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Soil/Sediment Characterization for the 216-A-29 Ditch

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Richland, WA 99352
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Abstract: This document provides a detailed description of the environmental samples collected from the 216-A-29 Ditch in 1988. Tables summarizing the laboratory data for radionuclides, metals, and soil chemistry are included.

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Soil/Sediment Characterization for the 216-A-29 Ditch

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March 1997

Prepared for the U.S. Department of Energy
Assistant Secretary of Environmental Management

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ACRONYMS AND ABBREVIATIONS

DQO	Data Quality Objectives
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
GC/MS	gas chromatograph/mass spectrometer
GM	Geiger-Mueller (detector tube)
ICP	inductively coupled argon plasma
MRAL I	Mobile Radionuclide Analysis Laboratory
OSHA	Occupational Safety and Health Administration
PCB	polychlorinated biphenyl
PUREX	Plutonium Uranium Extraction (Facility)
RCRA	*Resource Conservation and Recovery Act of 1976*
RPT	Radiation Protection Technician
TOC	total organic carbon
TWRS	Tank Waste Remediation System
UST	U.S. Testing, Inc.
WAC	Washington Administrative Code

1.0 INTRODUCTION

In 1987, an effort was initiated to develop a detailed site characterization plan as per the commitment in the Preliminary Closure/Post Closure Plan for the 216-A-29 Ditch submitted to the Washington State Department of Ecology (Ecology) in April 1987. This characterization effort is described in detail in this document.

In 1987 and 1988, development of sampling methodologies, characterization plans, and analytical protocols in support of the *Resource Conservation and Recovery Act of 1976* (RCRA) regulatory efforts were in the initial stages at the Hanford Site. The first site characterization plans developed were for the 2101-M Pond and the A-29 Ditch. The field methodologies, sample protocols, and analytical support (provided by U.S. Testing, Inc. [UST]) was the same at both sites. The *2101-M Pond Closure Plan* (DOE-RL 1989) was developed in concert with Ecology and the U.S. Environmental Protection Agency (EPA) regulators. These efforts eventually led to the clean closure of 2101-M Pond in 1995. However, reductions in funding led to a decision to provide other engineering alternatives for the A-29 Ditch. The sample data and analytical reports which had been developed from soil/sediment sampling at the A-29 Ditch were archived and no report was issued at that time.

The implementation of the Tank Waste Remediation System (TWRS) Phase 1 Privatization Project has necessitated the development of a site improvements corridor that would cross the retired A-29 Ditch. In support of that effort, the archived data was recovered and this document prepared. The primary purposes of this report are to:

- Provide a summary of the radiological, chemical, and organic analyses from that sampling
- Provide a historical perspective for how the project was designed and conducted in 1988
- Provide a detailed description of the A-29 Ditch as it existed in 1988
- Describe the 1988 field sampling effort
- Document the UST analytical procedures and protocols
- Provide some perspective on the 1988 data with regard to current environmental circumstances.

All of this taken together can be utilized to assist in the development of Data Quality Objectives (DQO) in support of the proposed development for the Phase 1 Privatization Project.

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2.0 SITE DESCRIPTION

The 216-A-29 Ditch no longer exists in the configuration it exhibited during the 1988 sampling effort. Therefore, a detailed description of the ditch as it existed in 1988 is necessary in order to ascertain why, how, and where the ditch was sampled.

The 216-A-29 Ditch (hereafter referred to as the A-29 Ditch) is located east of the 200 East perimeter, outside of the security-fenced area. The open, head-end of the ditch was located approximately 300 m (900 ft) east of the 200 East fence. It then flowed in a northeasterly direction for approximately 1,363 m (4,360 ft) to empty into the 216-B-3-3 Ditch, which flowed into the 216-B-3 Pond (Figure 1). Open expanses of land dominated by relatively undisturbed expanses of sagebrush and cheatgrass were located on the eastern and western borders of the ditch. Although the majority of the ditch length was located outside 200 East security fence, it was still within the restricted portion of the Hanford site. Direct access to the ditch was restricted to site personnel, since it was "posted" as a low-level radioactive waste site. The posting required that a Radiation Protection Technician (RPT) be present for admittance to the site.

2.1 FACILITY DESCRIPTION

The A-29 Ditch was a man-made, unlined earthen ditch that was approximately 1,683 m (5,385 ft) long (total for piped and open sections) and had been in use since 1955. All discharge to the ditch occurred within the 200 East Area perimeter fence. The discharge point from the Plutonium Uranium Extraction (PUREX) chemical sewer line was located at the northeast corner of the AP Tank Farm (Figure 2). The line fed through a diversion box in a 38 cm (15 in.) vitrified clay pipe and into a 91 cm (36 in.) corrugated metal pipe 7.6 m (25 ft) long. It then discharged to the open ditch along a 3 m (10 ft) of concrete spillway.

The wetted portion of the ditch varied from about 0.6-m (2-ft) wide at the head-end to approximately 1.2-m (4-ft) wide at its mouth (Figure 3). The water depth varied from about 0.6 m (2 ft) at the head-end to 10 cm (4 in.) at the confluence with the 216-B-3-3 Ditch. The height and width of the banks varied greatly along the length of the ditch. The banks were about 1-m (3-ft) high at the lower end. The width of the ditch varied from 1.2 m (4 ft) at the ditch head to over 15.3-m (50-ft) wide at the lower end. Figure 3 provides an indication of the variability in the ditch dimensions as the water moved downstream.

2.2 WASTE STREAM INFORMATION

The A-29 Ditch received liquid waste from the PUREX Plant and directed it into the 216-B-3 Pond. Flow rates varied from 378 to 5,290 L/min (100 to 1,400 gal/min), with an average flow of 3,760 L/min (970 gal/min).

Figure 1. Location of the A-29 Ditch in Relation to Other 200 East Area Facilities.

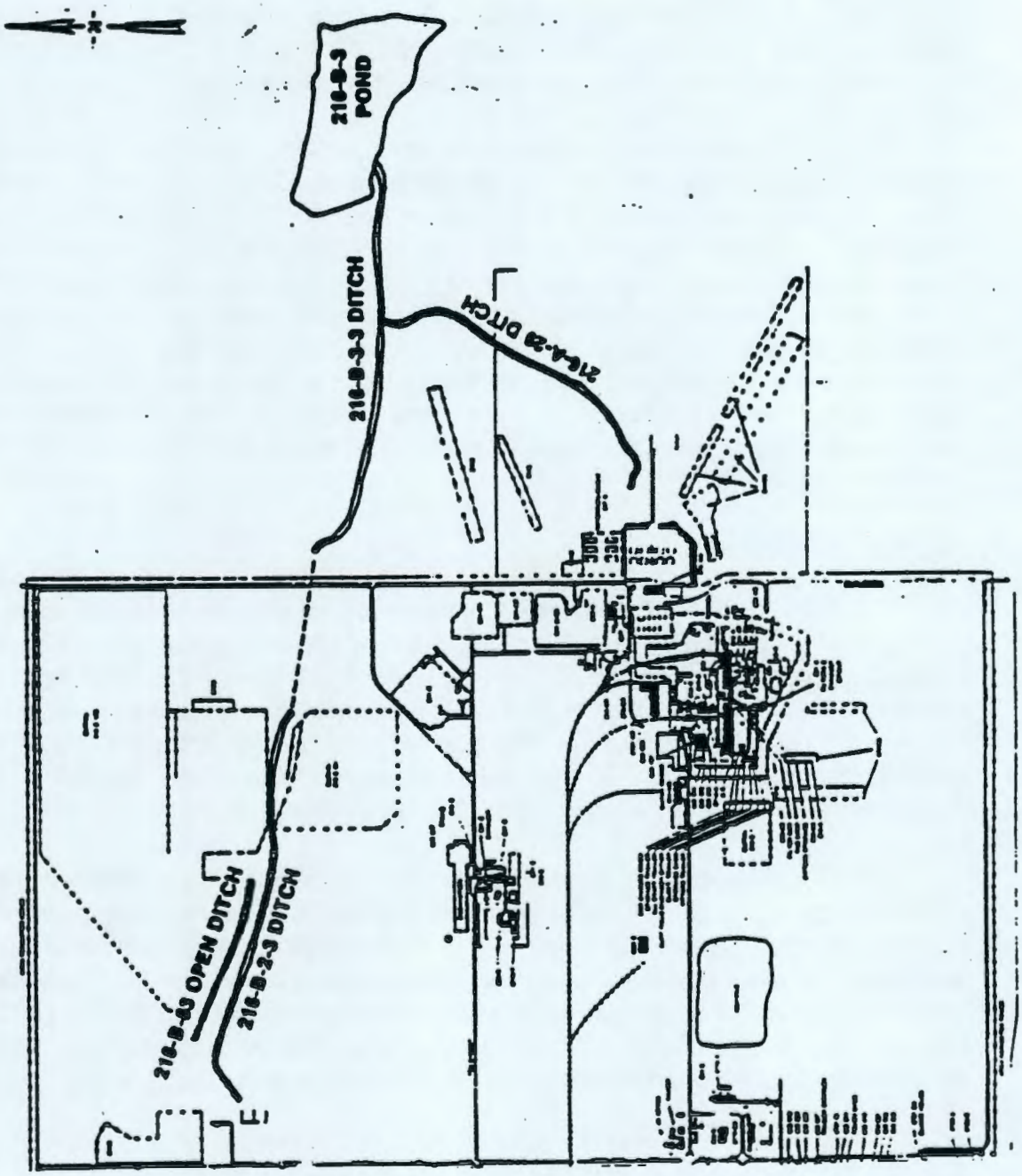
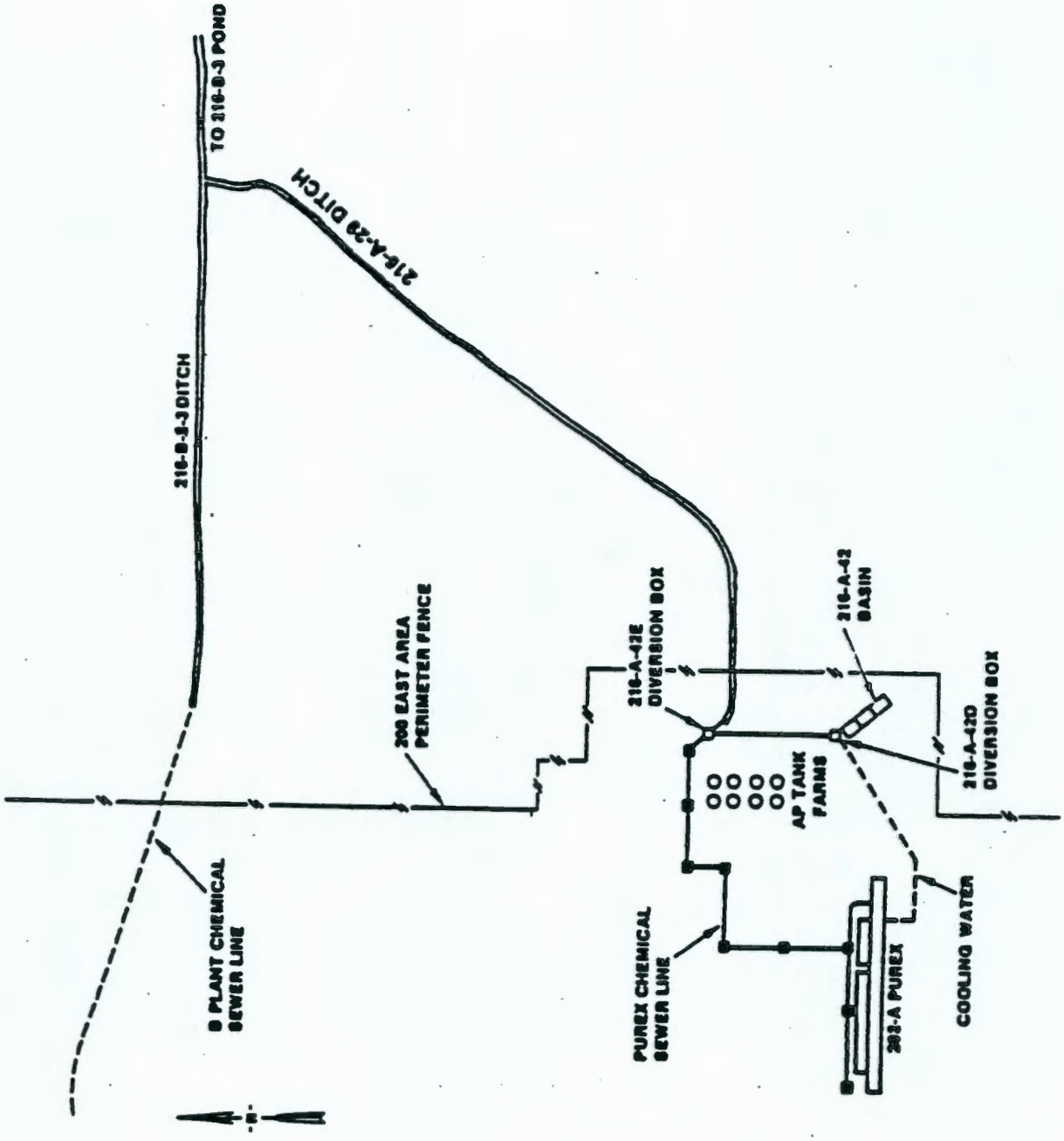


Figure 2. Schematic Diagram of A-29 Ditch Effluent Sources.



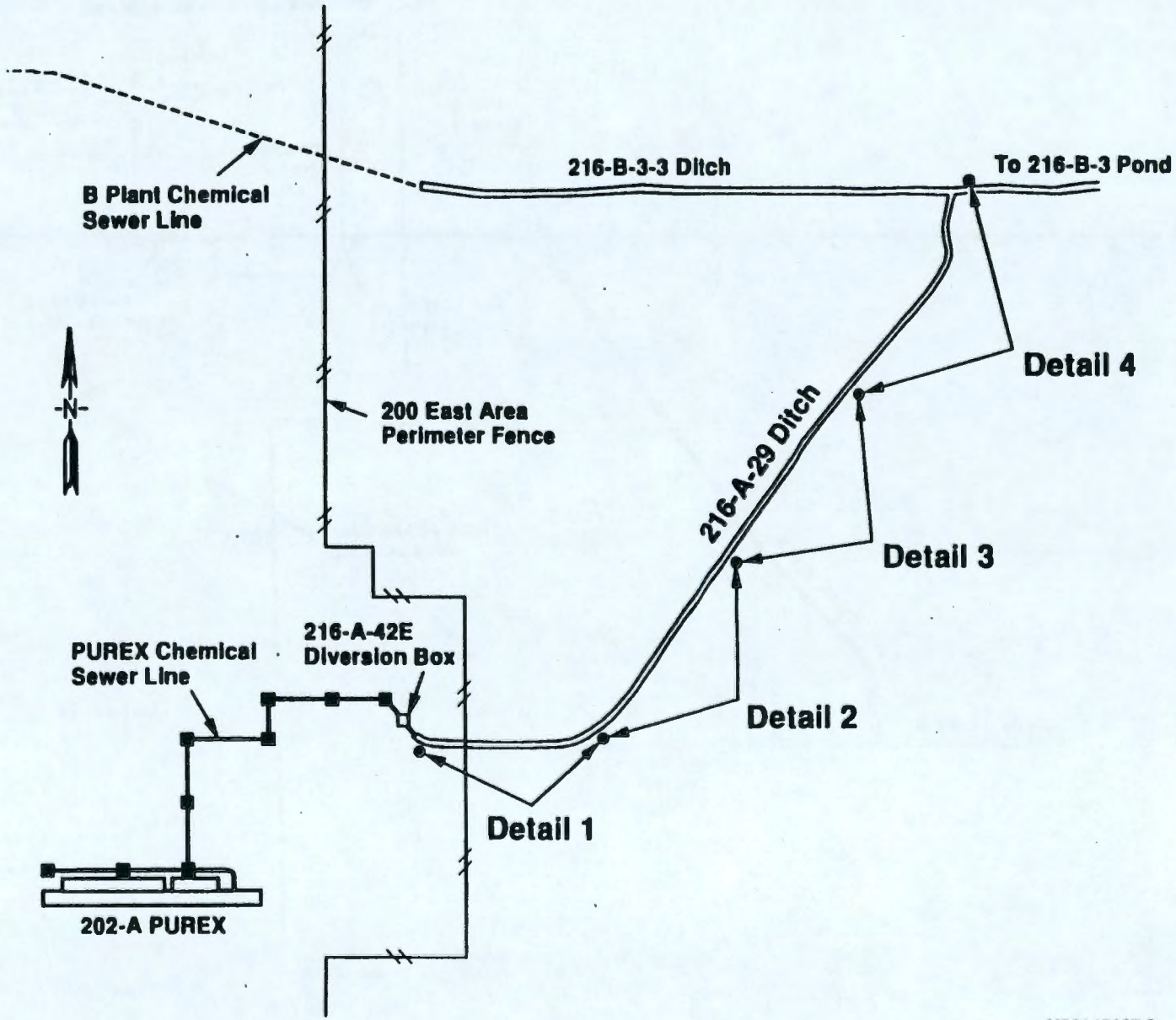


Figure 3a. Scale Map of the A-29 Ditch.

Figure 3b. Scale Map of the A-29 Ditch - Detail 1.

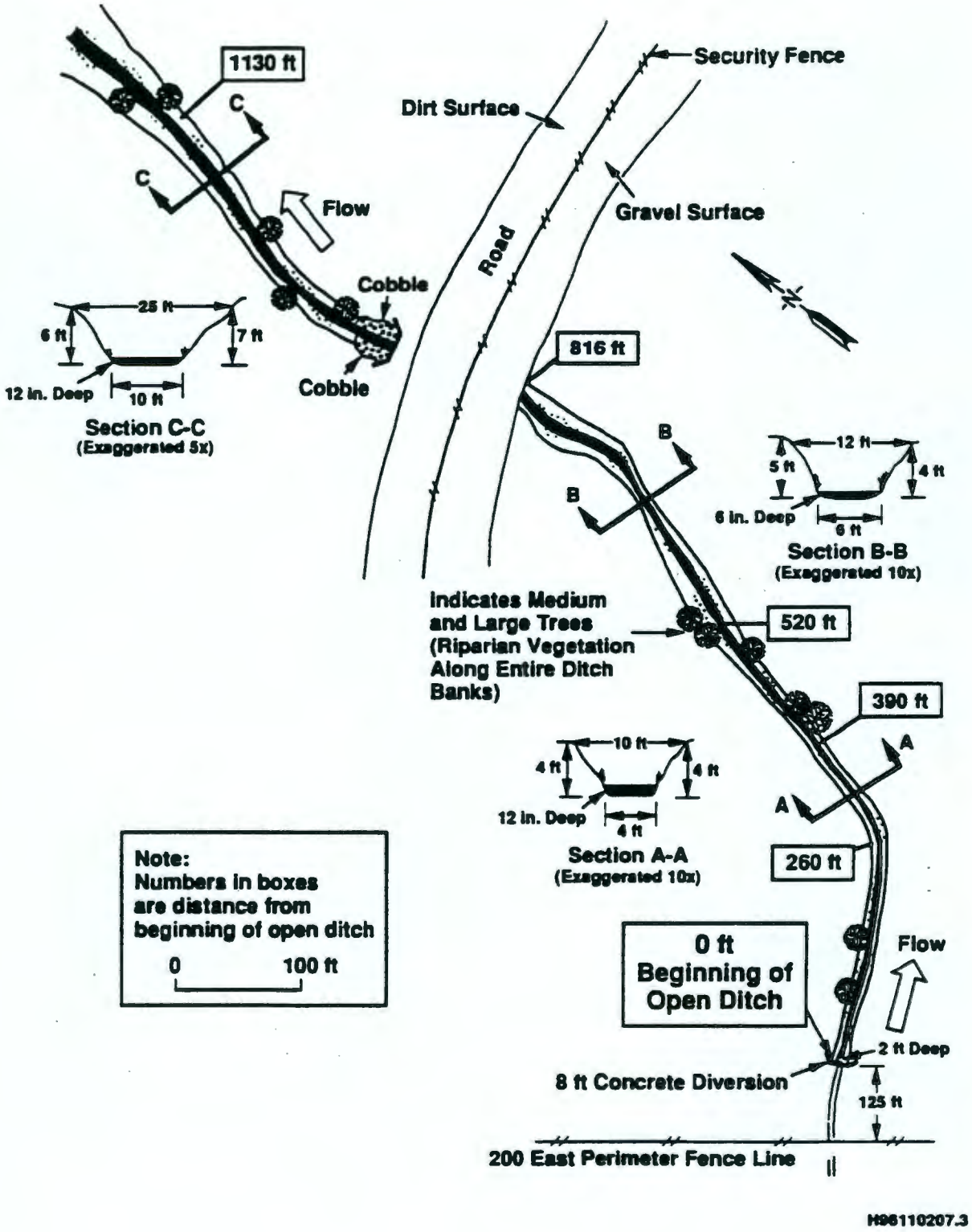


Figure 3c. Scale Map of the A-29 Ditch - Detail 2.

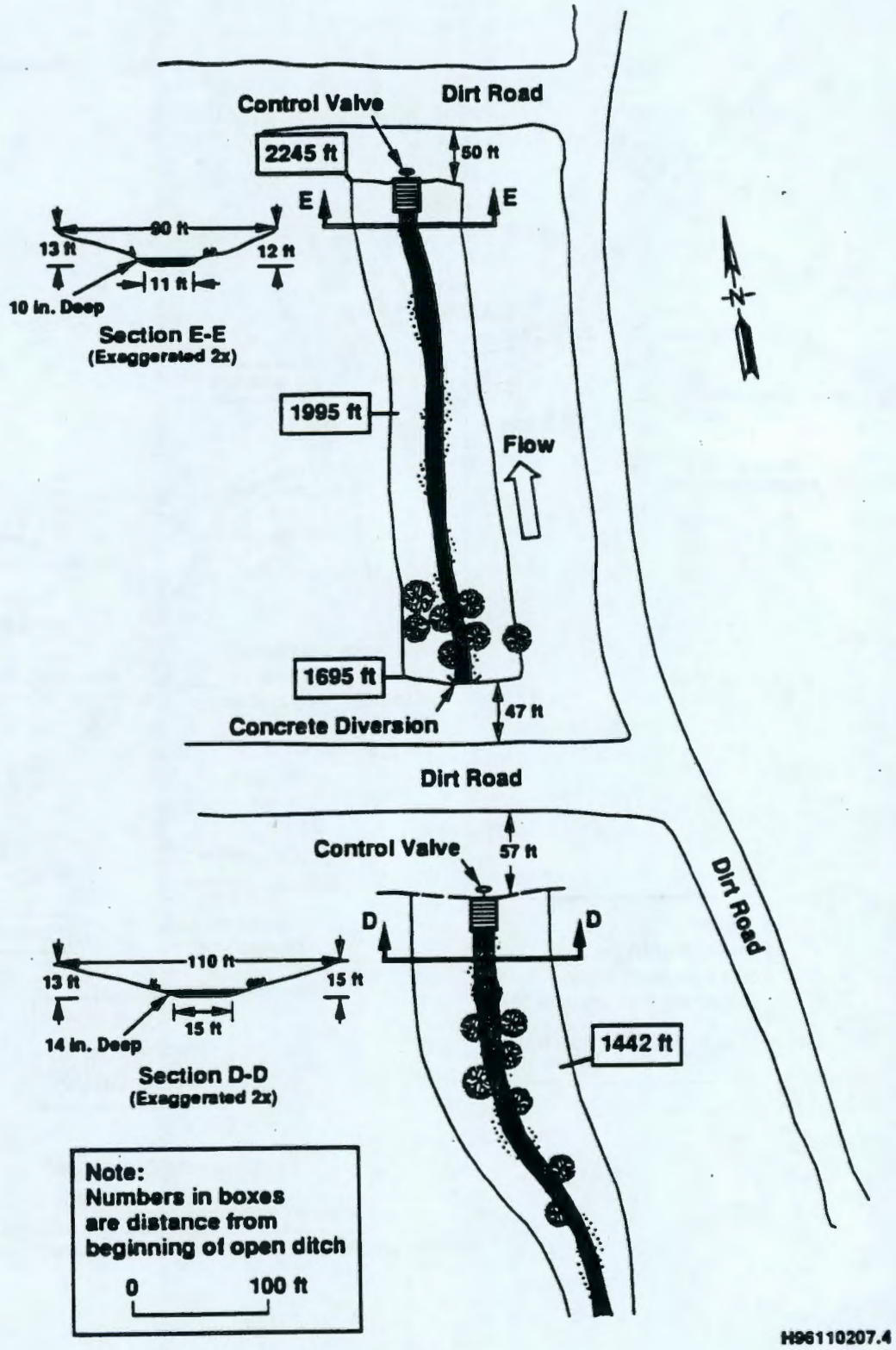


Figure 3d. Scale Map of the A-29 Ditch - Detail 3.

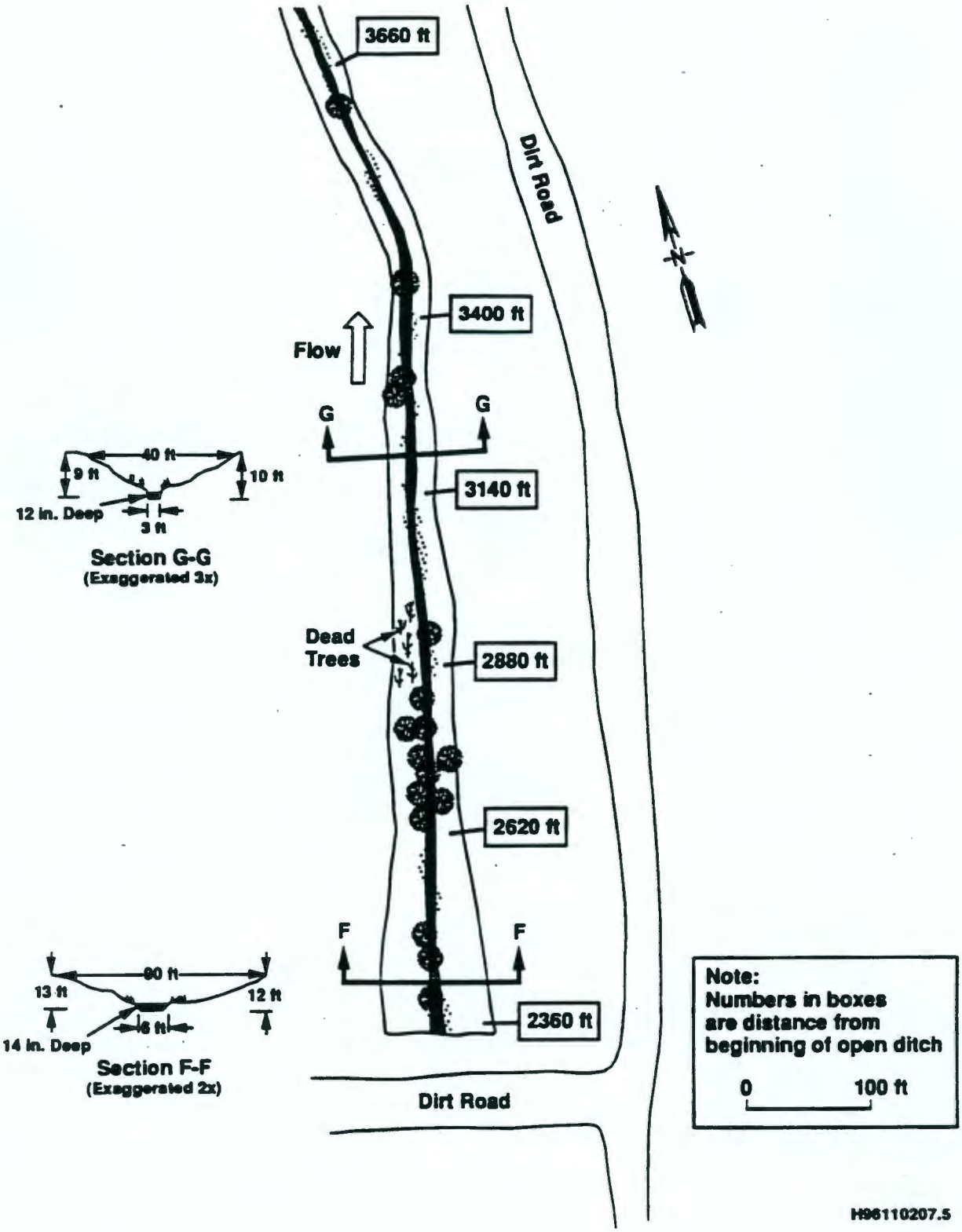
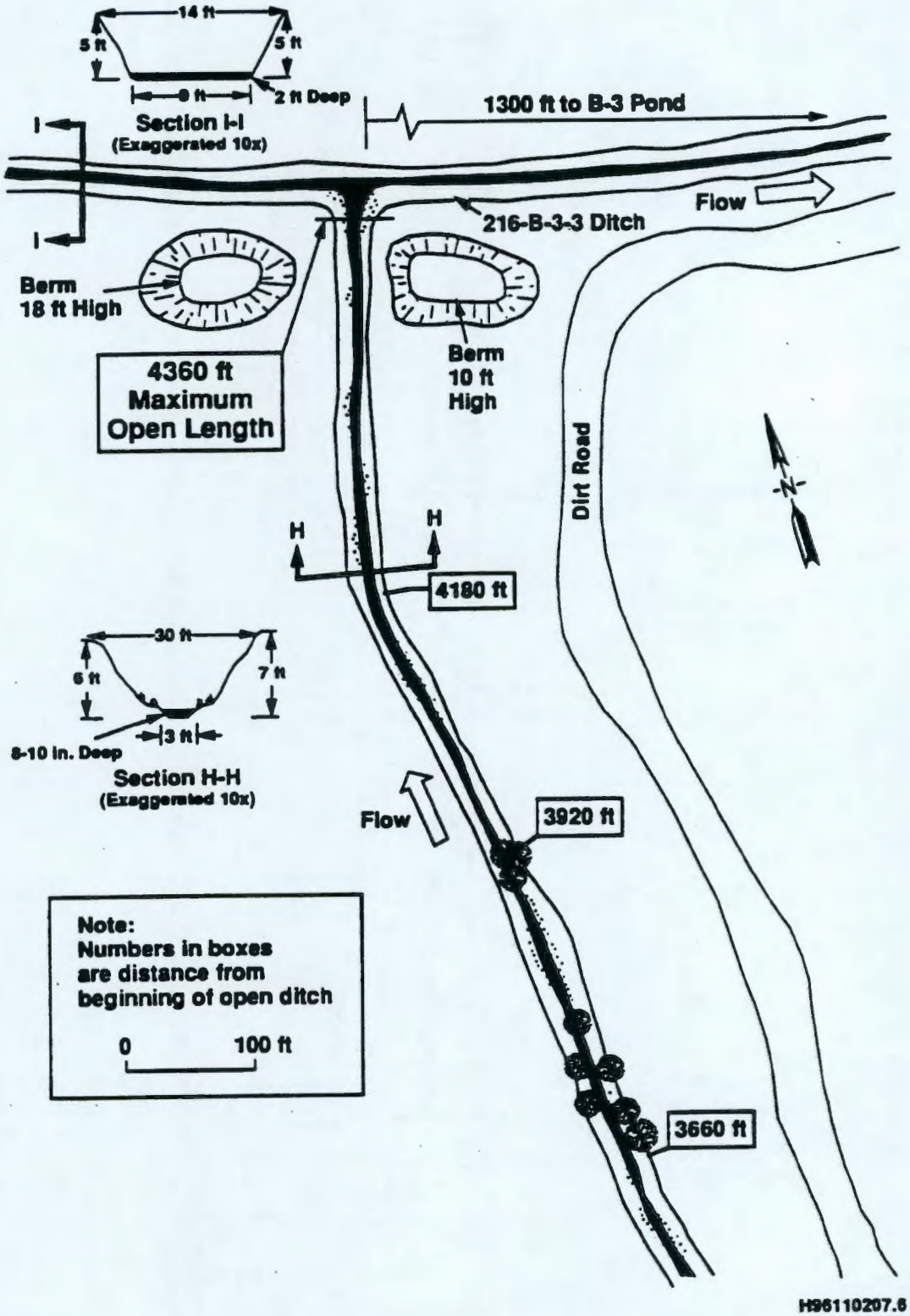


Figure 3e. Scale Map of the A-29 Ditch - Detail 4.



Prior to introduction of administrative controls to eliminate hazardous waste discharges, the A-29 Ditch received intermittent batches of spilled materials and/or off-specification chemicals. Additionally, routine corrosive effluent was discharged from the plant demineralizer regeneration system. Table 1 provides a summary of known and potential discharges to the ditch. The discharges of sodium hydroxide and sulfuric acid solutions from demineralizer operations occurred on a daily basis until February 1986.

The A-29 Ditch effluent had been sampled and analyzed for hazardous constituents. Data for 1985 through 1987 effluent sample periods are summarized in Table 2. The effluent did contain low-level radioactivity. These data indicated that this effluent was not a dangerous waste as defined in Washington Administrative Code (WAC) 173-303 (Ecology 1986).

2.3 HISTORICAL CHARACTERIZATION EFFORTS

A-29 Ditch had been a focus for routine sampling since 1976, to support the annual environmental surveillance reports for the 200 Areas radioactive waste sites. The values summarized in Tables 3 and 4 represent grab samples for ditch sediments and vegetation (not species specific) collected on an annual basis from the head-end of the ditch (Figure 3). Values ranged from less than detection limits to a high value of 127 pCi/gm in sediments for cesium-137. All of these values, with the exception of the 1984 value reported for Pu-239/240 in vegetation, were well below 200 Area soil standards (Boothe 1985).

In 1982, a radiological survey was conducted on the upper end of the A-29 Ditch in order to estimate the extent of contamination for removal prior to construction activities in the area. Sediment samples were collected from 5 shallow hand-cored ditch bottom borings to a depth of 0.9 to 1.2 m (3 to 4 ft) and auger borings along the ditch banks drilled to a depth of 3.7 m (12 ft). Radionuclides were analyzed utilizing the Mobile Radionuclide Analysis Laboratory (MRAL I). Radionuclide concentrations (gamma emitters) were determined to be at background levels, with the exception of cesium-137. The highest value for cesium-137 was found in the top (uppermost) sample from the ditch core samples; with a maximum observed value of 90 pCi/gm. The report in its entirety is included in Appendix C.

2.4 1988 SITE CONDITIONS

The riparian habitat which surrounded the A-29 Ditch was generally typical of the wetland communities created by man in the arid conditions of the shrub-steppe desert. The area immediately adjacent to the ditch was relatively undisturbed habitat consisting of sagebrush, cheatgrass, rabbitbrush, and various native grass species. Since the characterization efforts previously discussed were conducted, a number of projects had impacted the first 366 m (1,200 ft) of the open A-29 Ditch. A portion of this area was widened and the ditchbank removed to reduce contamination during construction of the 241-AP Tank Farm. The PUREX

Table 1.

Table 1. 216-A-29 Ditch Known and Potential Discharges.

Waste	Date	Description
Demineralizer regenerant	1955 to February 1986	Characteristic (corrosive)
Aqueous makeup tank heels and off-specification batches	1955 to October 1984	Characteristic (corrosive and EP[a] toxic)
N Cell prestart testing (oxalic acid, nitric acid, hydrogen peroxide, calcium nitrate)	April 11, 1983 to August 7, 1983	Characteristic (corrosive)
Potassium permanganate, sodium carbonate solution	October 19, 1983	CERCLA[b]-reportable release
Hydrazine HN solution	June 6, 1984 September 13, 1984 October 2, 1984	CERCLA-reportable release
Potassium hydroxide	December 2, 1984	CERCLA-reportable release
Sodium nitrate	February 8, 1985	CERCLA-reportable release
Nitric acid	August 22, 1984 January 18, 1985 May 27, 1985 June 25, 1985 October 28, 1985	CERCLA-reportable release
Sodium hydroxide	February 26, 1984 November 19, 1984 August 6, 1985	CERCLA-reportable release
Cadmium nitrate	May 16, 1984 December 18, 1985	CERCLA-reportable release
Hydrazine	July 9, 1986	CERCLA-reportable release

[a]Extraction procedure.
[b]Comprehensive Environmental Response, Compensation, and Liability Act.

Table 2. A-29 Ditch Preliminary Effluent Analytical Data

Sample	1st	2nd	3rd	4th	5th
Sampling Date	08/22/85	06/06/86	12/19/86	03/18/87	04/06/87
US Testing Number	50002	50054	50204	50260	50273
Stream Fraction	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00
Aluminum	<1.5E+02	2.0E+02	<1.5E+02	<1.5E+02	<1.5E+02
Ammonium	4.5E+02	<5.0E+01	1.2E+02	<5.0E+01	<5.0E+01
Antimony	<1.0E+02	<1.0E+02	<1.0E+02	<1.0E+02	<1.0E+02
Barium	3.4E+01	2.4E+01	3.1E+01	2.6E+01	2.4E+01
Beryllium	<5.0E+00	<5.0E+00	<5.0E+00	<5.0E+00	<5.0E+00
Cadmium	7.0E+00	<2.0E+00	<2.0E+00	<2.0E+00	<2.0E+00
Calcium	1.9E+04	1.4E+04	2.0E+04	2.1E+04	2.0E+04
Chromium	1.4E+01	<1.0E+01	<1.0E+01	<1.0E+01	<1.0E+01
Copper	8.0E+01	<1.0E+01	2.8E+01	<1.0E+01	<1.0E+01
Iron	<5.0E+01	2.2E+02	5.0E+01	6.8E+01	6.0E+01
Lead	<3.0E+01		<5.0E+00	<5.0E+00	
Magnesium	3.5E+03	3.2E+03	4.7E+03	4.7E+03	4.2E+03
Manganese	1.0E+01	1.3E+01	<1.0E-01	5.0E+00	<5.0E+00
Mercury	<1.0E-01	<1.0E-01	<1.0E-01	1.5E-01	
Nickel	1.6E+01	<1.0E+01	<1.0E+01	<1.0E+01	<1.0E+01
Potassium	6.1E+02	1.3E+03	8.2E+02	8.4E+02	7.4E+02
Silver	<1.0E+01	<1.0E+01	<1.0E+01	<1.0E+01	<1.0E+01
Sodium	3.1E+03	2.6E+03	1.2E+04	3.2E+03	2.0E+03
Strontium	<3.0E+02	<3.0E+02	<3.0E+02	<3.0E+02	<3.0E+02
Tin	<3.0E+02				
Uranium	4.8E-01	4.1E-01	4.2E-01	4.2E-01	
Vanadium	<5.0E+00	<5.0E+00	<5.0E+00	<5.0E+00	<5.0E+00
Zinc	4.7E+01	5.0E+00	1.0E+01	1.3E+01	7.0E+00
Chloride	1.2E+03	<5.0E+02	1.0E+03	1.2E+03	1.2E+03
Cyanide	<1.0E+01	<1.0E+01	<1.0E+01	<1.0E+01	<1.0E+01
Fluoride	2.8E+02	<5.0E+02	<5.0E+02	<5.0E+02	<5.0E+02
Nitrate	8.4E+02	<5.0E+02	5.4E+02	5.8E+02	<5.0E+02
Phosphate	<1.0E+03	<1.0E+03	<1.0E+03	<1.0E+03	<1.0E+03
Sulfate	1.0E+04	8.0E+03	1.2E+04	1.3E+04	1.1E+04
Acetone	6.7E+01				2.0E+02
Diisobutyl phthalate	2.0E+01				
pH (dimensionless)	8.1E+00	7.7E+00	8.56	7.12	8.52
Temperature (celsius)	3.3E+01	3.1E+01	1.6E+01	1.3E+01	2.5E+01
Alpha Activity (pCi/L)	4.9E-02	4.0E+00	6.0E-01	<1.8E-01	<4.2E-01
Beta Activity (pCi/L)	3.2E+00	2.3E+01	3.8E+00	4.9E+00	5.1E+00
Conductivity (uS/cm)	1.4E+02	1.3E+01	1.7E+02	1.1E+02	1.5E+02
Total Organic Carbon (ppb)	1.2E+03	2.5E+03	1.3E+03	1.2E+03	1.3E+03
Total Organic Halide (ppb)	<1.0E+02	1.7E+01	3.1E+01	2.8E+01	
Sulfide	<1.0E+03	1.3E+03	HTE	<1.0E+03	

Legend: Analyte concentrations are in ppb. Result notations include data that were not recorded (NR) and measurements by methods that were not in control (NIC) at the time of the measurement and measurements made after holding times were exceeded (HTE).

Table 3. Summary of Radionuclide Values for Grab Samples of Surface Sediments Collected from the A-29 Ditch. Data are from RHO Annual Environmental Surveillance Reports.

	Radionuclide (pCi/gm dry weight)				
Year	^{90}Sr	^{137}Cs	$^{239/240}Pu$	^{241}Am	^{60}Co
1986	1.4	127.0	9.7	ND[a]	LTD[b]
1985	1.9	33	22	ND	ND
1984	6.8	3.0	<1	<2	ND
1983	4.8	22.0	0.8	<6	ND
1982	ND	<3.0	0.35	2.8	ND
1981	3.7	9.3 ± 2.1	26.0	LTD	9.4 ± 2.5
1980	23.0	<2.0	0.5	0.4	ND
1979	2.9	2.1	<1.0	<9.2	ND
1978	3.5	7.8	2.8	0.9	LTD
1977	9.7	4.9	0.05	LTD	ND
1976	----------No samples collected----------				
200 Area Soil Standards[c]	400.0	400.0	60.0	300.0	300.0

a ND = No data available

b LTD = Less than detection limits

c Boothe, 1985

Table 4. Summary of Radionuclide Values for Grab Samples of Aquatic Vegetation Collected from the A-29 Ditch. Data from RHO Annual Environmental Surveillance Reports.

	Radionuclide (pCi/gm dry weight)				
Year	^{90}Sr	^{137}Cs	$^{239/240}Pu$	^{241}Am	^{60}Co
1986	3.5	<1	0.2	ND[a]	ND
1985	<1	<1	<1	ND	ND
1984	4.1	91	98	<5	LTD[b]
1983	0.5	15.0	19.0	<9.0	LTD
1982	0.8	27.4 ± 0.9	23.0	2.6	LTD
1981	1.4	9.2 ± 0.5	1.5	LTD	LTD
1980	<1	4.7	3.2	9.9	LTD
1979	45.1	8.6	14.4	<8.4	LTD
1978	0.7	8.1	18.2	4.8	LTD
1977	0.54	2.4	LTD	13.6	LTD
1976	LTD	8	15	10	LTD
200 Area Soil Standards[a]	400.0	400.0	60.0	300.0	300.0

a ND = No data available

b LTD = Less than detection limits

c Boothe, 1985

Plant had subsequently restarted increasing the flow rate through the ditch. Development of the Grout Facility had resulted in construction activities near the upper end of the ditch, including new roads and the fences indicated in Figure 3.

The flow rate of water in the ditch was moderate at approximately 3,780 L/min (1,000 gal/min) and the depth of water varied from about 0.6 m (2 ft) to 10 cm (4 in.). Areas of open water were limited and mostly located in the rechanneled, upper portion of the ditch. the remainder of the wetted portion of the ditch was overgrown with cattails, bulrushes, sedges, horsetail, speedwell, smartweed, and wild lettuce. Trees varying from 1.2 to 9.2 m (4 to 30 ft) in height were comprised primarily of peachleaf willow, sandbar willow, black cottonwood, and an occasional mulberry and dominated the ditch along its entire length (Figure 3).

The depth to groundwater was estimated to be approximately 82 m (270 ft) at the head-end and 52 m (170 ft) at the point the ditch emptied into the 216-B-3-3 Ditch.

Following the development of an engineering alternative for the rerouting of A-29 Ditch effluents to B-Pond, the A-29 Ditch was retired and covered with backfill soil in 1991/1992 (Smith 1992)

3.0 ANALYTICAL PARAMETERS

The UST company served as the Hanford Site contractor for analyses of environmental samples collected on site in 1988. All samples collected were preserved as per the applicable procedures and shipped to the UST Facility in Richland, Washington.

The parameters sampled for in soils and sediments collected at the A-29 Ditch were determined based on the following:

- General lack of information on hazardous waste constituents in effluents prior to 1983
- Reported releases of acids and bases
- Reported releases of calcium, nitrate, potassium permanganate, hydrazine, sodium nitrate, and cadmium nitrate.

Therefore, the samples from the A-29 Ditch were analyzed for a broad spectrum of water quality, groundwater quality, and Appendix VIII constituents. Also, a previous report (Riley et al. 1986) had identified the presence of low, but detectable quantities of PCBs (range - 6 to 230 μ/kg) in B-pond sediments. Therefore, although not reported to be a constituent of A-29 Ditch effluents, samples were also analyzed for PCBs. Table 5 summarizes these parameters. Additional information on analytical procedures and individual hazardous waste constituents is contained in the following procedures section and in Appendices A and B.

3.1 ANALYTICAL PROCEDURES

Analytical services for hazardous waste constituents in environmental media were conducted by the UST, Richland Division. All laboratory work aspects were covered by procedures, Quality Assurance and Quality Control Manuals. These manuals were:

Procedure Manual UST-RD-PM-9-80, Rev. 3, 03/86.

Counting Room Operating Procedures UST-RD-PM-9-80, Rev 2, 02/86.

Quality Control Manual UST-RE-QC-9-80, Rev. 4, 09/86.

Quality Assurance Manual UST-RD-QA-7-80, Rev. 7, 03/86.

Whenever available, SW-846 methods (EPA, 3rd ed., 1986 "Test Methods for Evaluating Solid Waste Physical/Chemical Methods") were used. Where SW-846 did not provide sufficient information to analyze for a particular constituent, another standard method (EPA) was used. Table 6 contains a summary comparison of the SW-846 and UST methods. Detailed information for each of these methods is provided in Section 3.2, Analytical Methods. A listing of individual analytes, as well as laboratory QA/QC methods, are presented in Appendices A and B.

Table 5. Analytical Parameters for Selected Soils Samples from A-29 Ditch.

pH	Osmium
Conductivity	Strontium[a]
Mercury	Zinc[a]
Ethylene glycol	Calcium[a]
Enhanced thiourea	Magnesium[a]
Total organic carbon	Nitrate
Total organic halides	Sulphate
cyanide	Chloride
Barium[a]	Fluoride
Cadmium[a]	Phosphate
Chromium[a]	Phosphate pesticides
Lead[a]	Chlorinated pesticides
Silver[a]	Arsenic
Sodium[a]	Ammonium
Nickel[a]	Selenium
Copper[a]	Thallium
Vanadium[a]	Uranium
Antimony[a]	Sulfide
Aluminum[a]	Chlorinated herbicides
Manganese[a]	VOA enhanced
Potassium[a]	Gross beta
Iron[a]	Gross alpha
Beryllium[a]	polychlorinated biphenyls

[a]Inductively coupled plasma metals.

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Table 6. Comparison of U.S. Environmental Protection Agency and U.S. Testing Methods

Analysis	Analytes determined	Analytical method number	
		Environmental Protection Agency[a]	U.S. Testing Co., Inc.
Gross alpha	alpha emitters (TRU)	EPA 680/4-75-001	112
Gross beta	beta emitters	EPA 680/4-75-001	111
Metals	[b]	SW-846, No. 6010	726
Mercury	mercury	SW-846, No. 7470	A21
Uranium	uranium		U-03
Ammonia	NH_3	Standard Methods No. 417-A-E	C80
Anions	Cl^-, F^-, NO_3^-, SO_4^{2-}, PO_4^{3-}	In-house ion chromatography	C78
Total organic carbon	total organic carbon	Standard Methods No. 505	C69
Total organic halides	total organic halides	SW-846, No. 9020	C68
Volatile organics analysis	53 organics	SW-846, No. 8240	731
Extractable organics	141 organics	SW-846, No. 8270	733
Direct injection organic	23 organics		736
Cyanide	CN^-	SW-846, No. 9010	C70
Sulfide	S^{2-}	SW-846, No. 9020	C78
Temperature[c]			
pH[c]		SW-846, No. 9040	
Conductivity[c]			

[a]When EPA methods were not available, techniques from Standard Methods (16th edition) were used whenever possible.

[b]Aluminum, silver, barium, beryllium, calcium, cadmium, chromium, copper, iron, potassium, magnesium, manganese, sodium, nickel, osmium, lead, antimony, tin, strontium, vanadium, and zinc.

[c]Field measurement.

3.2 ANALYTICAL METHODS

A brief description of each of the analytical methods utilized for hazardous waste constituents is provided below (Hembree et al. 1986, UST 1986). The EPA and UST methods are in parentheses.

Gross Alpha

This measurement (EPA 680/4-75-001; UST No. 112) is made to assess the radiological hazard to laboratory personnel from alpha-emitting isotopes that may be present. An aliquot of sample is evaporated to dryness and counted in a gas flow counter.

Gross Beta

The possible radiological hazard to laboratory workers from beta/gamma emitters is evaluated with this procedure (EPA 680/4-75-001; UST No. 111). An aliquot is evaporated to dryness and counted on a gas flow counter.

Metals

Twenty-one metals are determined simultaneously by inductively coupled argon plasma (ICP) spectroscopy (SW-846/#6010; U.S. Testing No. 726). All of the priority pollutant metals except mercury are measured. Other metals determined are toxic and mandated by Ecology or are of general interest for waste classification and management. The analytes determined are:

- Aluminum
- Silver
- Barium
- Beryllium
- Calcium
- Cadmium
- Chromium
- Copper
- Iron
- Potassium
- Magnesium
- Manganese
- Sidum
- Nickel
- Osmium
- Lead
- Antimony
- Tin
- Strontium
- Vanadium
- Zinc.

Mercury

Cold vapor atomic absorption spectroscopy (SW-846/#7470; UST No. A21) is used to quantify mercury. Mercury is reduced to the elemental state and purged from the solution into a cell positioned in the light path of an atomic absorption spectrometer. Absorption at 253.7 nm is a function of mercury concentration.

Uranium

No SW-846 method for uranium analysis exits. An in-house method (UST 08 No. 20-U-03-01) consisting of uranium purification by solvent extraction or anion exchange and quantification by fluorometry was used.

Ammonia

No SW-846 method is provided for ammonia, so Standard Method (1985) No. 417-A-E (UST No. C80) is used. An ammonia selective electrode is used to quantify the ammonia after adjusting the sample pH to above 11. Ammonia is complexed by silver and mercury, causing a low bias.

Anions

Chloride, fluoride, nitrate, sulfate, and phosphate are determined by ion chromatography. This method was developed by UST (UST No. 78) and is similar to other methods published in the open literature. While no official EPA or Ecology methods are formalized both agencies use ion chromatography extensively. The sample, nominally 100 mL and containing a mixture of the anions, is injected into the chromatograph. With proper selection of experimental conditions, the anions exit the instrument singly and are detected through the electrical conductivity.

Total Organic Carbon

The total organic carbon (TOC) content of a sample is determined (Standard method No. 505; UST No. C69) to cross-check the specific organic compound analyses. If the TOC exceeds the sum of the individual organic compounds found, the significant quantities of organics are present but neither identified nor quantified. If the sample TOC is exceeded by the sum of the individual organics found, then at least one specific organic analysis is in error. The TOC does not identify or quantify any specific compound.

The sample aliquot is combusted quantitatively and the CO_2 generated is quantified by automatic titration. All values reported are the average of duplicate analyses.

Total Organic Halides

Total organic halides (chlorides, bromides, and iodides, but not fluorides are determined (SW-846/No. 9020; UST No. C68) by absorbing them from the sample onto activated charcoal. the activated charcoal is pyrolized to convert organic halides into inorganic halides and the halides are quantified by microcoulometric-titration. Sample bottles must have no headspace to

prevent loss of volatile compounds. As with TOC, this method reveals the presence of a class of compounds but identifies and quantifies none. These results are generated for comparison with specific organic analyses (volatile organic analyses, herbicides, pesticides, direct-injection organics, and acid/base/neutral extractable organics) to decide if additional analyses are needed. All reported data are the average of duplicate analyses unless stated otherwise.

Volatile Organic Analyses

Fifty-three organic compounds are simultaneously determined with this method (SW-846/No. 8240; UST No. 731). The list of compounds regulated by Ecology. The analytes are purged from the waste by an inert gas and trapped onto a sorbent column. After purging is complete, the sorbent column is heated to flush the compounds into a gas chromatograph/mass spectrometer (GC/MS) where they are identified and quantified. When the sample is collected, absolutely no headspace (air) is allowed in the sample bottle to prevent loss of volatile compounds.

Extractable Organics

One hundred forty-one organic compounds are identified and quantified by this method (SW-846/No. 8270; UST No. 733). The sample (usually 1 L) is extracted with methylene chloride under acidic, basic, and neutral conditions. The methylene chloride, containing the extracted organic compounds being determined, is injected into a GC/MS for identification and quantification. The compounds determined by this method are tested as EPA-priority pollutants and also include as many of those compounds listed by WAC-173-303-9905 (Ecology 1986) that UST can determine.

Total Cyanide

The sample is distilled, converting the cyanide into hydrogen cyanide which is trapped in NaOH solution. Quantification is accomplished by titration with silver nitrate (SW-846/ No. 9010; UST No. C70). Note: This method will not determine reactive cyanides in samples that contain significant concentrations of iron, which is the case with some Hanford wastes.

Sulfides

Total and dissolved sulfides (except acid insoluble sulfides such as CuS) are determined by this method (SW-846/No. 9030, UST No. C78). The sample is treated by the addition of excess iodine, which oxidizes sulfide to elemental sulfur in the acidified sample. Sodium thiosulfate or phenylarsine oxide is used to back titrate the remaining excess iodine.

Organochlorine Pesticides

Most organochlorine pesticides, and if desired, polychlorinated biphenyls (PCBs), are determined by this method (SW-846/No. 8080; UST No. 729). The pesticides are extracted from the sample (which is at neutral pH) with methylene chloride and then injected into a GC equipped with an electron capture detector. If peak identification is uncertain, the extracted pesticides are analyzed by GC/MS. Those data are of higher than usual quality because the EPA and Ecology protocol requires that every sample analyzed be spiked to determine the recovery and detection limit for that particular sample.

Organophosphorus Pesticides

This method (SW-846/No. 8140; UST No. 734) quantifies regulated phosphorus pesticides. Methylene chloride is used to extract the pesticides from the neutral sample. Gas chromatography using a phosphorus-specific detector or a mass spectrometer is used for the final quantification. Every sample is spiked to determine the detection limits, recovery, and freedom from analytical interference for each sample.

Chlorinated Herbicides

Common regulated chlorinated herbicides are determined with this method (SW-846/No. 8150; UST No. 737). These compounds are manufactured and used in various forms (acid, salt, ester, etc.). The method includes a hydrolysis step to convert all chemical forms into the acid before analysis.

The samples are spiked, hydrolized with KOH, acidified with H_2SO_4, extracted with diethyl ether, converted to methyl esters with diazomethane, and quantified by gas chromatography.

The method is tedious and requires vigilant and careful execution because of the use of diethyl ether and diazomethane.

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4.0 SAMPLING PROCEDURES FOR SOIL/SEDIMENT

4.1 APPLICABLE STANDARDS

Site investigations were conducted in accordance with applicable DOE Orders and Operations and Engineering Contractor Procedures, and the Occupational Safety and Health Administration (OSHA) requirements for Hazardous Waste Operations and Emergency Response. Sampling design, methods, equipment, preservation, quality control, and analytical procedures conformed to the degree practical, with the EPA guidance contained in SW-846 (EPA 1982).

1. DOE Order 5780.1A, "Environmental Protection, Safety, and Health Protection Program for DOE Operations."

2. DOE-RL Order 5480.1, "Environmental Protection, Safety, and Health Protection Program for Richland Operations."

3. DOE Order 5480.2, "Hazardous and Radioactive Mixed Waste Management."

4. DOE Order 5480.4, "Environmental Protection, Safety, and Health Protection Standards."

5. DOE-RL Order 5480.4, "Environmental Protection, Safety, and Health Protection Standards."

6. DOE-RL Order 5480.11, "Requirements for Radiation Protection."

7. DOE Order 5480.14, "Comprehensive Environmental Response, Compensation, and Liability Act Program."

8. DOE Order 5484.1, "Environmental Protection, Safety, and Health Protection Information reporting Requirements."

9. DOE-RL Order 5484.1, "Environmental Protection, Safety, and Health Protection Information reporting Requirements."

10. DOE Order 5700.6A, "Quality Assurance."

11. DOE-RL Order 5700.1A. "Quality Assurance."

12. RHO-GM-MA-2, Volume 1, Book 2, Section 14, "Records Management."

13. RHO-GM-MA-2, Volume 3, Book 1, Section 31, "Management Control System."

14. RHO-GM-MA-2, Volume 3, Book 2, Section 33, "Performance Assessment and Analysis."

15. RHO-GM-MA-2, Volume 4, Book 1, Section 43, "Operations."

16. RHO-GM-MA-2, Volume 5, Book 2, Section 52, "Property," Section 53, "Procurement," and Section 54, "Shipping and Receiving."

17. RHO-GM-MA-2, Volume 6, Book 1, Section 61, "Safety," and Section 62, "Environment."

18. RHO-GM-MA-2, Volume 6, Book 2, Section 63, "Emergency Situation," and Section 64, "Health."

19. Title 42 USC 6901, et. seq., "Resource Conservation and Recovery Act of 1976 (RCRA), as amended.

20. Title 42, USC 9601, et. seq., (Superfund), "Comprehensive Environmental Response, Compensation, and Liability Act of 1980."

21. Pub. L. 99-499, "Superfund Amendments and Reauthorization Act of 1986" (SARA).

22. Title 29, USC 655, 657, "Occupational Safety and Health Act of 1970" (OSHA).

23. 29 CFR 1910, "Hazardous Waste Operations and Emergency Response," OSHA Interim Final Rule, Federal Register, Vol. 51, No. 244, December 19, 1986.

4.2 SAMPLE DESIGN

The sampling design and strategy was based on the sampling plan development information contained in SW-846 (EPA 1982) and other EPA guidance manuals and technical documents (DeVera et. al 1980; Mason 1983; Barth and Mason 1984; EPA 1983; Ford et al. 1984; Ford and Torina 1985). Based on the configuration of the site and the environmental conditions that existed there, the sampling strategy was proposed to characterize the sediments of the A-29 Ditch. The primary objectives of this sampling effort were to:

- Determine whether or not the soils and sediments of the ditch contained hazardous waste constituents

- Determine which specific hazardous constituents might be present in significant quantities and their concentrations

- Provide data and information for input to a future technical assessment of closure options for this unit.

4.3 GUIDANCE DOCUMENTS

A number of guidance documents and resource publications have been developed for use in preparing, designing, and executing adequate soil sampling program. The following were used where appropriate:

Samplers and Sampling Procedures for Hazardous Waste Streams, 1980, EPA-600/2-80-018

Characterization of Hazardous Waste Sites - A Methods Manual, 1984, EPA-600/4-84-076

Preparation of Soil Sampling Protocol: Techniques and Strategies, 1983, EPA-600/4-83-020

Soil Sampling Quality Assurance User's Guide, 1984, EPA-600/4-84-043.

4.4 SAMPLE LOCATIONS

The open portion of the ditch, which is approximately 1,330 m (4,360 ft) long, was divided into two sections to facilitate a stratified sampling approach. The upper head-end section of the ditch, which comprised the first 732 m (2,400 ft), received more intensive scrutiny because of the higher probability that various types of hazardous waste could concentrate in the sediments and soils of this section. The principle reasons for this rational were the greater depth of water in this upper section, lower flow rates when PUREX was not operating, and low water-flow speed because of the relatively small drop in gradient compared with the lower ditch area. Six sample sites were located along this section. An additional four samples sites were located along the lower 609 m (2,000 ft) of A-29 Ditch.

4.5 SAMPLE CONTAINERS AND PRESERVATION

Containers for hazardous waste samples were chosen based on their compatibility with the waste, resistance to leaking or breakage, ability to seal tightly, and required volume for an optimum sample. Containers for collecting and sorting hazardous waste samples were made of high-density plastic or glass bottles. The containers had tight, screw-type lids with Teflon or plastic liners. Table 7 contains a summary of the types and volumes used in the sample analysis. Table 8 contains a summary of the containers and preservation utilized for soil and sediment samples.

Table 7. Sample Preservation Details.

Analyte	Sample volume	Container/lid	Preservation[a]
Gross alpha	1 L	plastic/Teflon	2 mL HNO_3
Gross beta	1 L	plastic/Teflon	2 mL HNO_3
Metals[b]	250 mL	plastic/Teflon	0.5 mL HNO_3
Mercury	250 mL	plastic/Teflon	0.5 mL HNO_3
Ammonia	250 mL	glass/Teflon	0.5 mL H_2SO_4
Anions[c]	250 mL	plastic/Teflon	none
Total organic carbon	250 mL	glass	0.5 mL H_2SO_4
Total organic halide	250 mL	glass[d]	0.5 mL H_2SO_4
Volatile organics analysis	40 mL	glass[d]	none
Extractable organics[e]	1 L	glass/Teflon	none
Direct injection organics	10 mL	glass/Teflon	none
Cyanide	1 L	plastic/Teflon	2 mL 6M NaOH
Sulfide	1 L	plastic/Teflon	2 mL 6M NaOH, 2 mL 1 wt/vol% zinc acetate
Uranium	1 L	plastic/Teflon	2 mL, HNO_3

[a]All samples shall be cooled to 4 °C upon collection.

[b]Aluminum, silver, barium, beryllium, calcium, cadmium, chromium, copper, iron, potassium, magnesium, manganese, sodium, nickel, osmium, lead, antimony, tin, strontium, vanadium, and zinc.

[c]Chloride, fluoride, nitrate, sulfate, and phosphate.

[d]Glass container with silicone/Teflon septa, no headspace.

[e]From acidic, basic and neutral sample solutions.

Table 8. Sample Containers, Preservation Requirements, and Holding Times for Soil Samples. (sheet 1 of 2)

Contaminant	Container	Preservation	Holding time
Acidity	P, G	Cool, 4°C	14 d
Alkalinity	P, G	Cool, 4°C	14 d
Ammonia	P, G	Cool, 4°C	28 d
Sulfate	P, G	Cool, 4°C	28 d
Sulfide	P, G	Cool, 4°C	28 d
Sulfite	P, G	Cool, 4°C	48 h
Nitrate	P, G	Cool, 4°C	48 h
Nitrate-Nitrite	P, G	Cool, 4°C	28 d
Nitrite	P, G	Cool, 4°C	48 h
Oil and grease	G	Cool, 4°C	28 d
Organic carbon	P, G	Cool, 4°C	28 d
Metals			
Chromium VI	P, G	Cool, 4°C	48 h
Mercury	P, G		28 d
Metals except above	P, G		6 mo
Organic Compounds			
Extractables (including phthalates, nitrosamines organochlorine pesticides, PCBs nitroaromatics, isophorone, Polynuclear aromatic hydrocarbons, haleothers, chlorinated hydrocarbons and TCDD)	G, teflon-lined cap	Cool, 4°C	7 d (until extraction) 30 d (after extraction)
Extractables (phenols)	G, teflon-lined cap	Cool, 4°C	7 d (until extraction) 30 d (after extraction)
Purgables (halocarbons and aromatics)	G, teflon-lined septum	Cool, 4°C	14 d
Purgables (acrolein and acrylonitrate)	G, teflon-lined septum	Cool, 4°C	3 d
Orthophosphate	P, G	Cool, 4°C	48 h
Pesticides	G, teflon-lined cap	Cool, 4°C	7 d (until extraction) 30 d (after extraction)

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Table 8. Sample Containers, Preservation Requirements, and Holding Times for Soil Samples. (sheet 2 of 2)

Contaminant	Container	Preservation	Holding time
Phenols	P, G	Cool, 4°C	28 d
Phosphorus (elemental)	G	Cool, 4°C	48 h
Phosphorus (total)	P, G	Cool, 4°C	28 d
Chlorinated organic compounds	P, G	Cool, 4°C	7 d (until extraction) 30 d (after extraction)

P = Polyethylene.
G = Glass.

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Sample preservation should be performed immediately upon sample collection. For composite samples each aliquot should be preserved at the time of collection. When impossible to preserve each aliquot, then samples may be preserved by maintainin at 4°C until compositing and sample splitting is completed.

Samples shold be analyzed as soon as possible after collection The times listed are the maximum times that samples may be held before analysis and still considered vaild. Samples may be held for samples under study are stable for the longer time

For additional information, see Ford et al. (1983).

4.6 SAMPLE PLAN MODIFICATIONS

Under field conditions, the optimal aspects of preliminary sample design were not always achievable. Factors influencing these efforts were occasional equipment malfunction, adverse weather conditions, soil conditions, and physical barriers to coring equipment. Therefore, modifications to the proposed sample design sometimes became necessary. These changes, all of which were minor, were noted in the field logbook, and did not affect the quality of the field data or sampling efforts.

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5.0 FIELD ACTIVITIES

The sampling for A-29 Ditch was initiated on May 24, 1988. A team of four scientists and an RPT comprised the sampling team. Following a safety meeting, sampling was initiated at sample site 1 shown in Figure 4. A portable wooden bridge was utilized to place over the flowing portion of the ditch and the sample was collected from the middle of the ditch using a stainless-steel hand auger. The auger head was 7.6 cm (3 in.) in diameter and 33 cm (13 in.) long. An initial sample was collected from the surface sediments to a depth of 30 cm (12 in.) whenever possible. Gravelly areas would occasionally not allow penetration to the full 30 cm (12 in.). Whenever possible, a second sample was collected to the greatest depth the auger could penetrate; which was usually 61 to 91 cm (24 to 36 in.) Secondary samples to depth were only possible at sites 1, 2, 3, and 9 (Figure 4). A complete summary of the sample depths is provided with the sample data summaries discussed in the following sections.

Pre-cleaned augers were utilized for each sample. A volatile organic detector was used to provide a check on each sample as it was pulled. There were no positive readings above background levels for any of the samples collected. Samples from sites 1 and 2 were collected on May 5, 1988. After these sites were sampled, it was necessary to resume sampling at the southern end of the ditch due to the fence shown in Figure 4. Subsequent samples were collected from the furthest points downstream (sample sites 3 through 10, Figure 4) to reduce the possibility of any cross contamination of upstream samples.

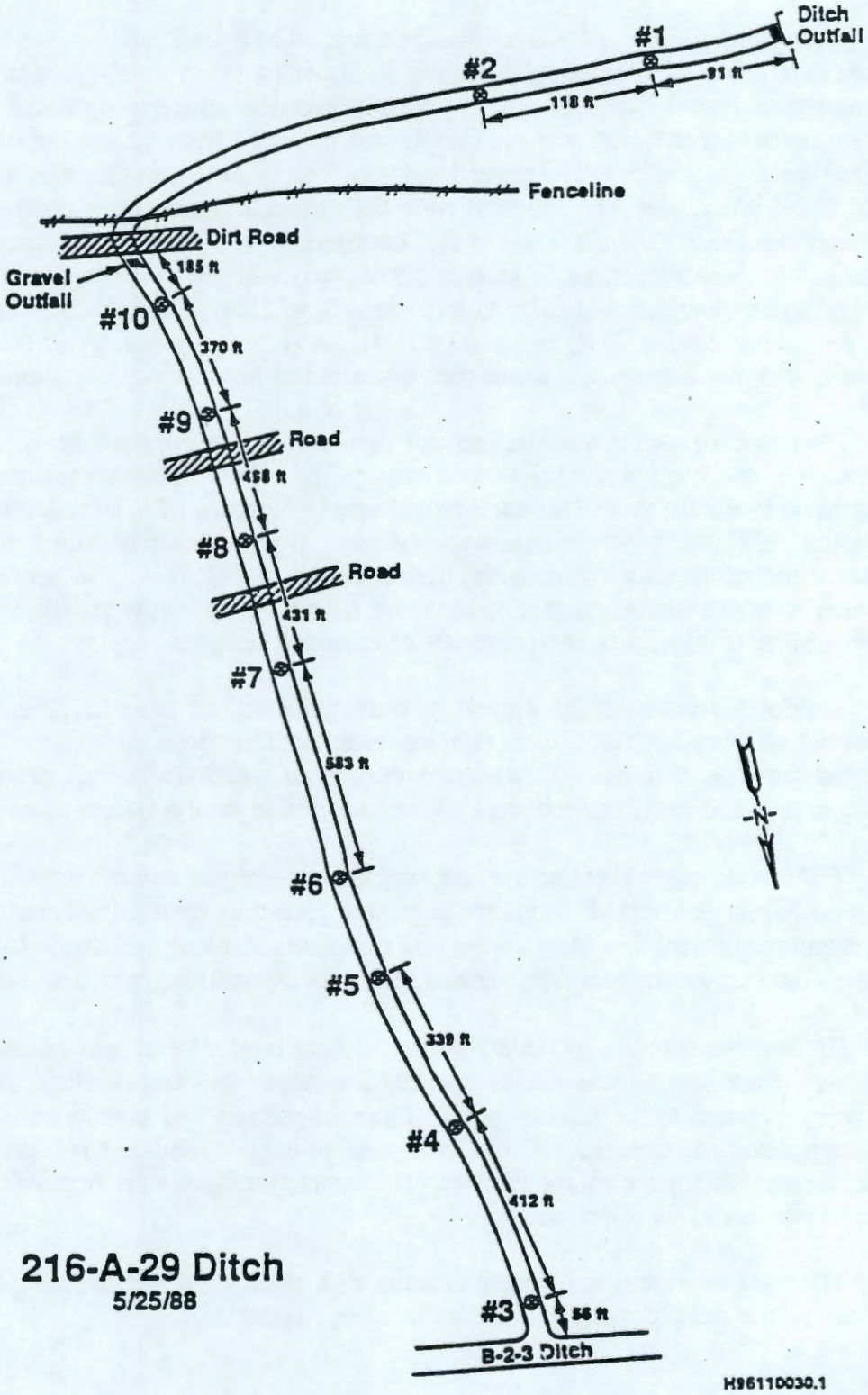
Samples from sites 3, 4, and 5 were collected on May 25, 1988. Sampling was concluded on May 26, 1988, with samples collected from sites 6, 7, 8, 9. and 10. Samples collected from sites 7 and 10 were the only ones which registered radioactivity readings (300 cpm and 150 cpm, respectively) above background on the Geiger-Mueller (GM) counter.

Following sample collection, the appropriate sample bottles were filled, the exterior wiped down, labeled, sealed in plastic bags, and placed in coolers containing "blue" ice. For each sample collected, a field data sheet was completed showing the sample location, the sample number, time collected, sampling method, name of the sampler, and field notes as needed.

Before transporting to the laboratory, a tamper-proof seal was placed on each sample container. Each sample was double checked for proper seal and labeling. All pertinent field data were recorded in the field logbook. Chain-of-custody and sample analysis request forms were completed and checked. All samples were re-bagged (double bags) and placed on ice or "blue" ice until they were shipped offsite. The sample locations were marked using a surveyor's stake so they could be relocated.

The field sampling information, along with photographs of the sample locations, were recorded in the field logbook and are included in Appendix D.

Figure 4. A-29 Ditch Sample Locations.



6.0 RESULTS AND DISCUSSION

This section provides a summary of the laboratory analyses data reported for contaminants of concern, which included radionuclides (total alpha, total beta, cesium-137, cobalt-60, total uranium), metals (strontium, zinc, barium, cadmium, chromium, silver, lead, nickel, copper, mercury, arsenic, and selenium), and organic compounds.

6.1 RADIONUCLIDES

For this effort, the sediments were sampled for total alpha, total beta, and total uranium concentrations as well as gamma-emitting radionuclides such as cobalt-60 and cesium-137. Summaries of the radionuclide data for the A-29 Ditch sediments are contained in Tables 9 and 10.

The three highest values reported in the data set for total alpha and total uranium were from sample sites 7, 9, and 10 (Figure 4) and two of the three highest readings for total beta were from sites 7 and 10 (Table 9). One of the higher values for total beta was from site 2 near the head-end of the ditch. The highest value reported for cobalt-60 was also from site 2, although most of the cobalt values were below detection limits.

The cesium-137 values demonstrated the greatest amount of variability, with site 10 being the highest reported value (140 pCi/g) and sites 2, 5, 7, 8, and 9 having values in excess of 40 pCi/g. The 140 pCi/g at site 10 exceeded the highest reported cesium-137 value (127 pCi/g) collected in 1986 by the routine monitoring program for A-29 sediment samples (see Table 3).

All of the values reported were below the existing 200 Area soil standards (Booth 1985) of 400 pCi/g for cesium-137 and 300 pCi/g for cobalt-60.

6.2 METALS

There is a paucity of information relative to the concentrations of metals in Hanford Site soils. The most extensive information for the Hanford Site is the Landeen et al. (1993) study conducted in the 100 Areas along the Columbia River. Data are summarized for metals in soils, various types of plants, as well as raptor pellets (hawks, owls), and coyote scat. However, the values obtained must be viewed with some caution since mining and refining activities in upper Columbia River drainages (Johnson 1991; Maxfield 1974; Silker 1964), no doubt, contribute to elevated background levels for metals in river sediments.

The metals data for A-29 Ditch at the 10 sample locations are summarized in Table 11. Most of the cadmium and silver values were below the detection limits, while all of the selenium values were less than detectable and are included for information only.

For comparative purposes, the maximum concentrations for metals data from the A-29 Ditch, 2101-M Pond, a RCRA site in the 200 Areas (DOE-RL 1993), and Landeen et al. (1993) are compared to the *Hanford Site Soil Background* values (DOE 1993) and are provided in Table 12.

Table 9. Summary of Radionuclide Data for A-29 Ditch Sediments (pCi/g).

Sample Site	Date	Sample Number	Depth (in)	Total Beta		Total Alpha		Total Uranium*	
				Result	Counting Error	Result	Overall Error	Result	Overall Error
1	5/24/88	A117	0-11	3.4E+01	±4.1E+00	2.9E+01	±5.4E+00	1.7E+00	±4.8E-01
1	5/24/88	A118	24-36	3.3E+01	±4.0E+00	2.4E+01	±5.2E+00	1.5E+00	±4.2E-01
2	5/24/88	A119	0-12	2.2E+02	±9.7E+00	2.8E+01	±5.9E+00	1.4E+00	±4.1E-01
2	5/24/88	A120	24-36	6.1E+01	±5.2E+00	3.8E+01	±7.3E+00	3.0E+00	±8.5E-01
3	5/25/88	A121	0-10	3.2E+01	±3.8E+00	2.0E+01	±5.0E+00	8.4E-01	±2.5E-01
3	5/25/88	A122	10-22	2.2E+01	±3.2E+00	2.0E+01	±5.1E+00	9.6E-01	±2.8E-01
4	5/25/88	A123	0-8	3.1E+01	±3.7E+00	1.1E+01	±3.4E+00	5.1E-01	±1.5E-01
5	5/25/88	A124	0-10	1.1E+02	±6.9E+00	2.6E+01	±5.5E+00	1.7E+00	±4.8E-01
6	5/26/88	A125	0-12	4.6E+01	±4.5E+00	1.8E+01	±4.5E+00	7.3E-01	±2.1E-01
7	5/26/88	A126	0-6	1.2E+02	±7.2E+00	1.2E+02	±1.7E+01	6.8E+00	±2.0E+00
8	5/26/88	A127	0-8	9.0E+01	±6.2E+00	5.5E+01	±9.4E+00	2.9E+00	±8.2E-01
9	5/26/88	A128	0-11	7.4E+01	±5.7E+00	1.6E+02	±2.2E+01	7.6E+00	±2.2E+00
9	5/26/88	A129	12-24	5.9E+01	±5.1E+00	9.1E+01	±1.1E+01	4.1E+00	±1.2E+00
10	5/26/88	A130	0-12	1.6E+02	±8.3E+00	1.2E+02	±1.6E+01	4.5E+00	±1.3E+00

*ug/g

Table 10. Summary of Radionuclide Data for A-29 Ditch Sediments (pCi/g).

Sample Site	Date	Sample Number	Depth (in)	Cobalt - 60		Cesium - 137	
				Result	Overall Error	Result	Overall Error
1	5/24/88	A117	0-11	---	---	3.7E+00	±3.7E-01
1	5/24/88	A118	24-36	3.2E-02	±2.8E-02	9.2E-01	±1.2E-01
2	5/24/88	A119	0-12	8.5E-02	±2.4E-02	6.3E+01	±6.3E+00
2	5/24/88	A120	24-36	---	---	1.7E+01	±1.7E+00
3	5/25/88	A121	0-10	---	---	8.2E+00	±8.3E-01
3	5/25/88	A122	10-22	2.1E-02	±2.1E-02	6.9E+00	±7.0E-01
4	5/25/88	A123	0-8	---	---	1.1E+01	±1.1E+00
5	5/25/88	A124	0-10	2.8E-02	±2.2E-02	7.2E+01	±7.2E+00
6	5/26/88	A125	0-12	---	---	8.4E+00	±8.5E-01
7	5/26/88	A126	0-6	---	---	7.2E+01	±7.2E+00
8	5/26/88	A127	0-8	---	---	1.0E+02	±1.1E+01
9	5/26/88	A128	0-11	---	---	7.3E+01	±7.3E+00
9	5/26/88	A129	12-24	---	---	4.2E+01	±4.2E+00
10	5/26/88	A130	0-12	---	---	1.4E+02	±1.4E+01

--- = below detection limits.

Table 11. Summary of Metals Data for A-29 Ditch Sediments (ppm). (sheet 1 of 2)

Sample Site	Date	Sample Number	Depth (in)	Analyte						
				Strontium	Zinc	Barium	Cadmium	Chromium	Silver	Nickel
1	5/24/88	A117	0-11	19.5	77	59.7	1.2	10.7	---	8.6
1	5/24/88	A118	24-36	18	78.9	49.8	---	9.9	---	9.1
2	5/24/88	A119	0-12	18.7	67.4	46.8	---	11.2	6.5	6.9
2	5/24/88	A120	24-36	19.1	62.8	36.6	---	10.6	---	6.9
3	5/25/88	A121	0-10	14.7	57	59.3	---	6.5	---	7.7
3	5/25/88	A122	10-22	20.1	48.4	59.3	---	9.4	---	6.3
4	5/25/88	A123	0-8	16.3	61.1	98.9	---	3.4	---	3.1
5	5/25/88	A124	0-10	14.1	85.4	49.2	---	8.8	1.5	5
6	5/26/88	A125	0-12	25.1	64	88.6	---	7.6	---	8.2
7	5/26/88	A126	0-6	22.8	202	80.6	12.1	21.5	1.8	11.4
8	5/26/88	A127	0-8	20.1	95.8	64.1	0.7	9.3	---	6.2
9	5/26/88	A128	0-11	15.1	74.7	40.2	---	14.9	---	4.9
9	5/26/88	A129	12-24	15.4	72.8	37.4	---	13.4	---	4.4
10	5/26/88	A130	0-12	35.5	236	10.5	---	38.3	43.4	21

--- = below detection limits.

Table 11. Summary of Metals Data for A-29 Ditch Sediments (ppm). (sheet 2 of 2)

Sample Site	Date	Sample Number	Depth (in)	Analyte				
				Copper	Mercury	Arsenic	Selenium	Lead
1	5/24/88	A117	0-11	7.1	1.6	4.9	---	104
1	5/24/88	A118	24-36	7.9	0.8	6	---	48
2	5/24/88	A119	0-12	5.5	1.1	2.4	---	39.8
2	5/24/88	A120	24-36	---	1.3	5.2	---	98.8
3	5/25/88	A121	0-10	---	---	1.1	---	53.6
3	5/25/88	A122	10-22	---	0.5	1.4	---	55.4
4	5/25/88	A123	0-8	---	---	0.9	---	10
5	5/25/88	A124	0-10	15	0.5	1.2	---	23.6
6	5/26/88	A125	0-12	---	0.69	1.1	---	8.7
7	5/26/88	A126	0-6	89.2	4.6	2	---	67.2
8	5/26/88	A127	0-8	7.8	2.1	1.3	---	16.1
9	5/26/88	A128	0-11	---	8.1	1.4	---	132
9	5/26/88	A129	12-24	---	7.3	0.9	---	262
10	5/26/88	A130	0-12	117	14.4	10	---	147

--- = below detection limits.

Table 12. Comparison of Maximum Metals Values for Soils at Selected Sites (ppm).

Analytes	A-29 Ditch	2101-M Pond[a]	100 Areas[b]	Background values[c]
Zinc	236	360	237	79
Barium	98.9	130	316	175
Cadmium	12.1	2.7	1.8	NC (11)[d]
Chromium	38.3	33	76.1	28
Silver	43.4	32	2	2.1
Nickel	21	17	17	25
Copper	117	2,500	26.8	30
Mercury	14.4	0.9	0.05	1.3
Arsenic	10	4	3	9
Lead	147	160	13.5	14.9

[a]DOE-RL 1989.
[b]Landeen et al. 1993.
[c]*Hanford Site Soil Background* (DOE 1993).
[d]Not calculated (number in parenthesis maximum observed).

In reviewing the metals data in Table 11, some trends become apparent. Sites 7 and 10 (see Figure 4) have the vast majority of maximum concentrations reported. If we look at the high and second highest values reported for all sample locations, site 10 has 9 of the 22 reported values (41%), site 7 has 5 of the 22 (23%), while no other sample site has more than 2 (9%) of the highest values. Additionally, site 10 has 8 of the 11 maximum values (73%) reported for each analyte (Table 11).

The proposed improvements that will cross the A-29 Ditch in support of the TWRS Phase 1 Privatization Project are in the general proximity of sample sites 7, 8, and 9 (Figure 4) as mentioned previously. Sample site 7 had 5 of the highest metals values reported, sample site 8 had none, and sample site 9 had 2. The proposed corridor for development would be very near the location for sample site 8. Table 13 contains a summary of the highest values reported for each analyte as well as the ranking for the metals values reported at these three sites. For comparative purposes, rankings were provided for only the two highest values for each analyte.

6.3 OTHER ANALYTES

Table 14 summarizes the analytical data reported for anions, ammonia, TOC and cyanide. Although some constituent values were all below detection limits (fluoride, phosphate, and cyanide), they are included for information. With regard to the other analytes, such as volatile organic compounds, semi-volatile organics, chlorinated herbicides, organophosphorus pesticides, PCBs, and anions (Table 15), the values reported were less than detection limits, at detection limits, or within normal ranges for the Hanford Site (DOE 1993).

In summary, the range of values reported for radionuclides at A-29 Ditch were all within the Hanford Site soil standards (Booth 1985). With regard to A-29 Ditch metals, the values reported for metals are below the soil cleanup limits proposed in the *Model Toxics Control Act* (Ecology 1992), with the possible exception of arsenic. However, the range of values reported for arsenic from the A-29 Ditch are within the values reported for *Hanford Site Soil Background* (DOE 1993) values (Table 12) and well below the maximum reported background concentration of 27.7 ppm.

Table 13. Comparison of Maximum Metals Values for Soils at Selected Sites (ppm).

Analytes	Site 7	Rank	Site 8	Rank	Site 9*	Rank
Zinc	202	2	95.8		74.7	
Barium	80.6		64.1		40.2	
Cadmium	12.1	1	0.7		LTD	---
Chromium	21.5	2	9.3		14.9	
Silver	1.8		LTD	---	LTD	---
Nickel	11.4	2	6.2		4.9	
Copper	89.2	2	7.8		LTD	---
Mercury	4.6		2.1		8.1	2
Arsenic	2		1.3		1.4	
Lead	67.2		16.1		262	1

* = Highest value for 2 samples collected.
LTD = Less than detection limits.

Table 14. Summary of Chemical Data for A-29 Ditch Sediments (ppm).

Sample Site	Date	Sample Number	Depth (in)	Analyte							
				Nitrate	Sulfate	Fluoride	Chloride	Phosphate	Ammonia	TOC	Cyanide
1	5/24/88	A117	0-11	---	7.8	---	5.6	---	---	44.9	---
1	5/24/88	A118	24-36	---	42.2	---	7.8	---	---	37	---
2	5/24/88	A119	0-12	---	5.1	---	4.3	---	5.6	55.6	---
2	5/24/88	A120	24-36	---	10	---	7.4	---	1.5	36	---
3	5/25/88	A121	0-10	1.9	3.1	---	1.3	---	---	29.7	---
3	5/25/88	A122	10-22	---	2.8	---	---	---	---	19.7	---
4	5/25/88	A123	0-8	1.3	11.3	---	1.2	---	---	18	---
5	5/25/88	A124	0-10	---	51.1	---	13.6	---	3.1	37.6	---
6	5/26/88	A125	0-12	---	43	---	---	---	1.4	39.6	---
7	5/26/88	A126	0-6	---	50.2	---	2	---	2.9	69.2	---
8	5/26/88	A127	0-8	---	93.1	---	---	---	3.4	31.7	---
9	5/26/88	A128	0-11	---	12.3	---	1.1	---	2.2	36.8	---
9	5/26/88	A129	12-24	---	8.9	---	1.7	---	NR	NR	---
10	5/26/88	A130	0-12	3.2	36.6	---	1.9	---	NR	NR	---

--- = Below detection limits.
NR = Not reported.

Table 15. Summary of Organic and Chemical Analytes for A-29 Ditch Sediments (ppm).

Sample Site	Date	Sample Number	Depth (in)	Analyte								
				Extractable Organics	Organochlorine Pesticides	PCBs	Chlorinated Herbicides	Organophosphorus Pesticides	Thiourea Compounds	Sulfide	Perchlorate	Ethylene Glycol
1	5/24/88	A117	0-11	---	---	---	---	NR	---	---	---	---
1	5/24/88	A118	24-36	---	---	---	---	NR	---	---	---	---
2	5/24/88	A119	0-12	6 unk/molsulf[a]	---	---	---	NR	---	---	---	---
2	5/24/88	A120	24-36	9 unk/molsulf	---	---	---	NR	---	---	---	---
3	5/25/88	A121	0-10	---	---	---	---	---	---	---	---	---
3	5/25/88	A122	10-22	---	---	---	---	---	---	---	---	---
4	5/25/88	A123	0-8	---	---	---	---	---	---	---	---	---
5	5/25/88	A124	0-10	1 unk	---	---	---	---	---	---	---	---
6	5/26/88	A125	0-12	---	---	---	---	---	---	---	---	---
7	5/26/88	A126	0-6	5 unk/molsulf	---	---	---	---	---	---	---	---
8	5/26/88	A127	0-8	3 unk/molsulf	---	---	---	---	---	---	---	---
9	5/26/88	A128	0-11	4 unk	---	ar1254[b] (1.2 ppm)	---	---	---	---	---	---
9	5/26/88	A129	12-24	2 unk	---	---	---	---	---	---	---	---
10	5/26/88	A130	0-12	7 unk	---	---	---	---	---	---	---	---

[a]Unknowns/molybdenum sulfide
[b]arachlor 1254

--- = below detection limits.
NR = Not reported.

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APPENDIX A

DETAILED QUALITY ASSURANCE INFORMATION FOR ENVIRONMENTAL SAMPLES ANALYTICAL LABORATORY SERVICES PROVIDED BY UNITED STATES TESTING, INC.

(From Hembree and Lardy 1986)

VI. QUALITY ASSURANCE

A. Basic Program Structure

The Contractor shall maintain a QA program acceptable to Battelle. The QA requirements shall be identified in an activity QA Manual. The QA Manual shall contain procedures for implementation of the QA requirements and shall be maintained current.

B. Organizational Structure and Responsibilities

The Contractor shall provide a chart or diagram illustrating the organization structure applied to this service activity and the relationship of the Quality Assurance Office (QAO) to the service activity staff.

A manager with the overall responsibility for implementing the QA requirements shall be identified in the QA Manual. The QA organization shall be administratively independent of analytical operations with separate reporting channels.

C. Specific QA Requirements

The following specific QA requirements shall be included in the Contractor's QA Manual:

1. Procurement - The procurement activity shall be planned and performed in a controlled and documentable manner.

   Procurement and subcontract requirements will be reviewed, the appropriate QA requirements applied, and the relevant items and services inspected to assure that procured items and services are suitable for their intended use.

2. Written Procedures - Written procedures shall be developed and implemented to control activities that could have a significant impact on the accuracy or validaty of data.

   Preparation, identification, and use of such procedures shall be controlled for critical steps or tests in the analytical process. Procedures shall be reviewed and revised as needed on a periodic basis, as stated in the QA Manual.

   Interferences shall be identified in the written procedure for each method. Procedures shall include the steps (precautions) taken to minimize the effect of interferences on performance criteria specified in this Statement of Work.

3. Document Control - Documents containing information that could have a significant impact upon quality (i.e., written procedures) shall be reviewed, identified, approved, updated, and distributed in a controlled manner.

4. Material Identification and Control - Positive identification and control measures shall be used to assure that samples and other critical items are identifiable at all stages of the analysis and traceable to their source and the resultant data.

5. Control of Measuring and Test Equipment - Measuring and test equipment shall be controlled and calibrated to assure the accuracy and reliability of required data. Relatability to the National Bureau of Standard or other recognized standards agencies shall be maintained.

6. Nonconformances and Corrective Action - Nonconforming materials, components or parts (including samples and data) shall be reported, controlled, and dispositioned in accordance with procedures in the QA Manual. A description of the corrective actions shall be included.

7. Quality Assurance Records - Evidence that QA and QC activities were performed shall be documented, reported to Battelle as requested, and preserved.

8. Quality Assurance Audits - The Contractor shall maintain a formal QA audit program. In addition, Contractor activity shall be subject to periodic routine audits scheduled approximately semiannually by Battelle. In addition, special or nonroutine audits may be scheduled by Battelle on an as-needed basis.

D. Training

Staff shall receive QA training appropriate to their participation. Training shall be performed as necessary to assure that each staff member understands the QA and technical requirements applicable to their work. All training, whether specific to QA or in other areas related to the work, shall be documented and accurate records kept.

E. Quality Control

The Contractor shall assure the integrity and validity of data through implementation of an internal quality control program. The program shall include the analysis of replicate, blank and spiked samples. A system of reviewing and analyzing the results of these samples shall be maintained to detect current problems due to contamination, calibration, calculations, inadequate procedures, or other causes. Standard methods shall be used whenever possible and methods that are developed or adapted shall be tested and completely documented. All methods and method changes shall be approved by Battelle.

The Contractor shall assure that facilities and equipment ar constructed and operated to emphasize radiological control to minimize the possibility of cross-contamination.

The internal quality control system shall be described in a written procedure(s) and shall include a corrective action system for discrepant results. In addition, the measuring and test equipment (including the DOE-owned Hanford External Dosimetry (TLD) System) will be calibrated and traceable to the data obtained by each unit of measuring and test equipment.

The Contractor shall provide routine reports informal to Battelle, within 30 business days of completion of each quarter, which describe the current status and results of ongoing QC evaluations for each service area. In addition, results of the QC program shall be formally reported to Battelle on an annual basis, within 30 business days after the completion of the operational year, which will include a summary of analytical results on standard samples, an evaluation of the status of the analytical procedures, and a description of any corrective actions taken to solve problems that have been identified.

F. Software Activities

1. Software Documentation - Each computer program that is a part of a software system and capable of being tested and evaluated independently of that system shall be separately documented prior to release for use. The point in the development of the software at which documentation is required and the minimum documentation requirements shall be established.

2. Software Testing - Verification of the computer code shall be established using data for which the correct result is known. The verification process shall be documented as proof it was performed and for future reference.

3. Software Control - Methods shall be established to help ensure that computer software changes are properly controlled and approved. Computer programs shall be identified using unique serial revision numbers.

4. Computer Program Certification and Validation - Computer programs shall be validated for adequacy to meet technical requirements of the task. The validity shall be documented.

5. Security of Software - Methods shall be established to help ensure the security of the software (i.e., help avoid unauthorized use and changes).

6. Error Control - Methods shall be developed to evaluate, control, and correct data-entry errors.

G. Intercomparisons and Audits

The Contractor shall provide reasonable access to all facilities and data for the purpose of verification of performance and to ensure that the conditions of this Statement of Work are being met. Battelle may submit blind or other audit samples to determine compliance with accuracy and precision requirements. Participation in the DOE Quality Assessment Program is mandatory. The Contractor shall also maintain its EPA Safe Drinking Water Act certification for measurement of radionuclides. The Contractor shall continue to participate in the EPA Environmental Radioactivity Laboratory Intercomparison Studies Program and report UST results, known values, and explanations of results outside limits to Battelle within 30 business days following the end of each calendar quarter. Battelle may also require participation in other intercomparison programs.

VII. HAZARDOUS CHEMICAL ANALYTICAL SUPPORT SERVICES (Task IV)

A. Services Required

In support of Hanford Environmental Surveillance Programs, the Contractor shall perform routine analysis of groundwater, surface water, soil, and process samples for the parameters and substances listed in table VII-1.

The Contractor shall perform the specified chemical analyses on groundwater, surface water, soil, or process samples that may contain
low levels of radioactive materials (generally at concentrations less than those specified in DOE Order 5480.1A as releasable to the environment). Routine samples constitute the bulk of the total and will be delivered to the Contractor during normal business hours in accordance with a schedule established by Battelle. Samples may also be delivered by other Hanford routine service customers.

The Contractor shall possess all capabilities and equipment necessary to receive, prepare, and analyze samples which contain both radioactive and hazardous chemical substances. The Contractor may often be required to perform several different analyses on a single sample.

The Contract shall add preservatives to sample collection containers as required by the analytical procedures. In accordance with the sampling schedule established by Battelle, the Contractor will be provided pre-cleaned (EPA approved) sample collection containers, for each week's sampling, 3 weeks prior to sample collection. Containers shall have been prepared and be available to Battelle 1 week prior to scheduled sample collection.

The samples to be analyzed by the Contractor may contain potentially hazardous organic and/or inorganic materials. It is the Contractor's responsibility to take all actions necessary to ensure his employee's safety.

B. Characteristics and Handling of Samples

The following are descriptions of samples:

1. Groundwater and Surface Water - Samples are water collected from wells or surface water bodies for radiological and chemical analyses. Samples may contain concentrations of tritium, other radioactive substances, or nitrate ion comparable with current levels found within Hanford groundwater.

2. Process Liquids - Water samples and liquids are collected from process streams, effluent ditches, trenches, pond, and cribs. Samples may contain concentrations of radioactivity at levels somewhat higher than found in groundwater samples.

3. Soil - Samples of surface or subsurface soil, sediments, sand and gravel. Samples may contain levels of radioactivity somewhat higher than found in ground water samples.

4. Nonroutine Samples - Nonroutine samples may be submitted as dictated by program needs and may require rapid or priority analysis. Samples will generally fit into one of the media categories given above, but may differ from routine samples in size, appearance, or matrix and may contain higher than routine levels of radioactive or chemical substances.

Routine samples will be delivered to the Contractor during normal business hours in appropriate containers based on the analysis to be performed. Some samples may require subsampling by the Contractor, and subsequent preservation and storage in accordance with the appropriate individual analytical procedures.

All analyses shall be performed within the maximum holding times prescribed by the approved analytical procedures.

C. Workload

The Contractor shall have the capability to perform hazardous chemical analytical tests within the minimums and maximums specified in ARTICLE IV - INDEFINITE QUANTITY AND ORDERING OF SERVICES, of the contract schedule.

D. Analytical Requirements

1. Normal Analyses - Required capabilities for normal analyses are listed in table VII-1.

   Analytical procedures and equipment shall be those in Test Methods for Evaluating Solid Wastes--Physical and Chemical Methods, SW-846, Second Edition. Procedures not available in SW-846 shall be those in Standard Methods for the Examination of Water and Wastewater, Sixteenth Edition, (1985).

   Other procedures may be used with prior Battelle approval provided the procedures are clearly documented by the Contractor prior to implementation. Contractor shall test the accuracy and effectiveness of these procedures through the performance of QC analyses. The results of the QC analyses shall be made available upon request to Battelle.

All procedures (including chain-of-custody) shall be compiled in a procedures manual that is maintained current and documents all approvals. All method and equipment changes shall be reviewed and approved by Battelle prior to implementation.

The Contractor shall maintain a computerized MS library search system capable of providing a forward comparison, utilizing the standard spectra contained in the EPA/NIH Mass Spectral Data Base. The most recent available EPA/NIH library shall be used.

The specific analytical requirements listed in table VII-1 include screening analyses for the list of Dangerous Waste Constituents contained in Washington Administrative Code (WAC) 173-303-9905 (Attachment 1).

2. Priority Analyses - Analytical procedures for priority analyses shall be the same as those for normal analyses. The only difference is expedited processing and reporting.

3. Rapid Analyses - Analytical procedures for rapid analyses of environmental or process samples shall be the same as those for normal analyses except that results shall be reported within 24 hrs from receipt of sample, or upon completion of the requested analysis consistent with procedural or equipment limitations. The Contractor shall contact Battelle or the designated customer representative prior to diluting and reanalyzing samples submitted and analyzed on a rapid basis. The customer will designate the processing category (normal, priority, or rapid) appropriate for the dilution and reanalysis. Rapid analysis capabilities may be continuously required over a 30-day period.

E. Performance Criteria

Analytical performance shall meet the requirement detailed in SW-846, Second Edition for analytical laboratories and for the performance of specific procedures.

The Contractor shall have written quality assurance and quality control procedures and shall conduct laboratory operations to the QA/QC criteria documented in SW-846, Second Edition and Handbook for Analytical QC in Water and Wastewater Laboratories, EPA-600/4-79-019 (1979). Documentation of QC evaluations shall be sufficient to verify the acceptability of laboratory operations and analytical performance.

The QA requirements detailed in Section VI, Quality Assurance, of this Statement of Work, shall apply to the Hazardous Chemical Analytical Support Services.

The quality control procedures for hazardous chemical analyses shall include (as appropriate to each analysis) evaluation of blanks, random matrix spikes (for 10% of samples), internal standards, surrogates, and standard calibration curves. Specific quality control procedures for individual methods shall be detailed in the Contractor's documented analytical procedures.

The Contractor shall comply with its written procedures for sample chain-of-custody and document control.

F. Reporting and Communication

1. Analytical Results - Reporting times for all normal analyses of water and process liquid samples shall be 25 business days from receipt of the sample and analytical request at the Contractor's laboratory. Reporting time for all normal analyses of soil samples shall be 35 business days. Priority analyses results for all sample media shall be reported within 10 business days from receipt of the sample. Priority results may be reported by telephone, but must be confirmed in writing with the next routine data transmittal to the customer. Rapid analysis results for all sample media shall be reported within 24 hours from receipt of the sample or upon completion of the requested analysis consistent with procedural and other equipment limitations. Rapid results may be reported by telephone, but must be confirmed in writing with the next routine data transmittal.

2. Immediate Notification - The Contractor shall immediately (COB) notify Battelle by telephone of lost samples, invalid results, or the loss of a capabilities which may adversely affect the analytical results. Written confirmation shall be provided to Battelle with the next routine data transmittal.

3. Report Format and Content - Results shall be stated in the units listed in table VII-1. Reports of results shall consist of both printed report and electronic data processing tapes. Report formats shall be compatible with Battelle electronic data processing system. The following information shall be reported for each analysis:

   - Laboratory identifier code
   - Code for insert/modify
   - Well code
   - Duplicate number (if applicable)
   - Constituent code (name and number)
   - Sample collection data
   - Extraction date
   - Analysis value (with flag for less than values where appropriate)
   - Sample size
   - Analysis date

- UST number
- Report date
- Number of dilutions
- Confirmation (if applicable)
- Comments

Other reporting formats may be used with prior Battelle approval. Reports shall be transmitted to the customer submitting the sample(s).

G. Sample Archives

The Contractor shall preserve and maintain identification on all unused portions of samples and any final analytical preparations with which measurements are made for at least 4 weeks following the final reporting of the complete results. Prior to final disposition the Contract shall request the authorized customer representative for authorization to dispose of above.

The Contractor shall maintain records of all data relative to sample analyses including raw, intermediate, final data and results in accordance with the General Requirements of this Statement of Work.

The Contractor shall assure the integrity and security of all samples (initial and unused portions), sample extracts and other preparations, and analytical data and results.

TABLE VII-1
Analytical Requirements for Normal and Priority Hazardous Chemical Analyses of Environmental and Process Samples. (sheet 1 of 6)

SUBSTANCE	MDC		SAMPLE SIZE	
	WATER	SOIL	WATER	SOIL
BARIUM	6 µg/L	0.6 µg/g		
CADMIUM	2 µg/L	0.2 µg/g		
CHROMIUM	10 µg/L	1 µg/g		
SILVER	10 µg/L	1 µg/g		
COPPER	10 µg/L	1 µg/g		
MANGANESE	5 µg/L	0.5 µg/g		
SODIUM	100 µg/L	10 µg/g		10 g
NICKEL	10 µg/L	1 µg/g		
VANADIUM	5 µg/L	0.5 µg/g		
ALUMINUM	150 µg/L	15 µg/g		
POTASSIUM	100 µg/L	10 µg/g	1 L	
IRON	50 µg/L	5 µg/g		
MAGNESIUM	50 µg/L	5 µg/g		
CALCIUM	50 µg/L	5 µg/g		
ZINC	5 µg/L	0.5 µg/g		
THALLIUM	10 ppb	1.0 µg/g		10 g
LEAD	5 µg/L	0.5 µg/g		10 g
MERCURY	0.1 µg/L	0.1 µg/g	500 mL	10 g
SELENIUM	5 µg/L	0.5 µg/g	1 L	10 g
ARSENIC	5 µg/L	0.5 µg/g		
ENDRIN	1 ppb	1.0 µg/g		
LINDANE	1 ppb	1.0 µg/g	2 L	50 g
METHOXYCLOR	1 ppb	1.0 µg/g		
TOXAPHENE	1 ppb	1.0 µg/g		
POLYCHLORINATED BIPHENYLS	1 ppb	1.0 µg/g	2 L	50 g

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TABLE VII-1
Analytical Requirements for Normal and Priority Hazardous Chemical Analyses of Environmental and Process Samples. (sheet 2 of 6)

SUBSTANCE	MDC		SAMPLE SIZE	
	WATER	SOIL	WATER	SOIL
2,4-D	1 ppb	1 µg/g		
2,4,5-TP SILVEX	1 ppb	1 µg/g	2 L	200 g
CARBOPHENOTHION	2 ppb	1 µg/g		
DISULFOTON	2 ppb	1 µg/g		
DIMETHOATE	5 ppb	1 µg/g		
METHYL PARATHION	2 ppb	1 µg/g	2 L	50 g
PARATHION	2 ppb	1 µg/g		
TETRAETHYLPYROPHOSPHATE	2 ppb	1 µg/g		
TETRACHLOROMETHANE	10 ppb	0.01 µg/g [a]		
METHYLETHYL KETONE	10 ppb	0.01 µg/g		
1,1,1-TRICHLOROETHANE	10 ppb	0.01 µg/g		
1,1,2-TRICHLOROEHTANE	10 ppb	0.01 µg/g	40 mL	10 g
1,1,2-TRICHLOROETHYLENE	10 ppb	0.01 µg/g		
PERCHLOROETHYLENE	10 ppb	0.01 µg/g		
XYLENE	10 ppb	0.01 µg/g		
CHLOROFORM	10 ppb	0.01 µg/g		
METHYLENE CHLORIDE	10 ppb	0.01 µg/g		
HEXACHLOROPHENE	10 ppb	1 µg/g		
NAPTHALENE	10 ppb	1 µg/g		
PHENOL	10 ppb	1 µg/g	2 L	50 g
CHLORINATED BENZENES	10 ppb	1 µg/g		
KEROSENE	10 ppm	1000 µg/g		
HYDRAZINE	30 ppb			
PHENOL	10 ppb	1 µg/g	2 L	50 g
DIRECT AQUEOUS INJECTION(b) GC/MS ANALYSES	3 ppm	10 µg/g	40 mL	50 g

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Table VII-1
Analytical Requirements for Normal and Priority Hazardous Chemical Analyses of Environmental and Process Samples. (sheet 3 of 6)

SUBSTANCE	MDC		SAMPLE SIZE	
	WATER	SOIL	WATER	SOIL
THIOUREA	200 ppb	2 µg/g	40 mL	50 g
CITRUS RED #2	1 ppm	10 µg/g	50 mL	50 g
CYANIDE	10 ppb	1 µg/g	2 L	50 g
DIOXIN	0.1 ppb	0.0002 µg/g	1 L	50 g
TOX (2 samples req.)	100 ppb		250 mL	(each sample)
TOX (2 samples req.)	20 ppb		250 mL	(each sample)
TOC	1 ppm	10 µg/g	750 mL	
EOX		1 µg/g		10 g
TOTAL CARBON (TC)	1 ppm	10 µg/g	750 mL	50 g
NITRATE	500 ppb	1 µg/g		
SULFATE	500 ppb	1 µg/g		
FLUORIDE	500 ppb	1 µg/g	125 mL	50 g
CHLORIDE	500 ppb	1 µg/g		
PHOSPHATE	1 ppb	2 µg/g		
SULFIDE	1 ppm	10 µg/g	1 L	50 g
PERCHLORATE	1 ppm	2 µg/g	125 mL	50 g
AMMONIUM ION	50 ppb	0.5 µg/g	350 mL	50 g
ETHYLENE GLYCOL	10 ppm	10 µg/g	50 mL	50 g
COLIFORM BACTERIA (d) (2 water sample req.)	2.2 mpn	2.2 mpn	100 mL (each sample)	50 g

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Table VII-1
Analytical Requirements for Normal and Priority Hazardous Chemical Analyses of Environmental and Process Samples. (sheet 4 of 6)

SUBSTANCE	MDC		SAMPLE SIZE	
	WATER	SOIL	WATER	SOIL
TOTAL DISSOLVED SOLIDS (TDS) (2 samples req.)	5 ppm		100 mL	
RADIUM	1 pCi/L	1 pCi/g	1 L	50 g
GROSS ALPHA	4 pCi/L	6 pCi/g	1 L	5 g
GROSS BETA	8 pCi/L	3 pCi/g	1 L	5 g
---------ENHANCED ANALYSES FOR 9905 EVALUATIONS(c)---------				
BARIUM	6 µg/L	0.6 µg/g		
CADMIUM	2 µg/L	0.2 µg/g		
CHROMIUM	10 µg/L	1 µg/g		
SILVER	10 µg/L	1 µg/g		
COPPER	10 µg/L	1 µg/g		
MANGANESE	5 µg/L	0.5 µg/g		
SODIUM	100 µg/L	10 µg/g		
NICKEL	10 µg/L	1 µg/g		
VANADIUM	5 µg/L	0.5 µg/g	1 L	10 g
ANTIMONY	100 µg/L	10 µg/g		
ALUMINUM	150 µg/L	15 µg/g		
POTASSIUM	100 µg/L	10 µg/g		
IRON	50 µg/L	5 µg/g		
MAGNESIUM	50 µg/L	5 µg/g		
BERYLLIUM	5 µg/L	0.5 µg/g		
CALCIUM	50 µg/L	5 µg/g		
ZINC	5 µg/L	0.5 µg/g		
OSMIUM	300 µg/L	30 µg/g		
STRONTIUM	300 µg/L	30 µg/g		
THIOUREA	200 ppb	2 µg/g		
1-ACETHYL-2-THIOUREA	200 ppb	2 µg/g		
1-(o-CHLOROPHYNEL)THIOUREA	200 ppb	2 µg/g		
DIETHYLSTILBESTEROL	200 ppb	2 µg/g		
ETHYLENETHIOUREA	200 ppb	2 µg/g	40 mL	50 g

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Table VII-1
Analytical Requirements for Normal and Priority Hazardous Chemical Analyses of Environmental and Process Samples. (sheet 5 of 6)

SUBSTANCE	MDC		SAMPLE SIZE	
	WATER	SOIL	WATER	SOIL
1-NAPTHYL-2-THIOUREA	200 ppb	2 µg/g		
N-PHENYLTHIOUREA	200 ppb	2 µg/g		
ENDRIN	1 ppb	1 µg/g		
LINDANE (and isomers)	1 ppb	1 µg/g		
METHOXYCLOR	1 ppb	1 µg/g		
TOXAPHENE	1 ppb	1 µg/g		
ALDRIN	1 ppb	1 µg/g		
CHLORDANE	1 ppb	1 µg/g		
4,4'-DDD	1 ppb	1 µg/g		
4,4'-DDE	1 ppb	1 µg/g	2 L	50 g
4,4'-DDT	1 ppb	1 µg/g		
ENDOSULFAN	1 ppb	1 µg/g		
HEPTACHLOR	1 ppb	1 µg/g		
HEPTACHLOR EPOXIDE	1 ppb	1 µg/g		
KEPONE	1 ppb	1 µg/g		
DIELDRIN	1 ppb	1 µg/g		
CHLOROBENZILATE	100 ppb	10 µg/g		
2,4-D	1 ppb	1 µg/g		
2,4,5-TP SILVEX	1 ppb	1 µg/g	2 L	200 g
2,4,5-T	1 ppb	1 µg/g		
TETRACHLOROMETHANE	10 ppb	0.01 µg/g[a]		
BENZENE	10 ppb	0.01 µg/g		
DIOXANE	500 ppb	0.5 µg/g		
METHYLETHYL KETONE	10 ppb	0.01 µg/g		
PYRIDINE	500 ppb	0.5 µg/g		
TOLUENE	10 ppb	0.01 µg/g	40 mL	10 g
1,1,1-TRICHLOROETHANE	10 ppb	0.01 µg/g		
1,1,2-TRICHLOROETHANE	10 ppb	0.01 µg/g		
1,1,2-TRICHLOROTHEYLENE	10 ppb	0.01 µg/g		

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Table VII-1
Analytical Requirements for Normal and Priority Hazardous Chemical Analyses of Environmental and Process Samples. (sheet 6 of 6)

SUBSTANCE	MDC		SAMPLE SIZE	
	WATER	SOIL	WATER	SOIL
PERCHLOROETHYLENE	10 ppb	0.01 µg/g		
XYLENE	10 ppb	0.01 µg/g		
FORMALDEHYDE	500 ppb	0.5 µg/g		
ADDITIONAL 9905 VOAs(b)	10 ppb	0.01 µg/g		
HEXACHLOROPHENE	10 ppb	1 µg/g		
NAPTHALENE	10 ppb	1 µg/g		
PHENOL	10 ppb	1 µg/g	2 L	50 G
CHLORINATED BENZENES	10 ppb	1 µg/g		
STRYCHNINE	50 ppb	5 µg/g		
MALEIC HYDRAZINE	500 ppb	50 µg/g		
NICOTINIC ACID	100 ppb	10 µg/g		
KEROSENE	10 ppm	1000 µg/g		
ADDITIONAL 9905 ABNs(b)	10 ppb	1 µg/g		

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(a) MDC will be reudced when samples contain high levels of interfering organics and dilution is necessary. MDC is reduced in direct proportion to dilution.
(b) See Table VII-2.
(c) Substances indicated in italics represent analytical enhancement, of existing analysis, for 9905 evaluation.
(d) Coliform analyses are performed in accordance with procedures contained in "Standards Methods for Examination of Water and Waste Water," Edition 1985. Procedure calls for five tubes, each containing replicate 10 mL portions of sample, to be tested. When none of the tubes test positive, the value is reported as <2.2 MPN.

APPENDIX B

DETAILED SUMMARY OF THE DANGEROUS WASTE CONSTITUENTS IDENTIFIED IN WAC-173-303-9905 BY ANALYTICAL CATEGORY

This appendix identifies the approach to be taken to analyze for the list of dangerous waste constituents contained in WAC 173-303-9905. U.S. Testing Company, Inc. will conduct analyses for those constituents on the list for which methodology is currently available.

Table E.1 contains a numbered list of all of the WAC 173-303-9905 constituents, the specific method to be used for analysis, and references to one of several other tables (E.2 through E.10) which associates each constituents with an analytical category. Where available, SW-846 (USEPA, July 1982 "Test Methods for Evaluating Solid Waste) methods will be used. Where SW-846 does not provide sufficient information to analyze for a particular constituent, another standard method is listed. Two categories of compounds will not be analyzed directly:

1. constituents unstable in water

2. constituents for which no analytical method is available.

The following approach will be taken when analyzing for volatile and semivolatile constituents (Tables E.2 and E.3). A quantitative analysis will be performed by GC/MS on those compounds from these lists which are also on the Priority Pollutant list (40 CFR Part 122). All other 9905 compounds will be searched for by NBS Library computer search of all peaks in the chromatogram of the sample which are greater than 20% of the nearest internal standard. Quantitation of the tentatively identified peak will be against the nearest internal standard, and the response factor will be assumed to be 1. Rigorous quantitation of tentatively identified compounds will be performed upon request, and the analyses are subject to the availability of standards.

Table E-1. Dangerous Waste Constituents List. (sheet 1 of 12)

	Constituent	Method[a]	Table
1	Acetonitrile	SW-846, 8270	E.3
2	Acetophenone	SW-846, 8270	E.3
3	Warfarin	SW-846, 8270	E.3
4	2-Acetylaminofluorene	SW-846, 8270	E.3
5	Acetyl chloride	Unstable	E.8
6	1-Acetyl-2-thiourea	SW-846, 8330	E.10
7	Acrolein	SW-846, 8240	E.2
8	Acrylamide	GC/MS, Dir. Inj.	E.4
9	Acrylonitrile	SW-846, 8240	E.2
10	Aflatoxins	Exotic	E.9
11	Aldrin	SW-846, 8080	E.6
12	Allyl alcohol	GC/MS, Dir. Inj.	E.4
13	Aluminum phosphide	Unstable	E.8
14	4-Aminobiphenyl	SW-846, 8270	E.3
15	Mitomycin C	Exotic	E.9
16	5-(Aminomethyl)-3-isoxazolol	SW-846, 8270	E.3
17	Amitrole	SW-846, 8270	E.3
18	Aniline	SW-846, 8270	E.3
19	Antimony and compounds	SW-846, 6010	E.5
20	Aramite	SW-846, 8270	E.3
21	Arsenic and compounds	SW-846, 7060	E.5
22	Arsenic acid	SW-846, 7060	E.5
23	Arsenic pentoxide	SW-846, 7060	E.5
24	Arsenic trioxide	SW-846, 7060	E.5
25	Auramine	SW-846, 8270	E.3
26	Azaserine	Exotic	E.9
27	Barium and compounds	SW-846, 6010	E.5
28	Barium cyanide	SW-846, 6010	E.5
29	Benz(c)acridine	SW-846, 8270	E.3
30	Benz(a)anthracene	SW-846, 8270	E.3
31	Benzene	SW-846, 8240	E.2
32	Benzenearsonic acid	SW-846, 7060	E.5
33	Benzene, dichloromethyl	SW-846, 8270	E.3

Table E-1. Dangerous Waste Constituents List. (sheet 2 of 12)

	Constituent	Method[a]	Table
34	Benzenethoil	SW-346, 8270	E.3
35	Benzidine	SW-846, 8270	E.3
36	Benzo(b)fluoranthene	SW-846, 8270	E.3
37	Benzo(j)fluoranthene	SW-846, 8270	E.3
38	Benzo(a)pyrene	SW-846, 8270	E.3
39	p Benzoquinone	SW-846, 8270	E.3
40	Benzotrichloride	Unstable	E.8
41	Benzyl chloride	SW-846, 8720	E.3
42	Beryllium and compounds	SW-846, 6010	E.5
43	Bis(2-chloroethoxy)methane	SW-846, 8270	E.3
44	Bis(2-chloroethyl)ether	SW-846, 8270	E.3
45	Chlornaphazine	SW-846, 8270	E.3
46	Bis(2-chloroisopropy)ether	SW-846, 8270	E.3
47	Bis(chloromethyl)ether	SW-846, 8240	E.2
48	Bis(2-ethylhexyl)phthalate	SW-846, 8270	E.3
49	Bromoacetone	SW-846, 8240	E.2
50	Methyl bromide	SW-846, 8240	E.2
51	4-Bromophenyl phenyl ether	SW-846, 8270	E.3
52	Brucine	Exotic	E.9
53	2-Butanone peroxide	Unstable	E.8
54	Butyl benzyl phthalate	SW-846, 8270	E.3
55	2-sec-butyl-4,6-dinitrophenol	SW-846, 8270	E.3
56	Cadmium and compounds	SW-846, 6010	E.5
57	Calcium chromate	SW-846, 6010	E.5
58	Calcium cyanide	SW-846, 9010	E.10
59	Carbon disolfide	SW-846, 8240	E.2
60	Carbon oxyfluoride	Unstable	E.8
61	Chloral	HC/MS, Dir. Inj.	E.4
62	Chlorambucil	Exotic	E.9
63	Chlordane	SW-846, 8080	E.6
64	Chlorinated benzenes	SW-846, 8270	E.3
65	Chlorinated ethane	SW-846, 9020	E.7
66	Chlorinated fluorocarbons	SW-846, 9020	E.7

Table E-1. Dangerous Waste Constituents List. (sheet 3 of 12)

	Constituent	Method[a]	Table
67	Chlorinated napthalene	SW-846, 9020	E.7
68	Chlorinated phenol	SW-846, 9020	E.7
69	Chloroacetaldehyde	GC/MS, Dir. Inj.	E.4
70	Chloroalkyl ethers	SW-846, 8270	E.3
71	P-Choroaniline	SW-846, 8270	E.3
72	Chlorobenzene	SW-846, 8240	E.2
73	Chlorobenzilate	AOAC - 6.431	E.6
74	p-Chloro-m-cresol	SW-846, 8720	E.3
75	1-Chloro-2,3-epoxypropane	SW-846, 8270	E.3
76	2-Chloroethyl vinyl ether	SW-846, 8240	E.2
77	Chloroform	SW-846, 8240	E.2
78	Methyl chloride	SW-846, 8240	E.2
79	Chloromethyl methyl ether	SW-846, 8240	E.2
80	2-Chloronaphthalene	SW-846, 8270	E.3
81	1-Chlorophenol	SW-846, 8270	E.3
82	1-(o-Chlorophenyl)thiourea	SW-846, 8330	E.10
83	3-Chloropropionitrile	GC/MS, Dir. Inj.	E.4
84	Chromium and compounds	SW-846, 6010	E.5
85	Chrysene	SW-846, 8270	E.3
86	Citrus red no. 2	AOAC-34.015B	E.10
87	Coal tars	SM-505	E.7
88	Copper cyanide	SW-846, 6010	E.5
89	Creosote	SM-505	E.7
90	Cresols	SW-846, 8270	E.3
91	Crotonaldehyde	SW-846, 8240	E.2
92	Cyanides	SW-846, 9010	E.10
93	Cyanogen	GC/MS, Dir. Inj.	E.4
94	Cyanogen bromide	AOAC-340.15B	E.10
95	Cyanogen chloride	AOAC-34.015B	E.10
96	Cycasin	Exotic	E.9
97	2-Cyclohexyl-4.6-dinitrophenol	SW-846, 8270	E.3
98	cyclophosphamide	Exotic	E.9
99	Daunomycin	Exotic	E.9

Table E-1. Dangerous Waste Constituents List. (sheet 4 of 12)

Constituent	Method[a]	Table
100 DDD	SW-846, 8080	E.6
101 DDE	SW-846, 8080	E.6
102 DDT	SW-846, 8080	E.6
103 Diallate	Exotic	E.9
104 Dibenz(a,h)acridine	SW-846, 8270	E.3
105 Dibenz(a,j)acridine	SW-846, 8270	E.3
106 Dibenz(a,h)anthracene	SW-846, 8270	E.3
107 7H-Dibenzo(c,g)carbazole	SW-846, 8720	E.3
108 Dibenzo(a,e)pyrene	SW-846, 8720	E.3
109 Debenzo(a,h)pyrene	SW-846, 8270	E.3
110 Debenzo(a,i)pyrene	SW-846, 8270	E.3
111 1,2-Dibromo-3-chloropropane	SW-846, 8240	E.2
112 1,2-Dibromoethane	SW-846, 8240	E.2
113 Dibromomethane	SW-846, 8240	E.2
114 Di-n-butyl phthalate	SW-846, 8270	E.3
115 Benzene, 1,2-dichloro	SW-846, 8270	E.3
116 Benzene, 1,3-dichloro	SW-846, 8270	E.3
117 Benzene, 1,4-dichloro	SW-846, 8270	E.3
118 Dichlorobenzene	SW-846, 9020	E.7
119 3,3'-Dichlorobenzidine	SW-846, 8270	E.3
120 1,4-Dichloro-2-butene	SW-846, 8240	E.2
121 Dichlorodifluoromethane	SW-846, 8240	E.2
122 1,1-Dichloroethane	SW-846, 8240	E.2
123 1,2-dichloroethane	SW-846, 8240	E.2
124 tran-1,2-Dichloroethene	SW-846, 8240	E.2
125 Dichloroethylene	SW-846, 9020	E.7
126 1,1-Dichloroethylene	SW-846, 8240	E.2
127 Methylene chloride	SW-846, 8240	E.2
128 2,4-Dichlorophenol	SW-846, 8270	E.3
129 2,6-Dichlorophenol	SW-846, 8270	E.3
130 2,4-D	SW-846, 8150	E.6
131 Dichlorophenylarsine	SW-846, 7060	E.5
132 Dichloropropane	SW-846, 9020	E.7

Table E-1. Dangerous Waste Constituents List. (sheet 5 of 12)

Constituent	Method[a]	Table
133 1,2-Dichloropropane	SW-846, 8240	E.2
134 Dichloropropanol	GC/MS, Dir. Inj.	E.4
135 Dichloropropene	SW-846, 9020	E.7
136 1,3-Dichloropropene	SW-846, 8240	E.2
137 Dieldrin	SW-846, 8080	E.6
138 1,2:3,4-Diepoxybutane	Unstable	E.8
139 Diethylarsine	SW-846, 7060	E.5
140 N,N-Diethylhydrazine	SW-846, 8240	E.2
141 Carbophenothion	AOAC-29.039	E.6
142 O,O-Diethylphosphoric acid, O-p-nitrophenyl ester	Exotic	E.9
143 Diethyl phthalate	SW-846, 8270	E.3
144 Thionazin	Exotic	E.9
145 Diethylstilbesterol	SW-846, 8330	E.10
146 Dihydrosafrole	SW-846, 8270	E.3
147 3,4-Dihydroxy-alpha-(methylamino) methyl benzyl alchol	Exotic	E.9
148 Diisopropylfluorophosphate	Unstable	E.8
149 Dimethoate	SW-846, 8140	E.9
150 3,3'-Dimethoxybenzidine	SW-846, 8270	E.3
151 p-Dimethylaminoazobenzene	SW-846, 8270	E.3
152 7,12-Dimethylbenz(a)anthracene	SW-846, 8270	E.3
153 3,3'Dimethylbenzidine	SW-846, 8270	E.3
154 Dimethylcarbamoyl chloride	Unstable	E.8
155 1,1-Dimethylhydrazine	SW-846, 8240	E.2
156 1,2-Dimethylhydrazine	SW-846, 8240	E.2
157 Thiofanox	SW-846, 8270	E.3
158 alpha, alpha-Dimethylphenethylamine	SW-846, 8270	E.3
159 2,4-Dimethylphenol	SW-846, 8270	E.3
160 Dimethyl phthalate	SW-846, 8270	E.3
161 Dimethyl sulfate	Unstable	E.8
162 Dinitrobenzene	SW-846, 8270	E.3
163 4,6-Dinitro-o-cresol and salts	SW-846, 8270	E.3

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Table E-1. Dangerous Waste Constituents List. (sheet 6 of 12)

Constituent	Method[a]	Table
164 2,4-Dinitrophenol	SW-846, 8270	E.3
165 2,4-Dinitrotoluene	SW-846, 8270	E.3
166 2,6-Dinitrotoluene	SW-846, 8270	E.3
167 Di-n-octyl phthalate	SW-846, 8270	E.3
168 1,4-Dioxane	SW-846, 8240	E.2
169 Diphenylamine	SW-846, 8270	E.3
170 1,2-Diphenylhydrazine	SW-846, 8270	E.3
171 Di-n-propylnitrosamine	SW-846, 8270	E.3
172 Disulfoton	SW-846, 8140	E.6
173 2,4-Dithiobiuret	Exotic	E.9
174 Endosulfan	SW-846, 8080	E.6
175 Endosulfan	SW-846, 8080	E.6
176 Ethyl carbamate	GC/MS, Dir. Inj.	E.4
177 Ethyl cyanide	GC/MS, Dir. Inj.	E.4
178 Ethylenebisdithiocarbamic acid	Exotic	E.9
179 Ethyleneimine	SW-846, 8270	E.3
180 Ethylene oxide	GC/MS, Dir. Inj.	E.4
181 Ethylenethiorea	SW-846, 8330	E.10
182 Ethylmethacrylate	GC/MS, Dir. Inj.	E.4
183 Ethyl methanesulfonate	SW-846, 8270	E.3
184 Fluoranthene	SW-846, 8270	E.3
185 Fluorine	Unstable	E.8
186 2-Fluoroacetamide	Exotic	E.9
187 Fluoroacetic acid	GC/MS, Dir. Inj.	E.4
188 Formaldehyde	Ion Chrom. (in-house)	E.10
189 Formic acid	Ion Chrom. (in-house)	E.10
190 Glycidylaldehyde	GC/MS, Dir. Inj.	E.4
191 Halomethane	HC/MS, Dir. 9020	E.7
192 Heptachlor	SW-846, 8080	E.6
193 Heptachlor epoxide	SW-846, 8080	E.6
194 Hexachlorobenzene	SW-846, 8270	E.3
195 Hexachlorobutadiene	SW-846, 8270	E.3
196 Lindane and isomers	SW-846, 8080	E.6

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Table E-1. Dangerous Waste Constituents List. (sheet 7 of 12)

Constituent	Method[a]	Table
197 Hexachlorocylopentadiene	SW-846, 8270	E.3
198 Hexachloroethane	SW-846, 8270	E.3
199 Hexachlorohexahydro-endo, endo-dimethanonaphthalene	Exotic	E.9
200 Hexachlorophene	SW-846, 8270	E.3
201 Hexachloropropene	SW-846, 8270	E.3
202 Hexaethyl tetraphosphate	Exotic	E.9
203 Hydrazine	Sw-846, 8270	E.3
204 Hydrocyanic acid	SW-846, 9010	E.10
205 Hydrofluoric acid	Unstable	E.8
206 Hydrogen sulfide	SW-846, 8240	E.2
207 Hydroxydimethylarsine oxide	SW-846, 7060	E.5
208 Indeno(1,2,3-cd)pyrene	SW-846, 8270	E.3
209 Iodomethane	SW-846, 8240	E.2
210 Iron Dextran	Exotic	E.9
211 Methyl isocyanate	Unstable	E.8
212 Isobutyl alcohol	GC/MS, Dir. Inj.	E.4
213 Isosafrole	SW-846, 8270	E.3
214 Kepone	SW-846, 8080	E.6
215 Lasiocarpine	Exotic	E.9
216 Lead and compounds	SW-846, 6010	E.5
217 Lead acetate	SW-846, 6010	E.5
218 Lead phosphate	SW-846, 6010	E.5
219 Lead subacetate	SW-846, 6010	E.5
220 Maleic anhydride	Unstable	E.8
221 Maleic hydrazide	AOAC-29.129	E.10
222 Malonoitrile	SW-846, 8270	E.3
223 Melphalan	SW-846, 8270	E.3
224 Mercury Fulminate	SW-846, 7470	E.5
225 Mercury and compounds	SW-846, 7470	E.5
226 Methacrylonitrile	SW-846, 8240	E.2
227 Methanethiol	SW-846, 8240	E.2
228 Methapyrilene	SW-846, 8270	E.3

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Table E-1. Dangerous Waste Constituents List. (sheet 8 of 12)

Constituent	Method[a]	Table
229 Metholonyl	SW-846, 8270	E.3
230 Methoxychlor	SW-846, 8080	E.6
231 2-Methylaziridine	SW-846, 8270	E.3
232 3-Methylcholanthrene	SW-846, 8270	E.3
233 Methyl chlorocarbonate	Unstable	E.8
234 4,4'-Methylenebis	SW-846, 8270	E.3
235 Methyl ethyl ketone	SW-846, 8240	E.2
236 Methyl hydrazine	GC/MS, Dir. Inj.	E.4
237 2-Methyllactonitrile	SW-846, 8270	E.3
238 Methyl methacrylate	SW-846, 8270	E.3
239 Methyl methanesulfonate	SW-846, 8270	E.3
240 2-Methyl-2-(methylthio) propionaldehyde-o-(methylcarbonyl) oxime	SW-846, 8270	E.3
241 N-Methyl-N'-nitro-N-nitrosoguanidine	Exotic	E.9
242 Methyl parathion	SW-846, 8140	E.6
243 Methylthiouracil	SW-846, 8270	E.3
244 Mustard gas	Exotic	E.9
245 Naphthalene	SW-846, 8270	E.3
246 1,4-Haphthoquinone	SW-846, 8270	E.3
247 1-Naphthylamine	SW-846, 8270	E.3
248 2-Naphthylamine	SW-846, 8270	E.3
249 1-Naphthyl-2-thiourea	SW-846, 8330	E.10
250 Nickel and compounds	SW-846, 6010	E.5
251 Nickel carbonyl	SW-846, 6010	E.5
252 Nickel cyanide	SW-846, 6010	E.5
253 Nicotine and salts	AOAC-43.444	E.10
254 Nitric oxide	Exotic	E.9
255 p-Nitroaniline	SW-846, 8270	E.3
256 Nitrobenzine	SW-846, 8270	E.3
257 Nitrogen dioxide	Unstable	E.8
258 Nitrogen mustard and hydrochloride salt	Exotic	E.9

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Table E-1. Dangerous Waste Constituents List. (sheet 9 of 12)

Constituent	Method[a]	Table
259 Nitrogen mustard N-Oxide and hydrochloride salt	Exotic	E.9
260 Nitroglycerine	Exotic	E.9
261 4-Nitrophenol	SW-846, 8270	E.3
262 4-Nitroquinoline-1-oxide	Exotic	E.9
263 Nitrosamine	SM-417	E.7
264 N-Nitrosodi-n-butylamine	SW-846, 8270	E.3
265 N-Nitrosodiethanolamine	SW-846, 8270	E.3
266 N-Nitrosodiethylamine	SW-846, 8720	E.3
267 N-Nitrosodimethylamine	SW-846, 8270	E.3
268 N-Nitroso-N-ethylurea	SW-846, 8330	E.3
269 N-Nitrosomethylethylamine	SW-846, 8270	E.3
270 N-Nitroso-N-methylurea	SW-846, 8330	E.10
271 N-Nitroso-N-methylurethane	SW-846, 8270	E.3
272 N-Nitrosomethylvinylamine	SW-846, 8270	E.3
273 N-Nitrosomorpholine	SW-846, 8270	E.3
274 N-Nitrosonornicotine	SW-846, 8270	E.3
275 N-Nitrosopiperidine	SW-846, 8270	E.3
276 Nitrosopyrrolidine	SW-846, 8270	E.3
277 N-Nitrososacrosine	Exotic	E.9
278 5-Nitro-o-toluidine	SW-846, 8270	E.3
279 Octamethylpyprophosphoramide	Exotic	E.9
280 Osmium tetroxide	SW-846, 6010	E.5
281 Endothol	Exotic	E.9
282 Paraldehyde	Exotic	E.9
283 Parathion	SW-846, 8140	E.6
284 Pentachlorobenzene	SW-846, 8270	E.3
285 Pentachloroethane	SW-846, 8240	E.2
286 Pentachloronitrobenzene	SW-846, 8270	E.3
287 Pentachlorophenol	SW-846, 8270	E.3
288 Phenacetin	SW-846, 8270	E.3
289 Phenol	SW-846, 8270	E.3
290 Phenylenediamine	SW-846, 8270	E.3

Table E-1. Dangerous Waste Constituents List. (sheet 10 of 12)

Constituent	Method[a]	Table
291 Phenylmercury acetate	SW-846, 7470	E.5
292 N-Phenylthiuourea	SW-846, 8330	E.10
293 Phosgene	Unstable	E.8
294 Phosphine	Exotic	E.9
295 Phorate	Unstable	E.8
296 Famphur	Unstable	E.8
297 Phthalic acid esters	SW-846, 8270	E.3
298 Phthalic anhydride	Unstable	E.8
299 2-Picoline	SW-846, 8270	E.3
300 Polychlorinated biphenyl	SW-846, 8080	E.6
301 Potassium cyanide	SW-846, 9010	E.10
302 Potassium silver cyanide	SW-846, 6010	E.5
303 Pronamide	SW-846, 8270	E.3
304 1,3-Propanesultone	Exotic	E.9
305 n-Propylamine	GC/MS, Dir. Inj.	E.4
306 Propylthiouracil	Exotic	E.9
307 2-Propyn-l-ol	GC/MS, Dir. Inj.	E.4
308 Pyridine	SW-846, 8240	E.2
309 Reserpine	SW-846, 8270	E.3
310 Resorcinol	SW-846, 8270	E.3
311 Saccharin and salts	Exotic	E.9
312 Sasfrol	SW-846, 8270	E.3
313 Selenious acid	SW-846, 7740	E.5
314 Selenium and compounds	SW-846, 7740	E.5
315 Selenium sulfide	SW-846, 7740	E.5
316 Selenourea	SW-846, 7740	E.5
317 Silver and compounds	SW-846, 6010	E.5
318 Silver cyanide	SW-846, 6010	E.5
319 Sodium cyanide	SW-846, 9010	E.10
320 Streptozotocin	Exotic	E.9
321 Strontium sulfide	SW-846, 6010	E.5
322 Strychnine and salts	AOAC-38.068	E.10
323 1,2,4,5-Tetrachlorobenaene	SW-846, 8270	E.3

Table E-1. Dangerous Waste Constituents List. (sheet 11 of 12)

Constituent	Method[a]	Table
324 TCDD	SW-846, 8270	E.3
325 Tetrachloroethane	SW-846, 8240	E.2
326 1,1,1,2-Tetrachlorethane	SW-846, 8240	E.2
327 1,1,2,2-Tetrachlorethane	SW-846, 8240	E.2
328 Tetrachlorethylene	SW-846, 8240	E.2
329 Tetrachloromethane	SW-846, 8240	E.2
330 2,3,4,6-Tetrachlorophenol	SW-846, 8270	E.3
331 Tetraethyldithiopyrophosphate	Unstable	E.8
332 Tetraethyl lead	SW-846, 67010	E.5
333 Tetraethylpyrophosphate	Exotic	E.9
334 Tetranitromethane	Exotic	E.9
335 Thallium and compounds	SW-846, 7840	E.5
336 Thallic oxide	SW-846, 7840	E.5
337 Thallium (1) acetate	SW-846, 7840	E.5
338 Thallium (1) carbonate	SW-846, 7840	E.5
339 Thallium (1) chloride	SW-846, 7840	E.5
340 Thallium (1) nitrate	SW-846, 7840	E.5
341 Thallium selenite	SW-846, 7840	E.5
342 Thallium (1) sulfate	SW-846, 7840	E.5
343 Thioacetamide	Exotic	E.9
344 Thiosemicarbazide	Exotic	E.9
345 Thiourea	SW-846, 8330	E.10
346 Thiuram	SW-846, 8270	E.3
347 Toluene	SW-846, 8240	E.2
348 Toluenediamine	SW-846, 8270	E.3
349 o-Toluidine hydrochloride	SW-846, 8270	E.3
350 Tolulene diisocyanate	Unstable	E.8
351 Toxaphene	SW-846, 8080	E.6
352 Bromoform	SW-846, 8240	E.2
353 1,2,4-Trichlorobenzene	SW-846, 8270	E.3
354 1,1,1-Trichloroethane	SW-846, 8240	E.2
355 1,1,2-Trichloroethane	SW-846, 8240	E.2
356 Trichloroethene	SW-846, 8240	E.2

Table E-1. Dangerous Waste Constituents List. (sheet 12 of 12)

Constituent	Method[a]	Table
357 Trichloromethanethiol	SW-846, 8240	E.2
358 Trichloromonofluoromethane	SW-846, 8240	E.2
359 2,4,5-Trichlorophenol	SW-846, 8270	E.3
360 2,4,6-Trichlorophenol	SW-846, 8270	E.3
361 2,4,5-T	SW-846, 8150	E.6
362 2,4,5-TP (Silvex)	SW-846, 8150	E.6
363 Trichloropropane	SW-846, 8240	E.2
364 1,2,3-Trichloropropane	SW-846, 8240	E.2
365 0,0,0-Triethyl phosphorothioate	SW-846, 8270	E.3
366 sym-Trinitrobenzene	SW-846, 8270	E.3
367 Tris(1-aziridinyl) phosphine sulfide	Unstable	E.8
368 Tris(2,3-dibromopropyl) phosphate	SW-846, 8270	E.3
369 Trypan blue	Exotic	E.9
370 Uracil mustard	Exotic	E.9
371 Vanadic acid, ammonium salt	SW-846, 6010	E.5
372 Vanadium pentoxide	SW-846, 6010	E.5
373 Vinyl chloride	SW-846, 8240	E.2
374 Zinc cyanide	SW-846, 6010	E.5
375 Zinc phosphide	Unstable	E.8

[a]SW-846: Environmental Protection Agency, 1982, Test Methods for Evaluating Solid Waste - Chemical/Physical Methods, SW-846. SM: American Public Health Association, 1985, Standard Methods for the Examination of Water and Waste Water, APHA, Washington, D.C. AOAC: Journal of the Association of Official Analytical Chemists.

Table E-2. Volatile Organics.
(sheet 1 of 2)

7	Acrolein
9	Acrylonitrile
31	Benzene
47	Bis(chloromethyl)ether
49	Bromoacetone
50	Methyl bromide
59	Carbon disulfide
72	Chlorobenzene
76	2-Chloroethyl vinyl ether
77	Chloroform
78	Methyl chloride
79	Chloromethyl methyl ether
91	Crotonaldehyde
111	1,2-Dibromo-3-chloropropane
112	1,2-Dibromoethane
113	Dibromomethane
120	1,4-Dichloro-2-butene
121	Dichlorodifluoromethane
122	1,1-Dichloroethane
123	1,2-Dichloroethane
124	trans-1,2-Dichloroethane
126	1,1-Dichloroethylene
127	Methylene chloride
133	1,2-Dichloropropane
136	1,3-Dichloropropane
140	N,N-Diethylhydrazine
155	1,1-Dimethylhydrazine
156	1,2-Dimethylhydrazine
168	Dioxane
206	Hydrogen sulfide

Table E-2. Volatile Organics.
(sheet 2 of 2)

209	Iodomethane
226	Methacrylonitrile
227	Methanethiol
235	Methyl ethyl ketone
285	Pentachloroethane
308	Pyridine
325	Tetrachloroethane
326	1,1,1,2-Tetrachlorethane
327	1,1,2,2-Tetrachlorethane
328	Tetrachlorethylene
329	Tetrachloromethane
347	Toluene
352	Bromoform
354	1,1,1-Trichloroethane
355	1,1,2-Trichloroethane
356	Trichloroethane
357	Trichloromethanethiol
358	Trichloromonofluoromethane
363	Trichloropropane
364	1,2,3-Trichloropropane
373	Vinyl chloride

Table E-3. Semi-Volatile Organics.
(sheet 1 of 5)

1	Acetonitrile
2	Acetophenone
4	2-Acetylaminofluorene
14	4-Aminobyphenyl
16	5-(Aminomethyl)-3-ioxazolol
17	Amitrole
18	Aniline
20	Aramite
25	Auramine
29	Benz[c]acridine
30	Benz[a]anthracene
33	Benzene, dichloromethyl-
34	Benzenethoil
35	Benzidine
36	Benzo[b]fluoranthene
37	Benzo[j]fluoranthene
38	Benzo[a]pyene
39	p Benzoquinone
41	Benzyl chloride
43	Bis(2-chloroethoxy)methane
44	Bis(2-chloroethyl) ether
45	Chlornaphazine
46	Bis(2-chloroisopropyl) ether
48	Bis(2-ethylhexyl) phthalate
51	4-Bromophenyl phenyl ether
54	Butyl benzyl phthalate
55	2-sec-Butyl-4,6-dinitrophenol
64	Chlorinated benzenes
70	Chloroalkyl ethers
71	p-chloraniline
74	p-Chloro-m-cresol

Table E-3. Semi-Volatile Organics.
(sheet 2 of 5)

75	1-Chloro-2,3-epoxypropane
80	2-Chloronaphythalene
81	2-Chlorophenol
85	Chrysene
90	Cresols
97	2-Cyclohexyl-4,6-dinitrophenol
104	Dibenz[a,h]acridine
105	Dibenz[a,j]acridine
106	Dibenz[a,h]anthracene
107	7H-Dibenzo[c,g]carbazole
108	Dibenzo[a,e]pyrene
109	Dibenzo[a,h]pyrene
110	Dibenzo[a,i]pyrene
114	Di-n-butyl phthalate
115	1,2-Dichlorobenzene
116	1,3-Dichlorobenzene
117	1,4-Dichlorobenzene
119	3,3'-Dichlorobenzidine
128	2,4-Dichlorophenol
129	2,6-Dichlorophenol
143	Diethyl phthalate
146	Dihydrosafrole
150	3,3'-Dimethoxybenzidine
151	p-Dimethylaminoazobenzene
152	7,12-Dimethlybenz[a]anthracene
153	3,3'-Dimethylbenzidine
157	Thiofanox
158	alpha,alpha-Dimethlphenethylamine
159	2,4-Dimethylphenol
160	Dimethyl phthalate
162	Dinitrobenzene
163	4,6-Dinitro-o-cresol and salts

Table E-3. Semi-Volatile Organics. (sheet 3 of 5)

164	2,4-Dinitrophenol
165	2,4-Dinitrotoluene
166	2,6-Dinitrotoluene
167	Di-n-octyl phthalate
169	Diphenylamine
170	1,2-Diphenylhydrazine
171	Di-n-propylnitrosamine
179	Ethylneneimine
183	Ethyl methanesulfonate
184	Fluoranthene
194	Hexachlorobenzene
195	Hexachlorobutadiene
197	Hexachlorocyclopentadiene
198	Hexachloroethane
200	Hexachlorophene
201	Hexachloropropene
203	Hydrazine
208	Indeno(1,2,3-cd)pyrene
213	Isosafrole
222	Malononitrile
223	Melphalan
228	Methapyrilene
229	Metholonyl
231	2-Methylaziridine
232	3-Methylcholanthrene
234	4,4'-Methylenebis(2-chloroaniline)
237	2-Methyllactonitrile
238	Methyl methacrylate
239	Methyl methanesulfonate
240	2-Methyl-2-(methylthio)propionaldehyde-o-(methylcarbonyl)oxime
243	Methylthioracil
245	Naphthalene

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Table E-3. Semi-Volatile Organics.
(sheet 4 of 5)

246	1,4-Naphthoquinone
247	1-Naphthylamine
248	2-Naphthylamine
255	p-Nitroaniline
256	Nitrobenzine
261	4-Nitrophenol
264	N-Nitrosodi-n-butylamine
265	N-Nitrosodiethanolamine
266	N-Nitrosodiethylamine
267	N-Nitrosodimethylamine
269	N-Nitrosomethylethylamine
271	N-Nitroso-N-methylurethane
272	N-Nitrosomethylvinylamine
273	N-Nitrosomorpholine
274	N-Nitrosonornicotine
275	N-Nitrosopiperidine
276	Nitrosopyrrolidine
278	5-Nitro-o-toluidine
284	Pentachlorobenzene
286	Pentachloronitrobenzene
287	Pentachlorophenol
288	Phenacetin
289	Phenol
290	Phenylenediamine
297	Phthalic acid esters
299	2-Picoline
303	Pronamide
309	Reserpine
310	Resorcinol
312	Safrol
323	1,2,4,5-Tetrachlorobenzene

Table E-3. Semi-Volatile Organics.
(sheet 5 of 5)

324	2,3,7,8-TCDD
330	2,3,4,6-Tetrachlorophenol
346	Thiuram
348	Toluenediamine
349	o-Toluidine hydrochloride
353	1,2,4-Trichlorobenzene
359	2,4,5-Trichlorophenol
360	2,4,6-Trichlorophenol
365	0,0,0-Triethyl phosphorothioate
366	sym-Trinitrobenzene
368	Tris(2,3-dibromopropyl) phosphate

Table E-4. Organics by GC/MS Direct Injection.

8	Acrylamide
12	Allyl alcohol
61	Chloral
69	Chloroacetaldehyde
83	3-Chloropropionitrile
93	Cyanogen
134	Dichloropropanol
176	Ethyl carbamate
177	Ethyl cyanide
180	Ethylene oxide
182	Ethyl methacrylate
187	Fluoracetic acid
190	Glycidylaldehyde
212	Isobutyl alcohol
236	Methyl hydrazine
305	n-Propylamine
307	2-Propyn-l-ol

Table E-5. Constituents That Only Require Analysis for Metal Specis. (sheet 1 of 2)

19	Antimony, NOS
21	Arsenic and compounds, NOS
22	Arsenic acid
23	Arsenic pentoxide
24	Arsenic trioxide
27	Barium and compounds, NOS
28	Barium cyanide
32	Benzenearsonic acid
42	Beryllium and compounds, NOS
56	Cadmium and compounds, NOS
57	Calcium chromate
84	Chromium and compounds, NOS
88	Copper cyanide
131	Dichlorophenylarsine
139	Diethylarsine
207	Hydroxydimethylarsine oxide
216	Lead and compounds, NOS
217	Lead acetate
218	Lead phosphate
219	Lead subacetate
224	Mercury fulminate
225	Mercury and compounds, NOS
250	Nickel and compounds, NOS
251	Nickel carbonyl
252	Nickel cyanide
280	Osmium tetroxide
291	Phenylmercury acetate
302	Potassium silver cyanide
313	Selenious acid
314	Selenium and compounds, NOS

Table E-5. Constituents That Only Require Analysis for Metal Specis. (sheet 2 of 2)

315	Selenium sulfide
316	Selenourea
317	Silver and compounds, NOS
318	Silver cyanide
321	Strontium sulfide
332	Tetraethyl lead
335	Thallium and compounds, NOS
336	Thallic oxide
337	Thallium acetate
338	Thallium carbonate
339	Thallium chloride
340	Thallium nitrate
341	Thallium selenite
342	Thallium sulfate
371	Vanadic acid, ammonium salt
372	Vanadium pentoxide
374	Zinc cyanide

Table E-6. Pesticides/Herbicides.

11	Aldrin
63	Chlordane
73	Chlorobenzilate
100	DDD
101	DDE
102	DDT
130	2,4-D
137	Dieldrin
141	Carbophenothion
149	Dimethoate
172	Disulfoton
174	Endosulfan
175	Endrin
192	Heptachlor
193	Heptachlor epoxide
196	Lindane and isomers
214	Kepone
230	Methoxychlor
242	Methyl parathion
283	Parathion
300	Polychlorinated biphenyl
351	Toxaphene
361	2,4,5-T
362	2,4,5-TP Silvex

Table E-7. Compounds to be Analyzed by Class.

TOX:	
65	Chlorinated ethane
66	Chlorinated fluorcarbons
67	Chlorinated naphthalene
68	Chlorinated phenol
118	Dichlorobenzene
125	Dichloroethylene
132	Dichloropropane
135	Dichloropropene
191	Halomethane
TOC:	
87	Coal tars
89	Creosote
Ammonium:	
263	Nitrosamine

Table E-8. Constituents Unstable in Water.

5	Acetyl chloride
13	Aluminum phosphide
40	Benzotrichloride
53	2-butanone peroxide
60	Carbon oxyfluoride
138	1,2,3,4-diepoxybutane
148	Diisopropylfluorophosphate
154	Dimethylcarbamoyl chloride
161	Dimethyl sulfate
185	Fluorine
205	Hydrofluoric acid
211	Methyl isocyanate
220	Maleic anhydride
233	Methyl chlorocarbonate
257	Nitrogen dioxide
293	Phosgene
295	Phorate
296	Famphur
298	Phthalic anhydride
331	Tetraethyldithiopyrophosphate
350	Toluene diisocyanate
367	Tris (1-aziridinyl) phosphine sulfide
375	Zinc phosphide

Table E-9. Constituents for Which No Analysis is Available. (sheet 1 of 2)

10	Aflatoxins
15	Mitomycin C
26	Azaserine
52	Brucine
62	Chlorambucil
96	Cycasin
98	Cyclophosphamide
99	Daunomycin
103	Diallate
142	0,0-diethylphosphoric acid, o-p-nitrophenyl ester
144	Thionazin
147	3,4-dihydroxyu-alpha-(methylamino) methyl benzyl alcohol
173	2,4-dithiobiuret
178	Ethylenebisdithiocarbamic acid
186	2-fluoroacetamide
199	Hexachlorohyxahydro-endo, endo-dimethanonaphthalene
202	Hexaethyl thetrphosphyate
210	Iron dextran
215	Lasiocarpine
241	N-methyl-N'-nitro-N-nitrosoguanidine
244	Mustard gas
254	Nitric oxide
258	Nitrogen mustard - HCl salt
259	Nitrogen mustard N-oxide and HCl salt
260	Nitroglycerin
262	4-nitroquinoline
277	N-nitrososacrosine
279	Octamethylpyrophosphoramide
281	Endothol
282	Paraldehyde
294	Phosphine

Table E-9. Constituents for Which No Analysis is Available. (sheet 2 of 2)

304	1,3-propanesultone
306	Propylthiouracil
311	Saccharin and salts
320	Streptozotocin
333	Tetraethylpyrophosphate
334	Tetranitromethane
343	Thioacetamide
344	Thiosemicarbazide
369	Trypan blue
370	Uracil mustard

Table E-10. Miscellaneous Organics and Inorganics.

86	Citrus red No. 2
92	Cyanide
58	Calcium cyanide
204	Hydrocyanic acid
301	Potassium cyanide
319	Sodium cyanide
94	Cyanogen bromide
95	Cyanogen chloride
188	Formaldehyde
189	Formic acid
221	Maleic hydrazide
253	Nicotine and salts
322	Strychnine
345	Thiourea
6	1-Acetyl-2-thiourea
82	1-(o-Chlorophenyl)thiourea
145	Diethylstilbesterol
181	Ethylenethiourea
249	1-Naphthyl-2-thiourea
268	N-Nitroso-N-ethylurea
270	N-Nitroso-N-methylurea
292	N-Phenylthiorea

PNL97-3272-E-10

APPENDIX C

LETTER REPORT ON RADIOLOGICAL SURVEY OF SEDIMENTS IN 216-A-29 DITCH

Internal Letter

Rockwell International

Date January 12, 1983

No .72710-83-006

TO: (Name, Organization, Internal Address)
.J. D. Galbraith
.Capital Projects
.2750-E/D-225/200 East Area

FROM: (Name, Organization, Internal Address, Phone)
.K. R. Fecht
.Environmental Technologies
.MO-936/200 West Area
.3-2971

Subject: .Radiological Survey of Sediments in the 216-A-29 Ditch

A radiological survey was conducted by the Environmental Technologies Group in the upper portion of the 216-A-29 Ditch. The purpose of the survey was to estimate the amount of contaminated or potentially contaminated sediments beneath the ditch that will be required to be removed prior to general construction activities in the proposed 241-AP Tank Farm. The results of the radiological survey and a conservative estimate of the amount of soil that needs to be removed are presented.

Sediment samples were collected for analysis from 5 shallow core borings in the ditch bottom and from 8 auger borings along the ditch banks. The borings were drilled on 5 transects across the ditch (Figure 1). The shallow core borings were hand cored to a depth of 3 to 4 feet and the 8 auger borings were drilled to a depth of about 12 feet. Sediments retrieved from the borings were surveyed by Radiation Monitoring Group personnel using portable field instruments and no detectable contamination was observed.

The sediments were sampled from the top, middle and bottom of each boring except for shallow core boring #1. Selected sediment samples were analyzed for the following radionuclides using the Mobile Radionuclide Analysis Laboratory (MRAL) I; ^{40}K, ^{60}Co, ^{137}Cs, ^{152}Eu, ^{228}Th, ^{88}Y, ^{241}Am, and ^{239}Pu. All radionuclide concentrations using MRAL I were comparable to background levels except for ^{137}Cs. The concentration of ^{137}Cs in the shallow core borings, particularly the top sample from the shallow core borings, is consistently higher than background levels. Incorporation of corrections for moisture which is estimated to range from 20 to 30 percent in the shallow core samples from the ditch bottom, will give a maximum observed value of 90 pCi/g in the top sample from shallow core boring #2. This highest observed value is a fraction of the acceptable limit of 400 pCi/g set in RHO-MA-139.

Based on the results of the analyses from MRAL I no radionuclide concentrations were detected at or in excess of soil standards set in RHO-MA-139. The highest concentrations of ^{137}Cs were found in the mud in the ditch bottom. The mud layer which consists of organic material and fine-grained sediments is about 6- to 9-inches thick. The ^{137}Cs values generally decreased with depth in the borings. Based on this data it is recommended that the upper 18 inches of the ditch bottom out to 3 feet beyond the shorelines on the ditch banks and the upper 18 inches of the ditch banks be considered contaminated sediments. These sediments then must be removed and disposed to an approved site for low-level radioactive materials.

J. D. Galbraith
Page 2
January 12, 1983

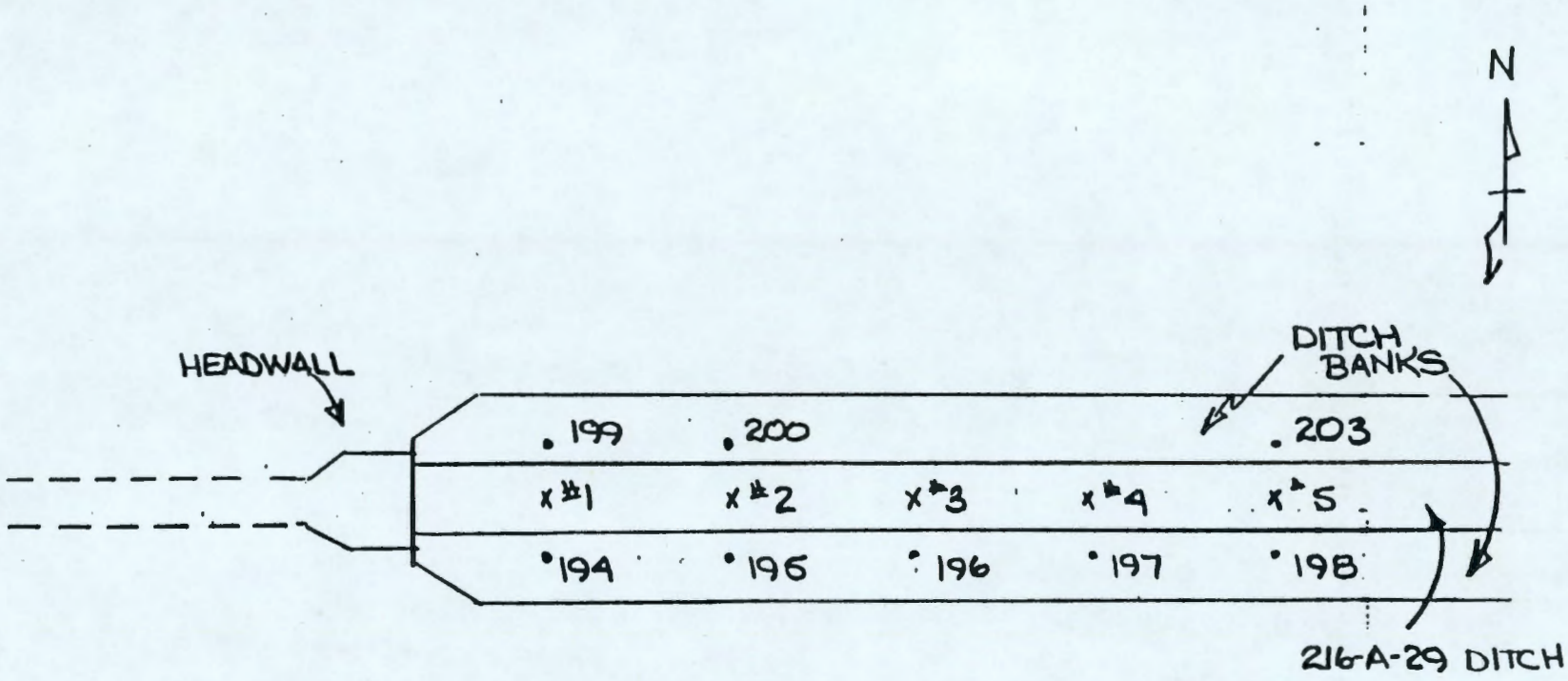
If you have any questions regarding this survey, please contact me.

K. R. Fecht, Staff Geologist
Environmental Technologies Group

KRF/lkd

Att.

cc: M. J. Graham
H. A. Haerer
W. F. Heine
W. P. Kunkel
R. M. Mitchell ✓
V. B. Subrahmanyam



• AUGER BORINGS
X SHALLOW CORE BORINGS

NOT TO SCALE

FIGURE 1 - MAP OF THE 216-A-29 DITCH WITH BOREHOLE LOCATIONS

APPENDIX D

A-29 DITCH FIELD LOGBOOK

PROJECT A-29 Ditch

Continued From Page New Site

Radio 150 > Jim McNett
Station 16

Prejob safety meeting : 0930

Date 5/24/88
location A-29 Ditch

Wind SSE at 8-10 mph
Temp ~ 68°F
Sunny & warm

Attendees —

		Payroll #	Rep
R.M.	Frederick	#61474	RF
D.S.	Landeen	#66761	Sa
R.C.	Roos	#58230	Sa
R.M.	Mitchell	#65497	Sa
E.J.	Rink	#61251	Tra

Team Leader & Site Safety

HNU Reading Background - <0.5 ppm at 1040

HNU Reading Sample pulled - <0.5 ppm at 1040

HNU Reading Sample pulled - <0.5 ppm at 1115

HNU Reading Sample pulled <0.5 ppm at 1150

HNU reading Sample pulled <0.5 ppm at 1215

Uniform - for sampler consists of single set of ... with double gloves & Tinder ... boots — watch for splash of materials into whites & reading for hydrazine

Special Instructions: Sample ... look for presence of Cadmium ... selected samples —

Monitor shut down after final sampling at 1230 hours.

The first set of soil and sediment samples were collected from the upper end of the open portion of the 216-A-29 Ditch near the outfall from the Purex facility.

Sample Site # 1

Sample site # 1 was located directly in the A-29 Ditch at a point 91 feet from the point of outfall (see map). A wooden bridge was used to collect the samples. Two samples were collected at the site using a stainless-steel hand auger

0-11" > Sample A117 - C of C = #17 Time = 1040 Sandy crumbling with reddish tinge —

11-24" > discarded material

24-36" > Sample A118 C of C = #18 Time = 1115

Continued on Page

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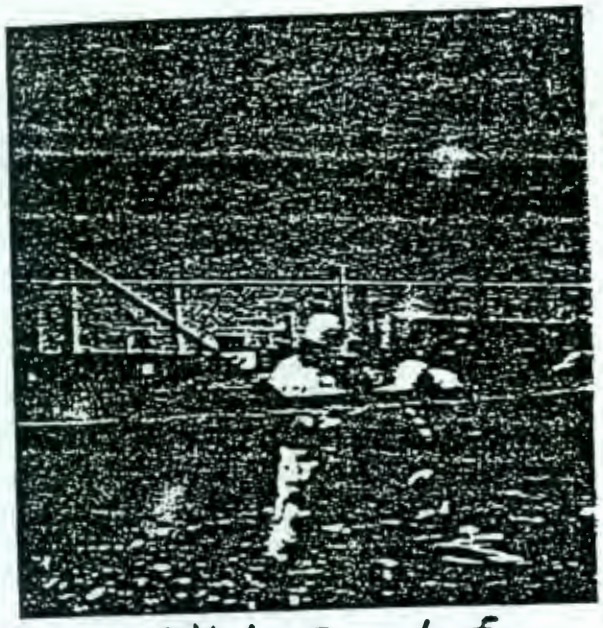
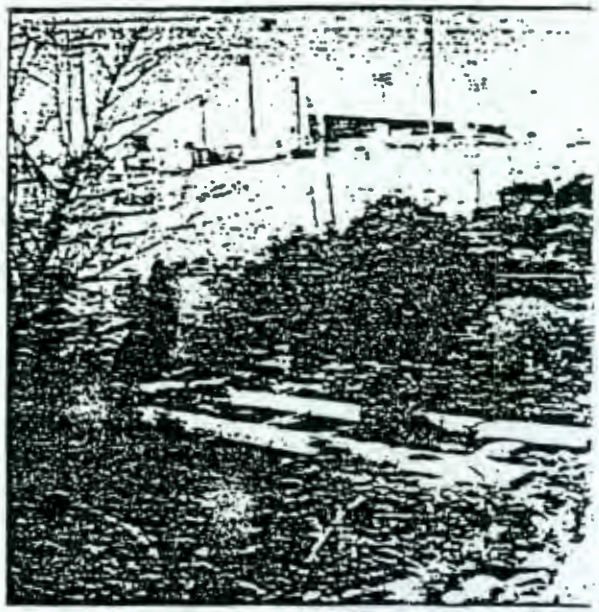
R M Mitchell — Signed — 5/24/88 — Date

[signature] — Signed — 2 June — Date



A-29 Ditch Sample from site #1
5/24/88
1055 E.J. Rink



A-29 Ditch Sample Site #1
5/24/88 Looking South
1050 E.J. Rink

Sample Site #2 was located downstream from site #1 approximately 118 feet. The wooden bridge was used again to gain access to the ditch for hand-augering

Surface

0-12" > Sample A119 CofC = #19 Sample had large amount of organic material & appeared discolored or oxidized when exposed to the air
Time = 1150

12-24" > discarded material

24-36 > Sample A120 CofC = #20
Time = 1215

Sampling was closed out at approx. 1310

Continued on Page 18

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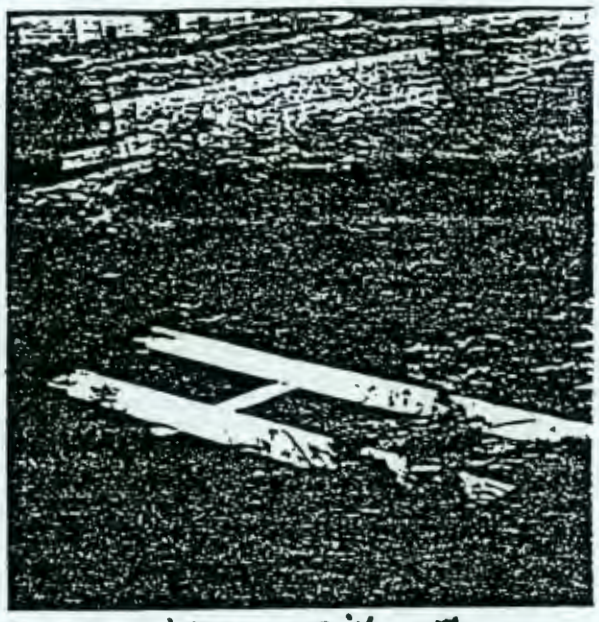
RM Mitchell	5/24/88	[signature]	2 June 88
Signed	Date	Signed	Date

A-29 Ditch Sample from
5/24/88 Site #2
1155 E.J. Rick



A-29 Ditch Site #2
5/24/88 Looking South
1150 E.J. Rick

After completion of the sampling at the head-end of the ditch it was necessary to exit the 200 East Area & drive thru to the A-29 Ditch site from the north because new fences have blocked access to the ditch from the south. It was determined that the sample sites in this area would be located at the bottom end of the ditch (see to reduce the possibility of CMS contamination of upstream samples.

Date = 5/25/88

Weather: Clear & warm ~ 74°F

Wind = 0-3 mph

Pre-job Safety Meeting:

Attendees	Page
R.M. Mitchell	654
E.J. Rick	612
D.E. Nelson	621
R.M. Frederick (RPT)	161
D.S. Landeen	166
R.C. Ross	58

Continued on Page

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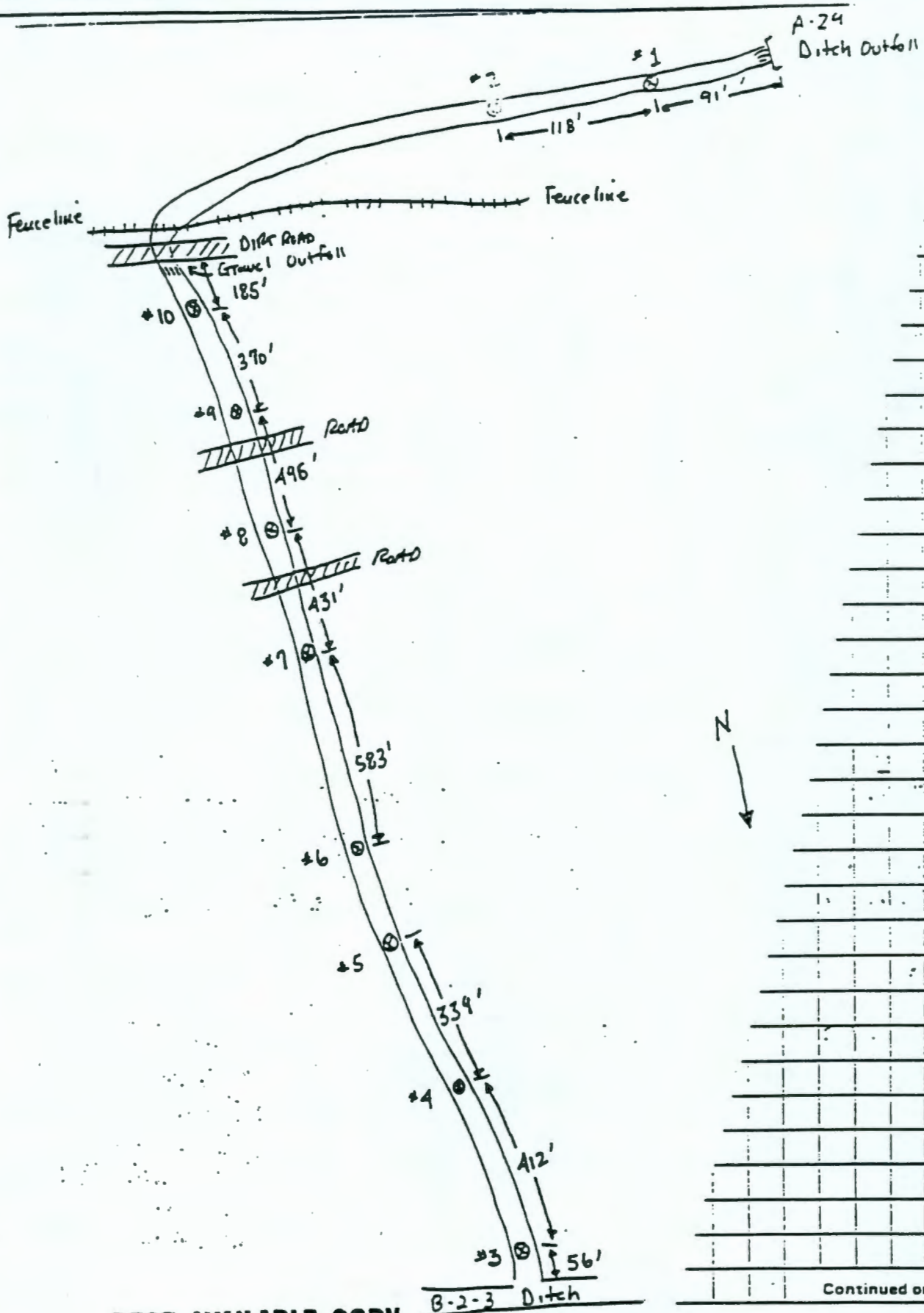
5/25/88 R.M. Mitchell
Signed Date

Signed Date

OJECT A-29 Ditch

Notebook No. 1

Continued From Page 18



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R M Fritchen	5/25/88	[signature]	2 June 88

Sample Site # 3 was located 56 feet from the point at which A-29 Ditch empties into the B-2-3 Ditch. Work commenced at approximately 0930 d to vehicle repair problems. The HNU was calibrated and background was determined to be at < 0.5 ppm at 10935.

The lower portion of A-29 Ditch has a much greater flow rate due to a combination drop in elevation and a restriction of the stream size from 3 to 4 feet on average. Therefore the bottom consists primarily of large cobble and obtaining a sediment sample was extremely difficult. Sites where samples were obtained at depth are noted (#3 & all other sample sites consisted of a single sample.

Surface

0-10" Sample # A121 HNU reading at sample pull was < 0.5 ppm
Time = 1015 C of C - #21

*Note: there was no discarded portion of the sample

10-22" Sample # A122 HNU reading at sample pull was < 0.5 ppm
Time = 1035 C of C = #22

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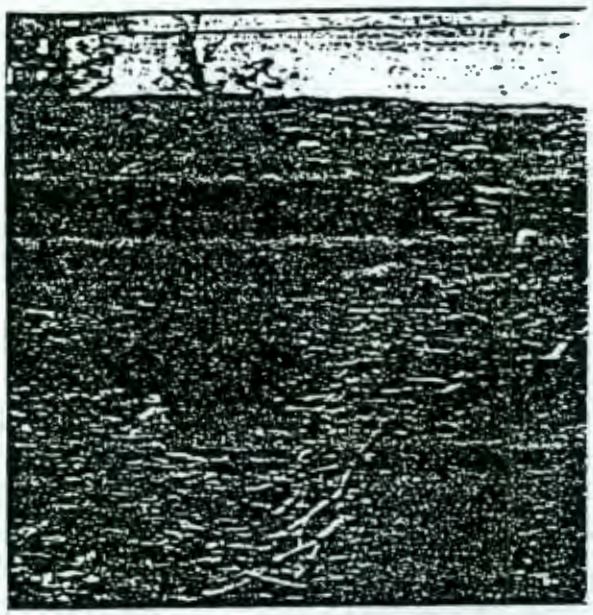
Signed Date Signed D

A-29 Ditch Site # 3
5/25/88 RM Mitchell



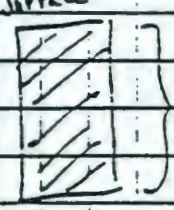
A-29 Ditch Site # 4
5/25/88 RM Mitchell

A-29 Ditch Site # 4
5/29/88 RM Mitchell

Sample Site # 4

Located approximately 412 feet south of site # 3. It was very difficult to locate an area where the cobble would allow the collection of a complete sample. No sample at depth!

surface



0-8" Sample # A123
C of C = #23
Time = 1120

HNU reading at sample pull was <0.5 ppm.

Continued on Page 22

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5/25/88 — Date
[signature] — Signed
2 June 88 — Date

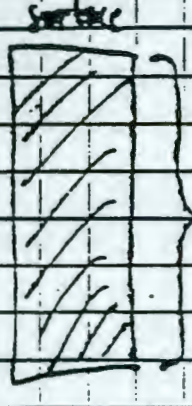
PROJECT A-29 Ditch

Continued From Page 21

Sample Site #5

Located approximately 339 feet south of #4. Here again the cobble nature of the ditch bottom only allowed for a single sediment sample

surface



0-10" Sample # A124

Time = 1145

CofC = #24

Hatch ready at sample out was at <0.5 ppm (background)

A-29 Ditch Site #5 Rampstake
5/25/88

Sampling for the day was closed out at approximately 1225.

Continued on Pag

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Richard Ross — Signed — 2 Jun — D.

JECT A-29 Ditch

Continued From Page 22

5/26/88 A-29 Ditch Sampling Project Safety Meeting —

Weather: clear, slightly overcast 68°F
wind 5-8 mph

Attendees	Payroll #
R M Mitchell	65497
D. S. Landeen	66761
R.C. Ross	58230 (RPT)
R.M. Frederick	61494
E.J. Rink	61251
S. J. Phillips	67410

Work commenced at 0820 hours with selection of sample site # 6

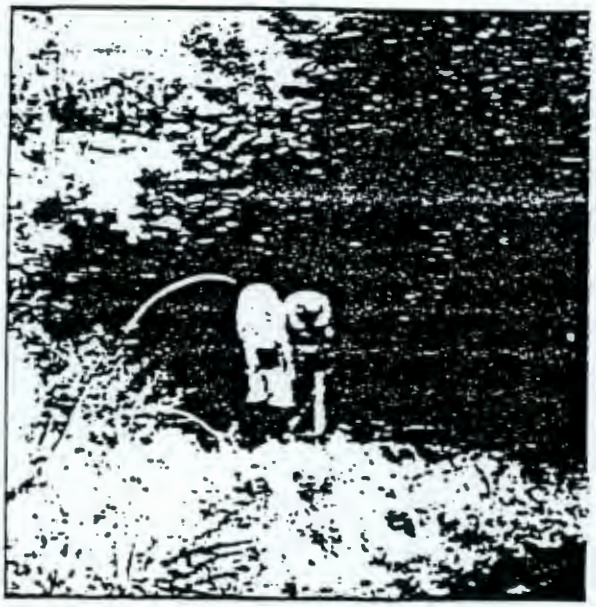
HNU was calibrated at 0825 and a background of 0.5 ppm was determined. Readings were taken by RM and HNU at each sample pull.

Sample Site #6 (location see map) A single sample was collected at this site

Surface

0-12" Sample # A125 Time = 0850 CofC #25

HNU reading at sample pull was <0.5 ppm



Site # 6 5/26/88 A29 Ditch

A-29 Ditch Site #6
5/26/88 Sampling
0900 E. J. Rink

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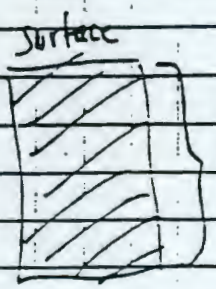
RM Mitchell — Signed — 5/26/88 — Date

[signature] — Signed — 2 June 88 — Date

Sample Site # 7 was located ~ 583 feet south of Site # 6 (see map)

Due to cobble a shallow sample was collected at this site which consisted of a large amount of organic material.



0-6" Sample # A126
C of C = #26
Time = 0915

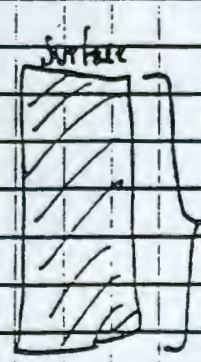
HNU ready at time of sample pull was < 0.5 ppm

* Note: Ready for this sample on GM was 300 cpm above background of 50 cpm.

A-29 Ditch 5/26/88
Site # 7 RM Nutchee

Sample Site # 8 was located approximately 431 feet South of Site # 7 (see map

The cobble bottom of the ditch again required a shallow sample



0-8" Sample # A127
C of C = #27
Time = 0955

HNU ready at time of sample pull = < 0.5 ppm

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R M Nutchee 5/26/88 [signature] 2 Ju

Signed Date Signed

SUBJECT A-29 Ditch

Continued From Page 29

Site # 8 A-29 Ditch
5/26/88 RM [illegible]

A-29 Ditch Site #8
5/26/88 Sample Removal
0955 E.J. Gink

A-29 Ditch 5/26/88
Site #9 RM [illegible]

A-29 Ditch Site #9
5/26/88 Sampling
1040 E.J. Gink

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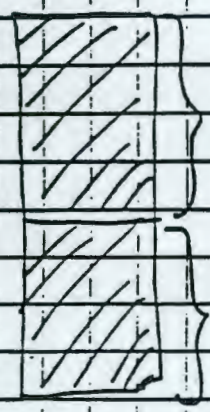
RM. [illegible]	5/26/88	[illegible]	2 June 88
Signed	Date	Signed	Date

Sample Site #9 was located ≈ 496 feet south of site #8. It was located in a "delta-type" area (see photograph) and therefore allowed a sample to be taken at depth.



0-11" Sample # A128 Time = 1040 HNU ready at sample pull was <0.5 ppm
C of C = #28

12-24" Sample # A129 Time = 1100 HNU ready at sample pull was <0.5 ppm
C of C = #29

Sample Site #10 was located ≈ 185 feet north of the cobbled area where the ditch goes under the main road area south RM north of the Grout Lancelain.

A single sample was collected at the site surface

0-12" Sample # A130
Time = 1125
C of C = #30

HNU reading at time of sample pull was <0.5 ppm.

* note: Ready a GM was 150 cpm above background of 50 cpm

A-29 Ditch Site #10 RM Hatchen 5/26/88

Continued on Page

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RM Hatchen 5/26/88 [signature] 2 June 1
Signed Date Signed Date