes will be pumped into polyethylene-lined drums and sampled and managed as described above. Residual liquid which cannot be pumped from the bermed area will be absorbed using absorbent pillows or pads and the absorbent placed in polyethylene lined drums.

At the conclusion of all decontamination activities, the liner of the temporary drum storage area will be allowed to air dry and will then be removed for disposal as described in Section 6.11.1.2.

6.11.2.2 Management Of Generated Wastes [40 CFR 265.114, 265.404]

Wastes which may be generated during closure of the SHLWS treatment area include personnel protective clothing, the liner from the temporary storage area, liquid decontamination wastes, and equipment which cannot be decontaminated. These wastes will be managed in the same manner as the wastes from the container storage areas, as described in Section 6.3.2.2.

6.11.2.3 Methods For Sampling And Testing To Demonstrate Success Of Decontamination [40 CFR 265.112(b)(4), 265.404]

The mixing pumps, spill pans, and large equipment will not be sampled to determine the effectiveness of chemical decontamination. Rather, effectiveness will be based on the removal of all visible contamination and the known effectiveness of the decontamination agents used. This equipment will be radiologically surveyed following decontamination to verify that all radioactive contamination has been removed.

6.11.2.4 Criteria For Determining The Extent Of Decontamination Necessary [40 CFR 265.112(b)(4)]

All equipment which comes into contact with dangerous/mixed wastes or dangerous/mixed waste residuals will be decontaminated as described in Section 6.11.2.1.

APPENDIX A
SAMPLING AND ANALYSIS PLAN

SAMPLING AND ANALYSIS PLAN
SIMULATED HIGH LEVEL WASTE SLURRY TREATMENT AND STORAGE (SHLWS T/S) UNIT CLOSURE

Approvals:

____

Project Manager — Date
Pacific Northwest Laboratory

____

Quality Engineer — Date
Pacific Northwest Laboratory

____

Operations Manager, Waste Technology Center — Date
Pacific Northwest Laboratory

____

Manager, Quality Assurance Division — Date
United States Department of Energy
Richland Operations Office

____

Director, Environmental Restoration Division — Date
United States Department of Energy
Richland Operations Office

____

QA Officer — Date
Washington Department of Ecology

____

QA Officer — Date
United States Environmental Protection Agency
Region X

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SAMPLING AND ANALYSIS PLAN
SIMULATED HIGH LEVEL WASTE SLURRY TREATMENT AND STORAGE (SHLWS T/S) UNIT CLOSURE

1.0 OBJECTIVES

This plan describes activities for sampling and analysis of soils and wastes at the Simulated High Level Waste Slurry Treatment and Storage (SHLWS T/S) unit. The objective of soil sampling is to determine if soils at the SHLWS T/S unit are contaminated with dangerous waste residuals above regulatory limits. The absence of dangerous waste residuals above regulatory limits will constitute verification that the closure performance standard has been met. If dangerous waste residuals are present above regulatory limits, the sampling will be used to determine the regulatory requirements for disposal of the soils. The objective of waste sampling is to collect sufficient data to designate decontamination wastes under WAC 173-303-070.

2.0 DATA REQUIREMENTS

Soils at the SHLWS T/S unit may have been contaminated by past spills or leaks of the wastes formerly stored at the unit. The requirements of WAC 173-303-610(2)(b) require that residuals in soil do not exceed:

(i) Background environmental levels, for any dangerous waste, managed at the facility, which either is listed under WAC 173-303-081 or 173-303-082 or is designated by the characteristics of WAC 173-303-090; and

(ii) At least the designation limits of WAC 173-303-084, or 173-303-101 through 173-303-103 for any dangerous waste, managed at the facility, which is not listed under WAC 173-303-081 or 173-303-082 and is not designated by the characteristics of WAC 173-303-090.

With respect to requirements under WAC 173-303-610(2)(b)(i), some of the SHLWS (PW-0) was designated as EHW under WAC 173-303-090 because of the concentration of barium, cadmium, chromium, and silver. To satisfy WAC 173-303-610(2)(b)(i), therefore, these four metals should not be present in soils above environmental background levels. All of the SHLWS was designated under WAC 173-303-090 as a corrosive waste. Soils should, therefore, be at background pH.

The SHLWS T/S storage area was not used to store wastes which are listed under WAC 173-303-081 or -082. The less-than-90-day storage area may, however, have been used to store listed wastes (information on the wastes stored at this area is incomplete). While information is lacking on the exact nature of listed wastes potentially stored at this area, it is likely that these wastes contained toxic organic constituents. To satisfy WAC 173-303-610(b)(i), organic listed waste constituents should be at background levels. Since exact constituents are not known, soils will be analyzed for a broad range of volatile and semivolatile organics using gas chromatography/mass spectrometry (GC/MS).

With respect to requirements under WAC 173-303-610(2)(b)(ii), the SHLWS is designated as a toxic waste mixture under WAC 173-303-084. Under WAC 173-303-084, wastes are designated as dangerous if the equivalent concentration of toxic constituents exceeds 0.001 percent. Individual constituents are assigned to one of five toxicity categories depending on toxicity. These categories are identified as X, A, B, C, and D, with X being the most toxic and D the least. The equivalent concentration is determined as the sum of the percentage of Category X constituents plus one-tenth the percentage of Category A plus one-hundredth the percentage of Category B plus one-thousandth the percentage of Category C plus one-ten thousandth the percentage of Category D. The results of waste designation of the three types of SHLWS stored and treated at the unit, PW-0, PW-7A, and a mixture of PW-0 and PW-7A are given in Tables 1 through 3, respectively. As shown in these tables, the following compounds are present in the waste and provide the basis for designation (toxicity categories are also identified for each compound):

$AgNO_3$ -- Category X
$BaNO_3$ -- Category C
$Cd(NO_3)_2 \cdot 4H_2O$ -- Category C
$Co(NO_3)_2 \cdot 6H_2O$ -- Category C
$Cr(NO_3)_3 \cdot 9H_2O$ -- Category D
$Fe(NO_3)_3 \cdot 9H_2O$ -- Category C
KNO_3 -- Category D
$NaNO_3$ -- Category D

Table 1. Results of Toxic Mixture Designation for PW-0 Waste

Constituent	Tox. Cat.	Conc. (ppm)	Equivalent Conc. (%)
$AgNO_3$	X	1,800	0.180
$Ba(NO_3)_2$	C	37,280	0.00373
$Cd(NO_3)_2 \cdot 4H_2O$	C	3,260	0.000326
$Co(NO_3)_2 \cdot 6H_2O$	C	15,380	0.00154
$Cr(NO_3)_3 \cdot 9H_2O$	D	25,370	0.000253
$Fe(NO_3)_3 \cdot 9H_2O$	C	232,660	0.0233
KNO_3	D	34,180	0.000341
$Ni(NO_3)_2 \cdot 6H_2O$	D	56,850	0.000568
$Sr(NO_3)_2$	D	30,190	0.000302
$ZrO(NO_3)_2 \cdot 2H_2O$	D	149,680	0.00150
MoO_3	C	88,950	0.00890
HNO_3	C	39,000	0.00390
TOTAL			0.224

Table 2. Results of Toxic Mixture Designation for PW-7A Waste

Constituent	Tox. Cat.	Conc. (ppm)	Equivalent Conc. (%)
$Fe(NO_3)_3 \cdot 9H_2O$	C	106,720	0.0107
$NaNO_3$	D	263,150	0.00263
HNO_3	C	120,000	0.0120
TOTAL			0.0253

Table 3. Results of Toxic Mixture Designation for PW-0/PW-7A Mixture

Constituent	Tox. Cat.	Conc. (ppm)	Equivalent Conc. (%)
$AgNO_3$	X	900	0.0900
$Ba(NO_3)_2$	C	18,640	0.00186
$Cd(NO_3)_2 \cdot 4H_2O$	C	1,630	0.000163
$Co(NO_3)_2 \cdot 6H_2O$	C	7,690	0.000769
$Cr(NO_3)_3 \cdot 9H_2O$	D	12,690	0.000126
$Fe(NO_3)_3 \cdot 9H_2O$	C	169,690	0.0170
KNO_3	D	17,090	0.000170
$Ni(NO_3)_2 \cdot 6H_2O$	D	28,430	0.000284
$Sr(NO_3)_2$	D	15,100	0.000151
$ZrO(NO_3)_2 \cdot 2H_2O$	D	74,840	0.000748
MoO_3	C	44,480	0.00445
HNO_3	C	77,000	0.00770
TOTAL			0.125

$Ni(NO_3)_2 \cdot 6H_2O$ -- Category D
$Sr(NO_3)_2$ -- Category D
$ZrO(NO_3)_2 \cdot 2H_2O$ -- Category D
MoO_3 -- Category C
HNO_3 -- Category C

The designation limit for waste constituents is not strictly defined. Under the WAC 173-303-084 procedure for waste designation, concentrations must be adjusted for toxicity to determine equivalent concentration. For wastes having a single constituent, the minimum concentration of the constituent that would cause the waste to be designated as dangerous would be the minimum equivalent concentration of 0.001 percent multiplied by the toxicity weighting factor. The toxicity weighting factor is 1 for Category X; 10 for Category A; 100 for Category B; 1,000 for Category C; and 10,000 for Category D. Using these values, the minimum concentration of a single constituent which would cause a waste to be designated as dangerous is as follows:

Category X -- 10 ppm
Category A -- 100 ppm
Category B -- 100 ppm
Category C -- 1,000 ppm
Category D -- 10,000 ppm

The above concentrations will be used as the designation limits for determining if the standard under WAC 173-303-610(2)(b)(ii) has been met.

Decontamination wastes generated during closure activities may contain the waste constituents described above. In order to properly manage and dispose of these wastes, it will be necessary to perform waste designation as described under WAC 173-303-070. To designate these wastes, it will be necessary to determine whether they contain toxic constituents above the designation limits in WAC 173-303-084 and whether they display the characteristics of extraction procedure (EP) toxicity and corrosivity under WAC 173-303-090.

For designation of decontamination wastes under WAC 173-303-084, the designation limits previously identified for soils will be used.

With respect to designation of decontamination wastes under WAC 173-303-090, the SHLWS had the characteristic of EP toxicity because of the presence of heavy metals. The waste did not contain any of the pesticides and herbicides included in the EP. To designate decontamination wastes under -090, therefore, it will only be necessary to analyze these wastes for toxic heavy metals and not for pesticides and herbicides. The designation limits for these metals in liquid wastes and extracts of solid wastes will be those given in WAC 173-303-090(8):

Arsenic -- 5 mg/L
Barium -- 100 mg/L
Cadmium -- 1 mg/L
Chromium -- 5 mg/L
Lead -- 5 mg/L
Mercury -- 0.2 mg/L
Selenium -- 1 mg/L
Silver -- 5 mg/L

3.0 ANALYTICAL PARAMETERS AND METHODS

The data needs described in Section 2.0 identify specific chemical parameters which must be determined to meet sampling and analysis objectives. The discussion in Section 2.0 also identifies, to the extent possible, the minimum levels at which contamination must be quantified in order to meet specific objectives (i.e., designation limits). Specific analyses and required minimum detection limits (MDLs) are summarized in Table 4. MDLs have generally been selected as 10 percent of the designation limits. Analytical methods have been selected which are capable of achieving the required MDLs. These methods and typical MDLs are summarized in Table 5. Selection of methods to meet specific objectives is discussed in the following sections.

3.1 DETERMINATION OF LEVELS ABOVE BACKGROUND IN SOILS

No required method detection limit could be identified with respect to background levels of metals in soils since background values have not been established. (National average values have been established for many metals, but because of great regional variability these values are not useful for establishing cleanup levels.) For these samples, therefore, the most sensitive atomic absorption (AA) methods available in SW-846 were selected.

Similarly, background levels of volatile and semivolatile organics are not known. Because specific constituents are not known, GC/MS methods specified in SW-846 will be used to analyze soils for these constituents. The detection limits, therefore, will be those associated with these methods. Capillary column methods are preferable since they have lower detection limits than packed column methods. For this reason, the capillary column method for semivolatiles was specified. The capillary column method for volatiles, however, has not been finally approved by EPA so the packed column method was

Table 4. Summary of Required Analyses and Required Detection Limits

Analysis	Required Detection Limit (mg/kg for soil, mg/L for waste)			
	Soil Background (-090)	Soil Designation Limits (-084)	Waste Designation Toxic Mixtures (-084)	Waste Designation EP Toxic Characteristic (-090)
Arsenic	N/R	N/R	N/R	0.5
Barium	*	52.5	52.5	10.0
Cadmium	*	47.5	47.5	0.1
Cobalt	N/R	32.0	32.0	N/R
Chromium	*	218	218	0.5
Iron	N/R	23.0	23.0	N/R
Lead	N/R	N/R	N/R	0.5
Mercury	N/R	N/R	N/R	0.02
Molybdenum	N/R	67.0	67.0	N/R
Nickel	N/R	321	321	N/R
Nitrate	N/R	98.0	98.0	N/R
Potassium	N/R	386	386	N/R
Selenium	N/R	N/R	N/R	0.1
Silver	*	0.64	0.64	0.5
Sodium	N/R	270	270	N/R
Strontium	N/R	414	414	N/R
Zirconium	N/R	394	394	N/R
Volatile Organics	*	N/R	N/R	N/R
Semivolatile Organics	*	N/R	N/R	N/R
pH	*	N/R	N/R	N/R

N/R - Analysis not required
* - Background level has not been established

Table 5. Summary of Analytical Methods and Typical Detection Limits[1]

Analysis	Soil Background (-090)	Soil Designation Limits (-084)	Waste Designation Toxic Mixtures (-084)	Waste Designation EP Toxic Characteristic (-090)
Arsenic	N/R[2]	N/R	N/R	6010 53 ug/L
Barium	7081 2 ug/L	6010 2 ug/L	6010 2 ug/L	6010 2 ug/L
Cadmium	7131 0.1 ug/L	6010 4 ug/L	6010 4 ug/L	6010 4 ug/L
Cobalt	N/R	6010 7 ug/L	6010 7 ug/L	N/R
Chromium	7191 1 ug/L	6010 7 ug/L	6010 7 ug/L	6010 7 ug/L
Iron	N/R	6010 7 ug/L	6010 7 ug/L	N/R
Lead	N/R	N/R	N/R	6010 42 ug/L
Mercury	N/R	N/R	N/R	7470 0.2 ug/L
Molybdenum	N/R	6010 8 ug/L	6010 8 ug/L	N/R
Nickel	N/R	6010 15 ug/L	6010 15 ug/L	N/R
Nitrate	N/R	N/A[3]	9200[4] 100 ug/L	N/R
Potassium	N/R	6010 Varies[5]	6010 Varies	N/R
Selenium	N/R	N/R	N/R	7740 2 ug/L

Table 5. (Continued)

Analysis	Soil Background (-090)	Soil Designation Limits (-084)	Waste Designation Toxic Mixtures (-084)	Waste Designation EP Toxic Characteristic (-090)
Silver	7761 0.02 ug/L	6010 0.7 ug/L	6010 0.7 ug/L	7761 0.02 ug/L
Sodium	N/R	6010 2.9 ug/L	6010 2.9 ug/L	N/R
Strontium	N/R	6010 0.03 ug/L	6010 0.03 ug/L	N/R
Zirconium	N/R	N/A	N/A	N/R
Volatile Organics	8240 0.5 ug/kg	N/R	N/R	N/R
Semivolatile Organics	8270 Varies[6]	N/R	N/R	N/R

Notes:

1 Analytical Methods are identified by EPA Method numbers per SW-846. Typical detection limits are for waters/extracts (ug/L) or for soils/sediments (ug/kg).

2 N/R indicates analysis is not required.

3 N/A indicates that no method is available.

4 Method 9200 will be used to determine concentration of nitrate in liquid wastes. No EPA method is available for solid wastes.

5 Detection limit for potassium varies depending on operating conditions.

6 Detection limits vary depending on constituents but are generally in the low mg/kg range.

specified. (While GC/MS methods are not as sensitive as GC methods, the use of GC methods is not practical since specific analytes of concern have not been identified.)

3.2 DESIGNATION OF TOXIC WASTE MIXTURES

The detection limits required for designation of soils or wastes under WAC 173-303-084 are generally much higher than those required for comparison to background levels. Inductively coupled plasma atomic emission spectroscopy (ICP) was selected for use in performing metals analysis as it is a highly efficient technique which satisfies the detection limits required under WAC 173-303-084. This method, EPA Method 6010, allows concentrations of numerous metals to be obtained in a single analysis rather than requiring multiple AA analyses.

Method 6010 does not detect zirconium. No AA methods are available in SW-846 for analysis of zirconium. The absence of zirconium analysis is not expected to effect waste designation since zirconium is only a minor contributor to the overall equivalent concentration for PW-0. In addition, ratios of the various metals are somewhat fixed by the waste composition and it is unlikely that there would be any soil or waste which would be designated solely because it contained zirconium nitrate.

No method is available in SW-846 for analysis of nitrate in soils. Nitrate in liquid wastes will be determined using Method 9200. pH of aqueous wastes resulting from equipment decontamination activities will be determined using the Method in Attachment 1 to Appendix B of WDOE 83-13.

3.3 DESIGNATION OF EP TOXIC WASTES

Concentrations of EP toxic metals must be determined through use of the methods referenced in WDOE 83-13, Appendix D, Table 1.A. This determination may also be made by Method 6010 (ICP) according to the applicability information stated within this Method for certain metals. Method 6010 provides an efficient technique that exceeds the required detection limits quite easily for the majority of the EP Toxic metals. For EP Toxic metals not appropriate for ICP analysis, direct aspiration flame AA methods, graphite furnace AA methods, or cold vapor AA methods will be used as appropriate. When more than one AA method was available for use, the most sensitive method was selected for use unless it was subject to interference with constituents known to be present in the wastes.

4.0 SAMPLING RATIONALE AND DESIGN

As described above, soil sampling activities are directed toward determining whether soils at the SHLWS T/S unit contain the EP toxic metals barium, cadmium, chromium, and silver or organic listed waste constituents above environmental background; have pH different than environmental background; and have toxic SHLWS constituents above WAC 173-303-084 designation limits. Soil samples will be collected to obtain data to make these determinations. The rationale for the sample program is predicated on the assumption soils at the SHLWS T/S unit contain waste constituents at environmental background levels. Random samples will be collected from uncontaminated soils outside the SHLWS T/S unit (i.e., background samples) and from within the unit (i.e., waste unit samples). Statistical tests will then be performed to determine whether there is a difference in mean population between these two populations.

Initially, sampling will be limited to surface soils (i.e., 0 to 12 inches in depth). All samples will be analyzed for ICP metals, EP toxicity metals, volatile organics, and semivolatile organics. If surface soils are found to be uncontaminated, samples from greater depths will not be collected. If surface contamination is found, additional samples will be collected from the initial sample locations at successive 12 inch increments to determine the extent of any vertical downward contaminant migration.

The number of samples required to make the above determination depends on the variability of the data. There is a natural variation in background levels of elements in soils. The variance of the mean concentration, if known, can be used to determine the number of samples required. The mean concentration and variance of barium, cadmium, chromium, and silver for the soils at the SHLWS T/S unit is not known. Previous characterization has identified the mean concentration and variance for several inorganic constituents in Hanford Area soils. These data include:

Constituent	Mean (mg/kg)	Standard Deviation (mg/kg)
Cadmium	0.7	0.7
Copper	12.2	1.3
Lead	4.4	0.7
Nickel	17.1	1.3
Zinc	60.6	12.5
pH	7.2	0.3
Fluoride	267	40.6

The above data were reported in Watson, et al., 1983, for soils from nine locations at Hanford.

To determine the number of samples to be collected, the above data were used to calculate the confidence interval (at 95 percent confidence) for the estimate of the difference between population means. The two populations, the background and the waste unit, were assumed to have the variances given above. The methods presented in Mendenhall, 1975, were used. Because the potential exists for the waste unit soils to have higher variability than the background soils, it was assumed that twice as many samples would be collected from the waste unit. The number of samples required to obtain a 95 percent confidence interval equal to one standard deviation is seven background samples and 14 samples from the waste unit.

No data are available concerning the background levels of volatile and semivolatile organics in soils. Generally, the background of toxic organics is assumed to be zero and any amount detected is assumed to be above background. The potential exists, however, for organic constituents to be present from sources other than waste management activities at the SHLWS unit. For this reason, samples will be collected in the same manner and from the same locations as for inorganics. Mean concentrations will be determined for the background area and for waste management areas.

Sample locations will be selected randomly from uniform grids within the background area and waste management unit. The background area is defined as a 45-ft wide strip along and south and west borders of the SHLWS T/S unit and a 45-ft strip north of Stone Street immediately north of the SHLWS T/S unit, as shown in Figure 1. The old concrete building foundations to the south of the SHLWS T/S unit will not be included in the areas to be sampled. The area to the east of the SHLWS T/S unit is paved and will not be sampled. The waste management area is defined as the SHLWS T/S storage area, SHLWS T/S treatment area, and less-than-90-day storage area (see Figure 1).

The background area was selected because it is close to the waste management area, is comprised of similar soils, surrounds the waste management area to the extent possible, and is outside the predominant wind direction from the SHLWS T/S unit (see Figure 2-6 of the Closure Plan for wind roses). It is noted that the background area may not be reflective of true environmental background because the surface material is not all native soil (i.e., much is imported gravel) and the area is located within an industrial area. The sampling is intended to determine whether waste management activities have resulted in contamination of soils in the waste management area above the background levels in adjacent surface materials. It is recognized that other activities within the 3000 Area may have resulted in background levels above native environmental background. The sampling will determine whether waste management activities have resulted in levels above the local background.

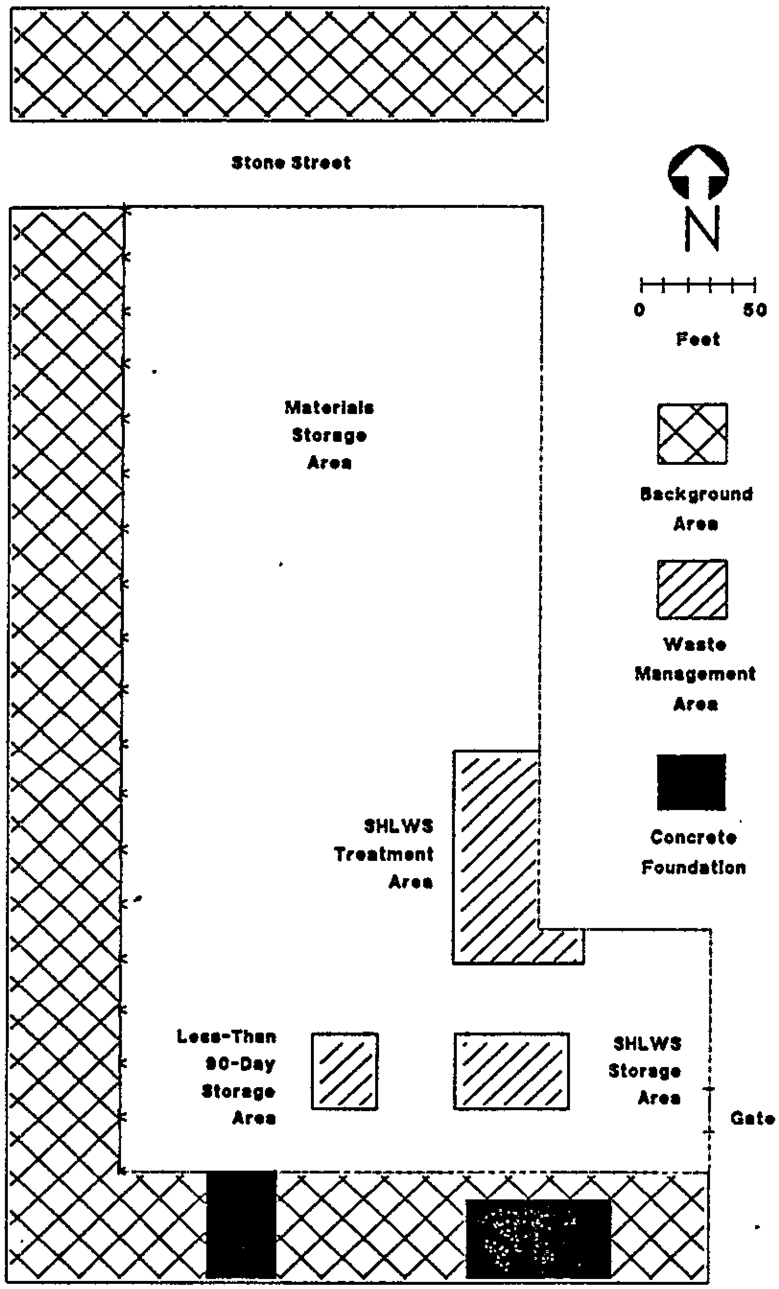

Figure 1. Location of Background Area and Waste Management Areas

Sample locations will be determined by gridding the background area and waste management area into uniform grids having approximately 20 times the number of required samples (i.e., 140 for the background area and 280 for the waste management area). Each grid will be numbered and a random number table will be used to select 7 background area grids for sampling and 14 waste management area grids for sampling. Each grid for the background area will be 15 ft (4.6 m) by 20 ft (6.1 m) and each grid for the waste management area will be 5 ft (1.5 m) by 5 ft. The grids for the background area will be subgridded into 100 subgrids. Five subgrids will be selected at random and subsamples collected at these 5 locations for compositing. The subgrids will be 1.5 ft (0.46 m) by 2.0 ft (0.6 m) and subsamples will be collected from the center of each subgrid. Five subsamples of approximately the same size (e.g., 1 kg) will be collected and thoroughly mixed to form the composite sample. For the waste management area, grab samples will be collected from the center of each grid selected for sampling. The gridding and subgridding system for the background and waste management areas is illustrated in Figures 2 and 3, respectively.

Following collection and analysis of samples, data will be used to calculate the mean and variance for each contaminant for the background and waste management areas. These data will then be used to determine whether there is a statistically significant difference between the mean concentrations for the two areas. The confidence interval for the estimate of the difference between the means will also be calculated. If the samples show a higher variance than originally assumed, the variance will be recalculated and enough new samples will be randomly selected to equal one standard deviation at a 95 percent confidence level.

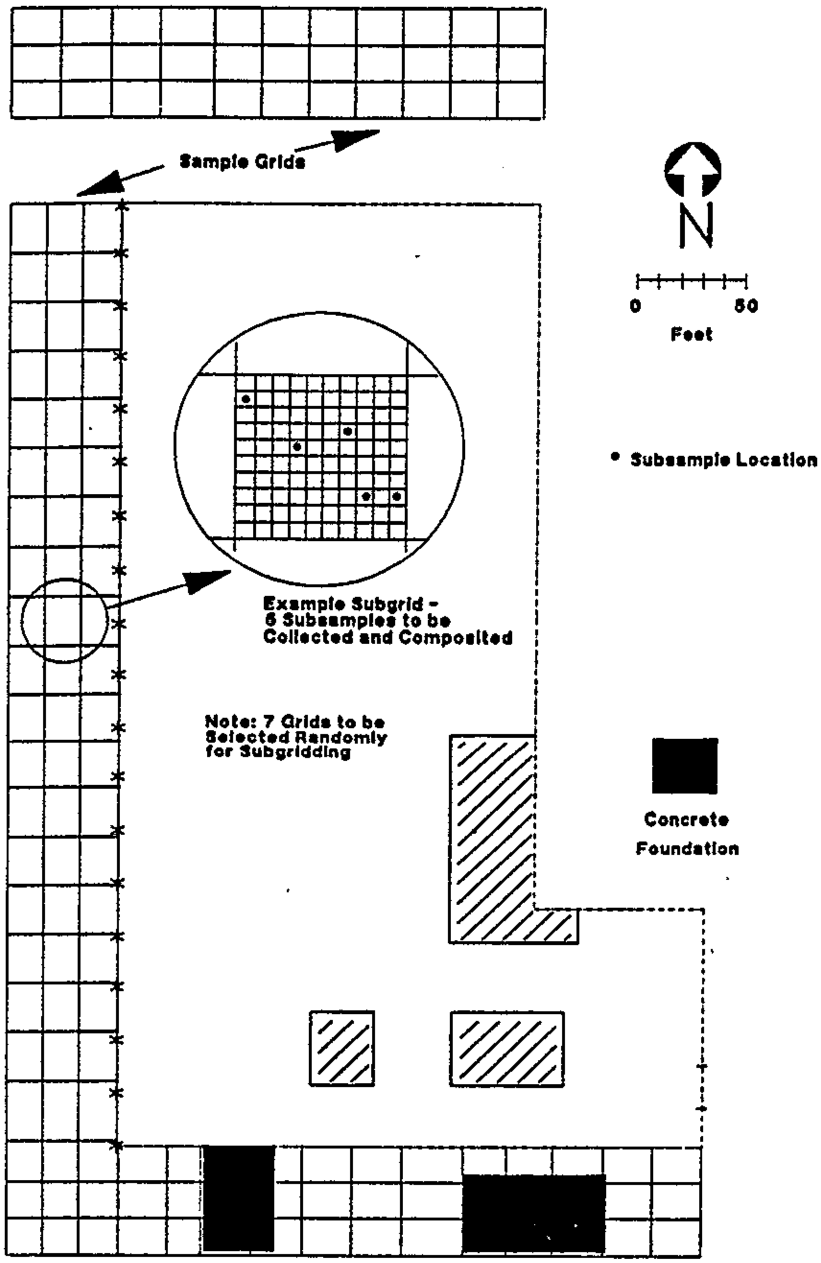

Figure 2. Sample Grids and Subgrids for the Background Area

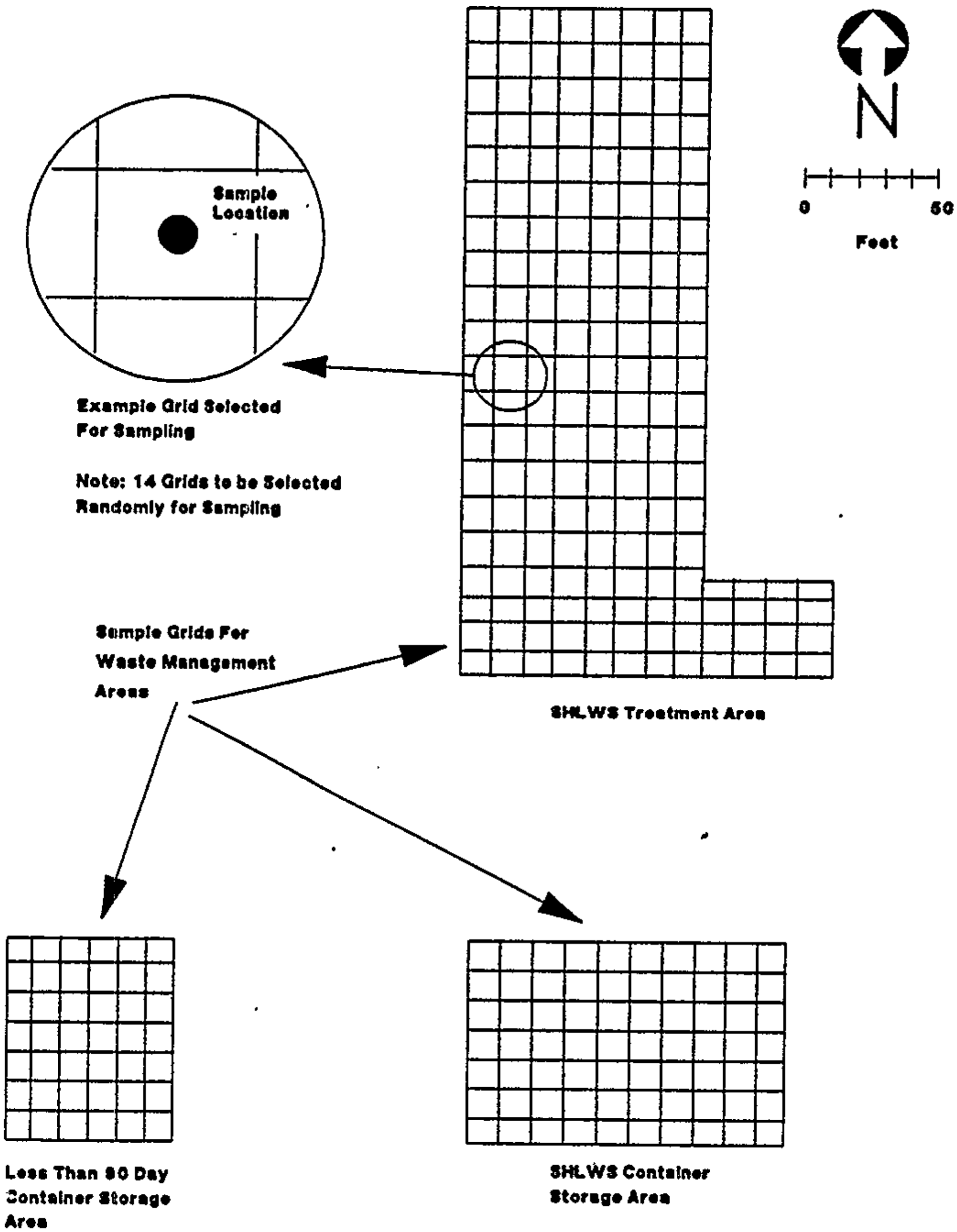

Figure 3. Sample Grids for the Waste Management Areas

Soil sampling will also be required for soil removal activities. As described in the Closure Plan, all areas of soil which appear to be visibly contaminated will be excavated and placed in drums. Records will be kept in the field notebook or geologist's log indicating the source of the soil in each drum. A sample of the soil removed from each potentially contaminated area will be collected and analyzed for ICP metals, EP toxic metals, volatile organics, and semivolatile organics. If the results indicate that contaminants are present above background, a sample will be taken from the location where the soil was removed to verify that all contaminated soil above background has been removed. If these samples indicate that residuals are still present above background, additional soil will be removed and the location resampled.

The results of the analysis of the soils placed in the drum will also be used to perform a dangerous waste designation of the soil in the drum. This designation will be used to determine whether the soils must be disposed of as dangerous wastes.

For the purpose of designating liquid wastes generated from equipment decontamination activities, composite samples will be collected from each batch (i.e., each drum) using a composite liquid waste sampler (COLIWASA).

The only solid wastes currently expected to require designation are waste pallets used to store drums of SHLWS. There are 76 of these pallets at the SHLWS T/S unit. These pallets have the potential to have been contaminated due to leakage from drums. A random number of these pallets will be sampled to determine whether they must be designated as dangerous waste. Initially, ten of the pallets will be selected at random and sampled. Analytical results will be used to determine the mean and variance of contaminant concentrations. The mean and variance will then be used to determine if additional pallets must be sampled.

Samples will be collected from 10 pallets chosen at random (i.e., pallets will be numbered and a random number table used to select ten for sampling). Subsamples will be collected by removing approximately 10 grams of wood from each of six locations on each pallet. The locations will primarily include the working surfaces of the pallets (upper surface and lower surface of the skids) which are most likely to be contaminated. In addition, areas that appear to be contaminated as indicated by discoloration or other surface irregularities will be sampled. These subsamples will be composited to form a sample for each pallet. The samples will be tested for EP toxicity and for ICP metals. Using these results, the mean and variance of the concentrations of toxic metals will be calculated and used to determine if the pallets are dangerous waste. The mean and variance data will also be evaluated using the procedures given in SW-846 (i.e., Section 9.1.1.3.1) to determine if additional random samples must be collected for statistical purposes. If this analysis indicates that additional samples are required, they will be obtained in the same manner as the original samples. The pallet samples will not be analyzed for organics because the SHLWS stored on the pallets does not contain organics.

5.0 SAMPLING METHODS

5.1 GENERAL DESCRIPTION OF SAMPLING ACTIVITIES

Soil samples will be collected according to the provisions outlined in this Section. Soil samples will be limited to a homogenized composite sample of the first 12 inches of soil at each designated sampling location. If contamination is found at these locations, these same locations will be resampled at successive 12 inch increments to determine the extent of any vertical downward contaminant migration.

Samples of liquid wastes from equipment decontamination activities will be collected from each drum of waste. Composite samples will be collected using a COLIWASA sampler as described in Test Methods for Evaluating Solid Wastes, EPA SW-846.

Samples of wooden pallets will be collected by removing approximately 10 grams of shavings from six locations on the pallets. Shavings will be collected using a stainless steel knife or chisel.

5.2 SAMPLE CONTAINERS

The number and types of sample containers required are summarized in Table 6. All sample containers will be precleaned and prelabeled before they are transported to the field.

Table 6. Summary of Sample Containers Required

Sample Type	Analysis	Required Container	Number of Containers per Sample
Soils	Metals	16 oz. Glass w/ Teflon cap seal	2
	EP Toxicity	16 oz. Glass w/ Teflon seal	2
	Volatile Organics	8 oz. Glass w/ Teflon-Lined Septum	2
	Semi-Volatile Organics	16 oz. Glass w/ Teflon cap seal	2
Liquid Waste	Metals/anion	16 oz. Polyethylene	2
	EP Toxicity	16 oz. Polyethylene	2
Pallet Chips	EP Toxicity	16 oz. Glass w/ Teflon cap seal	1

5.3 SAMPLING EQUIPMENT

Primary sampling equipment anticipated to be used will include precleaned shovels, hand augers, trowels, buckets, coolers (with ice), precleaned and prelabeled sample containers, various screens or sieves, a hammer, wooden stakes, and a stainless steel knife or chisel. All sampling equipment will be constructed of non-reactive material.

5.4 EQUIPMENT DECONTAMINATION

All sampling equipment which comes into contact with samples will be decontaminated between samples to prevent cross contamination and will also be decontaminated at the end of each working day. Equipment will be decontaminated in the following manner:

1) Equipment will be given a radiological survey by a radiation protection technologist (RPT) to determine whether it is radioactively contaminated. Radiological surveys will be performed using procedures specified in PNL-MA-507, Procedures for Radiation Protection Technologists. Separate decontamination lines will be used for radioactively contaminated equipment and nonradioactively contaminated equipment, and decontamination wastes from these two lines will be segregated. The two lines will use identical decontamination procedures.

2) Equipment will be thoroughly scrubbed using a solution of trisodium phosphate (TSP) at a strength of 1/4 pound TSP per gallon of clean water (30 grams per liter). All visible signs of contamination will be removed.

3) Equipment will be thoroughly rinsed with clean tap water, being certain that no TSP is left on the equipment.

4) Equipment will be thoroughly rinsed with reagent grade acetone followed by rinsing with deionized water.

5) Equipment will be thoroughly rinsed with 0.1N nitric acid followed by thorough rinsing with deionized water. Samples of rinse water will be periodically collected for equipment blanks to verify decontamination, as specified in Section 5.9.

6) If the equipment is not to be used immediately, it will be allowed to air dry and will be wrapped with aluminum foil, with the dull side of the foil toward the equipment.

7) All equipment will be surveyed by an RPT to confirm radiologic decontamination.

All decontamination wastes will be collected in polyethylene-lined drums. Prior to decontamination, equipment will be radiologically surveyed to determine if radioactive contamination is present. Decontamination wastes from radioactively-contaminated equipment will be kept separate from wastes from nonradioactively-contaminated equipment.

5.5 SAMPLING AND SAMPLING LOCATIONS

One set of samples will be obtained from each sample location.
The field notebook or geologist's log will be used to document sample collection activities and observations including the identification of the specific sample collected and the corresponding sample numbers.

A grid system discussed earlier will be established prior to sampling and will be used to identify and reference the random locations to be sampled. Wooden stakes identified with the sample number will be located at each sampling location and this location will be noted in the field notebook or geologist's log.

5.6 SAMPLE COLLECTION

The number and amounts of samples to be collected is summarized in Table 7. Each sample container for aqueous and soil samples will be filled

Table 7. Number and Amounts of Samples to be Collected

Sample Type	Number of Samples[1]	Sample Size
Soil Background		
Metals	7	2 - 16 oz. Glass Jar
EP Toxicity	7	2 - 16 oz. Glass Jar
Volatile Organics	7	2 - 8 oz. Glass Jar
Semivolatile Organics	7	2 - 16 oz. Glass Jar
Soil at Waste Management Areas		
Metals	14	2 - 16 oz. Glass Jar
EP Toxicity	14	2 - 16 oz. Glass Jar
Volatile Organics	14	2 - 8 oz. Glass Jar
Semivolatile Organics	14	2 - 16 oz. Glass Jar
Wood From Pallets		
Metals/EP Toxicity	10	1 - 16 oz. Glass Jar
Liquid Waste		
Metals/anions	TBD[2]	2 - 16 oz. Polyethylene Bottle
EP Toxicity	TBD	2 - 16 oz. Polyethylene Bottle

Notes: [1] Initial number of samples to be collected. Additional samples could be required based on analysis of mean and variance data. Numbers in table do not include quality control (QC) samples described in Section 5.9.

[2] To be determined based on volume of decontamination waste generated. One sample will be collected from each drum of waste.

with sample material leaving no head space in the container. Large stones or cobbles will be removed from the sample by sieving or screening if necessary. If sieving or screening is necessary, soil will be transferred directly to the sieve or screen and will be shaken into a collection bucket until enough material has been collected for the sample. The material will then be transferred directly into the sample container. Samples which will be analyzed for volatiles will not be sieved. Each container will then be sealed tightly, the sample label information completed, the lid of the sample sealed with tape, and the sample placed into the ice chest. Sample container lids will not be interchanged. Samples will be delivered to the laboratory at the conclusion of each work day. In the case an off-site analytical laboratory is to be utilized, each day's samples will be prepared for delivery or shipment to the analytical laboratory and will be transported the following work day. Regardless of the laboratory to be utilized, all samples will be packed in suitable containers to provide the required environmental conditions outlined in Table 8.

5.7 DOCUMENTATION

As samples are collected during the day, the appropriate documents such as chain of custody forms, request for analysis forms, and the field notebook or the geologist's log will be completed. Information to be noted for sampling activities includes the following:

- Personnel present during field operations;
- Procedures used for sampling (including any deviations from the SAP and reasons for deviations);
- Time of sample collection;
- Description of sample locations;

Table 8. Sample Preservation and Holding Time

Soils

- Metals: Preserve by cooling to $4^{\circ}C$; holding time 6 months
- Volatile Organics: Preserve by cooling to $4^{\circ}C$; holding time 14 days
- Semivolatile Organics: Preserve by cooling to $4^{\circ}C$; holding time 7 days until extraction, 40 days after extraction

Liquid Wastes

- Metals: Preserve by acidifying with nitric acid to $pH<2$ and cooling to $4^{\circ}C$; holding time 6 months
- EP Toxicity: Preserve by cooling to $4^{\circ}C$; holding time 6 months

Solid Wastes

- Metals: Preserve by cooling to $4^{\circ}C$; holding time 6 months
- EP Toxicity: Preserve by cooling to $4^{\circ}C$; holding time 6 months

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- Number and types of sample containers filled at each sample location; and
- Conditions during sampling (e.g., weather), especially conditions which could impact analytical results;

All original data recorded in field notes, chain-of-custody records, and other forms are written with permanent, waterproof ink; erasures of data will not be made. If an error is made on a document, the individual making the entry will correct the document by crossing a line through the error, entering the correct information, and dating and initialling the correction. Any subsequent error discovered on a document is corrected in the same manner (i.e., crossed through, initialed, and dated).

In all cases involving the use of a PNL analytical laboratory or other laboratory on the Hanford Site, samples will be maintained in restricted access areas and in the possession of field or analytical staff. If the samples are sent to an off-site analytical laboratory, tamper indicating seals will be used.

Sample possession will be recorded on a chain-of-custody (COC) form. The form to be used is shown in Figure 4. Each time possession of the sample or sample container is transferred between individuals, both the sender and receiver sign and date the COC form.

A photograph will be taken of each sampling location showing the sample identification number.

5.8 SAMPLE IDENTIFICATION

Each sample will be assigned a unique sample identification number. These numbers will be assigned in advance of the field effort and will be used to prepare sample labels for each container to be used. The sample label will contain the following information:

- Sample identification number (entered in advance);
- Date and time of sample collection (entered in field);
- Sample location (entered in field);
- Sample type (e.g., grab or composite) and sample media (entered in advance);
- Required analysis and preservatives (entered in advance); and
- Name of sampler (entered in field).

Battelle Pacific Northwest Laboratories P.O. Box 999 Richland, Washington 99352	CHAIN OF CUSTODY	

Company Contact: ______________________ Telephone: ____________

Samples Collected by: ______________ Date: __________ Time: __________

Sample Location: ______________________________

Ice Chest No.: ______________________ Field Logbook Page No.: __________

Remarks: ______________________________

____

Method of Shipment: ______________________________

Sample Identification

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____________	____________
____________	____________

CHAIN OF POSSESSION

Relinquished by:	Received by:	Date/Time:
Relinquished by:	Received by:	Date/Time:
Relinquished by:	Received by:	Date/Time:
Relinquished by:	Received by:	Date/Time

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Figure 4. Chain-of-Custody Form

Labels will be attached to each container before entering the field. Field information will be entered on the labels using waterproof ink. After the label is completed, it will be wrapped with waterproof, transparent tape. Similar information, including the sample number, sample location and description, number of containers, and analyses to be performed will be documented on the request for analysis form. This form will be provided by the analytical laboratory and will be completed using the procedures described in Section 5.7.

5.9 INTERNAL FIELD QC

Internal QC checks for field activities will be as follows:

- At least one duplicate sample of each sample parameter will be collected each day. The total number of duplicates will equal 10 percent of the total number of samples collected with a minimum of three.
- At least one equipment blank consisting of the last water rinse from equipment decontamination will be collected for each type of sampling device used each day.
- One travel blank (i.e., deionized/organic free water) will be prepared per day for volatile organic analysis.
- One container blank (i.e., deionized/organic free water in one of the precleaned but unused sample containers) will be submitted for each lot of sample containers used.

Duplicate samples will be used to establish precision of the data. The total number of field duplicate samples submitted will be three samples or 10 percent of the total number of samples, whichever is greater. The number of duplicate samples submitted each day will be one sample or 10 percent of the samples collected each day, whichever is greater. Duplicate samples will be obtained by collecting a single sample, ensuring it is homogeneous, and splitting it into two identical sample containers.

Blank samples will consist of equipment and travel blanks which will be used to determine if contamination is introduced during sampling procedures. Since the use of soil materials for blanks is unproven and impractical, deionized/organic-free water will be used for travel blanks. A sample of the last water rinse from tool decontamination will be collected and analyzed to confirm the absence of sample cross-contamination. One equipment blank will be collected for each ten decontamination cycles, but not less than once per day.

6.0 REFERENCES

Mendenhall, W. 1975. Introduction to Probability and Statistics. Duxbury Press, North Scituate, Massachusetts.

Watson, E. C., et al. 1983. Draft Environmental Characterization: Two Potential Locations on Hanford Site for a New Production Reactor. Prepared by the Pacific Northwest Laboratory for the U.S. Department of Energy, Richland, Washington.