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1.	200-UP-2 DESCRIPTION OF WORK PROJECT CHANGE FORM	ATT-1
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1.0 SCOPE OF WORK

This description of work (DOW) details the field activities associated with the test pit excavation and soil sampling at the 216-U-10 Pond (U-10 Pond) in the 200 West Area and will serve as a field guide for those performing the work. It will be used in conjunction with the 200-UP-2 *Resource Conservation and Recovery Act of 1976 (RCRA) Facility Investigation/Corrective Measures Study* (DOE-RL 1993a,[LFI]) and *Site Characterization Manual* (WHC 1988a). Test pits will be constructed to characterize the vertical extent of contaminants in sediments within and beneath the former U-10 pond. The constituents of concern for the project are presented in Table 1.

1.1 SITE BACKGROUND AND PROPOSED ACTIVITIES AT THE 216-U-10 POND

The U-10 Pond was constructed in 1944 to receive low-level liquid effluent from the various chemical reprocessing facilities within the 200 West Area. The U-10 Pond covered 30 acres and received approximately 4.3×10^{10} gal of contaminated liquid. Sampling conducted in 1980 indicated that the most significant radionuclides detected were Strontium-90, Cesium-137, and plutonium and uranium (DOE-RL 1993b). The pond was deactivated and stabilized in 1985 with clean fill. The thickness of the stabilization cover is variable across the former pond and ranges between 2 ft near the pond margins and delta area to 8 ft in the deepest section of the pond.

1.2 TEST PITS

Two test pits will be excavated in the stabilized U-10 Pond to an approximate depth of 30 to 35 ft. Maximum pit depth will be based on the amount of soil sloughing from the pit walls as well as the ability to maintain safe working conditions as specified in Hazardous Waste Operating Permit (HWOP) and the Radiation Work Permit (RWP). Test pit 216-U-10-TP-1 (TP-1) will be constructed in the former delta of the pond, and test pit 216-U-10-TP-2 (TP-2) will be placed in the deepest area of the former pond. Chemical and radiological samples will be obtained from each pit as the excavation is deepened. Test pit locations are presented in Figure 1.

2.0 GENERAL REQUIREMENTS

2.1 HEALTH AND SAFETY

All personnel working to this DOW will have completed the 40-Hr Hazardous Waste Site Worker Training Program and will perform all work in accordance with the following:

- WHC-CM-7-7, *Environmental Investigations and Site Characterization Manual* (EII) (WHC 1988d).

Table 1. 200-UP-2 Contaminants of Concern. Sheet 1 of 2.

Contaminants of Concern	Direct Analysis	Indirect Analysis	Contaminants of Concern	Direct Analysis	Indirect Analysis
Gross Alpha	X		Gross Beta	X	
THORIUM/ URANIUM					
Th-230		NOTE 1	U-234	X	NOTE 10
Th-231		NOTE 2	U-235	X	NOTE 9
			U-238	X	NOTE 10
TRANSURANICS					
Np-237	X		Pu-241		NOTE 11
Np-239		NOTE 3	Am-241	X	
Pu-238	X		Am-243	X	NOTE 3
Pu-239/240	X		Cm-244	X	
FISSION/ ACTIVATION PRODUCTS					
H-3 (Note 12)	X		Tc-99	X	
C-14 (Note 12)	X		Ru-106		NOTE 6
Na-22	X		I-129	X	
Co-60	X		Cs-134	X	
Se-79	X		Cs-137	X	NOTE 7
Sr-90	X	NOTE 4	Ba-137m		NOTE 7
Y-90		NOTE 4	Sm-151	X	
Zr-93	X		Eu-152	X	
Nb-93m		NOTE 5	Eu-154	X	
			Eu-155	X	
OTHER RADIONUCLIDES					
K-40	X				
Tl-207		NOTE 2	Bi-214		NOTE 1
Pb-211		NOTE 2	Po-214		NOTE 1
Pb-214		NOTE 2	Po-218		NOTE 1
Bi-210		NOTE 1	Po-231		NOTE 9
Bi-211		NOTE 2	Po-234m		NOTE 10
HEAVY METALS					
Arsenic	X		Manganese	X	
Barium	X		Mercury	X	
Beryllium (Note 8)	X		Nickel	X	
Cadmium	X		Selenium	X	
Chromium	X		Silver	X	

Table 1. 200-UP-2 Contaminants of Concern. Sheet 2 of 2.

Copper	X		Titanium	X	
Iron	X		Vanadium	X	
Lead	X		Zinc	X	
OTHER INORGANICS					
Boron	X		Fluoride	X	
Cyanide	X		Nitrate	X	
Nitrite	X				
VOLATILE ORGANICS					
Acetone	X		MIBK ("hexone")	X	
Carbon tetrachloride	X		Toluene	X	
Chloroform	X		1,1,1-Trichloroethane	X	
Methylene chloride	X				
SEMIVOLATILE ORGANICS					
Kerosene	X		Tributyl phosphate	X	

NOTES:

- 1 This radionuclide is a decay progeny of uranium-238 and will be analyzed based on the concentration of uranium-238 determined through direct analysis.
- 2 This radionuclide is a decay progeny of uranium-235 and will be analyzed based on the concentration of uranium-235 determined through direct analysis.
- 3 The analysis of americium-243 is accomplished through analysis of its short-lived progeny neptunium-239.
- 4 The analysis of strontium-90 is accomplished through analysis of its short-lived decay progeny yttrium-90.
- 5 This radionuclide is a decay progeny of zirconium-93 and will be analyzed based on the concentration of zirconium-93 determined through direct analysis.
- 6 The analysis of ruthenium-106 is accomplished through analysis of its short-lived decay progeny rhodium-106.
- 7 The analysis of cesium-137 is accomplished through analysis of its short-lived decay progeny barium-137m.
- 8 Beryllium is being added to the list of contaminants of potential concern because it is a suspected human carcinogen, it is known to be common in Hanford Waste streams, and it is detected in environmental samples from other Hanford studies.
- 9 The analysis of uranium-235 can involve either direct measurement or is accomplished by analysis of its short-lived decay progeny protactinium-231.
- 10 The analysis of uranium-234 and uranium-238 can involved either direct measurement or is accomplished by analysis of the short-lived decay progeny protactinium-234m.
- 11 Plutonium-241 concentrations are inferred from the concentrations of plutonium-238, plutonium-239, and plutonium-240.
- 12 The Constituent is analyzed for only in water samples.

Figure 1. Test Pit Site Location Map.

- WHC-CM-7-5, *Environmental Compliance Manual* (WHC 1988c)
- WHC-CM-1-6, *Radiological Control Manual* (WHC 1993c)
- WHC-IP-0692, *Health Physics procedures Manual* (WHC 1991)
- WHC-CM-4-11, *ALARA Program* (WHC 1988a)
- WHC-EP-0383, *Environmental Engineering, Technology, and Permitting Function Quality Assurance Program Plan* (WHC 1990)
- WHC-CM-4-3, *Industrial Safety Manual*, Vol. 1 through 4 (WHC 1987)
- WHC-CM-7-8, Vol 2, *Engineering and Geotechnology Functions and Procedures*, Rev. 1 (WHC 1988b)
- Site-specific health and safety plan/radiation work permits/job safety analysis

2.2 PREREQUISITES

The requirements and procedures applicable to the 200-UP-2 Operable Unit field activities are specified in the Environmental Investigations and Site Characterization Manual (WHC 1988d). Applicable EIIs include:

- EII 1.1 "Hazardous Waste Site Entrance Requirements"
- EII 1.5 "Field Logbooks"
- EII 1.13 "Readiness Review"
- EII 2.1 "Preparation of Hazardous Waste Operations Permit"
- EII 3.2 "Calibration and Control of Monitoring Instruments"
- EII 3.4 "Field Screening"
- EII 4.3 "Control of CERCLA and Other Past-Practice Investigation Derived Waste"
- EII 5.1 "Chain of Custody"
- EII 5.2 "Soil and Sediment Sampling"
- App. I "Test Pit/Trench Sampling"
- EII 5.4 "Field Decontamination of Drilling, Well Development, and Sampling Equipment"
- EII 5.5 "1706 KE Laboratory Decontamination of RCRA/CERCLA Sampling Equipment"
- EII 5.7A "Hanford Geotechnical Sample Library Control"
- EII 5.10 "Obtaining Sample Identification Numbers and Accessing HEIS Data"
- EII 5.11 "Sample Packaging and Shipping"
- EII 6.1 "Activity Reports of Field Operations"

EII 6.7 "Resource Protection Well and Test Borehole
Drilling"

EII 9.1 "Geologic Logging"

Additional requirements and procedures applicable to the 200-UP-2 Operable Unit can be found in *Engineering and Geotechnology Functions and Procedures*, Vol. 2, specifically EII.1, "Test Pit Excavation in Radiological Areas" (WHC 1988b).

Each item on the checklist for tasks requiring no readiness review (EII 1.13, "Engineering and Geotechnology Readiness Review" [WHC 1988d]) will be signed and dated by the cognizant engineer or field team lead leader (FTL) prior to the start of work.

3.0 FIELD ACTIVITIES

The following sections detail the activities to be conducted for the excavation and sampling and analysis of test pits in the U-10 Pond. Background information applicable to test pit excavation and sampling is presented in DOE-RL (1993a) Section 5.3, Field Activities, and its subsections. Information from these subsections has been excerpted and is attached as Appendix A to this document.

3.1 SCREENING, BACKGROUND, AND BASELINE ACTIVITIES

Each backhoe bucket of excavated material and all samples removed from the test pit will be field screened in the backhoe bucket for evidence of volatile organics and radionuclides (LFI, DOE-RL 1993a), Section 5.3.2.3). Soil screening for carbon tetrachloride will be conducted using an photoionization detector (PID) equipped with an 11.7 eV lamp. Radionuclides will be screened by alpha and Beta-gamma counting instruments. The action level for radionuclide screening is twice background and for volatile organic screening is 5 ppm. All instruments will be used, maintained, and calibrated consistent with EII 3.2, "Calibration and Control of Monitoring Instruments," and EII 3.4 "Field Screening." The field geologist will record screening results on the borehole log (EII 9.1, "Geologic Logging" [WHC 1988d]).

Prior to the excavation of test pits, a one-time background level for radiation outside the U-10 Pond will be established at the location presented on Figure 1. Instrument background will be measured holding the device less than 2.54 cm (1 in.) from soil excavated from a depth of 15.24 cm (6 in.). The field geologist will record the background levels on a field activity report per EII 6.1 "Activity Reports of Field Operations" (WHC 1988d).

A radiological baseline will be established at each test pit site before excavation and after each pit is completed. This activity will be performed to ensure that instrument background is defined for the test pits within the U-10 Pond and to ensure that the sites are restored to pre-excavation radiological levels. Screening results will be

recorded on the field activity report per EII 6.1, "Activity Reports of Field Operations (WHC 1988d).

3.2 TEST PIT ACTIVITIES

All test pits will be excavated in a manner that will minimize the damage to the surface stabilizing cover. Access onto the U-10 Pond and test pit sites will be limited to essential vehicles only. Staging areas will be designated for all nonessential equipment. Material collected for chemical, physical, and radiological analysis will be obtained from the backhoe bucket using standard soil sampling techniques per EII 5.2, "Soil and Sediment Sampling," Appendix I (WHC 1988d). Samples will be obtained from the exposed soils in the middle of the backhoe bucket. Sample depths will be recorded to the nearest foot and estimated using the measured dimensions of the backhoe bucket and arm.

The clean stabilization cover from each test pit will be separated from the underlying pond sediments. The clean cover will be placed directly on the ground, and pond sediments will be placed on plastic or approved covering. Field screening will be conducted to ensure that no contaminated cover material or pond sediments will be placed in the clean spoils pile. All excavated material will be continually wetted with water or other suitable control media. Spoils left overnight will be covered with plastic or other approved dust control media. All excavated material will be backfilled in the reverse order that it was removed. Each test pit site will be restored to pre-excavation radiological levels, which may require placement of clean fill. Changes from original grade will be minimized if additional uncontaminated fill is required. The cognizant engineer for the U-10 Pond will be notified before site abandonment. All waste generated during excavation activities (gloves or plastic) will be handled according to EII 4.3, "Control of CERCLA and other Past-Practice Investigation Derived Waste" (WHC 1988d).

The backhoe and bucket will be decontaminated between work on each test pit. After the contaminated pond sediments have been replaced in the test pit, the backhoe bucket will be decontaminated over the excavation and the clean stabilization cover will be replaced. The backhoe will then be moved to a designated decontamination pad and the entire rig decontaminated.

The site geologist will record all activities on the field activity report per EII 6.1 "Activity Reports of Field Operations" (WHC 1988d). Items for entry will include test pit numbers, site location drawings, the names of site personnel, sampling types, and sampling intervals.

All test pits will be logged according to EII 9.1, "Geologic Logging" (WHC 1988d). The geologic log will include the lithologic description, sample code and depth (Table 2), Hanford Environmental Information System (HEIS) numbers for each sample interval, test pit construction characteristics, screening results, and any general information the site geologist believes is pertinent to the characterization of the subsurface lithology. Each log sheet should contain no more than 10 ft of stratigraphic information.

Table 2. Sampling Codes.

Sample Type	Sample type Designation	Purpose of Sample
Archive	AR	Provide samples for future data needs.
Physical	PH	Provide material for determination of physical characteristics of vadose zone.
Chemical	CH	Provide material for chemical analysis to determine contaminant inventory and extent of contamination in the vadose zone.

3.3 SOIL SAMPLING

3.3.1 Geologic Sampling

All material removed from the test pit will be identified and described by the geologist and summarized on the Borehole Log. The expected lithologic sections are presented in Section 3.3.2 and in Figures 2A and 2B and include gravel fill, eolian deposits, organic rich silt, Hanford gravel interface, and Hanford gravels. Geologic samples for archive will be collected and described every 5 ft, at significant changes of lithology as determined by the field geologist, and from all other sampling points. Proposed sampling intervals and expected subsurface lithology are presented in Section 3.3.2 and in Figures 2A and 2B.

The archive sample is to provide the geotechnical library with material from sampling intervals and supply a representative physical record of the lithologies encountered during excavation activities. The field geologist shall archive only nonradioactive material. The field geologist will submit archive samples per EII 5.7A, "Hanford Geotechnical Sample Library Control" (WHC 1988d). Each archive sample will be labeled with the test pit number, sample depth interval (to the nearest foot), date, and time the sample was obtained. Chain of Custody documentation as detailed in EII 5.1, "Chain of Custody" (WHC 1988d) will be prepared by the site geologist. Splits of sample will be labeled, placed in a plastic bag, and given to the Health Physics Technician (HPT) for survey and release evaluation. Each archive interval will be logged in the field logbook and the borehole log.

3.3.2 Analytical Soil Sampling

Soil samples for chemical, physical, and radiological analysis will be collected as specified in the LFI (DOE-RL 1993a) Section 5.3.2.3, Source Area Borings (Appendix A), EII 5.2, Appendix I, "Soil and Sediment Sampling" (WHC 1988d), and as described below. Packaging and shipping requirements for samples transported offsite shall be selected

Figure 2A. Assumed Geology and Proposed Sampling Intervals for 216-U-10-TP-1.

Figure 2B. Assumed Geology and Proposed Sampling Intervals for 216-U-10-TP-2.

on the basis of total activity values and the preservation requirements applicable to the parameters of interest, as described in EII 5.11, "Sampling Packaging and Shipping" (WHC 1988d).

Approximately seven soil samples will be taken for chemical, physical, and radiological analysis from each test pit (a total of 14 samples) from the following intervals: (1) base of the clean fill cover, (2) brown windblown deposit of the former ditch bottom, (3) underlying black organic rich sediment, (4) Hanford gravel ditch interface, (5) 15 ft below ground surface, (6) at least one sample of the Hanford gravels and (7) the test pit bottom (see Figure 2A and B).

If the described sampling intervals are not encountered, the alternative sampling interval shall be as follows:

Samples will be collected from TP-1 at the base of the clean fill cover (1 m [3 ft]) and at 3, 4.5, 6.1, 7.6, 9 and 10.6 m (10, 15, 20, 25, 30 and 35 ft) below the surface. Samples will be collected from TP-2 at the base of the clean fill cover (2.4 m, [8 ft]), and at 3, 4.5, 6.1, 7.6, 9 and 10.6 m (10, 15, 20, 25, 30 and 35 ft) below the surface.

Sampling depths are approximate. The site geologist will use professional judgment to determine the appropriate interval for obtaining samples. Chemical and radiological samples will be field screened to ensure that the most contaminated material from each of the target intervals is submitted for analysis. All samples shall have a representative portion submitted to the 222-S Laboratory for total activity analysis that will be utilized for sample pre-shipment characterization. Chemical and radiological samples with a total activity of less than the established lab criteria shall be analyzed at an offsite laboratory. Those samples exceeding the lab criteria shall be routed to a designated onsite laboratory for analysis. Onsite and offsite laboratories shall be identified prior to initiating field activities and shall be mutually acceptable to Hanford Analytical Services Management (HASM) and the cognizant engineer.

Samples collected for physical analysis and unconditionally released by the HPT as nonradioactive will be submitted to the Geotechnical Engineering Cold Laboratory. Radioactive samples that do not exceed 25 mrem will be submitted to the Geotechnical Engineering Hot Laboratory. Samples exceeding 25 mrem will be stored at a temporary radioactive storage area until a determination is made if they will be analyzed. Physical samples not tested will be disposed of as waste. All sample containers will be labeled with applicable test pit number, sampling date, time, depth interval to the nearest foot (physical samples only), HEIS number, requested analysis, and the sampler's initials.

Sample splits of several intervals will be obtained for Ecology from each test pit. Ecology will be present and work in conjunction with the field team leader and the samplers to obtain sample splits. Ecology will assume the responsibility that the samples are properly collected. Shipping requirements will be determined based on the total activities (i.e., if the samples are <50 pCi/g total activity, Ecology will ship; if >50 pCi/g, Westinghouse Hanford Company (WHC) will ship.

pCi/g total activity, Ecology will ship; if >50 pCi/g, Westinghouse Hanford Company (WHC) will ship.

3.3.2.1 Physical Property Analyses. Samples for determining the physical parameters of the U-10 Pond and the underlying sediments will be collected at the intervals described above. Chain of Custody documentation will be prepared by the site geologist for each day's sampling. The project geologist will supply HEIS numbers for physical samples to the site geologist at the beginning of test pit activities. Container requirements for physical samples are contingent on the size of material being sampled. Sample container requirements are presented in Table 3. Material larger than 7.62 (3 in.) will be removed before placing it in the sample container. The following parameters using the American Society for Testing and Materials (ASTM) methods (LFI, DOE/RL 1993a) will be used on physical samples. The applicable WHC Geotechnical Engineering Lab Gel numbers will be requested on the sampling and analysis request form:

- Bulk density
- Particle size distribution (ASTM D422-63) (Gel-07)
- Moisture content (ASTM D2216) (Gel-14)
- CaCO₃ Content (Gel-19)

3.3.2.2 Chemical and Radiological Analyses. Soil samples for characterizing chemical and radiological contaminants within the U-10 Pond and the underlying sediments will be collected from the intervals described in Section 3.4.2. Chain of custody documentation will be prepared by the Environmental Field Services (EFS) sampling scientist. Container and volume requirements for chemical and radiological samples are presented in Table 4. The laboratory will use existing Level IV Contract Laboratory Program (CLP) methods and methods approved under their contract for radiological analyses (Level V, Level III for anions). Samples will be analyzed for the constituents as specified in Table 4.

Table 3. Physical Characterization Samples.

Analyses	Silt to Sand	Sand to Gravel
Archive	2 pint containers	2 pint containers
Sieving (Gel-07)*	1 pint container	1 gal plastic bag
Moisture content (Gel-14)*	1 moisture tin	1 moisture tin
Calcium carbonate (Gel-19)*	Combine analyses with above sample	Combine analyses with above liner
Bulk mass density	Combine analyses with sieve sample	Combine analyses with sieve container
HPT release	1 pint plastic bag	1 pint plastic bag

*Westinghouse Hanford Company, Geotechnical Engineering Lab method procedure number (Gel-#).

Table 4. Analytical Methods for Target Analytes. (sheet 1 of 4)

Analyte ^{a/}	General Analytical Technique ^{b/}	Soil and Sediment Analysis Method ^{c/}	Container and Volume ^{d/}	Comments
Gross Alpha	Gas proportional	h	f	-
Gross Beta				-
Acetone	Volatile Organic Analysis	CLP-VOAs	Gs 250 ml	-
Carbon Tetrachloride				-
Chloroform				Gs 125 ml Weston
Methylene Chloride				-
MIBK (hexone)				-
1,1,1 Trichloroethane				-
Toluene				-
Americium-243 (NP-239)	Gamma Spectrometry	h	f	Am-243 measured by counting NP-239
Cesium-134				-
Cesium-137 (Ba-137m)				Cs-137 measured by counting Ba-137m
Cobalt-60				-
Europium-152				-
Europium-154				-
Europium-155				-
Potassium-40				-
Ruthenium-106				Ru-106 measured by counting Rh-106
Sodium-22				-
Uranium-235 (PA-231)	Alpha Spectrometry	h	f	For most samples U-235 measured by counting Pa-231
Uranium-234/238 (Pa-234m)				For most samples U-234/238 measured by counting Pa-234m

Table 4. Analytical Methods for Target Analytes. (sheet 2 of 4)

Analyte ^d	General Analytical Technique ^{b,c}	Soil and Sediment Analysis Method ^d	Container and Volume ^d	Comments
Americium-241 Curium-244 Neptunium-237 Plutonium-238 Plutonium-239/240 Uranium-234 ^d	Alpha Spectrometry	h	f	May also use gamma spectrometry - - - - -
Uranium-234 ^d Uranium-238 ^d	Alpha Spectrometry	h	f	- -
Iodine-129 Strontium-90 (Y-90) Technetium-99	Beta Counting ^d	h	f	Sr-90 measured by counting Y-90 -
Barium Beryllium Boron Cadmium Chromium Copper Iron Lead Manganese	ICP Analysis	CLP-Metals	g i	P 500 ml Weston - - - - - - - -

Table 4. Analytical Methods for Target Analytes. (sheet 3 of 4)

Analyte ^{a/}	General Analytical Technique ^{b/}	Soil and Sediment Analysis Method ^{c/}	Container and Volume ^{d/}	Comments
Nickel	ICP Analysis	CLP-Metals	g	-
Silver				-
Titanium				P 500 ml Weston
Vanadium				-
Zinc				-
Arsenic	GFAA	CLP-Metals	g	-
Selenium	GFAA	CLP-Metals	g	-
Cyanide	Colorimetric	CLP-TAL	G 125 ml	G 250 ml Weston
Tributyl Phosphate	GC	CLP-Semi-VOAs	aG 250 ml	aG 500 ml Weston
Selenium-79	Beta Counting ^{e/}	h	f	-
Samarium-151				-
Zirconium-93				-
Mercury	Atomic Adsorption	CLP-Metals	g	-
Kerosene	GCFID	8015 ⁱ	Gs 125 ml	-
Nitrate	Colorimetric	353.2	P/G 125 ml	-
Nitrite		353.2		-
Additional Analyses for Water Samples Only				
Fluoride	Ion Chromatography	300	P/G 125 ml	-

Table 4. Analytical Methods for Target Analytes. (sheet 4 of 4)

Analyte ^d	General Analytical Technique ^a	Soil and Sediment Analysis Method ^c	Container and Volume ^d	Comments
Carbon-14	Beta Counting ^d	--	--	Not applicable for soil samples
Tritium		--	--	Not applicable for soil samples

G = Glass; P = Plastic; Gs = Glass septum w/zero headspace; aG = amber Glass

TBD = To Be Determined

M = method modified to include extraction from the solid medium, extraction method is matrix and laboratory-specific

Prescribed Procedures for Measurement of Radioactivity in Drinking Water (EPA 1980a)

Test Methods for Evaluating Solid Waste (SW 846) Third Edition (EPA 1986)

Methods for Chemical Analysis of Water and Waste (EPA 1983)

Radionuclide Method for the Determination of Uranium in Soil and Air (EPA 1980b)

EML Procedures Manual (DOE/EML 1990)

Eastern Environmental Radiation Facility Radiochemistry Procedures Manual (EPA 1984)

High Resolution Gamma-Ray Spectrometry of Water (ASTM 1985)

^a In addition to the analytes listed in this table, there are many progeny isotopes whose concentrations may be derived from known parent concentrations. Radionuclides related to U-238 include: Th-230, Bi-210, Po-214, and Po-218. Radionuclides related to U-235 include: Th-231, Tl-207, Pb-214, and Bi-211. Nb-93m is related to Zr-93. Pu-241 concentrations are inferred from Pu-238, Pu-239, and Pu-240.

The radionuclides listed in parenthesis under the analyte column are measured as part of the analysis of the adjacent radionuclide.

^b The analytical techniques are listed in the order that they should be performed. Gross alpha, gross beta, and VOA analyses will always be done first. Gamma Spectrometry will be done next because it generally does not require destruction of any sample. Alpha spectrometry, Sr-90 and Tc-99 analyses will next be done if sufficient sample exists. The next priority is to perform ICP analyses. Approximately 2 lbs (1 kg) of material will be required to perform these primary analyses. If more sample exists, then several additional, secondary analyses may be performed. These are shown on the table below the ICP analysis. In borings, additional drive samples should be collected, if possible, to insure that all analyses can be run.

^c These analytical methods should be considered examples of possible analytical techniques to use. Individual labs may have other techniques developed for some analytes.

^d The uranium analyses will be conducted periodically to confirm the uranium concentrations calculated from the Pa-234m or Pa-231 analyses. Two samples from each deep boring and one sample from each test pit or shallow boring will undergo this confirmatory analysis. No uranium analyses will be done on surface soil or sediment samples.

^e Analytes that will be studied by beta counting are listed in the order that they should be analyzed. For instance, the Sr-90 analysis should be made first, followed by the Tc-99 analysis.

^f All samples submitted for radionuclide analysis will be placed in a P/G 750 ml bottle.

^g All samples submitted for CLP-Metals analysis will be placed in a P 250 ml bottle.

^h Analytical methods for radionuclide analysis are laboratory specific. (Examples of standard methods include ASTM D3549, ASTM D3865, ASTM D3972, ASTM D2334.)

ⁱ Samples collected for the 200-UP-2 Limited Field Investigation (LFI) activities that require analysis for kerosene will be analyzed at TMA by SW-846 method 8015. Kerosene is not listed in the SW-846 reference procedure as a compound that is included on the target list for 8015, Non-Halogenated Volatile Organics. Through its contract with HWC, TMA has adapted method 8015 to include kerosene as a target compound using its characteristic "fingerprint."

^j Volumes listed are for TMA except where noted in comment column for split analysis where bottle size differs.

4.0 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS

Internal quality control samples shall be collected at each facility by the sampling scientist as specified in Quality Assurance Project Plan, (DOE-RL 1993a, Appendix A) with the revisions as outlined below. The sampling shall be documented in the sampling logbook per EII 1.5, "Field Logbooks" (WHC 1988d).

Field Duplicate Samples. A minimum of one duplicate per test pit or one duplicate for every 20 samples shall be collected, whichever is greater. Duplicate samples shall be retrieved from the same sampling location using the same equipment and sampling technique and shall be placed in two identically prepared and preserved containers. All field duplicates shall be analyzed independently to provide an indication of the reproducibility of sampling and/or analysis techniques.

Split Samples. At the direction of the cognizant engineer, and if a laboratory is designated, split samples shall be collected at the same frequency as duplicate samples.

Field Blanks. Field blanks shall consist of silica sand, transferred into clean sample containers at the site. Field blanks are used as a check on environmental contamination and shall be collected for each test pit, or one for every 20 samples, whichever is greater.

Equipment Rinsate Blanks. Equipment rinsate blanks consist of pure deionized distilled water washed through decontaminated sampling equipment and placed in clean sample containers. Equipment blanks are used to verify the adequacy of sampling equipment decontamination procedures and shall be collected at the same frequency as field duplicate samples where applicable.

Volatile Organic Analysis (VOA) Trip Blanks. The VOA trip blanks consist of pure deionized distilled water added to clean sample containers, accompanying each batch of coolers shipped to the analytical facility. Trip blanks shall be returned unopened to the laboratory and are prepared as a check on possible contamination originating from container preparation methods, shipment, handling, storage, or site conditions. The trip blank shall be analyzed for volatile organic compounds (EPA's target compound list).

5.0 SCHEDULE

Test pits activities are scheduled to begin with the excavation and sampling of test pit #2 during the week of August 21, 1993. The schedule for Test pit #1 will be determined by the review of test pit #2 health and safety information and chemical and radiological screening data. This schedule is subject to change, and the operable unit coordinator should be contacted for the current status. An agreement Activity Notification form will be issued at least five days prior to the start of field work.

6.0 ALARA CONSIDERATIONS AND CHANGES TO THE DESCRIPTION OF WORK

Test pits will be excavated utilizing the guidance of the As Low As Reasonably Achievable (ALARA) program. After completing the first test pit, the Remedial Investigation Coordinator will evaluate the impact of excavation activities on worker health and safety. If it is determined that an

alternative method for obtaining samples that utilizes a greater control for the spread of contamination is required, this DOW will be revised.

Field changes to this DOW, such as changing sampling methods, analyzing different parameters, using different analytical methods, or significantly changing the sampling interval will be submitted on the attached form (Attachment 1) and kept on file with the operable unit coordinator. Copies will be submitted to the regulatory agencies and the appropriate field personnel within 10 working days. Changes made before beginning field activities must result in a revised DOW.

7.0 REFERENCES

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- DOE/EML, 1990, *EML Procedures Manual*, U.S. Department of Energy, Washington, D.C.
- DOE-RL 1992, *U-Plant source Aggregate Area Management Study*, DOE/RL-91-52, Rev. 0, U.S. Department of Energy, Richland Field Office, Richland Washington.
- DOE-RL 1993a *200-UP-2 RCRA Facility Investigation/Corrective Measures Study*, DOE/RL-91-19 Rev.0, U.S. Department of Energy, Richland Field Office, Richland Washington.
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- EPA, 1988, *USEPA Contract Laboratory Program Statement of Work for Inorganic Analysis*, Sample Management Office, U.S. Environmental Protection Agency, Washington, D.C.
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- WHC, 1988c, *Environmental Compliance Manual*, WHC-CM-7-5, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1988d, *Environmental Investigations and Site Characterization Manual*, WHC-CM-7-7, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1988e, *Radiological Control Manual*, WHC-CM-1-6 (WHC 1993c), Westinghouse Hanford Company, Richland, Washington.
- WHC, 1990, *Environmental Engineering, Technology, and Permitting Function Quality Assurance Program Plan*, WHC-EP-0383, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1991, *Health Physics Procedures Manual*, WHC-IP-0692, Westinghouse Hanford Company, Richland, Washington.

Attachment 1

200-UP-2 DESCRIPTION OF WORK
PROJECT CHANGE FORM

Date:

Person Initiating Change:

Change:

Reason for Change:

APPROVAL:

Field Team Leader:

Operable Unit Coordinator:

Quality Assurance:

APPENDIX A

TEST PIT EXCAVATION AND SAMPLING BACKGROUND INFORMATION

(This appendix consists of excerpts of subsections from *200-UP-2 RCRA Facility Investigation/Corrective Measures Study*, DOE/RL-91-19, Rev. 0. It is included for background information only).

5.3 FIELD ACTIVITIES (TASKS 2 TO 6)

This section describes the field activities to be performed for the LFI. The field activities are designed to accomplish the following tasks: source characterization (Task 2), geologic investigation (Task 3), surface water sediment investigation (Task 4), vadose zone investigation (Task 5), and air investigation (Task 6). These tasks are described in Section 5.1. Section 5.3 is intended to provide sufficient detail for field data gathering activities to prepare specific DOWs for these tasks.

Table 5-7 summarizes the field activities that are planned at each waste management unit and unplanned release site. Several activities that are not associated with individual waste management units are listed on the table under their own headings. In addition, the table has been divided between primary field activities and supporting field activities. Supporting field activities must generally be conducted along with each of the primary field activities. The subsections of this work plan describing each field activity and waste management unit are also listed on the table.

Section 5.3.1 discusses the locations and frequencies of each activity, and is subdivided by waste management unit and unplanned release. The protocols and procedures for each type of field activity are described in Section 5.3.2. Section 5.3.3 describes the laboratory analyses that each sample will undergo.

5.3.1 Sampling Locations and Frequencies

The sampling locations and frequencies of many of the later activities are contingent upon the results of the initial activities. The general order of activities at each waste management unit will include the following:

- (1) Surface radiation surveys
- (2) Subsurface spectral geophysics on appropriate existing wells
- (3) Electromagnetic (EM) surveys
- (4) Ground penetrating radar (GPR) surveys
- (5) Surface soil and surface water sediment sampling
- (6) Test pits
- (7) Borings with spectral geophysics as casing is telescoped
- (8) Perched water sampling.

Surface radiation surveys are run for both health and safety reasons and to identify surface soil or sediment sampling locations. If no surface contamination is detected during the initial surface radiation survey and no surface contamination is expected, as at surface stabilized areas, then no surface soil or sediment sampling will occur at that waste management unit. Subsurface investigation such as borings and test pits will proceed whether or not surface contamination is detected. Surface geophysics and surface radiation survey results will be used to locate subsurface soil sampling (boring) locations in cases where no engineering drawings are available for the facility.

Subsurface spectral gamma logging will also be used to refine the sampling intervals in nearby proposed borings.

The proposed field activities at each waste management unit are described below.

5.3.1.4 Ponds, Ditches, and Trenches. A unified high priority sampling program is planned for the 216-U-10 Pond and its associated ditches (216-U-11 Trench, 216-Z-1D Ditch, 216-Z-11 Ditch, and 216-Z-19 Ditch).

216-U-10 Pond System Sampling. A unified surface radiation survey will be run over the 216-U-10 Pond, the 216-U-11 Trench, the 216-U-14 Ditch, the 216-Z-1D Ditch, the 216-Z-11 Ditch and the 216-Z-19 Ditch (Figure 5-9). This survey will cover an approximate area of 372,000 m² (4,000,000 ft²). If contamination is detected, up to ten surface soil samples may be collected from the most contaminated areas. This area has been surface stabilized, so if no radionuclide contamination is detected during the survey no samples need to be collected.

One test pit to an approximate depth of 11 m (35 ft) will be excavated in the center of the 216-U-10 Pond delta area (Figure 5-9). Chemical samples will be collected at the base of the clean fill cover (about 1 m [3 ft] below the surface) and at 1.5, 3, 6, and 11 m (5, 10, 20, and 35 ft) below the surface. A physical sample representative of the material underlying the pond fill (below 1 m [3 ft]) will also be taken.

One test pit will also be dug through the center of the 216-U-10 Pond to an approximate depth of 11 m (35 ft). Chemical samples will be collected at the base of the clean fill (about 1.5 m, 5 ft from the surface), and at 3, 4.5, 7.5, and 11 m (10, 15, 25, and 35 ft) below the surface. These depths are approximate, and the excavated material should be screened in the field so that the most contaminated soils are sampled. A physical sample representative of the material underlying the old pond (below 2 m [6 ft]) will also be taken.

5.3.2.3 Source Area Borings. Six deep borings will be made during the 200-UP-2 Operable Unit field investigations (Table 5-7). Additional shallow borings may be required if conditions prevent test pits to be excavated at one of the proposed sites or if a test pit reaches its maximum depth and still is in contaminated material (Section 5.3.2.5). Each deep boring will extend to the caliche layer, which is generally between 46 and 60 m (150 and 200 ft) deep. If perched water is encountered in the boring, a well will be installed that is screened against the water-bearing interval.

Drilling. The borings will be sited to avoid buried obstructions and to target areas that appear most contaminated. Before drilling commences, an onsite and offsite utility check should be performed and the area checked with a pipe and cable locator. In all cases, drilling will also be preceded by a surface radiation survey of the area and at some locations (Table 5-1) surface geophysics and soil gas surveys. If a boring through a crib encounters contamination at such high levels that it cannot be continued as determined by health physics personnel, it should be abandoned and a new boring begun immediately outside the crib. Also, if a boring does not encounter a caliche layer or another significant aquitard at the same approximate depth, it will extend to the groundwater (unconfined aquifer).

The drilling technique used on the boreholes will be the cable-tool method or one of other acceptable technologies. Drilling operations will be conducted according to EII 6.7, "Resource Protection Well and Test Borehole Drilling," and EII 5.4, "Field Decontamination of Drilling, Well Development and Sampling Equipment" (WHC 1988a). A short drive barrel or split-spoon sampler (0.6 m [2 ft] maximum length) will be used to remove soils (slough and/or pristine material) from the borehole between sampling intervals. Hard tool drilling will only be initiated as a last resort when drilling conditions are not conducive to the use of the drive barrel or split-spoon sampler. The decision to drill with the hard tool will be made by the drilling field team leader only after consultation with the well-site geologist and/or the project coordinator.

Temporary casing will be driven frequently to minimize the slough in the borehole. Casings will be telescoped through intervals of contamination to limit the driving of contaminants deeper into the vadose zone. The approximate casing sizes to be used will be 15, 20, and 25 cm (6, 8, and 10 in.) casings. The casings will be telescoped as contaminant concentrations decrease. The 25 cm (10 in.) casing will be run to at least 2 m (7 ft) below the crib or french drain and will be telescoped when grab samples from the boring are less than 5,000 ct/min according to field screening. The 20 cm (8 in.) casing will be used to control gross contamination from 500 to 5,000 ct/min. The 15 cm (6 in.) casing will be used to control gross contamination below 500 ct/min. For borings at which little or no contamination is expected, such as at the 2607-W-5 Septic Tank and Drain Field or at the boring between the 216-U-1/216-U-2 and 216-U-16 Cribs, only 15 and 20 cm (6 and 8 in.) casings need be used. For the shallow boring at the 216-U-10 Pond, only 15 cm (6 in.) casings will be used. Whenever the casing is telescoped, an RLS gamma spectrometer survey will be run on the hole. The survey procedures are outlined in Section 5.3.2.6.

As drilling proceeds, the well-site geologist will be responsible for completing the borehole geologic log. The borehole geologic log will be completed according to EII 9.1, "Geologic Logging" (WHC 1988a). The geologic log will contain sample type and depth, lithologic description, crib construction characteristics, and any other geologic information the well-site geologist believes is pertinent to the characterization of the subsurface stratigraphy. Each log sheet should contain no more than 3 m (10 ft) of stratigraphic information.

If perched water is encountered in a boring, a perched water well will be installed that is screened against the water-bearing interval. Each telescoped casing will be cut and left in place so that it extends about 1 m (3 ft) in the larger-diameter casing above. Any hole that does not encounter perched water will be abandoned. Holes will be abandoned according to the procedures outlined in EII 6.10, "Abandoning/Decommissioning Ground Water Wells" (WHC 1988a).

Perched water wells will be installed after the boreholes have been advanced to the proper depth. The design and specification of these wells will be according to the information presented in WHC-S-014 (Hodge 1990). In general, the wells will be constructed of 0.1 m (4 in.) inner diameter 304 stainless steel, joint-threaded casing, and wire-wrapped well screen. The screen slot and pack sand size will be determined from the results of sieve

analyses. The wells will be installed according to procedures outlined in EII 6.8, "Well Completion" (WHC 1988a).

Sampling. Chemical, physical, and archive samples will be collected from each borehole. The split-spoon sampler will be the primary device for collecting these samples. If an insufficient sample is collected with the split-spoon, an alternative sampling method may be used, such as repeating the sampling at the same interval. All split-spoon sampling depths will be recorded to the nearest 0.025 m (0.10 of a foot). All depths will be recorded to the nearest 0.025 m (0.10 of a foot). The chemical, physical, and archive sampling intervals are unit- and depth-specific and are described along with the individual borings in Section 5.3.1. The sampling intervals are only approximate depths and may be modified at the discretion of the onsite geologist. If perched water is encountered in a boring the sampling interval should be modified such that at least one chemical and physical sample is collected in the saturated zone. Physical and chemical samples are generally grouped together so that the two sets of data may be compared. Chemical samples always take precedence over physical samples, which take precedence over archive samples. Sample intervals may be extended by driving the split-spoon sampler a second time if an insufficient sample is collected during the first attempt. It should be noted that some borings will require continuous sampling over part of their length to meet these sampling requirements. This is particularly true of the first 4.5 m (15 ft) drilled beneath each of the cribs.

Chemical samples will be collected in accordance with EII 5.2, "Soil and Sediment Sampling" (WHC 1988a). Chemical samples will be collected with a split-spoon sampler with stainless steel liners. Drilling personnel will not overdrive the sampling device. The split-spoon and liners will be decontaminated before use according to EII 5.5, "1706 KE Laboratory Decontamination of Resource Conservation and Recovery Act/Comprehensive Environmental Response, Compensation, and Liability Act (RCRA/CERCLA) Sampling Equipment" (WHC 1988a). Prior to sampling, slough in the borehole will be removed to the greatest extent possible. Sampling personnel will transfer samples from the split-spoon liners to the appropriate sample containers and preserve them in accordance with the EPA guidelines set forth in *Test Methods for Evaluating Solid Wastes* (EPA 1986). All chemical samples will be geologically logged by the well-site geologist. Chemical samples will be labeled with the appropriate Hanford Environmental Information System (HEIS) number to accommodate sample tracking and data entry into the HEIS system.

All samples and cuttings will be field screened for evidence of volatile organics and radionuclides. Volatiles will be screened by the field geologist or other qualified personnel using an organic vapor monitor. Radionuclides will be screened by alpha and gamma counting instruments. All instruments will be used, maintained, and calibrated consistent with EII 3.2, "Calibration and Control of Monitoring Instruments" (WHC 1988a), and EII 3.4, "Field Screening" (WHC 1988a). Radionuclides will be screened according to EII 3.4, "Field Screening" (WHC 1988a). The field geologist will record screening results in the borehole log (EII 9.1, "Geologic Logging" [WHC 1988a]). For two of the proposed borings (at the 2607-W-5 Septic Tank and Drain Field, and at the boring between the 216-U-1/216-U-2 and 216-U-16 Cribs), the decision to analyze a chemical sample from one of the designated intervals is dependent upon the results of the field screening. If a sample from either of these two

borings does not contain radionuclide or volatile organic contamination above the set action levels, it should not be sent for analysis.

For the other three borings, the number of chemical samples that are sent to the lab may also be reduced by field screening. If two or more chemical samples in a row are found to be below action levels, then only every second sample will be sent to the lab for analysis. If later field screening identifies contamination deeper in the boring, then material from every designated sampling interval will be sent to the lab until two or more chemical samples in a row are below action levels.

The action level for radionuclide screening is twice background. Readings of less than twice the average background are within the normal background variability for the site and so are not indicative of the presence of anthropogenic radionuclide. The action level for volatile organic screening is 5 ppm above background. The 5 ppm limit is based on the total volatile organic compounds detected as either benzene or methane equivalents. Either a FID (flame ionization detector) or PID (photoionization detector) can be used to detect the volatile organics found within the 200-UP-2 Operable Unit. The relative response ratios of the chlorine based compounds for either the FID or PID range from 10% for carbon tetrachloride (FID) to 105% for 1,1,1-trichloroethane (FID). In order to detect the chlorinated compounds using survey type instruments under ambient, uncontrolled conditions the 5 ppm action level provides reasonable confidence in detection of these compounds. Prior to initiating drilling, determine a one-time instrument background reading using the above instruments at a background site to be determined in the field. Instrument background will be measured on freshly disturbed surface soil, holding the instruments less than 2 cm (1 in.) from the soil. The field geologist will record the background levels in the borehole log according to EII 9.1, "Geologic Logging" (WHC 1988a), prior to the start of drilling.

Physical samples will be collected by the same procedures as for chemical samples. Most of the physical samples will undergo a limited set of physical analyses (Type A samples), but two samples from each borehole will undergo a much larger set of physical analyses (Type B samples). Both suites of physical analyses are described in Section 5.3.3. The samples to undergo the additional analyses will be selected by the field geologist on site. Portions of physical samples that have been unconditionally radiologically released will be sent to an existing storage facility to be archived. Contaminated samples will be sent to a long-term storage facility if one is available. If one is not available, such samples will not be collected. The nonradioactive samples will be archived according to EII 5.7A, "Hanford Geotechnical Sample Library Control" (WHC 1988a).

The samples must be collected and transported in a manner that preserves the original moisture content and soil structure. Type A samples will be collected in sample sleeves and/or "moisture tins." The sample in the sleeve must be in an undisturbed state and the sleeve must be as full as possible.

5.3.2.4 Backhoe Test Pits. Backhoe test pits are planned at the 216-U-10 Pond and the 207-U Retention Basin. A similar trenching effort has already taken place at the 316-5 Process Trenches (DOE 1991b). The maximum depth that can be reached by trenching is about 12 m (39 ft).

The excavation field work will be conducted using a crawler-mounted backhoe on a full revolving base or other appropriate equipment. The excavations will be done at the center of the waste management units to the necessary depth. None of the waste management units that are assigned excavations have collapse potential; therefore, the backhoe may be positioned as close as necessary to each unit.

Sampling areas will be designated at least 9 m (30 ft) away from the excavation pit within reach of the bucket. Samples will be collected from the backhoe bucket using hand tools and standard soil sampling techniques identified in EII 5.2, "Soil and Sediment Sampling, Appendix I Test Pit/Trench Sampling" (WHC 1988a). Samples will be logged by a geologist. After the test pit has been completed, it will be backfilled with the excavated material. This action will require regulator approval. Such approval has been granted at other Hanford study areas in the past.

5.3.2.12 Sample Designation and Handling. Field logs will be maintained to record all field observations and activities according to EII 1.5, "Field Logbooks" (WHC 1988a). Samples for laboratory analysis will be taken at 11 waste management units and along 2 pipelines within the 200-UP-2 Operable Unit as indicated in Tables 5-7 and 5-8. These will be placed in containers and properly preserved. All samples for laboratory analysis will be transported under chain of custody in accordance with EII 5.1, "Chain of Custody" (WHC 1988a), and EII 5.11, "Sample Packaging and Shipping" (WHC 1988a). Laboratory analysis will be conducted on designated samples. The analysis of the soil and source samples will include determination of physical, chemical, and radiological characteristics.

The HEIS is used to track the sample and laboratory data obtained during these investigations. Each sample will be identified and labeled with a unique HEIS sample number. The HEIS numbers will be assigned in the field according to EII 5.10, "Obtaining Sample Identification Numbers and Assessing HEIS Data" (WHC 1988a). The sample location and corresponding HEIS numbers will be documented in the field logbook.

5.3.2.13 Decontamination Equipment and Procedures. Equipment decontamination will occur in conjunction with most of the sampling activities planned at the 200-UP-2 Operable Unit. The methods will generally consist of washing or steam cleaning with a detergent/water or other decontamination solution. Rinsing with a diluted nitric acid solution may be necessary to remove metal oxides and hydroxides. Field decontamination of drilling equipment, where applicable, shall be performed within impoundments in the decontamination zone to ensure that all wash liquids are captured. All wash liquids used for decontamination purposes must be properly disposed of according to applicable state/federal regulations. Drilling and backhoe equipment will be decontaminated before use on another borehole as required to ensure the safety of personnel and prevent cross-contamination of samples.

Decontamination procedures have been established for the Hanford Site by Westinghouse Hanford and are provided in the *Environmental Investigations and Site Characterization Manual*, which includes decontamination requirements and specific methods for radiological and nonradiological contamination. The EII 5.4, "Field Decontamination of Drill, Well Development and Sampling Equipment" (WHC 1988a), establishes methods and equipment for decontaminating drilling

equipment to mitigate cross contamination during drilling and samples collected for physical analysis only. The EII 5.5, "1706 KE Laboratory Decontamination of Equipment for RCRA/CERCLA Sampling" (WHC 1988a), establishes methods and equipment for decontaminating sampling equipment that is used for both physical and analytical testing.

5.3.2.14 Investigation Derived Waste. Investigation derived waste generated by LFI/FFS activities will be managed according to EII 4.3, "Control of CERCLA and Other Past-Practice Investigation Derived Waste" (WHC 1988a), or as agreed upon by the cognizant regulators (DOE, EPA, Ecology). If investigation derived waste is managed according to EII 4.3, the following exception to the procedure applies: Because of excessive turnaround times between sample submittal to the labs and receipt of sample analysis, if the 90 day clock (waste generation to disposal) is determined by the cognizant regulators to be appropriate for the RI/FS, the clock will not begin until generator receipt of the sample analyses results used for waste designation purposes. The samples collected for the LFI study will be sufficient for waste designation and waste management unit characterization.

5.3.2.15 Geodetic Surveys. Surveying applies to almost all the tasks required to complete the operable unit characterization and will occur at most of the waste management units within the operable unit (see Table 5-7). Surveys are to be completed by a licensed surveyor, registered in Washington State. Surveyors will be accompanied, at least initially, by the Field Team Leader (or designee) to familiarize the surveyors with specific locations. At least two vertical controls will be referenced to a U.S. Geological Survey datum obtained from a permanent bench mark. The NAD83 datum (Lambert Projection) will be used for horizontal control and the NGVD 1929 datum will be used for vertical control.

Horizontal (x,y coordinates) locations of surface soil samples; surface water sediment samples; and the corners of surface geophysical, surface radiation, and soil gas survey grids will be professionally surveyed. Horizontal and vertical locations (x, y, z coordinates) will be professionally surveyed for those soil borings that have a well screen installed. Abandoned borings and test pits will also be surveyed.

5.3.3 Laboratory Analysis

Surface soil samples, vadose zone soil samples (from borings and test pits), sediment samples, and perched water samples will be sent for chemical analysis. Air monitoring samples collected from the high volume samplers are controlled under a separate program and are typically analyzed for ⁶⁰Co, ⁹⁰Sr, ²³⁸Pu, ²³⁹Pu, ²⁴⁰Pu, uranium, gross alpha, and gross beta. Only vadose zone soil samples will be sent to the laboratory for physical analyses. Table 5-8 summarizes the types of samples that will be collected from each of the waste management units. The table also lists the general chemical and physical analyses that will be required. These analyses are described in greater detail in Sections 5.3.3.1 and 5.3.3.2.

5.3.3.1 Chemical Analyses. Table 5-9 lists the contaminants of concern for the 200-UP-2 Operable Unit and specifies the suggested method of analysis. For some of the analytes, the contract laboratory may have to use a different analytical method than the suggested one. If an insufficient sample exists to

perform all of the analyses, the analyses should be prioritized in the order they are listed on the table (Table 5-9, footnotes b,e). The concentrations of many of the radionuclide contaminants of concern (Table 3-2) will be calculated from parent or daughter relationships. The radionuclides whose concentrations will be calculated in this way are listed in Table 3-2 and on the bottom of Table 5-9 (footnote a).

For the reasons listed below, the list of contaminants of concern may be modified for some samples.

- (1) Surface soil samples will not be analyzed for volatile organics. These compounds are unlikely to persist in near-surface conditions.
- (2) Perched water samples will be analyzed for three additional analytes: fluoride, ^{14}C , and tritium. In addition, each water sample will undergo radionuclide and inorganic analyses on both filtered and unfiltered samples.
- (3) Only two samples from each deep boring, and one sample from each test pit through the 216-U-10 Pond will be run for the full list of target analytes. The first samples collected beneath the assumed waste inflow point into the soil column or the samples that appear most contaminated by field screening, whichever is most appropriate, should undergo the full suite of analyses. The other samples from the boring or test pit should be saved until after the initial analytical results have been reviewed. Gamma spectrometry will be run on all samples whatever the results from the first samples. However, for other analyses, only those analytes that had positive detections in the first samples will be analyzed for in the other samples from that boring or test pit.

Uranium isotopic analyses will only be made on the one or two samples from each boring or test pit that undergoes the full suite of target analyses (Table 5-9, footnote d). Whatever the results from these initial samples, the subsequent samples will not undergo uranium isotopic analyses because uranium concentrations will be calculated from ^{231}Pa and $^{234\text{m}}\text{Pa}$ concentrations (measured via gamma spectrometry). Uranium isotopic analyses will not be run on any surface soil or sediment samples for the same reason.

Samples from the pH boring at the 216-U-12 Crib will be analyzed for total uranium and nitrates.

5.3.3.2 Physical Analyses. There are two suites of physical analyses. Type A physical analyses involve a limited suite of physical analyses and will be done on all samples from test pits and on most of the samples from deep borings. Type B physical samples involve additional physical analyses and will be done on two samples from each deep boring. The samples will be analyzed using American Society for Testing and Materials methods.

The following physical analyses will be run on Type A samples:

- Bulk density
- Particle size distribution
- Moisture content
- CaCO_3 content.

The following physical analyses will be run on Type B samples:

- The four Type A analyses listed above
- Saturated hydraulic conductivity
- Unsaturated hydraulic conductivity
- Matric potential and soil moisture retention curves
- Particle density
- Cation exchange capacity
- Organic carbon content
- pH and, if possible, Eh
- Mineralogy.

Samples from the pH boring at the 216-U-12 Crib will undergo a very limited suite of analyses:

- pH
- CaCO_3 content.

END

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