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DRAFT LEVEL 1 REMEDIAL INVESTIGATION WORK PLAN
316-3 WASTE DISPOSAL TRENCHES

ICF Northwest
Richland, Washington

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Pacific Northwest Laboratory
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A13	276-300	A99	601-Up
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TABLE OF CONTENTS

	<u>Page</u>
1.0 Introduction	
1.1 General	1-1
1.2 Objectives	1-2
2.0 Background	
2.1 Physical Setting	
2.1.1 Location and Description	2-1
2.1.2 Regional Physiography and Surficial Geology	2-4
2.1.3 Site Physiography and Surficial Geology	2-4
2.1.4 Bedrock Geology	2-7
2.1.5 Soils	2-10
2.1.6 Climate	2-10
2.1.7 Surface Water	2-11
2.1.8 Regional Hydrogeology	2-12
2.1.9 Site Hydrogeology	2-13
2.2 Site History and Response Actions	2-14
3.0 Initial Evaluations	
3.1 The Nature and Extent of Site Problems	
3.1.1 Types and Apparent Volumes of Wastes Disposed	3-1
3.1.2 Extent of Hazardous Substances	3-3
3.1.3 Major Contaminant Parameters Identified and Concentrations Detected	3-6
3.2 Potential Pathways of Contaminant Migration	
3.2.1 General	3-13
3.2.2 Groundwater	3-13
3.2.3 Surface Water	3-15
3.2.4 Air	3-15
3.3 Potential Exposure to Migrating Contaminants	3-16
3.4 QA/QC Review of Existing Data Base	3-17

TABLE OF CONTENTS (Continued)

	<u>Page</u>
4.0 Work Plan Rationale	
4.1 Work Plan Approach	4-1
4.2 Data Needs	4-2
4.1.1 Problem Identification	4-3
4.1.2 Risk Assessment and Environmental Impact	4-7
4.1.3 General Response Action Screening	4-8
5.0 RI Tasks	
5.1 Task 1 - Technical Management and Support	
5.1.1 Subtask 1.1 - Project Management	5-1
5.1.2 Subtask 1.2 - Field Work Support	5-2
5.1.3 Subtask 1.3 - Quality Control	5-2
5.1.4 Subtask 1.4 - Sample Management	5-2
5.2 Task 2 - Existing Data Review	
5.2.1 Subtask 2.1 - Site Visit and General Reconnaissance	5-3
5.2.2 Subtask 2.2 - Hydrogeology and Groundwater Monitoring Data	5-4
5.2.3 Subtask 2.3 - Hydrologic and Surface Water Monitoring Data	5-5
5.3 Task 3 - Field Data Collection	
5.3.1 Subtask 3.1 - Surface Radiation Monitoring	5-5
5.3.2 Subtask 3.2 - Subsurface Sediment Sampling	5-6
5.4 Task 4 - Laboratory Analysis	5-11
5.5 Task 5 - Geochemical Characterization of Sediments	5-11
5.6 Task 6 - Data Evaluation	
5.6.1 Subtask 6.1 - Validation of Laboratory Data	5-12
5.6.2 Subtask 6.2 - Data Evaluation	5-12

LIST OF FIGURES

Figure 1.	General Location of 316-3 Trenches	<u>Page</u> 2-2
Figure 2.	Location of 316-3 Trenches Within the 300 Area	2-3
Figure 3.	Location of the Hanford Site and Pasco Basin	2-5
Figure 4.	Geologic Cross-Sections at 300 Area	2-8
Figure 5.	Location of Cross-Sections Shown in Figure 4	2-9
Figure 6.	Layout of 300 Area Laboratory Waste System	2-15
Figure 7.	Present 300 Area Groundwater Quality Monitoring Network	3-7
Figure 8.	Existing and Abandoned 300 Area Monitoring Wells	3-12
Figure 9.	Subsurface Sample Locations for 316-3 Trenches Level I Remedial Investigation	5-9
Figure 10.	Proposed Schedule for 316-3 Trenches Level I RI	6-2

TABLE OF CONTENTS (Continued)

	<u>Page</u>
5.7 Task 7 - Public Health/Endangerment Assessment	
5.7.1 Subtask 7.1 - Selection of Contaminants of Concern and ARARs	5-13
5.7.2 Subtask 7.2 - Environmental Fate and Transport	5-13
5.7.3 Subtask 7.3 - Exposure Evaluation	5-14
5.7.4 Subtask 7.4 - Toxicity Evaluation	5-14
5.7.5 Subtask 7.5 - Risk Characterization	5-15
5.8 Task 8 - Initial Screening of Remedial Technologies	5-15
5.9 Task 9 - Reporting	5-16
6.0 Project Schedule	6-1
7.0 References	7-1
Appendix A - WC Procedure A13057 - Inactive Waste Site Soil Sampling Procedures	A-1
Appendix B - Procedure for Inactive Waste Site Soil Sampling Using Cable Drilling Tools	B-1
Appendix C - Site Health and Safety Plan	C-1

LIST OF TABLES

	<u>Page</u>
Table 1. Summary of Geologic History of Pasco Basin	2-6
Table 2. Sources, Types, and Estimated Volumes of 300 Area Retention Wastes, 1960	3-2
Table 3. Estimated Chemical Contaminant Inventory for 316-3 Trenches	3-4
Table 4. Description of Sediment Samples Taken From 316-3 Trenches, June, 1987	3-8
Table 5. Analyte and Analytical Methods for Sediment Samples at 316-3 Trench Site, June, 1987	3-9
Table 6. Results of Analysis of Sediment Samples Collected at 316-3 Trench Site, June, 1987	3-10
Table 7. Analytes and Analytical Methods for 316-3 Trenches Level ■ RI	5-8

1.0 INTRODUCTION

1.1 GENERAL

Pacific Northwest Laboratory (PNL) is undertaking a remedial investigation (RI) of two inactive leaching trenches located in the 300 Area at the U. S. Department of Energy (DOE) Hanford Site. This RI is being conducted as part of implementation of Phase II of the DOE Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Program being performed under DOE Order 5480.14. The 300 Area leaching trenches (facility number 316-3) were selected for further characterization under Phase II based on the results of the Phase I Installation Assessment (DOE, 1986a). In Phase I, inactive waste disposal sites at Hanford were ranked using the Environmental Protection Agency's Hazard Ranking System (HRS) and DOE's Modified Hazard Ranking System (mHRS). The 316-3 Trenches had an HRS/mHRS migration score of 79.28. This score is above the value of 28.5 used to determine whether further action at a site should be conducted.

This work plan describes the work to be performed for the initial level of site characterization for the 316-3 Trenches. This initial site characterization effort will include a review of existing environmental contamination, data for the 300 Area as well as collection and analysis of environmental samples to better characterize subsurface contamination at the site. The work described herein will comply with the requirements of Phase II of the DOE CERCLA Program as well as comply with the RI requirements given in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The work corresponds to Level I of site characterization, as described in the general RI methodology plan for Hanford. As a result, the work is directed toward the following steps which are identified in the general RI plan as important for Level I:

- verify the validity of the "observed release" parameter assumed during the Phase I analysis;

- o determine the extent of the contamination plume in the vadose zone;
- o verify that all potential contaminants were identified during Phase I;
and
- o determine the potential for contaminant migration.

The work plan summarizes an initial evaluation of existing data and background information and defines the scope of the site characterization activities. Sections 2 and 3 summarize the evaluation of existing data. Section 4 identifies the rationale for the proposed approach, which is described in Section 5. Section 6 presents a schedule for performing the work.

1.2 OBJECTIVES

The objectives of the site characterization for the 316-3 Trenches are to determine the extent of the contamination of subsurface sediments, groundwater, and possibly surface water. As part of the Level I effort, these contaminant characterization data will be used to define the nature and extent of problems at the site, evaluate potential human health and environmental hazards, and identify and select required remedial actions. The results of the Level I effort will also be used to identify any future characterization or assessment activities related to contamination at the site and to identify any additional data requirements needed to support selection of a remedial action.

Following completion of the Level I RI, a Work Plan for the Level II RI will be prepared if the results:

- Identify an environmental or health risk needing further characterization.
- o Determine that environmental contamination and migration pathways must be characterized in more detail than possible with existing data and those data collected during Level I.
- o Determine that additional data are required to support selection of remedial technologies and alternatives.

2.0 BACKGROUND

2.1 PHYSICAL SETTING

2.1.1 Location and Description

The 316-3 Trenches are two inactive leaching trenches located at the DOE Hanford Site in **Benton** County in south central Washington. The trenches were each 500 ft long by approximately 20 ft wide by 20 ft deep and were constructed in 1953. The location of the trenches is the east central portion of the 300 Area, just north of the Chemical Engineering Laboratory (324 Bldg), as shown in Figure 1. The trenches are approximately 700 ft west of the Columbia River and approximately 3 mi north of the city of Richland.

The 316-3 Trenches were unlined trenches used primarily for the disposal of very low level radioactive laboratory wastewaters. Flows to the trenches were reported to range from 30,000 gal/day in late 1954 to 100,000 gal/day in 1956 (Heid, 1956). The average flow in 1960 was reported to be 125,000 gal/day (Haney, 1960). Following cessation of liquid waste disposal in 1963, the trenches were used for disposal of contaminated sediments removed from the 300 Area South Process Pond (facility 316-1). The trenches have since been backfilled and the entire area occupied by the trenches is now gravel surfaced except for two storage buildings (Bldgs 3718-E and 3718-G) which have been constructed at the site. The locations of these buildings are shown in Figure 2.

The 316-3 Trenches are located within the 300 Area security fence which prevents access by the public. In addition, most of the trench area is located within the 324 Building exclusion area fence, which prevents access by staff not working within that area. There are no other markers or fences specifically identifying the location of the buried trenches.

The adjacent Columbia River is used for recreational purposes including boating, fishing, and swimming. In addition, the River is used as a downstream source of drinking water for the cities of Richland, Kennewick, and Pasco, as well as for the 300 Area.

Figure 1. General Location of 316-3 Trenches

Figure 2. Location of the 316-3 Trenches Within the 300 Area

2.1.2 Regional Physiography and Surficial Geology

The Hanford Site is located in the Pasco Basin within the Columbia River Basalt Plateau (Figure 3). The Pasco Basin forms the physiographic low of the larger Columbia Basin, with the Hanford Site located over the structural low of the Pasco Basin. The Hanford Site is bordered to the southwest, west, and north by large anticlinal ridges and to the northeast by the cliffs of the White Bluffs. Elevations range from approximately 345 ft above Mean Sea Level (AMSL) in the southeastern portion of the Site to 3,586 ft AMSL at the summit of the Rattlesnake Hills southwest of the Site. The White Bluffs rise to a maximum elevation of 980 ft AMSL (ERDA, 1975).

The Pasco Basin appears to have been formed by slow continuous subsidence coupled with periodic flooding with basaltic lava flows. As the anticlinal ridges to the south of the basin rose, they obstructed the flow of the Columbia River, flattening the gradient and causing deposition of alluvial deposits known as the **Ringold** Formation. The river then began to incise a channel through the ridge and lowered its base elevation, subsequently eroding the **Ringold** Formation. Later, catastrophic floods of glacial meltwater flowed through the Pasco Basin depositing glaciofluvial sediments in the basin, including coarse deposits known as the Pasco Gravels. More recently, the site has received eolian deposits, with the formation of dunes at some locations. The geological history of the Pasco Basin is summarized in Table 1.

2.1.3 Site Physiography and Surficial Geology

Surface materials at and near the 300 Area consist of alluvial and eolian deposits. The topography at location of the trenches is generally flat and has been altered by construction activities. The elevation at the site of the trenches is approximately 400 ft AMSL. The high water elevation of the Columbia River at the 300 Area is approximately 340 ft AMSL.

The surficial geology of the 300 Area is discussed in detail by Lindberg and Eond (1979). Unconsolidated deposits at the 300 Area consist

Figure 3. Location of the Hanford Site and Pasco Basin

Table 1. Summary of Geologic History of Pasco Basin

QUATERNARY		Period	Epoch	Group	Subgroup	Formation	K-Ar Age Years x 10 ⁶	Member or Sequence	Sediment Stratigraphy or Basalt Flows														
Pleistocene/ Holocene	Pliocene																						
TERTIARY	Miocene	Columbia River Basalt Group	Yakima Basalt Subgroup	Saddle Mountains Basalt	Hanford			Surficial Units	Loess														
									Sand Dunes														
									Alluvium and Alluvial Fans														
									Landslides														
									Talus														
									Colluvium														
									Ringold			Touchet Beds/ Pasco Gravels											
				Grande Ronde Basalt				16.1				Plio-Pleistocene Unit											
												Fanglomerate	Upper Ringold										
													Middle Ringold										
													Lower Ringold										
													Basal Ringold										
												Saddle Mountains Basalt								Goose Island Flow			
																				Martindale Flow			
																				Basin City Flow			
																				Levey Interbed			
																				8.5	Ice Harbor Member	Upper Elephant Mountain Flow	
																						Lower Elephant Mountain Flow	
																				10.5	Elephant Mountain Member	Rattlesnake Ridge Interbed	
																						Upper Pomona Flow	
																				12.0	Pomona Member	Lower Pomona Flow	
																						Selah Interbed	
	Esquatzel Member	Upper Gable Mountain Flow																					
		Gable Mountain Interbed																					
		Gable Mountain Interbed																					
		Cold Creek Interbed																					
13.6	Asotin Member	Huntzinger Flow																					
		Wilbur Creek Member																					
		Wahluke Flow																					
		Sillusi Flow																					
		Umatilla Flow																					
		Priest Rapids Member	Mabton Interbed																				
			Lolo Flow																				
15.6	Roza Member	Rosalie Flows																					
		Quincy Interbed																					
		Upper Roza Flow																					
		Lower Roza Flow																					
Saddle Mountains Basalt								Squaw Creek Interbed															
								Aphyric Flows															
								Phyric Flows															
								Vantage Interbed															
								Undifferentiated Flows															
								Rocky Coulee Flow															
								Unnamed Flow															
								Cohassett Flow															
								Undifferentiated Flows															
								McCoy Canyon Flow															
Schwana Sequence								Intermediate-Mg Flow															
								Low-Mg Flow Above Umtanum															
								Umtanum Flow															
								High-Mg Flows Below Umtanum															
								Very High-Mg Flow															
At Least 30 Low-Mg Flows																							

Ellensburg Formation T₁

of, in ascending order, the **Ringold** Formation, glaciofluvial deposits, and eolian deposits. Geologic cross-sections of the 300 Area near the 316-3 Trenches are shown in Figure 4. The location of these cross-sections are shown in Figure 5.

The **Ringold** Formation consists of gravels, sands, silts, and clays deposited by the ancestral Columbia River. The **Ringold** Formation is approximately 100 ft thick at the location of the 316-3 Trenches. The lower part of the Formation consists of approximately 40 ft of silt and clay with occasional sand and gravel. These deposits are overlain by a complex association of gravel and sand with occasional silt and clay lenses. As shown in Figure 4, there is an ancient river channel incised in the **Ringold** Formation beneath the 300 Area. The trenches are located above this channel.

The glaciofluvial deposits at the 300 Area are coarse-grained deposits known as Pasco Gravels, which were deposited in the Pasco Basin by catastrophic floods. The deposits are typically graded, with boulders at the base of each sequence and ranging upward through cobbles, gravels, and sand. Two such sequences of graded deposits are found at the 300 Area. The finer portion of the upper sequence, however, has apparently been eroded away and surface deposits include cobbles and boulders. As shown in Figure 4, the Pasco Gravels at the location of the 316-3 Trenches are approximately 80 ft thick.

Surface sediments at and near the 300 Area consist of eolian deposits of sand and silt. These deposits have locally formed dunes, especially north and southwest of the 300 Area. In the vicinity of the 316-3 Trenches, these deposits are thin.

2.1.4 Bedrock Geology

Bedrock in the Pasco Basin consists of the Columbia River Basalt Group which is of Miocene and Pliocene age. This Group is comprised of a sequence of basalt flows and inter-bedded sediments. The Columbia River Basalt Group is underlain by older basalts to an estimated depth of over 12,000 ft. The basalt bedrock at the 300 Area dips to the northwest at a

Source: Lindberg and Bond, 1979

Figure 4. Geologic Cross-Sections at 300 Area

Source: Lindberg and Bond, 1979

Figure 5. Locations of Cross-Sections Shown in Figure 4

gradient of 25 ft/mile along the axis of the Pasco Syncline (Lindberg and Bond, 1979).

2.1.5 Soils

The surficial sediments deposited in the Pasco Basin have undergone very little weathering due to the continuously arid to semi-arid climate of the site. For this reason, there is no true soil profile (i.e., soil horizons developing from weathering of parent material). Surface soils (i.e., the uppermost sediments within the plant root zone) at the location of the 316-3 Trenches consist primarily of thin deposits of windblown sands and silts. These soils are underlain by much coarser glaciofluvial deposits. The surface soils generally have a high permeability such that surface runoff occurs only when the ground is frozen. Because of the arid climate and sparse vegetation, the surface soils have a very low organic content.

2.1.6 Climate

The climate at the Hanford Site is characterized by low precipitation, generally mild temperatures, and occasional high winds. The yearly average daily maximum and minimum temperatures are 64.8°F and 41.4°F, respectively, as measured at the Hanford Meteorological Station (HMS). The average annual precipitation measured at the HMS is 6.25 inches. The summers are generally hot and dry. The high average daily maximum temperature of 91.8°F and average daily minimum temperature of 61.0°F occur during July. The lowest mean monthly precipitation and average monthly relative humidity also occur during July and are 0.14 inches and 31.8 percent, respectively. Winters are mild for the latitude and are somewhat wetter than the summers. The low average daily maximum temperature of 36.7°F and average daily minimum temperature of 22.1°F occurs during January. The highest mean monthly precipitation also occurs during January and is 0.93 inches. The highest average monthly relative humidity occurs during December and is 80.4 percent (ERDA, 1975).

Mean monthly wind speeds range from a low of 6.0 mph in December to a high of 9.2 mph in June with a yearly average of 7.6 mph. The prevailing wind direction is from the northwest to west-northwest, but the strongest winds are from the southwest. Windspeeds are generally the lowest in the midmorning and the highest in the late evening. Average daily variations range from as much as 8 mph in the summer to as little as 1 mph in the winter. The maximum peak gust recorded at the HMS was 72 mph in June, 1957. Peak gusts over 40 mph are observed 26 times per year on the average (ERDA, 1975).

2.1.7 Surface Water

The major surface water feature at the Hanford Site is the Columbia River, which is located approximately 700 ft east of the 316-3 Trenches. The Columbia is the largest river in the Pacific Northwest and drains most of the land area in the Northwest. In the Columbia Basin the river is used extensively for irrigation as well as for production of electricity with hydroelectric dams. The river is also used as a source of drinking water by a number of municipalities, including the city of Richland, whose water intakes are approximately three miles downstream from the 300 Area, and the cities of Kennewick and Pasco. A sanitary water intake for the 300 Area is located approximately 400 ft downstream of the 316-3 Trenches. The river, including the reach at and downstream of the 300 Area, also sees heavy recreational use for boating, fishing, and swimming.

The river reach from Priest Rapids Dam, which is several miles upstream of the Hanford Site, to the head of the McNary Dam reservoir pool, which is located near the city of Richland, is the last free-flowing reach of the Columbia River within the United States. This reach, which includes the river reach adjacent to the 300 Area, is characterized by islands, submerged rock ledges, and gravel bars. The bed material is typically sands, gravels, and cobbles. The river in this reach varies in width from 1,200 to 1,800 ft and ranges in maximum depth from 10 to 40 ft, with an average maximum depth of 25 ft (ERDA, 1975).

Although the reach at Hanford is free-flowing, its flow is controlled by the upstream Priest Rapids Dam. Flows through this hydroelectric dam can vary widely depending on power demands. During the summer, fall, and winter, the daily flows can range from as low as 36,000 cfs to as much as 160,000 cfs. Flows are higher during the spring when there is heavy runoff. Peak flows during spring runoff have recently ranged from 160,000 cfs to 550,000 cfs. The long-term annual average flow at Hanford is 120,000 cfs. Maximum river velocities range from 3 **ft/sec** to over 11 **ft/sec**, depending on cross-section and flow (ERDA, 1975).

2.1.8 Regional Hydrogeology

A number of water-bearing units are present beneath the Hanford Site. The upper-most aquifer is located in the upper **Ringold** Formation in the western part of the Site and in the **Ringold** and overlying Pasco Gravels in the eastern part of the Site. This aquifer is generally unconfined, although locally confined zones exist. The bottom of this aquifer is the silts and clays of the middle and lower **Ringold** Formation or, in some locations, the top of the basalt flows. In some areas, there are also sands and gravels in the lower **Ringold** which form the uppermost confined aquifer.

Natural recharge of the unconfined aquifer occurs to the southwest at the foot of the Rattlesnake Hills and Yakima Ridge. The major source of artificial recharge is liquid waste disposal in the 200 Areas, where approximately 15,000,000 **gal/day** of water are discharged to the ground (DOE, 1986b). Lesser amounts of artificial recharge occur in the **100N** and 300 Areas.

Flow in the unconfined aquifer is generally toward the Columbia River, which forms a discharge boundary. Both the flow direction and the groundwater gradient have been significantly influenced by the large volumes of wastewater which are disposed of at the 200 Areas. The water table has been raised by as much as 75 **ft** due to mounding beneath waste disposal sites. Gradients at the mounds are as much as 30 **ft/mile**. Hydraulic properties of the aquifer material vary substantially with

location. Values of hydraulic conductivity measured at Hanford range from 10 to 700 **ft/day** for the **Ringold** Formation and from 1,000 to 12,000 **ft/day** for the Pasco Gravels (ERDA, 1975).

Beneath the **Ringold** Formation is the series of basalt flows in which are found a number of confined aquifers. Aquifers in the basalt are found in inter-bedded sediments and scoria and breccia zones forming the tops and bottoms of flows. The confined aquifers are generally not well characterized.

2.1.9 Site Hydrogeology

The hydrogeology of the 300 Area is described in detail by Lindberg and Bond (1979). Groundwater is found beneath the 316-3 Trenches in a shallow unconfined aquifer in the Pasco Gravels and **Ringold** Formation. The depth to the water table beneath the Ponds is approximately 50 **ft**. The flow direction of the water table aquifer at the 300 Area is generally to the east toward the Columbia River. During periods of high river stage, however, gradient reversal and bank storage can occur. The aquifer is recharged locally by discharges to active liquid waste disposal units. The largest source of recharge is the 300 Area Process Trenches, which are located approximately 2,000 **ft** north of the **316-3** Trenches. The Process Trenches receive approximately 1,000,000 **gal/day** of process wastewaters. There is some slight mounding of groundwater beneath the Process Trenches, the effect of which is to steepen the groundwater gradient toward the Columbia River. An additional source of recharge is the Sanitary Leaching Trenches, **which** are located approximately 1,200 **ft** north of the 316-3 Trenches. The Sanitary Leaching Trenches receive several hundred thousand gallons per day of sanitary wastewater. A small amount of recharge also occurs at the ash disposal pits which are located several hundred feet north of the 316-3 Trenches. The locations of the sanitary trenches and ash pits **are** included in Figure 2.

The transmissivity of the unconfined aquifer, as determined from aquifer tests on wells in the 300 Area, is typically on the order of 100,000 **ft²/day**. A groundwater model of the 300 Area used transmissivity

values of approximately 2,000,000 ft²/day for the area near the 316-3 Trenches (Lindberg and Bond, 1979). The model predicted groundwater travel times from the 300 Area to the Columbia River on the order of weeks to months.

2.2 SITE HISTORY AND RESPONSE ACTIONS

The 316-3 Trenches went into operation in 1953 as part of the expansion of laboratory facilities in the 300 Area. The trenches were constructed as part of a liquid waste disposal system to serve the Works Laboratory Area. Facilities which went into operation in 1953 and were connected to this liquid waste disposal system were the Radiochemistry Building (325 Bldg), the Pile Technology Building (326 Bldg), the Radiometallurgy Building (327 Bldg), the Mechanical Development Building (328 Bldg), and the Biophysics Laboratory (329 Bldg). The Fuels Development Laboratory (308 Bldg) was added to the system in 1960. The trenches were retired in 1963.

The 300 Area liquid waste disposal system consisted of two separate waste lines, as shown in Figure 6. One line, known as the crib waste line, was used for liquid wastes which were too contaminated for ground disposal at the 300 Area. These wastes were stored in tanks at the 340 Bldg and periodically hauled by tank truck to the 200 West Area for disposal in the 216-S-20 crib. The other line, known as the retention waste system, was used for uncontaminated and slightly contaminated wastewaters which could be discharged to the ground in the 300 Area. Wastes in the retention system were discharged to one of four 25,000 gallon retention basins and held for analysis. If analysis showed the wastes to be below discharge limits, they were discharged to the 316-3 Trenches for disposal. If above limits, they would be transferred to the crib waste tanks and held for disposal in the 200 West Area.

Because of difficulties with sampling, the contents of the retention basins were sometimes released to the trenches without sampling. Haney (1960) estimated that 40 per cent of the wastes received were discharged to the trenches without sampling. Because of this practice, it

Source: Haney, 1960

Figure 6. Layout of 300 Area Laboratory Waste System

is possible that wastes exceeding discharge limits were unknowingly released to the trenches. Available sampling data for the period from 1953 through 1960, however, indicated that the discharge limits were never exceeded (Haney, 1960).

In 1963, the 316-3 Trenches were taken out of service and were later backfilled. Trench backfill consists, in part, of contaminated sediments excavated from the 300 Area South Process Pond. According to internal correspondence, a plan was approved in August, 1965, for use of the 316-3 Trenches for disposal of approximately 10,000 yd³ of such sediments, as well as for some coal ash. Sediments in the South Process Pond were known to be contaminated with uranium and a number of heavy metals (DOE, 1986a). The concentrations associated with the sediments placed in the 316-3 Trenches, however, are unknown.

A portion of the retired trench area was recently used for testing of a liquid waste solidification process. The test involved excavating a trench approximately 50 ft by 20 ft by 9 ft deep located immediately east of the 3727 Building (see Figure 2). Foreign material (i.e., discolored sediments) was encountered in the lower 2 to 3 ft of the excavation indicating that the excavation had entered the inactive waste trenches. The excavation was lined with a synthetic membrane liner and filled with a grout mixture created from a nonradioactive simulated liquid waste. After the grout had solidified it was removed and samples of the liner removed at three locations to test for compatibility with the grout. The lined excavation is presently open.

3.0 INITIAL EVALUATIONS

3.1 THE NATURE AND EXTENT OF SITE PROBLEMS

3.1.1 Types and Apparent Volumes of Wastes Disposed

The 316-3 Trenches were used to dispose of laboratory "retention" wastes received by the 300 Area laboratory waste system. These wastes were liquid wastes which were normally uncontaminated but which had the potential for contamination. Sources of these wastes included sinks, sumps, and drains in the Works Laboratory Area (i.e., Bldgs 308, 325, 326, 327, 328, and 329). Most of the waste volume (i.e., more than 75 per cent) consisted of flow from equipment cooling water and seal water. The remainder of the flow was from laboratory sinks and equipment (Haney, 1960). The estimated distribution of flows in 1960 is shown in Table 2.

Waste disposal policies called for wastes to be released to the 316-3 Trenches only if below discharge limits of 5×10^{-6} uCi/ml total alpha activity and 1×10^{-6} uCi/ml total beta activity. The alpha limit was set as one-tenth the recommended occupational maximum permissible concentration (MPC) for plutonium-239 in drinking water. The limit for beta was set equal to the MPC for strontium-90 (Haney, 1960).

An inventory of liquid volume, plutonium, and beta activity discharged to the trenches during the period from August, 1954, through October, 1956 was reported by Heid (1956). This inventory consisted of 2.83×10^8 liters waste volume, 3.09 gm plutonium, and 0.226 Ci beta activity. To estimate the total maximum radioactivity inventory which might have been discharged to the trenches, the total estimated volume of flow was multiplied by discharge limits. The estimated volume of flow received by the trenches is 10^9 liters (DOE, 1986a). Multiplying this volume by the discharge limits results in a total inventory of 5 Ci alpha activity and 1 Ci beta activity.

The chemical characteristics of the wastes received by the trenches were not determined. As shown in Table 2, the majority of the wastes received were cooling water and seal water, which should not have

Table 2. Sources, Types, and Estimated Volumes of 300 Area Retention Wastes, 1960 (Gallons/day)

<u>Type of Waste</u>	<u>Laboratory Building</u>			
	<u>325</u>	<u>326</u>	<u>327</u>	<u>328</u>
Equipment cooling and seal water*	40,000	25,000	10,000	20,000
Other types (sinks, lab equipment)	--- 30,000 (Total all Buildings) ---			

* In most cases this equipment was operated continuously and the water was collected in basement sumps and pumped into the retention waste line.

Source: Haney, 1960

been chemically contaminated. It is expected that chemical contamination would have been limited to occasional spills or discharges of laboratory chemicals to sinks and drains.

Following closure of the site for disposal of liquid wastes, the trenches were used for disposal of contaminated sediments excavated from the South Process Pond (facility 316-1). According to internal Hanford correspondence, plans were made in July, 1965, for excavation of approximately 10,000 yd³ of sediments from the South Pond for disposal in the 316-3 Trenches. According to this correspondence, it was planned to cover the uranium-contaminated sediments with material excavated from ash sluicing pits. According to other internal correspondence dated August, 1965, this plan was approved. The chemical inventory associated with this disposal of South Process Pond sediments was estimated in the Phase I report (DOE, 1986a). This inventory is presented in Table 3, and is based upon results of sampling of the South Process Pond sediments and an estimate of the percentage of the South Pond chemical inventory that was received by the 316-3 Trenches.

The letter describing the planned excavation of the South Pond sediments also mentioned the use of the 316-3 Trenches for the disposal of the contents of a burial ground which was located at the site of the 324 Bldg. From descriptions of facility locations in the Phase I report, it is assumed that this burial ground was the 618-6 Burial Ground. According to the Phase I report, the contents of the 618-6 Burial Ground were removed from the site of the 324 Bldg in 1962 and moved to the 618-10 Burial Ground, which is located north of the 300 Area. Because of this information, it believed that the 316-3 Trenches did not receive material from the 618-6 Burial Ground.

3.1.2 Extent of Hazardous Substances

Available information, although limited, indicates the presence of radioactive and chemical contaminants in the 316-3 Trenches. Contaminated sediments excavated from the 300 Area South Process Pond are known to have been placed in the 316-3 Trenches. While the sediments placed in the 316-3

Table 3. Estimated Chemical Contaminant Inventory for 316-3 Trenches

<u>Chemical</u>	<u>Inventory, kg</u>
Mercury	10
Chromium (VI)	1,000
Cadmium	20
Lead	600
Fluoride	2,000
Uranium	10,000
Nickel	3,000
Zinc	1,000
Silver	300
Beryllium	10
Copper	20,000

Source: DOE, 1986a

Trenches in 1965 were not sampled, the sediments in the bottom of the South Process Pond were sampled in the early 1970s. Analysis of these samples indicated the presence of many of the chemical contaminants identified in Table 3. Sediment samples were also recently obtained from the excavation made behind the 3727 Building as part waste stabilization tests. Analysis of these samples indicated the presence of many of these same contaminants.

Less is known of the extent of hazardous substances which may have migrated from the 316-3 Trenches due to liquid waste disposal. Given the high hydraulic conductivity of the glaciofluvial and alluvial sediments beneath the trenches and the high rate of discharge to the trenches, migration of soluble contaminants to groundwater is expected. Water released to the trenches is known to have been radioactively contaminated. Levels of radioactivity, however, should have been below discharge limits of 5×10^{-6} uCi/ml total alpha and 1×10^{-6} uCi/ml total beta. Available data (Haney, 1960) indicate that these discharge limits were not known to have been exceeded during the period 1953 to 1960. During this period, approximately 60 per cent of the wastes received by the retention system were sampled prior to discharge. Wastewaters received by the trenches were not characterized with respect to chemical contamination. These wastewaters could have contained small amounts of chemical contamination from laboratory operations.

If discharges to the trenches were kept below the above limits, these discharges would not likely have resulted in groundwater contamination at levels of concern. The above limits can be compared to current limits given in Nuclear Regulatory Commission (NRC) regulations for allowable levels of radionuclides above background (10 CFR 20 Table II). There are no Table II limits for total alpha and total beta. Therefore, for comparison purposes, soluble plutonium 239 was chosen as a conservative analog for total alpha (i.e., an alpha emitter with a low limit) and soluble strontium 90 as a conservative analog for total beta. The respective Table II limits for these radionuclides are 5×10^{-6} uCi/l and 3×10^{-7} uCi/l, respectively.

Groundwater monitoring in the 300 Area has shown elevated levels of inorganic contaminants such as uranium, nitrate, chromium, and fluoride.

The relationship between the observed groundwater contamination and wastes disposed to the 316-3 Trenches, however, is unknown. The current groundwater quality monitoring network for the 300 Area is shown in Figure 7. As can be seen in this figure, there are no wells in the immediate vicinity of the 316-3 Trenches. The nearest well is Well 3-10, which is approximately 600 ft east of the trenches. This well is probably not a useful indicator of groundwater contamination associated with the trenches because of:

- o The distance between the well and the trenches;
- The presence of other potential sources of contamination in the area; and
- The complexity of groundwater flow in the area.

In addition to migration of contaminants associated with liquid wastes discharged to the trenches, migration of contaminants associated with trench backfill is also possible. As mentioned previously, available data indicate that sediments in the 316-3 Trenches are contaminated with chemicals (principally metals) and radioactivity (principally uranium). The presence of such contaminants presents the opportunity for leaching and subsequent migration to groundwater though it is not known whether such migration has occurred.

3.1.3 Major Contaminant Parameters Identified and Concentrations Detected

No analytical data are available quantifying the contaminant inventory presently associated with the 316-3 Trenches. As mentioned previously, sediment samples were obtained from a small portion of the trench area from an excavation prepared for a waste stabilization testing program. Five samples were collected during June, 1987, from three locations as described in Table 4 and analyzed for the analytes given in Table 5. Analytes above detection limits are summarized in Table 6. (It should be noted that organic analysis is not yet complete and that additional organic contaminants may be present above detection. Inorganic and radiological analyses are complete.) Samples 003A001, 003A002,

Figure 7. Present 300 Area Groundwater Quality Monitoring Network

Table 4. Description of Sediment Samples Taken From 316-3
Trench Site, June, 1987

<u>Sample</u>	<u>Description</u>
003A001	East wall of excavation, approximately 15 ft from the south end. Approximately 2.5 ft above bottom of trench. Sample depth 3 to 6 inches.
003A002	Same location as 003A001. Sample depth 12 to 18 inches.
0036001	West wall of excavation, approximately 20 ft from the south end. Approximately 2 ft above bottom of trench. Sample depth 6 to 8 inches.
003B002	Same location as 003B001. Sample depth 12 to 18 inches.
003C001	East wall of excavation, at north end. Approximately 5 ft above bottom of trench.

Table 5. Analytes and Analytical Methods for Sediment
Samples Taken At 316-3 Trench Site, June, 1987

<u>Analysis</u>	<u>Method Reference</u>
ICP Metals - Enhanced List	6010 ¹
AA Metals	
Arsenic	7060 ¹
Mercury	7471 ¹
Lead	7421 ¹
Selenium	7740 ¹
Thallium	7841 ¹
Volatile Organics - Enhanced List	8240 ¹
Acid/Base/Neutral Organics - Enhanced List	8270 ¹
Polychlorinated Biphenyls	8080 ¹
Ion Chromatography	
Gross Alpha	
Gross Beta	

¹ EPA SW846 Procedures: Test Methods for Evaluating
Solid Waste, 2nd Edition, 1984

Table 6. Results of Analysis of Sediment Samples Collected at
316-3 Trench Site, June, 1987

Analyte	Units	Detection Limit	Sample				
			003A001	003A002	003B001	003B002	003C001
Gross Beta	pCi/g	3.00E+00	1.51E+02	3.60E+02	3.24E+02	3.78E+02	2.58E+01
Gross Alpha	pCi/g	6.00E+00	8.73E+01	1.93E+02	1.99E+02	2.34E+02	
Aluminum	ug/g	1.50E+01	1.46E+04	1.91E+04	2.36E+04	2.67E+04	1.32E+04
Barium	ug/g	6.00E-01	8.70E+01	1.20E+02	1.24E+02	1.33E+02	1.11E+02
Beryllium	ug/g	5.00E-01	1.00E+00	1.00E+00	1.00E+00	2.00E+00	8.00E+00
Cadmium	ug/g	2.00E-01	1.00E+00	2.00E-01	4.00E-01	4.00E-01	1.00E+00
Calcium	ug/g	5.00E+00	1.89E+04	2.65E+04	2.60E+04	3.32E+04	2.42E+04
Chloride	ug/g	1.00E+00		1.07E+00			
Chromium	ug/g	1.00E+00	7.20E+01	1.90E+02	2.44E+02	2.59E+02	2.40E+01
Copper	ug/g	1.00E+00	4.39E+02	2.85E+03	2.15E+03	2.68E+03	1.95E+02
Fluoride	ug/g	1.00E+00		1.88E+00	1.15E+00	1.84E+00	2.04E+00
Iron	ug/g	5.00E+00	2.96E+03	2.48E+04	3.16E+04	3.35E+04	3.15E+04
Manganese	ug/g	5.00E+00	8.09E+03	4.40E+02	1.11E+04	1.16E+04	7.79E+03
Manganese	ug/g	5.00E-01	3.04E+02	1.80E+01	3.42E+02	3.47E+02	3.96E+02
Mercury	ug/g	1.00E-01	9.44E-01	2.72E+00	1.89E+00	2.77E+00	4.93E-01
Nickel	ug/g	1.00E+00	5.90E+01	1.71E+02	1.86E+02	2.21E+02	1.70E+01
Nitrate	ug/g	1.00E+00	2.06E+01	2.38E+01	3.04E+01	3.01E+01	7.96E+00
Potassium	ug/g	1.00E+01	7.84E+02	4.90E+01	9.84E+02	1.54E+03	1.83E+03
Silver	ug/g	1.00E+00		1.80E+01	1.30E+01	1.80E+01	
Sodium	ug/g	1.00E+01	2.38E+02	2.73E+02	4.01E+02	4.42E+02	2.33E+02
Strontium	ug/g	3.00E+01			6.00E+01	6.70E+01	
Sulfate	ug/g	1.00E+00	9.38E+00	1.56E+01	2.58E+01	3.65E+01	5.20E+01
Vanadium	ug/g	5.00E-01	6.50E+01	4.00E+00	6.80E+01	7.30E+01	6.70E+01
Zinc	ug/g	5.00E-01	5.80E+01	8.10E+01	8.80E+01	9.70E+01	5.90E+01
PCB Arochlor 1248	ug/g	1.00E-01	1.30E+00	9.90E+00	5.00E+00	8.40E+00	1.10E-01

003B001, and 003B002 were taken near the bottom of the excavation in what appeared to be contaminated backfill. The radioactivity of these samples was measured at 25 to 500 counts/minute using a Geiger/Mueller detector. Sample 003C001 was taken near the top of the excavation in what appeared to be clean backfill. This sample had no detectable radioactivity and is probably most representative of background. As can be seen in Table 6, contaminant levels in the first four samples are generally higher than in the last sample.

Other available analytical data include results of analysis of sediment samples collected from the South Process Pond in 1974. These results were used to derive the estimated chemical inventory for the trenches for the Phase I report (Table 3). The results of the 1974 South Pond sediment sampling showed elevated levels of inorganics including copper (up to 87,000 ug/g), uranium (up to 7,600 ug/g), nickel (up to 3,100 ug/g), and fluoride (up to 16,000 ug/g). The concentrations of these contaminants in sediments excavated from the South Pond in 1965 and placed in the 316-3 Trenches, however, are unknown.

There are numerous existing groundwater monitoring data for the 300 Area. In general, these data show elevated levels of uranium, beta emitters, fluoride, chloride, chromium, and nitrate. As mentioned previously, however, the current groundwater monitoring network in the 300 Area is not adequate to characterize contamination associated with disposal to the 316-3 Trenches. Past monitoring data may potentially be of use. All monitoring wells which have been constructed in and around the 300 Area are shown in Figure 8. As this figure indicates, there are several wells located near the trenches, namely Wells 3-8, 3-11, and 3-12. These wells are no longer in use and have apparently been abandoned. Data collected from these wells in the past may be of use in characterizing past migration of contaminants from the trenches. The use of these data will be investigated during the Level I RI.

Surface water monitoring data are generally indicative of contamination related to the contaminated groundwater. As with the groundwater data, these data will require extensive review which is beyond

Figure 8. Existing and Abandoned 300 Area Monitoring Wells

the scope of the work plan preparation. Review of existing surface water monitoring data will be accomplished as one of the tasks of the RI.

Air monitoring data for the Hanford Site generally show levels of gross alpha and gross beta in the 300 Area to be higher than off-site. There are numerous possible sources of this contamination in the 300 Area, however, and the contribution of the 316-3 Trenches, if any, has not been characterized. Airborne migration of contaminants disposed of to the 316-3 Trenches is not expected to presently be of concern because of the backfilling and site stabilization which has occurred.

3.2 POTENTIAL PATHWAYS OF CONTAMINANT MIGRATION

3.2.1 General

The primary potential migration pathway available is migration in groundwater. Because of the large volume of liquid wastes disposed of to the 316-3 Trenches, this pathway was scored as having an observed release for the HRS/mHRS ranking (DOE, 1986a). A secondary related pathway is migration in surface water following discharge of contaminated groundwater to the Columbia River. Because of the known occurrence of groundwater discharges to surface water, this pathway was also scored as having an observed release for the HRS/mHRS ranking (DOE, 1986a). Airborne migration was not considered to be an important pathway because of the site stabilization activities that have been implemented. Because there was no documentation of observed releases, this pathway was not scored for the HRS/mHRS ranking (DOE, 1986a). The above migration pathways are discussed below.

3.2.2 Groundwater

There are two modes of contaminant migration to groundwater associated with the 316-3 Trenches. The first is direct infiltration of contaminants in liquid wastes discharged to the trenches. The migration potential for this mode is quite high given the nature of past activities.

Available data indicate trench discharges on the order of 100,000 gal/day. This volume of water divided by the trench dimensions results in a net recharge on the order of 1 ft/day. Given the shallow depth to groundwater (approximately 50 ft) and the period of operation (over 10 yrs) water discharged to the 316-3 Trenches certainly reached groundwater and the Columbia River. The primary mitigating factor for this pathway is the reportedly low concentration of contaminants in the wastes discharged to the trenches (Heid, 1956; Haney, 1960).

The second mode of contaminant migration to groundwater is leaching of contaminants associated with the South Pond sediments disposed of in the trenches. The potential for migration associated with this pathway depends on the availability (i.e., leachability) of contaminants from the sediments and the availability of moisture infiltration for leaching. Neither of these factors has been characterized at this site, but both are expected to be associated with a low potential for migration. The contaminants present in the South Pond sediments are not expected to be particularly soluble and mobile because they represent the contaminants that separate from the liquid stream discharged to the Pond. Climatic and hydrogeologic conditions at Hanford are generally associated with a low infiltration and recharge. The potential can be locally high, however, due to surface features (e.g., collection and ponding of surface runoff).

The main groundwater pathway appears to be infiltration to the shallow unconfined aquifer and subsequent migration to the river. Downward migration to the lower unconfined and upper confined aquifers, however, is also a possibility. This downward migration has not been well characterized.

While the hydrogeologic aspects of contaminant migration are well characterized (at least for the upper unconfined aquifer) and indicate a high potential for migration, the geochemical aspects of contaminant migration are less well known, though equally important. The geochemical behavior of the contaminants discharged to the trenches is believed to have a major effect on the potential for migration. For example, soluble contaminants which do not interact with sediments would have the greatest potential for migration. Such contaminants would be expected to infiltrate

readily to groundwater and be transported to the river. Soluble contaminants which interact with sediments (e.g., most of the metals) would be transported to varying degrees depending on the strength of their interactions with the sediments.

While monitoring data strongly indicate that some contaminants have migrated to groundwater, the migration potential of other contaminants (i.e., those associated with sediments) is not well characterized. Characterization of this potential will require a better understanding of the geochemical behavior of the contaminants.

3.2.3 Surface Water

The potential for surface water migration is directly related to the potential for groundwater migration. That is, contaminants must be able to first migrate through the groundwater in order to reach the surface water. As described above, the ability of contaminants to reach surface water will depend strongly on the geochemistry of the contaminants. Once in surface water, the migration potential will also depend on the type and nature of geochemical interactions which occur. For example, contaminants which remain soluble will display a greater potential for migration than those which interact with sediments and become associated with the river bed.

3.2.4 Air

The potential for airborne migration of particulate contaminants (e.g., metals and most radionuclides) depends on several factors. The most important of these is the availability for transport. In order for migration to occur, the contaminants must first be located on the surface and exposed to the wind. At present, there is a very low potential for airborne migration of contaminants. All contaminants released to the facility are presently below grade and are covered to prevent wind erosion and dispersal. The migration potential of vapor contaminants (e.g., organic solvents) depends only on the ability of vapors to come in contact

with the wind. While there is a potential pathway for migration of organic vapors, such materials are not known to have been disposed of to the site.

3.3 POTENTIAL EXPOSURE TO MIGRATING CONTAMINANTS

Exposure to contaminants disposed of to the 316-3 Trenches requires that receptors be present along the migration pathways. At present, there is no use of groundwater in the area known to be contaminated (i.e., the shallow unconfined aquifer between the 300 Area and the Columbia River). The potential for exposure, therefore, is related to the potential for groundwater contamination to extend beyond the shallow unconfined aquifer to other aquifers which are potentially used.

Surface water migration offers the potential for exposure to migrating contaminants. The downstream cities of Richland, Kennewick, and Pasco as well as the 300 Area use the Columbia River for drinking water supplies, creating the **potential** for direct human exposure. Columbia River water is also used as a downstream source of irrigation water, creating the potential for human exposure through food crops irrigated with contaminated water. Human exposure is also possible through recreational use, either through direct contact with contaminated water, or through consumption of contaminated game fish. Surface water also offers the potential for exposure of aquatic biota to contaminants and for food chain uptake of these contaminants by higher predators. Because receptors are known to be present, the potential for exposure depends on the potential for contaminants to be present in the River.

While not a migration pathway, direct contact is a potential exposure mechanism. Direct contact by the public is not currently of concern because of the restricted access to the 316-3 Trenches. The future importance of this exposure mechanism depends on the future disposition of the trenches.

3.4 QA/QC REVIEW OF EXISTING DATA BASE

Very limited data were available describing the wastes received by the **316-3** Trenches. Monthly inventories were available describing the content of plutonium and total beta activity in the trench influent from August, **1954**, through October, **1956** (**Heid, 1956**). The **quality** assurance aspects of these data were not described. **It** is assumed that samples were collected and analyzed using standard Hanford laboratory quality assurance procedures and that the data provide an accurate estimate of the amounts of these contaminants received during this period.

Data from analysis of sediment samples collected from the South Process Pond in **1974** were used to estimate the inventory of contaminants in the trench backfill. The quality assurance aspects of these sediment data were previously reviewed during preparation of the RI Work Plan for the Process Ponds and no major concerns were identified. The chief concern with the use of these data to estimate the trench inventory is how representative they are of the sediments actually excavated from the South Pond and placed in the **316-3** Trenches. The data were collected during **1974** and **it** is unknown how representative the data are of the sediments in the South Pond in **1965** when the excavation took place. Also, the **1974** data showed considerable spatial variation of contaminant concentrations in the Pond sediments. Average contaminant values were used to estimate the inventory in the trenches and may not be representative of the actual sediments excavated.

Data from samples collected from an excavation into the inactive trench area were used to provide evidence of contamination. These samples were collected using procedures appropriate for the types of samples collected and the environmental medium being sampled. These procedures are described in Appendix A. The analytical methods used to analyze these samples are identified in Table 4 and are appropriate for the analytes and media. In summary, no quality assurance concerns were identified for the procedures used to collect these data. Because of the very limited sampling area, these data are useful only for indicating the presence of contamination, and not for characterizing the extent of contamination.

As mentioned previously, there is an extensive existing data base resulting from past and ongoing monitoring of groundwater at the 300 Area. Review of these data was beyond the scope of work plan preparation, but will be performed as part of the RI. This review will include evaluation of QA/QC concerns. Potential QA/QC concerns with respect to existing groundwater data are expected to relate primarily to well construction methods and materials, sample locations, and sampling methods.

Also, there is an extensive existing data base resulting from past monitoring of surface water at Hanford. Review of these data was beyond the scope of work plan preparation, but will be performed as part of the RI. This review will include evaluation of QA/QC concerns. Potential QA/QC concerns include the representativeness of sample locations and methods for characterizing contamination associated with the 316-3 Trenches.

4.0 WORK PLAN RATIONALE

4.1 WORK PLAN APPROACH

The Level I RI for the 316-3 Trenches includes a site characterization program to collect data directed toward defining the nature and extent of contamination problems at the site, evaluating potential human health and environmental hazards, and identifying and evaluating remedial actions. Consistent with the general RI methodology plan for Hanford, the work focuses on the following steps identified as important for Level I efforts:

- verify the validity of the "observed release" parameter assumed during the Phase I analysis;
- determine the extent of the contaminant plume in the vadose zone;
- o verify that all potential contaminants were identified during Phase I; and
- o determine the potential for contaminant migration.

Also consistent with the general RI plan for Level I, the work will maximize the use of existing data and monitoring structures. Specific activities to be conducted include:

- o Site visit and general reconnaissance.
- Detailed evaluation of existing groundwater and geohydrologic data and planned and ongoing geohydrologic investigations elsewhere in the 300 Area.
- o Detailed evaluation of existing surface water and hydrologic data and planned investigations related to other sites in the 300 Area.
- o Sampling and analysis of subsurface sediments in and beneath the trenches.
- Data evaluation.
- Risk assessment.
- Reporting.

The specific data needs that will be addressed by the above activities are identified in Section 4.2. Section 5 presents a detailed **outline** of the proposed RI tasks, including objectives and deliverables to be accomplished during these tasks. The RI schedule is included as Section 6.

4.2 DATA NEEDS

The ultimate objective of site characterization activities is to provide data to establish **if** there are public health and environmental hazards and to support selection of remedial actions to address these hazards. As Level **I** of the site characterization, the proposed effort will focus on better characterization of the contaminants present at the site; their extent, particularly in the subsurface; and their migration **potential**.

As noted in the review of existing data related to the sites, past investigations have not focused solely on these sites as a source of contamination, nor have they adequately addressed all contaminants or environmental media potentially of interest or concern. Specifically, existing data for subsurface sediments and for the facility waste inventory indicate the presence of subsurface contamination at the site. These data are not adequate, however, to determine the extent of this contamination or its migration **potential** and **related** hazard. In addition, there exists substantial data from groundwater and surface water monitoring for the area which may be potentially of use but which have not been evaluated with respect to the objectives of the RI.

Because of the existing data gaps, specific data needs for the Level **I** RI have been developed. Consistent with the ultimate RI objectives, data needs are grouped into three categories, which are:

- 1) Those data necessary to support the FS which indicate the nature and extent of site contamination sources and potential routes of contaminant release and migration (Section 4.2.1, Problem Identification);

- 2) Those data which determine the potential impact and risks to human health and the environment from the presence or release of contaminants from the site (Section 4.1.2, Risk Assessment and Environmental Impact);
- 3) Those data necessary to support the FS which will aid in defining cost-effective remedial measures to reduce the risk or threat posed by the presence or release of contaminants (Section 4.1.3, Remedial Action Screening).

Specific data needs to be addressed during the Level I RI are discussed below.:

4.1.1 Problem Identification

Site and Contaminant Characterization. Existing data are inadequate to fully characterize contaminant inventories and the extent of past contaminant migration. There are two primary routes associated with past migration of contaminants from the trenches. These routes are related to the two modes of disposal at the trenches, namely:

- 1) Use of the trenches for disposal of liquid retention wastes; and
- 2) Use of the trenches for disposal of sediments removed from the South Process Pond.

Contamination resulting from the disposal of liquid retention wastes would be associated with direct infiltration of these wastes to subsurface sediments and groundwater. There are presently no data to characterize contamination of either subsurface sediments or groundwater from past liquid waste disposal operations. Available data relate only to radiological characteristics of the retention wastes and suggest a low potential for contamination, due mainly to the low concentration of radionuclides in these wastes.

With respect to disposal of contaminated sediments from the South Pond, contamination would be associated with leaching of contaminants from these sediments, with subsequent infiltration. Data from recent analysis of sediment samples taken from one end of the trenches indicate the

presence of chemical and radiological contamination. These samples were inadequate, however, to define the vertical migration of contamination. In addition, these samples were taken at only one location and are inadequate to define the extent of contamination at the site.

For both of the above disposal modes, additional data are also needed to characterize the contaminant inventories present. The present chemical inventory for the 316-3 Trenches, which was developed for the Phase I Report (DOE, 1986a), is based on one-time sampling of the South Pond sediments for heavy metals. Additional data are needed to verify the inorganic contaminants present in the inventory as well as to identify the presence of any organic contaminants which have not been previously analyzed for. The contaminant inventory for the trenches is also based on the assumption that the liquid discharges to the trenches contained negligible chemical contamination. Because of the potential for undocumented discharges related to laboratory operations, additional data are also needed to verify this assumption.

Specific data needs related to site contamination, therefore, are:

- Identification and quantification of the inorganic, organic, and radioactive hazardous substances present in the sediments removed from the South Process Pond and disposed of to the trenches;
- Identification of the areal extent of sediment disposal to the trenches;
- Characterization of the vertical extent of chemical and radiological subsurface contamination associated with past migration from the trenches;

Groundwater contamination at the site also needs additional characterization. Available hydrogeologic data clearly indicate that wastewater discharged to the trenches has reached groundwater. As discussed in Section 3, there presently exists a significant amount of groundwater monitoring data for the 300 Area. These data were collected as part of the site-wide groundwater monitoring effort at Hanford and, as a result, were collected to satisfy objectives different from those of the

RI. It is possible, however, that some of these data may be useful in terms of characterizing contamination resulting from past disposal to the trenches. In addition, there are other ongoing groundwater characterization studies in the 300 Area related to active liquid waste disposal facilities (e.g., 300 Area Process Trenches). Ongoing and planned activities may provide useful data for the RI.

Consistent with Level I of the general RI methodology for Hanford, groundwater data needs will be limited to those which can be satisfied without installation of additional monitoring structures. Specific groundwater data needs include:

- Evaluation of existing monitoring data, existing monitoring wells, and planned monitoring networks in terms of their applicability to site characterization of the 316-3 Trenches.
- Characterization, using those data which are applicable to the site investigation, of the types, distribution, and concentrations of organic, inorganic, and radiological contaminants present in the shallow unconfined and deeper aquifers near the trenches;
- Evaluation and characterization, using applicable data, of the relationship of the observed groundwater contamination to wastes received by the trenches; and
- Identification of additional required hydrogeologic investigations and groundwater monitoring, considering the available data, applicability of existing wells, and planned monitoring networks,

Existing surface water monitoring data are similar to existing groundwater data. That is, the data were collected to identify contamination in the Columbia River but were not collected to characterize this contamination with respect to its relationship to the 316-3 Trenches. As with the groundwater data, it is possible that some existing surface water monitoring data will be useful for the site characterization.

Specific surface water monitoring data needs include:

- Evaluation of existing monitoring data and planned monitoring networks in terms of their applicability to site characterization of the 316-3 Trenches.
- Characterization, using those data which are applicable to the site investigation, of the types, distribution, and concentrations of organic, inorganic, and radiological contaminants present in the Columbia River upstream and downstream of the trenches;
- Evaluation and characterization, using applicable data, of the relationship of the observed surface water contamination to wastes received by the trenches; and
- Identification of additional required investigations and surface water monitoring, considering the available data and planned monitoring networks.

Potential for Contaminant Migration. The primary pathway for migration of contaminants from the 316-3 Trenches is groundwater. With respect to migration of contaminants in groundwater, the hydrogeology (i.e., transport medium) is generally well characterized, particularly the shallow unconfined aquifer. Contaminant migration in other aquifers may also be of concern and may require additional characterization. For purposes of the Level I investigation, however, data needs will be limited to those which can be addressed without installation of additional monitoring structures. Specific data needs include:

- a Identification of the types, concentrations, and distribution of contaminants in aquifers below the shallow unconfined aquifer; and
- Characterization of the interconnection between the shallow unconfined and deeper aquifers in terms of properties which affect contaminant transport (i.e., hydraulic gradient, hydraulic conductivity, porosity).

One area of groundwater and surface water contaminant migration which is not well characterized is the geochemical aspect of migration. That is, the geochemical interactions affecting the availability of contaminants for leaching and migration are complex and poorly

characterized. Such information will be needed in order to determine the migration potential of contaminants associated with sediments in and beneath the trenches. These data may also be needed to determine the fate of contaminants following discharge to surface water. Specific data needs include:

- Identification of the minerals and chemical forms of contaminants present in sediments;
- Identification and characterization of the factors controlling the solubility of inorganic contaminants; and
- Characterization of the factors controlling the rate of migration of contaminants in groundwater (e.g., distribution coefficients).

Migration by the air pathway is presently not of concern. As mentioned previously, the potential for migration is primarily related to the availability for contaminants to be eroded by the wind. The site is presently well stabilized and offers little potential for wind erosion.

4.1.2 Risk Assessment and Environmental Impact

The primary means of contaminant exposure appears to be to surface water, with a lesser potential for groundwater exposure. The data needs described above should better characterize the actual and expected future concentrations of contaminants in these media. To determine risk and impact, additional data will be needed to determine what acceptable levels of contamination are and what receptors are likely to be impacted. The former will first require identification of the contaminants present at the site. Once all contaminants have been identified, applicable or relevant and appropriate requirements (ARARs) can be identified. Major potentially impacted receptors have been identified for surface water and groundwater, respectively as:

- Municipal, agricultural, and recreational users of the Columbia River, and aquatic biota in the River; and

- Nearby users of groundwater in the lower unconfined and confined aquifers.

Potential receptors, critical habitats, endangered species, archeological areas, and other concerns with respect to environmental impact have been previously characterized (e.g., ERDA, 1975; Price, 1986) and should not require further characterization. Additional specific data needs for risk assessment and environmental impact are, therefore, identification of ARARs for each contaminant identified at the site.

4.1.3 General Response Action Screening

Potential general response actions were identified and screened as part of the work plan preparation. The early identification of potentially feasible remedial actions allows for definition of site characterization tasks to produce data necessary to assess endangerment and define cost-effective remedial action alternatives. Sufficient data do exist to make an initial assessment of general response actions and to direct certain data-gathering activities during the RI which will support more detailed screening efforts to identify and evaluate specific remedial technologies. This initial assessment is based on the assumption that site contamination is of a nature that remediation is necessary. The final determination of the need for remedial action will be based on an assessment of the data collected during the site characterization.

Response Action Identification. There are eight general categories of response actions that include technologies to remediate waste or contaminant sources, contamination migrating along pathways, and exposure of receptors to contaminants. These categories include:

- 1) No action;
- 2) Use and access restrictions;
- 3) Alternate water supplies;

- 4) Containment technologies applied to contaminant sources (barriers and encapsulation) and contaminant migration pathways (flow barriers and flow modification);
- 5) Removal of contaminants from contaminant source (usually combined with disposal or treatment technologies) and locations along contaminant transport routes (groundwater recovery, surface water or leachate collection, sediment removal);
- 6) Disposal of contaminated or treated materials, including waste products (usually to a secure facility), groundwater, surface water, and leachate (usually after treatment), and soil and sediments;
- 7) Treatment of contaminants (usually after removal or collection) including wastes, contaminated soil and sediment, surface water, leachate, and groundwater (after recovery or at the point of use); and
- 8) In-situ treatment of wastes, groundwater, and contaminated soils and sediments at the source.

Potentially Applicable General Response Actions. The existing site data indicate that several general response actions exist which could potentially be required. The need for any actions will, of course, depend on the results of the site characterization and assessment of the risk posed by the site. Actions which may potentially be required at the site can be divided into three groups: no action, on-site action (source control), and off-site action (migration control). Because of the focus of the Level I RI, data needs are primarily related to the first two groups of potential actions. That is, the Level I RI will focus on collecting data to better characterize the contaminant inventory at the site; the extent of contaminant migration from the site, particularly in the vadose zone; and the potential for future migration from the site. Such data will be useful for determining the need for remedial actions (i.e., the adequacy of the no action alternative) and for determining the initial technical feasibility of on-site actions.

No Action. The need for remedial action will depend on the risk associated with contaminants in liquid wastes formerly discharged to the

316-3 Trenches or contained in the contaminated sediments disposed of to the trenches. The no-action alternative may be the cost-effective alternative for the 316-3 Trenches if the existing contamination levels do not exceed levels set by ARARs.

Specific data needs related to the no-action alternative are the actual and expected contaminant concentrations in various environmental media and the acceptable or allowable concentrations. These data needs will be fulfilled by collection and evaluation of the data described in Sections 4.2.1 and 4.2.2, respectively.

On-Site Actions (Source Control). The need for on-site actions will depend on the hazard posed by the contaminants at the site (i.e., in and beneath the trenches). In addition, determination of the feasibility of any actions will depend on additional site characterization.

Potentially applicable on-site actions include:

- 1) Containment of Source: This action could be used if it were necessary to control migration of contaminants from the sediments and groundwater in and below the trenches. Potentially applicable technologies include:
 - Contain contaminated groundwater at the site using either physical or hydraulic barriers; and
 - Isolate contaminated sediments with physical barriers to prevent introduction into migration pathways.
- 2) Removal of Contaminants: This action could be used if it were necessary to control migration of contaminants from the sediments and groundwater in and below the trenches. Potentially applicable technologies include:

- Excavation and removal of contaminated sediments (additional disposal or treatment of contaminated materials would be required); and
 - Withdrawal of contaminated groundwater beneath the site (additional treatment of withdrawn groundwater would be required).
- 3) Disposal of Contaminated or Treated Materials: This action would apply to excavated materials generated by item 2 above.
 - 4) Treatment of Contaminants: This action would apply to excavated materials or withdrawn groundwater generated by item 2 above.
 - 5) In-Situ Treatment: This action could be used if it were necessary to control migration of contaminants from sediments and groundwater in and below the trenches. Potentially applicable technologies include:
 - In-situ treatment of contaminated sediments; and
 - In-situ treatment of contaminated groundwater.

The most important data needs for on-site actions for the Level 1 RI are those data which determine technical feasibility. These data will be used to identify the technically feasible alternatives requiring more specific data collection during the Level II RI. As is evident from the above discussion, applicable on-site actions are generally in two classes, those which address sediment contamination and those which address groundwater contamination. Important data needs for the sediment-related actions are the vertical extent of contamination in the vadose zone and the physical and chemical properties of the subsurface sediments. These data needs were previously addressed in Sections 4.2.1 and 4.2.2. Important data needs for the groundwater-related actions are the extent of groundwater contamination, which will determine the effectiveness of controlling contamination at the source, and the physical characteristics of the aquifer materials, which will determine the effectiveness of containment and capture technologies. While new groundwater data are not being collected as part of the Level I RI, the review of existing groundwater data (Section 4.2.1), along with the characterization of the

subsurface contamination at the site (Section 4.2.1) , should allow initial characterization of the extent of groundwater contamination at the site. Similarly, the review of existing geohydrologic data should identify required aquifer characteristics.

Off-Site Actions (Migration Control). The need for off-site actions will depend, in part, on the actual or potential exposure of receptors to contaminants at levels which pose a hazard. The feasibility of any action will, of course, depend on additional site characterization data. Potentially applicable off-site actions include:

- 1) Use and Access Restrictions: This action could be used to prevent exposure of human receptors to contaminants in the Columbia River and could include restriction of fishing, boating, and swimming access.
- 2) Alternate Water Supplies: This action could be used to prevent exposure of municipal and agricultural users of contaminated groundwater and/or surface water. Potentially applicable technologies include:
 - Replace water supplies contaminated by the site with uncontaminated sources;
 - Treat individual water supplies to remove contaminants migrating from the site; and
 - Monitor wells and/or intakes for water quality degradation.
- 3) Removal of Contaminants: This action could be used to control exposure to contaminated sediments or groundwater away from the source. Potentially applicable technologies include:
 - Withdrawal of contaminated groundwater downgradient of the site (would require additional treatment); and
 - o Dredging of river sediments contaminated by groundwater discharges (would require additional treatment or disposal).

- 4) Disposal of Contaminated or Treated Materials: This action would apply to dredged sediments generated in Item 3 above.
- 5) Treatment of Contaminants: This action would apply to dredged sediments or withdrawn groundwater generated in Item 3 above.
- 6) In-Situ Treatment: This action could be used to treat contaminants in shallow groundwater away from the site.

Potentially applicable off-site actions are related to groundwater contamination and possibly to related surface water contamination. Data needs related to off-site actions include the present and expected future extent of contamination in the groundwater and surface water. These data will determine the need to consider such actions and will identify where they should be implemented. These data needs are previously addressed in Sections 4.2.1 and 4.2.2. Also needed are data defining the physical and chemical characteristics of the aquifer and contaminants which could affect technical feasibility. Collection of existing data will was previously addressed in Section 4.2.1.

5.0 RI TASKS

The RI of the 316-3 Trenches is being conducted using a phased approach, as described in the generic Hanford RI Plan. The first phase, referred to as the Level I RI, will focus heavily on review of existing data and is directed toward better characterization of site contamination (i.e., identifying the contaminants present and their extent). Section 4 identified various data needs for the Level I RI. These data needs can generally be summarized as:

- Identification and quantification of the contaminants present in the South Pond sediments disposed of to the 316-3 Trenches;
- Characterization of the vertical extent of contaminant migration from liquid and solid wastes disposed of to the 316-3 Trenches;
- Characterization of contaminant and sediment geochemistry with respect to those factors influencing contaminant migration potential;
- Characterization of local groundwater contamination and geohydrologic factors influencing contaminant migration potential;
- Characterization of local surface water contamination;
- Identification of applicable or relevant and appropriate requirements (ARARs) for the contaminants present at the site.

The above data needs will be satisfied through performance of a series of Tasks which are described below.

5.1 TASK 1 - TECHNICAL MANAGEMENT AND SUPPORT5.1.1 Subtask 1.1 - Project Management

Project management activities will be conducted through PNL's Inactive Waste Site Surveillance (IWSS) Program. Contact will be maintained with PNL Hanford Environmental Program management staff and with DOE Richland Operations (RL) staff during performance of the RI.

Project management activities during Level 1 will include preparation of monthly reports to keep PNL and RL management staff informed of the technical, financial, and schedule status of the project. Other responsibilities include controlling budgets and schedules; selecting, coordinating, and scheduling staff, subcontractors, and other Hanford contractors for task assignments; maintaining project quality control and assurance programs; and preparation of a work plan for Level II of the RI, if required.

5.1.2 Subtask 1.2 - Field Work Support

Under this subtask, PNL will coordinate the efforts of other Hanford contractors and/or subcontractors involved with field work (e.g., sampling). PNL will also provide required support for field activities. Required field support will include excavation of subsurface sediment sampling locations, subsurface sediment sampling, collection of subsurface core samples, radiation monitoring, and surveying of the location and elevation of sample locations

5.1.3 Subtask 1.3 - Quality Control

This subtask will involve review of project files and project deliverables, site inspection during the field activities, and inspections and review of laboratory QA/QC procedures. Project deliverables to be reviewed include technical memoranda, the Draft Level I RI Report, and the Final Level I RI Report. This subtask will also involve preparation of field QA/QC samples (e.g., blanks, duplicates, spikes) for laboratory analysis. The PNL representative present during sampling will be responsible for QA/QC sample preparation.

5.1.4 Subtask 1.4 - Sample Management

The objective of this subtask is to track the progress of samples delivered to the analytical laboratory and to manage the analytical data

received from the laboratory. This subtask will include maintenance of sample chain-of-custody records, receipt of the analytical data from the laboratory, and supervision of entry of the data to the environmental data base.

Sample identification shall conform to a standard method of identification developed for Hanford RIs. This sample identification method consists of a series of three codes which specify the facility, location, and sample, respectively. The samples collected during June, 1987, at the excavation near the 3727 Building were identified using this convention and sample identifications assigned during this effort will be consistent with the previous effort. The facility code assigned during the previous sampling was "003". This code will, therefore, constitute the first three characters of the sample identification. The three locations sampled during June, 1987, were identified as "A", "B", and "C". The fourth character of the sample identifications will, therefore, begin with "D" and go through "E", "F", "G", and so on. Samples collected at each location will be assigned consecutive codes "001", "002", "003", and so on. The location and sample identification codes will be assigned by the PNL Sampling Representative.

5.2 TASK 2 - EXISTING DATA REVIEW

5.2.1 Subtask 2.1 - Site Visit and General Reconnaissance

The objective of this subtask, is to visit the site to gain familiarity with site characteristics which may influence conduct of the RI, particularly the field activities. The site visit will be attended by PNL staff and Hanford contractor and subcontractor staff involved with the RI. Particular emphasis will be placed on identifying potential health and safety concerns related to field activities and identifying site access problems. Potential access problems include overhead power lines, work around Buildings 3718-E and 3718-G, railroad tracks near the east end of the trenches, and work near the 324 Exclusion Area security fence.

The site visit will also be used to identify the location for collection of background samples. This location will be selected near the 316-3 Trenches at an area which does not appear to have been contaminated by nearby operations. The location should be away from underground waste lines to avoid the possibility of contamination from underground leaks. Analysis of background samples will provide a baseline from which to identify areas of contamination. In addition, uncontaminated background samples may be required by the laboratory for matrix blank and spike samples.

5.2.2 Subtask 2.2 - Hydrogeologic and Groundwater Monitoring Data

The objective of this subtask is to review and evaluate existing hydrogeologic and groundwater monitoring data for application to the Level I RI site characterization. Data sources to be evaluated include past Hanford groundwater monitoring data collected in the 300 Area from existing monitoring wells, groundwater monitoring data collected for the ongoing RCRA compliance effort in the 300 Area, well logs from existing wells, results of aquifer tests, and any other hydrogeologic investigations conducted in the area. The focus of this evaluation will be on identifying hydrogeologic and groundwater monitoring data which can be used to characterize groundwater contamination in the vicinity of the 316-3 Trenches and to characterize vertical and horizontal groundwater movement near the trenches. Of particular interest will be data collected in the past from wells located near the trenches such as Wells 3-3, 3-4, 3-8, 3-11, 3-12, and 4-2 (Figure 8). Evaluation of the use of past data should give careful consideration to data quality with respect to well construction methods and sampling techniques. The review of data for this subtask should be coordinated with a similar review being performed as part of the Level I RI for the 300 Area Process Ponds.

The deliverable for this subtask will be a summary report which identifies the existing geohydrologic and monitoring data near the 316-3 Trenches, summarizes evaluation of those data with respect to their applicability to the RI, identifies data gaps which must be addressed

during Level II of the RI, and presents recommendations for collecting those data during Level II.

5.2.3 Subtask 2.3 - Hydrologic and Surface Water Monitoring Data

The objective of this subtask is to review and evaluate existing hydrologic and surface water monitoring data for application to the Level I RI site characterization. Data sources to be evaluated include Hanford surface water monitoring data collected from the Columbia River near the 300 Area, surface water monitoring data collected near the 300 Area for any other related environmental programs, and results of any other studies related to transport of contaminants in the Columbia River. The focus of this evaluation will be on identifying hydrologic and surface water monitoring data which can be used to characterize any surface water contamination related to waste disposal at the 316-3 Trenches and which can be used to characterize transport of these contaminants in the River. Evaluation of existing surface water monitoring data will include consideration of the sampling and analysis methods used to obtain the data, in particular the locations of samples and the use of vertical and horizontal sample integration. The review of data for this subtask should be coordinated with a similar review being performed as part of the Level I RI for the 300 Area Process Ponds.

The deliverable for this subtask will be a summary report which identifies the existing hydrologic and monitoring data near the 300 Area, summarizes evaluation of those data with respect to their applicability to the RI, identifies data gaps which must be addressed during Level II of the RI, and presents recommendations for collecting those data during Level II.

5.3 TASY 3 - FIELD DATA COLLECTION

5.3.1 Subtask 3.1 - Surface Radiation Monitoring

The objective of Subtask 3.1 is to obtain data on the extent and magnitude of current radioactive surface contamination at the site of the

316-3 Trenches. This information will be used to determine health and safety requirements for work at the site and to assess the potential for atmospheric releases of surface contamination. Radiation monitoring will be performed using hand-held survey instruments or more sensitive vehicle mounted instruments, depending on access restrictions.

5.3.2 Subtask 3.2 - Subsurface Sediment Sampling

The primary objectives of subsurface sediment sampling is to better characterize the inventory of contaminants in the 316-3 Trenches and to determine the vertical distribution of contaminants beneath the trenches. This information is needed to evaluate actual or potential releases from the trenches as well as to evaluate the technical feasibility of possible remedial alternatives.

Two types of subsurface sampling will be performed. The first will involve excavation of trenches with a backhoe to the bottom of the trench or to the maximum depth possible with the equipment. Samples will then be collected from the sides of the trench walls. This method of sampling is designed to obtain data which best characterize the current contaminant inventories in the trenches. The method of sampling from the walls of open trenches allows visual inspection of the materials present in the trenches and creates less sample disturbance than coring techniques. The limitation to this method is the depth that can be obtained. The use of a backhoe is presently recommended based on anticipated access restrictions. The use of larger equipment capable of deeper excavation will be considered based on the results of the site visit.

The second type of sampling will involve collecting core samples using cable tool drilling methods. These samples will be collected at various depths through the stratigraphic column to a depth of approximately ten (10) ft above the water table. Sampling will be terminated at this depth to minimize the potential for groundwater contamination related to sampling. These core samples are designed to obtain data which characterize the past vertical migration of contaminants from the trenches and the future migration potential. This sampling method was selected in

order to obtain samples at greater depth than would be possible with trench excavation. All samples will be analyzed for the analytes given in Table 7. The list of analytes is the same as that used for the previous sampling at the 316-3 Trenches and is the same as that being used for the Level I RI for the 300 Area Process Trenches. This list is necessarily broad in order to identify materials which may have been discharged to the trenches for which no documentation exists.

Subsurface sampling efforts will involve collecting samples in excavations at four (4) locations in each of the two trenches. The sample density was based on collection of one sample for each 100 ft of lineal trench length. The final sample locations will be selected during the initial site visit, based on access considerations, but will include one sample in four of the five 100-ft segments, as shown in Figure 9. The segment from East coordinate 15,600 ft to East coordinate 15,700 ft will not be sampled because of interference with the buildings located there. In addition to these eight sample locations, a background sample location will also be selected in an area near the trenches which has no documented contamination. This location will be selected during the initial site visit. The final sample locations will be surveyed or map spotted with respect to the 300 Area grid to within an accuracy of 5 ft. Within each excavation, samples will be collected from undisturbed material within the excavation walls at the surface and approximately every five (5) ft in depth to the bottom of the excavation. Final sample depths will be determined in the field by the PNL Sampling Representative on the basis of the observed stratigraphy. Sample depths will be recorded in the field with respect to a temporary reference point. The elevations of the temporary reference points will be surveyed to establish the sample elevations with an accuracy of 0.1 ft.

Sample collection methods will generally be those described in Westinghouse Hanford Company (WHC) Procedure A13057, "Inactive Waste Site Soil Sampling Procedure" (Appendix A). In addition to the samples specified in the above Procedure, two additional 1-kg samples will be collected in 1-liter wide-mouth polyethylene bottles for archiving and for possible analysis using X-ray diffraction or other methods.

Table 7. Analytes and Analytical Methods for 316-3
Trenches Level I RI

<u>Analysis</u>	<u>Method Reference</u>
ICP Metals - Enhanced List	6010 ¹
AA Metals	
Arsenic	7060 ¹
Mercury	7471 ¹
Lead	7421 ¹
Selenium	7740 ¹
Thallium	7841 ¹
Volatile Organics - Enhanced List	8240 ¹
Acid/Base/Neutral Organics - Enhanced List	8270 ¹
Polychlorinated Biphenyls	8080 ¹
Ion Chromatography	
Gross Alpha	
Gross Beta	

¹ EPA SW846 Procedures: Test Methods for Evaluating
Solid Waste, 2nd Edition, 1984

6-9

Figure 9. Subsurface Sample Locations for 316-3 Trenches
Level I Remedial Investigation

Samples for chemical and radiological analysis will be collected from a small particle size fraction separated by sieving. This fraction is being separated because of the requirements of the analytical procedures and because most of the contaminants are expected to be associated with the smaller sizes. In assessing the total inventory and distribution of contaminants at the site, however, it is important to account for the presence of large particles which may have little contamination associated with them (e.g., cobbles). For this reason, the on-site PNL Sampling Representative will maintain a written log of the stratigraphy encountered (i.e., description of the material size fractions encountered).

Subsurface sampling will also involve collection of samples from five coring locations. These locations will include three locations between the trenches, as shown in Figure 9, as well as one location above each of the two trenches. The locations above the trenches will be selected in the field based upon access considerations. The three sample locations adjacent to the trenches are intended primarily to identify contaminant migration from the trenches associated with discharge of liquid wastes, rather than from leaching from contaminated sediments in the trenches. That is, liquid discharges are expected to have resulted in significantly more lateral migration because of the large volumes disposed. The relatively small amount of liquid infiltrating through the sediments from rainfall is assumed to migrate vertically downward. Samples from the corings adjacent to the trenches will be collected at the surface and every five ft to the bottom of the hole. Samples from the corings through the trenches will be collected every five ft from the ground surface to the bottom of the trench, every 2.5 ft from the bottom of the trench to 10 ft below the trench, and every five ft for the remainder of the hole. The greater sampling density at the bottom of the trench is intended to detect contaminants leached from the sediments which may have migrated only a short distance. The sampling procedures for collecting the core samples will be those given in "Procedures for Inactive Waste Site Soil Sampling Using Cable Drilling Tools" (Appendix B).

The PNL Sampling Representative will maintain a record of all sampling activities using sample log sheets supplied by PNL. Strict

chain-of-custody will be maintained for all samples collected for chemical and radiological analysis. A record of chain-of-custody will be maintained with PNL-supplied chain-of-custody forms. Because of radioactive contamination present at the sites, a Radiation Work Procedure will be developed prior to the start of on-site work. Specific safety procedures are given in the Site Health and Safety Plan (Appendix C).

5.4 TASK 4 - LABORATORY ANALYSIS

The objective of this task is to provide laboratory analytical services to support the RI. This effort will be conducted by U. S. Testing Laboratories, under subcontract to PNL.

5.5 TASK 5 - GEOCHEMICAL CHARACTERIZATION OF SEDIMENTS

The objective of this task is to collect data on the geochemistry of contaminated sediments as it relates to the migration potential of contaminants. The specific activities carried out under this task will depend on the results of the sediment sampling and analysis conducted in Tasks 3 and 4. If these results indicate the presence of significant contamination associated with the sediments, Task 5 will be conducted to determine the mobility of these contaminants. This task will involve laboratory analyses (i.e., X-ray diffraction) to characterize the mineralogy of the sediments and to determine major chemical species present. Specific procedures for analysis of contaminated samples by X-ray diffraction are presently under development by PNL. The task may also involve laboratory leaching tests and/or geochemical modeling to evaluate contaminant solubility.

Specific activities to be conducted under this task will be identified upon review of the sediment sampling and analysis results. At that time, an amended work plan will be prepared describing these activities.

5.6 TASK 6 - DATA EVALUATION

5.6.1 Subtask 6.1 - Validation of Laboratory Data

The objective of this **subtask** is to review the analytical data associated with the sediment sampling to assure its validity. Laboratory QA/QC records will be reviewed to identify any limitations associated with use of the analytical data.

5.6.2 Subtask 6.2 - Data Evaluation

The objective of this **subtask** is to evaluate the existing data collected during Task 2, the new field data collected during Task 3, and any additional laboratory data collected during Task 5. The focus of this evaluation will be on characterizing the nature and extent of contamination in the various environmental media at and around the 316-3 Trenches and on characterizing the migration potential of these contaminants.

Specific analyses and evaluations to be performed will include:

Summarizing the presence of environmental contaminants at levels above background.

Summarizing the extent of surface radioactivity present at levels above background.

Preparation of contaminant profiles indicating the vertical distribution of contaminants beneath the trenches.

Evaluation of subsurface conditions apparently influencing migration of contaminants.

Evaluation of geochemical characteristics affecting contaminant migration.

- Generation of groundwater contours.
- Identification of hydraulic gradients, flow directions, and flow rates.
- Identification of contaminants present in groundwater and generation of isopleths showing the extent of groundwater contamination.

- Identification of contaminants present in surface water above background.

5.7 TASK 7 - PUBLIC HEALTH/ENDANGERMENT ASSESSMENT

5.7.1 Subtask 7.1 - Selection of Contaminants of Concern and ARARs

The objective of this **subtask** is to identify contaminants associated with the **316-3** Trenches which are of concern with respect to public health and environmental endangerment. Initially, all the existing and new monitoring data collected in previous tasks will be reviewed to identify **all** contaminants present. Contaminants of concern will be selected from these contaminants based on concentration, toxicity, and environmental fate and transport characteristics. Those contaminants selected will be those judged to be most likely to result in endangerment to **public** health and the environment.

In conjunction with this effort will be identification of applicable or relevant and appropriate requirements (ARARs). **ARARs** will include environmental standards and criteria related to the contaminants of concern as well as other general requirements related to environmental impact. Establishment of ARARs will be performed in close cooperation with the DOE **Richland** Operations Office, the Washington Department of Ecology, and Westinghouse Hanford Company.

The result of this **subtask** will be an identification of the contaminants of concern and ARARs and a discussion of the rationale used to select these contaminants and ARARs.

5.7.2 Subtask 7.2 - Environmental Fate and Transport

The objective of this task is to assess the environmental fate and transport of each of the contaminants of concern. The physical and chemical properties of each of these chemicals will be discussed, along with relevant properties of the transport medium (**e.g.**, vadose zone and

aquifer properties). The results of the geochemical characterization conducted in Task 5 will also be discussed.

The result of this task will be a summary discussion of the environmental fate and transport and migration potential of each of the contaminants of concern.

5.7.3 Subtask 7.3 - Exposure Evaluation

The objective of this subtask is to evaluate actual and potential exposure to contaminants of concern. Evaluation of exposure potential will initially involve characterization of potentially affected receptors vis-a-vis the exposure pathways identified in the previous subtask. This information will then be used to identify all completed exposure pathways (i.e., pathways including a source of contamination, a mechanism for release, an environmental transport medium, a point of potential contact, and a mode of exposure). After exposure pathways have been identified, data collected and evaluated in previous tasks will be used to estimate environmental concentrations for each contaminant of concern at exposure points. This evaluation will incorporate analytical data and information from the environmental fate and transport subtask and may involve modeling of various environmental media. It is expected that simple analytical models will be sufficient for this evaluation. If more complex modeling is required, it would be performed as part of Level II of the RI.

The result of this subtask will be estimates of exposure for all reasonable pathways for each contaminant of concern in each environmental medium. These exposure estimates will be tabulated for subsequent use in the risk characterization. Because the Level I sampling is biased toward collection of samples with maximum levels of contamination, the exposure estimates developed for this subtask should represent maximum exposures.

5.7.4 Subtask 7.4 - Toxicity Evaluation

The objective of this subtask is to collect any toxicity data needed to support the risk characterization. Toxicity data will be required for those contaminants which do not have exposure standards or

criteria as part of ARARs. Reviews of toxicological data will be performed for these contaminants. The result of this subtask will be summaries of toxicological profiles for each contaminant.

5.7.5 Subtask 7.5 - Risk Characterization

The objective of this subtask will be to characterize the risk associated with the wastes discharged to the 316-3 Trenches. For most contaminants, the risk will be characterized by comparing estimated environmental concentrations with standards and criteria identified in the ARARs. If ARARs do not exist for any route of exposure, quantitative risk assessments will be performed.

The quantitative risk assessment will be based on the estimated exposure levels calculated in Subtask 7.3. For each population at risk, the total intake by each route of exposure will be calculated by adding the intakes from each pathway. For each exposure, a chronic daily intake (DCI) will be calculated. Critical toxicity values (i.e., numerical values derived from dose-response information for individual compounds) will be used in conjunction with the intake determinations to characterize risk. Two different types of critical toxicity values may be used:

- The acceptable daily intake for chronic exposure (AIC); and
- The carcinogenic potency factor (for carcinogens only).

The result of this subtask will be a summary of the risk associated with exposure to each of the contaminants of concern.

5.8 TASK 8 - INITIAL SCREENING OF REMEDIAL TECHNOLOGIES

The objective of this subtask is to perform an initial screening of remedial technologies which may be required at the site. The need for remedial action will be based upon the results of the risk characterization performed in Subtask 7.5. The risk characterization will serve to identify the populations at risk and the contaminant migration routes. The initial screening will be based primarily on technical feasibility. As discussed

previously, the technical feasibility of possible actions will be based on an evaluation of the extent of contamination and the physical and chemical properties of the subsurface materials (i.e., vadose zone and aquifer properties). Technically feasible alternatives will be identified. Each technically feasible alternative will be evaluated to identify any additional data which must be collected during Level II of the RI to support further remedial alternative evaluation during the FS.

The result of this task will be a summary discussion identifying the remedial technologies considered for the 316-3 Trenches, evaluating the feasibility of each alternative, and identifying additional data needs.

5.9 TASK 9 - REPORTING

The objective of this task is to document the results of the previous tasks. An RI report will be prepared which summarizes Level I activities, results, and conclusions. The report will provide documentation of data obtained for Level I tasks, as well as data evaluation and identification of additional tasks and data needs for the Level II RI. The deliverables for this task will be a draft and final RI Report.

6.0 PROJECT SCHEDULE

The proposed schedule for the Level ■ RI of the 316-3 Trenches is shown in Figure 10.

Figure 10. Proposed Schedule for 316-3 Trenches Level RI

7.0 REFERENCES

DOE. 1986a. Draft Phase I Installation Assessment of Inactive Waste-Disposal Sites at Hanford. Department of Energy, Richland, Washington.

DOE. 1986b. Draft Environmental Impact Statement, Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes, Hanford Site, Richland, Washington, DOE/EIS-0113. Department of Energy, Washington, D.C.

ERDA. 1975. Final Environmental Impact Statement, Waste Management Operations, Hanford Reservation, Richland, Washington, ERDA-1538. Energy Research and Development Administration, Washington, D.C.

Haney, W. A. 1960. Disposal of Radioactive Liquid Wastes From 300 Area Laboratory Facilities, HW-64292. General Electric Company, Richland, Washington.

Heid, K. R. 1956. Summary of Liquid Radioactive Wastes Discharged to Ground - 300 Areas Through October 1956, HW-47055. General Electric Company, Richland, Washington.

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

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APPENDIX A

**WHC PROCEDURE A13057
INACTIVE WASTE SITE SOIL SAMPLING PROCEDURE**

Mantech Engineering Development Laboratory <small>Environmental Protection & Control Corporation P.O. Box 1079 m</small>		PAGE <u>1</u> OF <u>12</u>	
PROCEDURE NUMBER	FACILITY		DATE
A13057	316-1, 316-2 and 316-3		4/30/87
TITLE			REVISION TO
Inactive Waste Site Soil Sampling Procedure			0
PREPARED BY	REVIEWED BY	APPROVED BY	
D. L. Pursley	See EDT A13057	See EDT A13057	

1.0 Purpose

This procedure defines the methods to be used in obtaining soil samples from the bottom of the 300 Area inactive waste sites and for preparing and handling these samples from the field to the laboratory. All samples must be taken and controlled per EPA Publication SW-846, Second Edition, July 1982, "Test Methods for Evaluating Solid Waste," such that they are compatible with State and Federal Regulatory compliance requirements.

2.0 General

- 2.1 The inactive waste sites include the South Process Pond (316-1), the North Process Pond (316-2) and the 307 Disposal Trench. These sites will be sampled at specific points **determined** by PNL. A stake will be placed in the site of each sample excavation. Each sample location will yield samples from several depths as determined by PNL. The sample hole will be excavated to the proper depth keeping in mind personnel safety and then **sampled** at each of the **predetermined** elevations starting at the bottom and working up to the surface. Excavations ~~may~~ be completed using hand tools or large excavating equipment.
- 2.2 Each complete sample **will** consist of a set of () separate bottles of soil. Each bottle will be filled with soil leaving no head-space and then sealed tightly. Bottle caps must not be interchanged. A seal ~~tape~~ **will** be placed over each bottle lid and then the bottles will be packed in ice for transport to the laboratory. Each set of bottles will be pre-labeled to **include** the **sample** location code and other information as required by

PNL and to indicate laboratory **testing requirements**.

When each sample has been labeled **and** packed **in ice** In the transport cooler, a CHAIN-OF-CUSTODY form will be filled out (PNL Form **#BC-1200-345 (7-85)**). The sample **information** will then be entered in the "Sample Log" and a 'Sample Analysis Request Form' will be filled out. Each sample will have **all** except one bottle transported to US. Testing with one 250 ml sample kept by **WHC** in refrigeration at the 325 Building. Separate coolers will be used for samples transmitted to US. Testing and **WHC** Storage. For each delivery, the chain-of-custody forms **will** be signed by both the person **relinquishing** the samples and the person receiving the **samples**. See the sample of "Chain-Of-Custody," "Sample Log Form" and "Sample Analysis Request Form" in Appendix A.

- 2.3 Samples** must include only fine materials without stones. **If** separation of the finer materials from gravel and cobbles becomes a problem screens will be used along with hand brushing of the finer materials from the larger stones. Three U.S. standard screens will be available with screen sizing of Tyler **#6, #9 and #16**. The sample will be dug and transferred directly to a screen and shaken into a bucket until sufficient material is available for the sample bottles.

Prior to first sampling of the day and between samples the **sampling** tools will be steam cleansed. This cleaning will stop cross **contamination** between samples. Equipment required will include shovels, a pick, trowels, U.S. standard screens, brush, steam cleaner, coolers, ice, sample bottles and buckets.

- 2.4 Personnel present for the sampling shall include a Radiation Protection **Technician** (RPT), a Waste Systems Operation (WSO) Technician, a PNL **IWSS** representative and a Waste Systems **Engineering (WSE)** representative. The PNL IWSS representative will also be a geologist and will examine materials from which the samples are taken and keep a **written** log of stratigraphy encountered. The backhoe and backhoe operator **will** be available as required. The Waste Systems **Engineering** representative will **fill** out the "chain-of-custody" form, the "Sample Log Form" and the Sample Analysis Request Form. The **WSE** representative will also keep a log of all unusual happenings or deviations. The **PNL** IWSS geologist will also complete the third party inspection **checklist**.
- 2.5 **The U.S.** Testing laboratory can handle a maximum of fifteen samples per week so field personnel obtaining the samples must be aware of the laboratory status so their limit is not exceeded. **U.S.** Testing must also be notified each morning that samples will be delivered that day. PNL will make delivery of samples to the back door (**North** East side of Building) where lab personnel can be signaled by a bell. The cooler full of samples will be left and any empty coolers will be picked up.
- 2.6 Copies of sampling paperwork will be provided to Waste Systems Engineering and the PNL IWSS representative at the end of the day. This will include copies of the "chain-of-custody" form, "Sample Log Form," "Sample Analysis Request **Form**," and the geologists log. **All** paperwork will be completed in black ink.

- 2.7 **All** samples shall be transported **in their** coolers to the U.S. **Testing** laboratory or to WHC storage by the **end** of the day the samples are taken.

3.0 Safety

Safety concerns are those **typical** hazards associated with an outdoor worksite. These include steep sides on the process ponds and excavation sites with loose materials that are potential tripping hazards and extreme weather conditions. Personnel must be aware of the conditions' and plan accordingly. The ponds themselves contain uranium, potentially other radioactive or hazardous materials and standard radiological precautions **must** be observed. All work will be performed under a Radiation Work Procedure (RWP).

4.0 Prerequisites

- 4.1 **The** pond area to be sampled must be dry enough to move around in and dig without problems with surface water. Wet conditions will affect the sampling procedure and cause cross **contamination** of **samples**.
- 4.2 Radiological protection gear and clothing shall be available along with a copy of the applicable RWP.
 Responsibilities: Radiological Clothing - Waste Systems
Operations
 RUP Copy: Project Engineering

- 4.3** All tools and equipment shall be available for locating **and** staking out the sample **sites**, digging, preparing the **samples** and transporting the samples. Pre-labeled sample bottles, trowels, coolers with ice, steam cleaner, sieves, brush, plastic sheet, pen, evidence seal tape, clipboard, field logbook and proper forms.

Responsibilities:

Hand **Tools:** Project **Engineering/Waste** System Engineering

Transporting Samples: IWSS Representative to US Testing; **WSO**
to **325** Building.

Backhoe and Operator: Kaiser Engineers Hanford

- 4.4** Notify the testing laboratory that sampling is proceeding and verify the **WHC** sample storage area is available.

Responsibility: Waste Systems Engineering.

- 4.5** Notify the PNL IWSS representative.

Responsibility: Waste Systems Engineering

5.0 Procedure

- 5.1** Determine the first **sample** site in the correct waste site. Record the location. Measure and stake the site of the **sample** excavation.
- 5.2** At the location of the first **sample**, select a set of **sample** bottles for the surface **sample**. Collect materials from the surface of the ground and transfer to the sieve. Shake the

material through the sieve into a bucket until sufficient materials are collected to fill the sample bottles. Fill the bottles completely (no head space). Cap the bottles tightly without **interchanging** bottle caps and place the **evidence** seal tape on each bottle. Place the sample bottles in the proper ice chest and make sure they are packed with ice.

- 5.3 Register the sample in the "**sample** log" and provide any necessary or interesting observations. Fill out the "Chain-Of-Custody" form and the 'Sample Analysis Request' form for the **sample**. Steam clean all sampling tools. -
- 5.4 Using the stakes for alignment, use the shovel and pick or the backhoe and dig a hole deep enough to provide samples from the proper lower sample elevations. Using a trowel, scrape some material from the wall and elevation of the lowest sample. This will remove material that might cause cross contamination of the sample. With the trowel, sample the materials at this elevation and transfer the material to a selected sieve. Shake the material through the sieve into a bucket and add more from the **same** location until enough material is available to fill the **sample** bottles (approximately 1-1/2 liters). Fill the **pre-labeled** sample bottles completely (no head space) from the sieved material in the bucket. Cap the bottles tightly as they are filled and place evidence seal tape over the cap. Bottle caps must not be interchanged. Place the sample bottles for U.S. Testing in the proper cooler and place the WHC backup sample in the proper cooler. Make sure all sample bottles are packed in ice.

- 5.5 Register the sample in the **"sample log"** and provide any necessary or Interesting **disruptions** or observations. **Fill** out the 'Chain-Of -Custody' **forms** and a 'Sample **Analysis** Request' **form** for the sample. **Steam** clean all tools to prevent cross **contamination** between **samples**.
- 5.6 Select the next set of pre-labeled **sample** bottles. Scrape a **small amount** of soil from the **side** of the hole at the next elevation to **remove** material that **may** potentially cross contaminate the **sample**. Dig out and screen enough material **into** a clean bucket to provide a sample that will **fill** the sample bottles. Fill the sample bottles **from** the bucket, cap **them** tightly and place evidence seal tape **on** each cap. Place the bottles in the proper coolers for US. Testing and WHC and **make** sure they are packed in ice.
- 5.7 Register the sample in the **"Sample Log Form"** and provide any necessary or interesting disruptions or observations. Fill out the **"Chain-Of-Custody"** **forms** and a **"Sample Analysis Request Form"** for the **sample**. **Steam** clean **all sampling** tools.
- 5.8 Repeat steps 5.6 and 5.7 until all elevations at the site are **sampled**.
- 5.9 Select a **new sample** location from in the waste site, locate and stake the site.
- 5.10 Repeat steps 5.2 through 5.9, continue to sample the waste site until all locations have been completed.

NOTE: The testing laboratory can take a limited number of samples per week. Laboratory requirements must be coordinated ~~as~~ the sampling proceeds. Do not begin a sample excavation unless all samples ~~from~~ the excavation can be handled by the laboratory within the shelf life of the sample for the type analysis to be completed. (Five days maximum)

NOTE: Any deviations from this procedure will be noted in **the** ~~USE~~ Representatives Log in detail.

Pacific Northwest Laboratories
P.O. Box 444
Bellevue, Washington 98004

Company Contact _____ **Telephone:** _____

Samples Collected by: _____ **Date:** _____ **Time:** _____

Sample Location: _____

Ia Chest No.: _____ **Field Logbook Page No.:** _____

Remarks: _____

Method of Shipment: _____

[illegible][illegible]

Relinquished by ·

Retinquished by:

Relinquished by:

Relinquished by:

Received by:

Received by

Received by:

Received by:

Date/Time:

Dare Time :

Date/Time:

Date / Time

Sample Log Form

[illegible]

SAMPLE ANALYSIS REQUEST

Westinghouse
W/B-46 / 337 Bldg. !/ WHC / 300 Area

United States Testing Company, Inc.
2800 George Washington Way
Richland WA 99352

Collector _____

Received by _____

Date /Time Sampled _____

Title _____

Company Contact Carolyn Dupuis 376-3318

Date _____ Time _____

CHAIN OF CUSTODY NO- _____

☐ WATER ☒ SOIL ☐ C

SAMPLE ID _____

☐ OTHER _____

UST SAMPLE ID _____

COMMENTS

FULL ANALYSIS

	CODE	CONSTITUENT	(3) 40ml G	(2) 250ml G	(3) 125ml G			
1	725	ICP METALS 6010						
2	726	ICP METALS 6010 ENHANCED						
3	A20	ARSENIC			X			
4	A21	MERCURY			X			
5	A22	SELENIUM			X			
6	A23	THALLIUM			X			
7	A24	THIOUREA 8330						
8	727	METHOD 8330 ENHANCED		X				
9	A51	LEAD BY GFAA			X			
10	739	PCB						
11	728	PESTICIDES 8080						
12	729	PESTICIDES 8080 ENHANCED		X				
13	730	VGA METHOD 8240						
14	731	VGA METHOD 8240 ENHANCED	X					
15	732	A/B/N 8270						
16	733	A/B/N 8270 ENHANCED		X				
17	734	PESTICIDES METHOD 8140		X				
18	C68	TOX	X					
19	C69	TCC		X				
20	C70	CYANIDE			X			
21	735	NITRATE, SULPHATE,..... (IC)			X			
22	C77	PERCHLORATE			X			
23	C78	SULFIDE			X			
24	C80	AMMONIUM ION		X				
25	C81	ETHYLENE GLYCOL		X				
26	109	COLIFORM BACTERIA			X			
27	181	RADIUM			X			
28	212	ALPHA			X			
29	111	BETA			X			
30	C36	DIOXIN		X				
31	C37	CITRUS RED #2			X			
32	191	CONDUCTIVITY						
33	159	pH						
34	736	DIRECT AQUEOUS INJECTION		X				
35	738	HERBICIDE 2,4-D, 2,4,5-TP SILVEX						
36	737	HERBICIDE 8150 ENHANCED		X				

Appendix B -- Procedures for Inactive Waste Site Soil Sampling
Using Cable Drilling Tools

1.0 Purpose

This procedure defines the methods to be used in obtaining soil samples from the 316-3 Trenches and for preparing and handling these samples from the field to the laboratory. All samples must be taken and controlled per EPA Publication SW-846, Second Edition, July 1982, "Test Methods for Evaluating Solid Waste," such that they are compatible with State and Federal Regulatory compliance requirements.

2.0 General

2.1 The sites to be sampled are located at the 316-3 Trenches in the 300 Area. These sites will be sampled at specific points determined by PNL. A stake will be placed in the site of each sample core. Each sample location will yield samples from several depths as determined by PNL. The subsurface samples for evaluation of the 316-3 Trenches will be collected using a cable drilling rig and a drive barrel sampler.

2.2 Each complete sample will consist of a set of 10 separate bottles of soil including the following:

- 3 each - 40 ml. glass bottles.
- 2 each - 250 ml. glass bottles.
- 3 each - 125 ml. glass bottles.
- 2 each - 1 liter polyethylene bottles.

Each bottle will be filled with soil leaving no head-space and then sealed tightly. Bottle caps must not be interchanged. A seal tape will be placed over each bottle lid and then the bottles will be packed in ice for transport to the laboratory. Each set

of bottles will be labeled in the field to include the sample location, depth, and other information as required by PNL and to indicate laboratory testing requirements. When each sample has been labeled and packed in ice in the transport cooler, a CHAIN-OF-CUSTODY form will be filled out (PNL Form #BC-1200-345 (7-85)) The sample information will then be entered in the "Sample Log" and a "Sample Analysis Request Form" will be filled out. Each sample will have all except one bottle transported to U.S. Testing with one 250 ml. sample kept by WMC in refrigeration at the 325 Building. Separate coolers will be used for samples transmitted to U.S. Testing and WMC storage. For each delivery, the chain-of-custody forms will be signed by both the person relinquishing the samples and the person receiving the samples. See the sample of "Chain-Of-Custody," "Sample Log Form," and "Sample Analysis Request Form" in Appendix A of this procedure.

- 2.3 Samples must include only fine materials without stones. If separation of the finer materials from gravel and cobbles becomes a problem screens will be used along with hand brushing of the finer materials from the large stones. U.S. standard screens will be available with screen sizing of Tyler #9 (2.00 mm). The sample will be transferred directly to a screen and shaken into a bucket until sufficient material is available for the sample bottles. Prior to the first sampling of the day and between samples the sampling tools will be steam cleansed. This cleaning will eliminate cross contamination between samples. Equipment required will include shovels, trowels, U.S. standard screens, brush, steam cleaner, coolers, ice, sample bottles and buckets.
- 2.4 Personnel present for the sampling shall include a Radiation Protection Technician (RPT), a Waste Systems Operation (WSO) Technician, a PNL IWSS representative and a Waste Systems Engineering (WSE) representative. The PNL IWSS representative will also be a geologist and will examine materials from which the

samples are taken and keep a written log of stratigraphy encountered. The cable drilling rig used for sample core collection will be staffed by qualified WHC Geotechnical Engineering personnel as necessary. The WSD will fill out the "chain-of-custody" form, the "sample log form" and the "sample analysis request form". The WE representative will also keep a log of all unusual happenings or deviations. The PNL IWSS geologist will also complete the third party inspection checklist.

- 2.5 The U.S. Testing laboratory can handle a maximum of fifteen samples per week so field personnel obtaining the samples must be aware of the laboratory status so their limit is not exceeded. U.S. Testing must also be notified each morning that samples will be delivered that day. PNL will make delivery of samples to the back door (north east side of building) where lab personnel can be signaled by a bell. The cooler full of samples will be left and any empty coolers will be picked up.
- 2.6 Copies of sampling paperwork will be provided to Waste Systems Engineering and the PNL IWSS representative at the end of the day. This will include copies of the "chain-of-custody forms," "Sample Log Forms," "Sample Analysis Request Forms," and the geologists log. All paperwork will be completed in black ink.
- 2.7 All samples shall be transported in their coolers to the U.S. Testing laboratory or to WHC storage by the end of the day the samples are taken. PNL shall retain the 1 liter polyethylene bottled samples.

3.0 Safety

Safety concerns are those typical hazards associated with an outdoor worksite. These include uneven surfaces with loose materials that pose potential; tripping hazards and potential extreme weather conditions.

Personnel must be aware of the conditions at the **worksite** and plan accordingly.

The 316-3 Trenches are known to contain chemical and radioactive contaminants that may include the following:

- Beryllium
- Cadmium
- Chromium
- Copper
- Lead
- Mercury
- Nickel
- Polychlorinated Biphenyls
- Silver
- Uranium
- Zinc

Specific safety procedures and equipment for work at the 316-3 Trenches are described in the Site Health and Safety Plan for the site (Level I RI Plan, Appendix C).

4.0 Waste Disposal.

Core segments remaining after sample collection shall be stored on-site until chemical and radiological analysis is complete. The material will be stored under plastic to prevent wind dispersal. After analysis is complete, the material shall be disposed of according to Westinghouse Hanford Company procedures appropriate for the observed levels of contamination.

5.0 Prereauisites

5.1 The sample location must be dry enough to move around in and handle samples without problems with surface water. Wet

conditions will affect the sample handling procedure and cause cross contamination of samples.

- 5.2 Protective gear and clothing, as described in the Site Health and Safety Plan, shall be available along with a copy of the Plan.
- 5.3 All tools and equipment shall be available for locating and staking out the sample sites, collecting the core samples, preparing the samples and transporting the samples. Tools and equipment include cable drill rig with core barrel sampler, sample bottles and labels, trowels, coolers with ice, steam cleaner, sieves, brush, plastic sheet, pen, evidence seal tape, clipboard, field logbook and proper forms.
- 5.4 Notify the testing laboratory that sampling is proceeding and verify the WHC sample storage area is available.
- 5.5 Notify the PNL WSS representative.

6.0 Procedure

- 6.1 Determine the first sample location at the waste site. Record the location. Measure and stake the location of the sample. Label sample bottles with identification supplied by PNL sampling representative.
- 6.2 At the location of the first sample, select a set of sample bottles for the surface sample. Collect materials from the surface of the ground and transfer to the sieve. Shake the material through the sieve into a bucket until sufficient materials are collect to fill the sample bottles. Fill the bottles completely (no head space). Cap the bottles tightly without interchanging bottle caps and place the evidence seal tape

on **each** bottle. Place the sample bottles in the proper ice chest and make sure they are packed with ice.

- 6.3 Register the sample in the "sample log" and provide any necessary or interesting observations. Fill out the "chain-of-custody" form and the "Sample Analysis Request" form for the sample. Steam clean all sampling tools.
- 6.4 **MOVE** the cable drilling rig into place over the sample location.
- 6.5 **Drive** the sampler to the desired depth and withdraw the tube containing the sample core. Prior to removing samples from the **core** barrel, label sample bottles with the sample identification supplied by the PNL sampling representative. Remove the sample core from the barrel and place it on a chemical resistant plastic sheet. With a trowel, sample the materials at the desired elevation and transfer the material to a selected sieve. Shake the material through the sieve into a bucket and add more from the **same** location until enough material is available to fill the **sample** bottles (approx. 3.5 liters). Fill the next set of sample bottles completely (no head space) from the sieved material in the bucket. Cap the bottles tightly as they are filled and place **evidence** seat tape over the cap. Bottle caps must not be interchanged. Place the sample bottles for U.S. Testing in the proper cooler and place the WHC backup sample in the proper cooler. **Make** sure all sample bottles are packed in ice.
- 6.6 Register the sample in the "sample log" and provide any necessary or interesting observations. Fill out the "chain-of-custody" **forms** and a "sample analysis request" form for the sample. Steam clean all tools to prevent cross contamination between samples.
- 6.7 Repeat steps 6.5 and 6.6 until all elevations at the location are **satisfied**.

6.8 **Select** a new sample location at the site, locate and stake the site.

6.9 **Repeat** steps 6.2 through 6.8. Continue to sample until all locations have been completed.

Note: The testing laboratory can take a limited number of samples per week. Laboratory requirements must be coordinated as the sampling proceeds. Do not begin a sample coring unless all samples from the core can be handled by the laboratory within the shelf life of the sample for the type analysis to be completed. (five days maximum)

Note: Any deviations from this procedure will be noted in the representative log in detail.

Appendix C -- Site Health and Safety Plan.

1.0 General

The remedial investigation field study (RI) of the **316-3** Trenches located at the 300 Area of the Department of Energy Hanford Site shall be conducted in a manner consistent with Code of Federal Regulations, Title 29, Part 1910.120, "Hazardous Waste Operations and Emergency Response; Interim Final Rule." The RI of the **316-3** Trenches will involve the use of a backhoe, or other earth-moving equipment, and cable-type drilling equipment to **collect** subsurface samples for characterization of organic, inorganic, and radioactive contamination at the site. Since the possibility exists for excess exposure to hazardous and radioactive materials, planning to assure that exposures to workers and the public are as low as reasonably achievable (ALARA) is **one** of the primary aspects of Hanford RI planning.

2.0 Entry Objectives

The objective of entry into the contaminated area of the **316-3** Trenches is to collect subsurface waste and sediment samples for characterization of radioactive and chemical contamination present and the extent of the migration of those contaminants.

3.0 Training and Education

Training of the characterization team is the first requirement to assure that the work at each site is performed with minimum risk to both workers and the general public. The team performing the **characterization** will be trained to a level commensurate with the hazards expected at the sites to be studied. At a minimum, the employees will receive 40 hours of training in the following areas:

- Employee rights and responsibilities;
- Nature of anticipated hazards;
- Radiation zone training;
- Emergency help, self-rescue, and first aid;
- Vehicle operation;
- Mandatory rules and regulations
- Safe **use** of field equipment;
- **Handling**, storage, and transportation of hazardous and radioactive materials;
Personal protective equipment (PPE) and clothing, use and care, particulzrly fitting, operation, and use of self-contained breathing apparatus (SCBA) ;
- Safe **sampling** techniques;
- Site **surveillance**, observation and safety plan development;
- Use and decontamination of protective clothing and equipment; and
- Use of field test equipment for radioactivity, explosivity, and other measurements as needed.

In addition to this basic training, each inexperienced employee will be accompanied by an employee experienced in characterization activities for a minimum of three days during field activities,

Only qualified personnel shall operate the earth-moving equipment, cable drilling vehicle, and associated machinery.

All employees who will manage the characterization efforts at the sites will receive an additional eight hours of **training** to cover the following topics:

- o Management of restricted and safe zones; and
- o Rules for handling untrained site visitors.

Personnel to receive this additional management training shall include, at minimum, the Project Team Leader, the Drill Rig Chief, and the Site Safety Officer.

Records of each employee's training will be maintained as required by 29 CFR 1910 and each employee shall receive eight hours of classroom refresher training annually.

4.0 Medical Surveillance

All employees will receive medical examinations at the start of their employment and annually thereafter. These examinations will allow medical staff to monitor employees for any adverse health effects related to exposure to contaminants during site characterizations.

Medical examinations will also determine if a particular worker is physically able to perform the work required by this work plan without undue risk to his health. The worker shall inform the examining physician of the potential hazards of the work including a list of the contaminants expected to be encountered and the personal protection equipment required. In particular, the physician shall determine the existence of conditions that may reduce the effectiveness or prevent the use by the employee of self-contained breathing apparatus. The physician shall also determine the presence of conditions that may pose undue risk to the employee while performing the physical tasks of this work plan using Level B personal protection equipment. This would include any condition that increases the employee's susceptibility to heat stress.

The examining physician's report shall not include any non-occupational diagnoses unless directly related to the employee's fitness for the work required.

Employee medical records shall be maintained as required by 29 CFR 1910.

5.0 Environmental and Personal Monitoring

An environmental monitoring program shall be conducted at the 316-3 Trenches during characterization operations. All work at the 316-3 Trenches will be performed under a Radiation Work Permit (RWP) authorized by Westinghouse Hanford Company (WHC) Radiation Protection Division and all

work will conform to the exposure limitations of that Permit. A WHC Radiation Protection Technician will be in attendance at all site activities and will enforce the measures stated in the RWP. The environmental monitoring program will include the following measures at a minimum:

- Monitoring air for combustible gasses and organic vapors in the vicinity of excavations and bore holes ;
- Monitoring general site for **beta/gamma** radiation;
- Monitoring of extracted sample cores for radioactivity prior to sample collection;
- Multipurpose dosimeters for each member of the field team and for visitors; and
- Personal radiation detectors for each member of the field team.

The following airborne contaminant standards will be used :

- Radionuclide concentrations in air, DOE Order 5480.1;
- Threshold Limit Values (TLV) (American Conference of Governmental Industrial Hygienists); and
- Occupational Safety and Health Standards, 29 CFR 1910.

Exposure to ionizing radiation shall be limited to the standards given in Radiation Protection, PNL-MA-6.

The specific standards applicable to this field study of the 316-3 Trenches based on the suspected chemical hazards present are shown in Table C-1.

If temperatures at the site are above 70° F, site personnel shall be monitored for heat stress by monitoring body temperature at rest periods and **work/rest** periods shall be adjusted according to the standards stated in Threshold Limit Values (TLV) (American Conference of Governmental Industrial Hygienists).

Table C-1 Threshold Limit Values for Chemical Contaminants Expected To be Encountered at the 316-3 Trenches

<u>Contaminant</u>	<u>Threshold Limit Value Time Weighted Average</u>	
	<u>ppm</u>	<u>mg/m³</u>
Beryllium	--	0.002
Cadmium	--	0.05
Chromium (VI)	--	0.05
Copper	--	1
Lead	--	0.15
Mercury	--	0.1
Nickel	--	0.1
Nitrate	NA	NA
Polychlorinated Biphenyl Arochlor 1248	--	0.5
Silver	--	0.1
Zinc	--	10

NA - Values Not Available

Source: American Conference of Governmental Industrial Hygienists (1986)

6.0 Engineered Safeguards

Engineered safeguards will be employed as necessary at the field study of the 316-3 Trenches to prevent accidents and reduce personnel exposure to chemicals and radiation. Specific safeguards include the following:

- a Properly installed shields on all machinery and vehicles particularly shields on moving parts of the drill rig; and
- a The use of greenhouses or additional radiation shielding if on-site monitoring indicates excessive exposure to personnel.

7.0 Personal Protective Equipment

Initial entry for characterization of the 316-3 Trenches shall be conducted at Level C personal protection. This level of protection is based on consideration of the materials likely to be present, as indicated by previous subsurface sampling at one location in the trenches. No changes to the specified levels of protection shall be made without the approval of the site safety officer and the project team leader. Specific protective equipment for initial entry (excavation) into the 316-3 Trenches shall include the following:

- Tyvek^(a) Coverall (upgrading to Saranex^(a) if integrity of the Tyvek is threatened by contaminants encountered).
- Respirator with full face cover mask equipped with filter cartridges for particulates and organic vapors.
- Heavy duty rubber gloves tape-sealed to coverall with leather outer gloves for drill rig crew and heavy equipment operators. Sample collection and handling personnel shall wear inner and outer rubber gloves tape-sealed to coverall.
- Rubber boots with steel toe and shank and disposable boot covers.
- Hard Hat.
- Hearing Protection if noise levels exceed 80 dBA.
- Multipurpose Dosimeter.
- Personal Radiation Detector (GM type).
- 2-Way Radio Communication for each individual.

(a) Tyvek and Saranex are registered tradenames of the E. I. Du Pont de Nemours Company, Wilmington, Delaware.

If on-site environmental monitoring indicates that adequate respiratory protection may be maintained without use of respirators, the site safety officer and project team leader may authorize change in personal protection equipment to Level D maintaining the same level of body contamination protection specified above.

8.0 General Safe Work Practices

The following general safe work practices will be observed during the 316-3 Trenches field study:

- Eating, drinking, chewing gum or tobacco, or smoking will be prohibited in the controlled zone.
- No facial hair that interferes with face-to-mask seal of respirators will be allowed.
- Personnel shall avoid direct contact with contaminated materials unless necessary for sample collection or required observation.
- Personnel not involved in operation of heavy equipment or the cable drill rig shall remain a safe distance from the rig as indicated by the equipment operators or drill rig chief.
- Following decontamination procedures or any time when leaving the controlled zone, personnel should wash face and hands thoroughly.
- Personnel shall use the "buddy system" at all times while operating in the controlled zone.
- Above all, personnel shall exercise common sense in all aspects of the field study.

If safety concerns arise during the course of the field study that are not satisfactorily addressed by this safety plan, the site safety officer and the project team leader shall determine the correct actions and necessary amendments to the safety plan prior to continuation of work at the site.

9.0 Standard Operating Procedures for Field Study

The procedures for on-site organization, management, control, decontamination, general operations, and emergency actions for the 316-3 Trenches field study are outlined below.

9.1 Onsite Organization and Coordination.

Personnel shall be named to the following positions and shall carry out the functions of those positions at the site. This safety plan shall not be considered complete until these positions are delegated by project management.

Project Team Leader	_____
Site Safety Officer	_____
Drill Rig Chief	_____
Radiation Protection Technician	_____
Recordkeeper	_____
PNL IWSS Representative	_____
Waste Systems Operations Technician	_____
Waste Systems Engineering Representative	_____
Field Tear Leader	_____
Field Tear Members	_____

All personnel arriving or departing the site should log in and out with the Recordkeeper. All activities on site must be cleared through the Project Team Leader.

9.2 Onsite Control

The Site Safety Officer and Radiation Protection Technician are designated to coordinate access control and security on the site. A temporary Exclusion Zone shall be established at each sampling location at the 316-3 Trenches as indicated in the Work Plan. The preliminary Exclusion Zone boundaries shall be fifty (50) feet from the edge of the excavation or fifty (50) feet from the core hole in all directions, depending on the type of sampling being performed. The Exclusion Zone shall be clearly marked with red warning tape and, if necessary, Radiation Area Signs. Exclusion Zone boundaries shall be adjusted to greater or smaller dimensions based on results of field radiation monitoring, however the dimensions of the Exclusion Zone shall be large enough to permit easy operation of required heavy equipment, easy handling of drill tools, and sample collection operations. Standards for Exclusion Zone shall be consistent with those stated in Radiation Protection PNL-MA-6. No unauthorized person shall be within the Exclusion Zone.

The onsite Command Post and staging area shall be established near the Exclusion Zone on the upwind (westerly) side. Exact location for the Command Post shall be determined after initial site visit and shall consider ease of vehicle access, availability of any required utilities, and proximity to the various individual sample locations at the site.

9.3 Hazard Evaluation

The following substances are known or suspected to have been disposed of at the 316-3 Trenches. The primary hazards of each substance are identified. The concentrations of these substances which were detected during previous sampling at one location in the 316-3 Trenches are given in Table C-2.

**Table C-2 Concentrations of Contaminants Detected in Previous
Sampling of 316-3 Trench Area**

Analyte	Units	Detection	Sample				
		Limit	003A001	003A002	0038001	003B002	003C001
Gross Beta	pCi/g	3.00E+00	1.51E+02	3.60E+02	3.24E+02	3.78E+02	2.58E+01
Gross Alpha	pCi/g	6.00E+00	8.73E+01	1.93E+02	1.99E+02	2.34E+02	
Aluminum	ug/g	1.50E+01	1.46E+04	1.91E+04	2.36E+04	2.67E+04	1.32E+04
Barium	ug/g	6.00E-01	8.70E+01	1.20E+02	1.24E+02	1.33E+02	1.11E+02
Beryllium	ug/g	5.00E-01	1.00E+00	1.00E+00	1.00E+00	2.00E+00	8.00E+00
Cadmium	ug/g	2.00E-01	1.00E+00	2.00E-01	4.00E-01	4.00E-01	1.00E+00
Calcium	ug/g	5.00E+00	1.89E+04	2.65E+04	2.60E+04	3.32E+04	2.42E+04
Chloride	ug/g	1.00E+00		1.07E+00			
Chromium	ug/g	1.00E+00	7.20E+01	1.90E+02	2.44E+02	2.59E+02	2.40E+01
Copper	ug/g	1.00E+00	4.39E+02	2.85E+03	2.15E+03	2.68E+03	1.95E+02
Fluoride	ug/g	1.00E+00		1.88E+00	1.15E+00	1.84E+00	2.04E+00
Iron	ug/g	5.00E+00	2.96E+03	2.48E+04	3.16E+04	3.35E+04	3.15E+04
Manganese	ug/g	5.00E+00	8.09E+03	4.40E+02	1.11E+04	1.16E+04	7.79E+03
Manganese	ug/g	5.00E-01	3.04E+02	1.80E+01	3.42E+02	3.47E+02	3.96E+02
Mercury	ug/g	1.00E-01	9.44E-01	2.72E+00	1.89E+00	2.77E+00	4.93E-01
Nickel	ug/g	1.00E+00	5.90E+01	1.71E+02	1.86E+02	2.21E+02	1.70E+01
Nitrate	ug/g	1.00E+00	2.06E+01	2.38E+01	3.04E+01	3.01E+01	7.96E+00
Potassium	ug/g	1.00E+01	7.84E+02	4.90E+01	9.84E+02	1.54E+03	1.83E+03
Silver	ug/g	1.00E+00		1.80E+01	1.30E+01	1.80E+01	
Sodium	ug/g	1.00E+01	2.38E+02	2.73E+02	4.01E+02	4.42E+02	2.33E+02
Strontium	ug/g	3.00E+01			6.00E+01	6.70E+01	
Sulfate	ug/g	1.00E+00	9.38E+00	1.56E+01	2.58E+01	3.65E+01	5.20E+01
Vanadium	ug/g	5.00E-01	6.50E+01	4.00E+00	6.80E+01	7.30E+01	6.70E+01
Zinc	ug/g	5.00E-01	5.80E+01	8.10E+01	8.80E+01	9.70E+01	5.90E+01
PCB Arochlor 1248	ug/g	1.00E-01	1.30E+00	9.90E+00	5.00E+00	8.40E+00	1.10E-01

<u>Contaminant</u>	<u>Primary Hazards</u>
Beryllium	Toxic if inhaled
Cadmium	Toxic if inhaled or ingested
Chromium	Toxic if inhaled or ingested
Copper	Toxic if inhaled or ingested or on contact
Lead	Toxic if inhaled or ingested or on contact
Mercury	Toxic if inhaled or absorbed through skin or on contact
Nickel	Toxic if inhaled or ingested
Polychlorinated Biphenyls	Toxic if inhaled, ingested, or absorbed, or on contact
Silver	Toxic if inhaled or ingested or on contact
Uranium	Toxic if inhaled or ingested or on contact

Additional hazards that may be encountered at the 316-3 Trenches field study include work within excavations to collect samples. Excavation sidewalls will be of such a slope as to prevent collapse (i.e., approximately 1:1)

9.4 Personal Protection Equipment

Personal protection equipment as defined in Section 8.0 of this safety plan shall be worn by all personnel performing operations in the Exclusion Zone and also by personnel performing decontamination operations.

9.5 Communication Procedures

9.5.1 All personnel working in the Exclusion Zone shall be equipped with two-way radio units. The channel designated for specific use in the Exclusion Zone is _____. All other onsite radio communications will use channel _____. Personnel in the Exclusion Zone should remain in constant radio communication or within sight of the Project Team Leader. Any failure of radio communication

requires an evaluation of whether personnel should leave the Exclusion Zone.

9.5.2 A series of three (3) one-second horn blasts is the emergency signal to indicate that all personnel should leave the Exclusion Zone. In addition, a loud hailer shall be available.

9.5.3 The following standard hand signals will be used in case of radio communications failure:

Hand gripping throat.....Out of air, can't breathe
Grip partner's wrist or
both hands around waist.....Leave area immediately
Hands on top of head.....Need assistance
Thumbs up.....OK, affirmative
Thumbs down.....No, negative

9.5.4 Telephone communication to the Command Post shall be established as soon as possible. The telephone number is_____

9.6 Decontamination Procedures

Decontamination procedures shall be consistent with Level C decontamination protocol and shall utilize the following stations:

1. Contaminated equipment drop.
2. Boot cover and outer glove wash and rinse.
3. Boot cover and outer glove removal.
4. Coverall/boot wash and rinse.
5. Boot removal.
6. Coverall removal.
7. Inner glove wash and rinse.
8. Respirator removal.
- Inner glove removal.

10. Field wash.

Emergency decontamination will include stations 3, 4, 5, and 8.

The following decontamination equipment is required:

- Containers for contaminated tools (station 1)
- Plastic drop cloths (all stations as needed)
- Decontamination solution (stations 2,4,7)
- Long-handled scrub brushes (stations 2,4,7)
- Pressure sprayers for rinse (stations 2,4,7)
- Wash tubs or other containers for wash residue containment (stations 2,4,7)
- Drums for collection of used decontamination solution (stations 2,4,7)
- Garbage cans and plastic liners for holding contaminated personal protection equipment (stations 3,5,6,8,9)
- Buckets and wash basins (stations 2,4,7,10)
- Tables or stands and benches/chairs (stations 2,4,5,10)

The decontamination solution used will be a solution of Detergent and Water with a Water Rinse.

9.7 Emergency Procedures

The Site Safety Officer is directly responsible to the Project Team Leader for safety recommendations on the site. In the event that an onsite emergency results in evacuation of the Exclusion Zone, personnel shall not reenter the Exclusion Zone until: 1) the conditions resulting in the emergency have been corrected; 2) the hazards have been reassessed; 3) the Site Safety Plan has been reviewed; and 4) site personnel have been briefed on any changes in the Site Safety Plan. The following emergency procedures shall be used.

9.7.1 Emergency Medical Care.

- Kadlec Hospital at 888 Swift Blvd. in Richland, telephone 946-4611, is located approximately 15 minutes from the 300 Area.
- Local ambulance service is available from the 300 Area Fire Station, Telephone 811. Their response time from the station to the 316-3 Trenches is 3 to 5 minutes.
- The following first aid equipment shall be maintained onsite:
 - First aid kits adequate for the size of the field team.
 - Emergency eye wash stations (2).
 - Portable oxygen supply.

9.7.2 Emergency medical information for the suspected substances at the 316-3 Trenches are as follows:

<u>Contaminant</u>	<u>Symptoms</u>	<u>First Aid</u>
Beryllium	Inhalation: Respiratory symptoms, weakness, fatigue, weight loss, carcinogenic	Eye: Irrigate immediately
Cadmium	Inhalation, Ingestion: Pulmonary edema, dyspnea, cough, tight chest, substernal pain; headache; chills, muscle aches; nausea, diarrhea; anosmia, emphysema; proteinuria; anemia; carcinogenic	Eye: Irrigate immediately; Skin: Soap wash; Breathing: Artificial respiration; Ingestion: Immediate medical attention
Chromium	Inhalation, Ingestion: Histologic fibrosis of lungs; carcinogenic	Eye: Irrigate immediately; Skin: Soap wash; Breathing: Artificial respiration; Ingestion: Immediate medical attention

<u>Contaminant</u>	<u>Symptoms</u>	<u>First Aid</u>
Copper	Inhalation, Ingestion, Contact: Irritation of mucus membrane, pharynx; nasal perforation; eye irritation; metal taste; dermatitis	Eye: Irrigate immediately; Skin: Soap wash; Breathing: Artificial respiration; Ingestion: Immediate medical attention
Lead	Inhalation, Ingestion, Contact: Lassitude; insomnia; pallor, eye grounds; anorexia , weight loss, malnutrition; constipation , abdominal pain, colic; hypotension; anemia; gingival lead line; tremors, paralysis	Eye: Irrigate immediately; Skin: Soap wash; Breathing: Artificial respiration; Ingestion: Immediate medical attention
Mercury	Inhalation, Absorption, Contact: Cough, dyspnea, bronchitis, pneumonia; tremors; insomnia; irritability, indecision; headache; fatigue, weakness; stomatitis, salivation; gastrointestinal, anorexia, weight loss; proteinuria; irritation of eyes, skin	Eye: Irrigate immediately; Skin: Soap wash; Breathing: Artificial respiration; Ingestion: Immediate medical attention
Nickel	Inhalation, Ingestion, Contact: Sensitization dermatitis; allergic asthma; nasal cavities; pneumonitis; carcinogenic	Eye: Irrigate immediately; Skin: Soap wash; Breathing: Artificial respiration; Ingestion: Immediate medical attention
Polychlorinated Biphenyls	Inhalation, Absorption, Ingestion, Contact: Irritation of eyes, skin; acne-form dermatitis ; jaundice; dark urine; carcinogenic	Eye: Irrigate immediately; Skin: Soap wash; Breathing: Artificial respiration; Ingestion: Immediate medical attention

<u>Contaminant</u>	<u>Symptoms</u>	<u>First Aid</u>
Silver	Inhalation, Ingestion, Contact: Blue-gray eyes, nasal 'septum, throat, skin; skin irritation, ulceration; gastro- intestinal	Eye: Irrigate immedi- ately; Skin: Soap wash; Breathing: Artificial respiration; Ingestion: Immediate medical atten- tion
Uranium	Inhalation, Ingestion, Contact: Dermatitis	Eye: Irrigate immedi- ately; Skin: Soap wash; Breathing: Artificial respiration; Ingestion: Immediate medical atten- tion

Source: NIOSH Pocket Guide to Chemical Hazards, 1985.

9.7.3 Emergency Telephone Numbers

- Police: Hanford Patrol 811
- Fire: 300 Area Fire Station 811
- Ambulance: 200 Area Fire Station 811
- Hospital: Kadlec Hospital 946-4611
- Hanford Environmental Health Found. 376-6210
- Radiological Assistance 376-5118

9.7.4 Procedure for Personal Injury in the Exclusion Zone.

Upon notification of an injury in the Exclusion Zone, the emergency signal of three one-second horn blasts will be sounded. All site personnel will assemble at the decontamination line. The injured person will be removed to the decontamination line and the Site Safety Officer and the Project Team Leader should evaluate the nature of the injury and the extent of decontamination possible prior to movement of the injured person to the Support Area. Appropriate first aid shall be initiated and

ambulance summoned if required. No person shall reenter the Exclusion Zone until the cause of the injury or symptoms is determined and measures to prevent recurrence taken.

9.7.5 Procedure for Personnel Injury in the Support Area.

Upon notification of an injury in the Support Area, the Project Team Leader and the Site Safety Officer will assess the nature of the injury. If the cause of the injury or loss of the injured person does not affect the performance of site personnel, **operations** may continue, with initiation of first aid and **summoning** of ambulance if required. If the injury increases the risk to others, the emergency signal of three one-second horn blasts will be sounded and all site personnel shall move to the decontamination area for further instructions. Activities on site will stop until the added risk is removed or minimized.

9.7.6 Procedure for Fire or Explosion.

Upon notification of a fire or explosion on site, the emergency signal of three one-second horn blasts will be sounded and all site personnel assembled at the decontamination line. The fire department will be alerted and all personnel moved to a safe distance from the involved area.

9.7.7 Procedure for Personal Protective Equipment Failure.

If any site worker experiences a failure or **alteration** of protective equipment that affects the protection factor, that person and **his/her** buddy shall immediately leave the Exclusion Zone. Reentry shall not be permitted until the equipment has been repaired or **replaced**.

9.7.8 Procedure for Failure of Other Equipment.

If equipment on site fails to operate properly, the Project Team Leader and Site Safety Officer shall be notified and then determine the effect of this failure on continuing operations on site. If the failure affects the safety of personnel or prevents completion of the Work Plan tasks, all personnel shall leave the Exclusion Zone until the necessary repairs are made.

9.7.9 Emergency Escape Routes.

In the event that emergency situation prevents exiting the Exclusion Zone by way of the decontamination area, exit the Exclusion Zone in any direction, preferably upwind.

10.0 Acknowledgment of Site Safety Plan

All site personnel have read the above plan and are familiar with its provisions.

Name

Signature

Date

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