OU10 REVISED FINAL WORK PLAN
INDEX OF REPLACEMENT PAGES
10/14/92

Table of Contents
Replace pages v, vi, and xii

Section 7
Replace pages 7-55 to 7-89

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

LIST OF TABLES

1981) The EMD OP for the NaI scintillation detector is presently under development and will be available prior to any OU10 Phase I field work

Surficial samples and depth profile samples will be collected at a subset of the HPGe survey locations, not necessarily at the grid nodes, to determine the vertical extent of radionuclide contamination These samples will be collected at HPGe/NaI "hot spots" and in areas where radionuclides were not detected This information is required in soil or gravel covered sites only to determine the vertical distribution of gamma emitting radionuclides contributing to the HPGe survey readings Comparison of HPGe survey readings with surficial soil and depth profile samples will allow correlation of these remote and direct measurements At selected soil covered survey points, surficial soil samples will be collected using the RFP method presently outlined in EMD OP GT 08 Subsurface soil samples will also be collected from selected locations at 0- to 2-, 2- to 4-, and 4- to 6-inch vertical depths to provide profile information and allow correlation of radionuclide depth distributions with HPGe measurements These surficial and subsurface samples will be measured onsite for radionuclide concentration using a laboratory HPGe The availability of a laboratory HPGe for OU10 field samples is currently uncertain In the event a laboratory HPGe is not available by the time OU10 field work commences, samples will be sent to a radiochemistry laboratory for analysis.

All HPGe and NaI readings will be plotted and contoured on maps of the IHSSs. DOE will present the results of the surveys to EPA and CDH to determine where additional readings on a finer grid spacing are needed If readings warrant additional measurements, a grid spacing of 75 ft will be used to further define the area of radioactive contamination If readings above background are detected near the existing boundary of OU10 IHSSs, the grid will be expanded past the existing boundary. Both the initial HPGe survey and additional measurements on the finer grid and beyond IHSS boundaries will be completed in Stage 1 The Stage 1 HPGe results will be used to plan Stage 2 sampling of asphalt/concrete and soil for radionuclide analyses

7 4 3 Soil Gas Sampling Procedure

Soil gas sampling will be conducted in accordance with EMD OP GT 09 All soil gas locations will be cleared for underground utilities prior to sample collection Soil gas samples will be collected from 5 ft below the ground surface If soil gas samples are to be collected beneath asphalt or concrete, an electrical rotary hammer will be used to reach the soil surface Other related EMD OPs can be referenced in EMD OP GT 09, Section 4 2, and equipment requirements are listed in Section 5 3 1.1.

The soil gas samples will be analyzed using a portable gas chromatograph (GC). The GC will be calibrated prior to initial use in accordance with EMD OP GT 09A using standards prepared for the analytes listed in Table 7-5.

7 4 4 Pipeline Investigation

Pipeline investigation is part of the field operation referred to as "tank and ancillary equipment inspection" in Section 7 3 The sampling design and locations for pipeline investigation are discussed below Pipeline inspection and sampling will be conducted using a three-stage approach. This section details activities to be conducted during each of the three stages of the pipeline investigations

Tentative Stage 1 pipeline test pit locations will be at pipeline endpoints and known structural features Information derived from additional data compilation activities, field observations, surface radiation surveys, and analytical results from previous investigation will dictate the specific sampling intervals required The decision process for identification of sampling locations is discussed below

7 4 4 1 Stage 1 Investigation

As discussed in Section 7.2, the investigation is designed to locate areas of contamination in OU10 vadose zone soils, based on conceptual model release scenarios (Section 2.2) and to provide an assessment of the nature of contamination at these locations Pipelines will be investigated by excavating a series of test pits These test pits will provide the following

- Confirmation of pipeline location and configuration
- Visual inspection of pipeline integrity
- Samples of surface soils
- Samples of pipeline trench backfill
- Samples of native soils beneath the pipeline trench
- Samples of any residue in pipelines

The Stage 1 pipeline investigation will be conducted in accordance with all applicable EMD OPs Activities will be governed by EMD OPs as follows

- Any prework radiation survey of test pit locations will be conducted according to EMD OP FO 16
- Prior to excavation, test pit locations will be cleared according to EMD OP GT 10
- Surface soil samples will be collected according to the appropriate EMD OPs listed in Table 7-2
- Test pits will be excavated and sampled according to EMD OP GT 7
- Water encountered in test pits will be sampled in accordance with EMD OP SW 3

- Field parameters will be measured on test pit water samples in accordance with EMD OP SW 2

- Residue sampling in pipelines will be performed according to the EMD OPs revision presented in Section 11 0 of the Final Phase I RFI/RI Work Plan for Operable Unit 9

- Wastes generated during the excavation of test pits and pipeline opening and sampling will be handled in accordance with EMD OP FO 8

- Test pit locations will be surveyed to achieve final location and elevation accuracies of ±0.1 ft per EMD OP GT.17

Location of Test Pits

As discussed in the pipeline release conceptual model (Section 2 2), pipeline releases are most likely to occur at structural features in the pipeline Structural features will be identified as primary test pit locations Examples of structural features include the following

- Valves, cleanouts, manholes, and other pipeline openings
- Elbows, tees, and reducers
- Pipe/tank connections
- Transitions in pipeline materials

As described in Section 7 3, test pit construction will be performed at documented fittings, elbows, and valves However, certain conditions may exist which mandate closer test pit spacing Test pit spacing will be reduced under the following conditions

- Poor pipeline integrity is observed in a test pit

- Poor pipeline integrity is observed in pipeline video inspection (see discussion below under Pipeline Video Inspection)

- Pipeline pressure testing results indicate pipeline leakage (see discussion below under Pipeline Pressure Testing)

The rationale for the reduction in test pit spacing is to double the sampling density in areas of uncertain conditions This will increase the probability of identifying areas of contamination along the pipelines

Surface Soil Sampling

A surface soil sample will be collected from each test pit location prior to excavation of the test pit The sample location will be as close as possible to the center of the area to be excavated Surface soil samples for radionuclide analysis will be collected in accordance with the grab sample method described in OP GT 8 using the CDH method, and GT 17 For nonradiological analysis, surficial soil will be collected from a 6-inch square area sampled to a depth of 6 inches (i e , a sample of dimensions 6 by 6 by 6 inches) according to the method outlined in OU1 Technical Memorandum 5. Overlying pavement or other surface cover will be removed if necessary This will provide sufficient sample volume to perform the analyses specified in Section 7 5 The SOPs for this type of surficial soil sampling will be approved by EPA and CDH before implementation

Test Pit Excavation Procedures

Test pits will be excavated in accordance with the applicable provisions of EMD OP GT 7 Test pit excavation will commence after collection of a surface soil sample at the test pit location, and after removal of any pavement or other surface cover as necessary Pipelines must be exposed in their *in situ* condition so that unbiased assessment of pipeline integrity can be made Test pit construction will, therefore, be performed in a manner that does not damage the *in situ* conditions of the pipelines. Mechanized digging equipment (e g , backhoes) will be used to remove only the bulk of material covering the pipeline. Periodic manual probing may be necessary to measure the depth of the remaining cover Once a depth of cover less than 1 ft remains, test pit excavation will be completed with shovels Information gathered to complete excavation permitting procedures, described in EMD OP GT 10, will help in planning the excavation by identifying potential interferences (e g , nearby underground utilities)

Test Pit Logging and Sampling

Test pit logging and sampling will be conducted in accordance with EMD OP GT 7, Logging and Sampling of Test Pits and Trenches At each test pit, the condition of the exposed pipe material will be described and documented Evidence of pipeline degradation (e g , excessive corrosion, holes, cracks) will be described in detail The pipeline and test pit will be photographed and sketched in accordance with EMD OP GT.7 The location and invert elevation of the pipe will be surveyed Soil exposed in the excavations will be described for visible contamination, extent of trench backfill, and the type of backfill material

Discrete soil samples will be collected at each of the following locations

- In trench backfill directly beneath the pipeline
- In native soil directly below trench

After collection of soil samples, one sample of pipeline residue will be collected at every test pit where feasible to characterize wastes In instances where no residue is present, one wipe sample may be taken on the interior surface of pipeline components if radioactive contamination is suspected Wipe samples will be collected and tested according to EMD OP FO.16 This will provide a qualitative measure of radionuclide contamination In addition, inside surface radiological dose rate measurements will be obtained by inserting a low-energy gamma probe radiation detector into the pipeline These measurements will be useful in verifying process piping historical data and allow for future disposal criteria. Valves, cleanouts, and other pipeline openings will be the preferred locations for collection of residue samples Where other access is unavailable, the pipe will either be cut open or dismantled at test pit exposure Pipe sections which are dismantled will be reassembled, if possible Pipe sections that are cut or that cannot be reassembled will be grouted closed with a plug of nonshrinking cement

If groundwater is encountered in a test pit, a groundwater grab sample will be collected in accordance with EMD OP SW 3 and submitted for analysis As discussed in Section 7 5, field parameters will be measured on the groundwater sample No attempt will be made to open pipelines and collect residue samples The trench backfill directly below the pipeline will be sampled if possible, but the native soil directly beneath the trench will not be sampled. The depth at which groundwater is encountered will be recorded

Pipeline Location and Tracing

In general, it is expected that pipeline structural features will allow pipeline alignments to be traced sufficiently to locate test pits along the alignment Where structural features are absent or widely spaced, however, pipeline location devices may be utilized to trace the pipelines The method used will depend upon the pipe construction material Conductive pipes can be readily located by attaching a transmitter to the outer surface of the pipe This produces a signal along the buried pipeline that can be traced by a detector at the surface For nonconductive pipes, a flexible steel tape or similar conductive material must be inserted into an opening in the pipe and fed down the pipeline to carry the signal Alternatively, a transmitting sound can be inserted and moved down the pipeline with push rods or a steel tape Pipeline video inspection (see discussion below) can also be utilized to trace pipeline alignments by providing azimuth and range data Ground-penetrating radar (GPR) may provide another method of tracing pipelines, although its efficacy may be limited by the clayey, cobble-rich soil of the site and by congestion of pipelines and utility lines at many locations

Pipeline location and tracing methods will be field-tested if it appears that pipeline tracing will be necessary to the Stage 1 pipeline investigation Specific procedures for performing pipeline location and tracing will be provided by the contractor(s) selected to provide the service These procedures will be modified as necessary to support the objectives of the OU10 RFI/RI and conform with project-specific health and safety or environmental protection requirements

Pipeline Pressure Testing

In order to more fully evaluate the current status of the pipeline system, pressure testing will be performed where possible on pipeline segments between available access points (test pits, valves, etc.). Pressure testing will not be performed where potential access points are below the water table

Pipeline pressure testing may aid in detecting release locations in unexcavated portions of pipelines, and in confirming the integrity of pipelines that appear sound in test pits Where successfully performed, the testing will provide an additional measure of assurance that sections of pipeline which are not visually inspected have been evaluated Pressure testing results together with historical data may provide sufficient justification to remove a particular pipeline section from further investigation and, more importantly, from having to be addressed by a final remedial action for OU10

It should be noted that contamination may exist at locations where pipeline leaks were excavated and repaired Contamination may also exist at locations where a replacement pipeline was installed in the same alignment where an older, leaking pipeline was removed Pipelines that currently test "tight" may have ben repaired, or may be a replacement line for an older pipeline which leaked. Historical data may help identify locations of pipeline repair and replacement However, it is expected that maintenance and construction records for the pipelines will be incomplete

Techniques using tracer gas (typically helium) or sensors to detect air motion around leaks can be employed during pressure testing to identify specific leak locations along pipelines

Pipeline Video Inspection

Video inspection of pipeline interior may be beneficial in evaluating the integrity of the pipeline and in tracing pipeline alignments In particular, video inspection may aid in evaluating leaks detected through pipeline pressure testing, and aid in evaluating pipelines that are not conducive to pressure testing (e g , vitrified clay pipelines). Video inspection can be performed on pipelines as small as 3 inches in diameter

The potential applicability and benefits of pipeline video inspection depend upon the same factors that are identified above for pipeline pressure testing Pipeline video inspection may be field-tested in order to evaluate its feasibility and potential benefits to the Stage 1 pipeline investigation. As with pipeline pressure testing, specific procedures for conducting video inspections will be provided by the contractor(s) selected to provide the service These procedures will be modified as necessary to support the objectives of the OU10 RFI/RI and conform with project-specific health and safety or environmental protection requirements

7 4 4 2 Stage 2 Investigation

As discussed in Section 7 3, the Stage 2 pipeline investigation will target contaminated sites identified during the Stage 1 investigation The Stage 2 investigation is designed to provide a reasonable preliminary assessment of the extent of vadose zone soils contamination along pipeline alignments The initial spread of contamination from pipeline releases is expected to be preferentially aligned along the pipeline It is also expected that contaminant movement into native soils surrounding the pipeline trench will occur primarily from the bottom of the trench Therefore, Stage 2 soil borings will be drilled along the pipeline alignments and will sample both trench fill material and native soil underlying the trench The spacing of borings along the alignment is meant to help differentiate aerially restricted, lower-volume releases from potentially more significant higher-volume releases The following discussion outlines the methods and procedures which will be employed during Stage 2

Test pits (and borings for removed pipeline) identified as contaminated by Stage 1 analytical results will be sampled by soil borings drilled in a nominal pattern around the test pits as described in Technical Memorandum 1 When a contaminated test pit is detected, additional soil borings will be drilled along the alignment in both directions from the contaminated pit Where drilling rig access is restricted, the borings will be drilled as closely as possible to this nominal pattern It may be possible in such instances to drill the borings with a hand auger, depending upon the depth required Similarly, obstructions along the pipeline alignment (e g , a building or security fence) may require modification of the nominal spacing

Surface soil samples will be collected using the grab method described in EMD OP GT 8, Surface Soil Sampling Each surface soil sample will consist of a 6-inch-square area sampled to a depth of 6 inches Soil borings will be drilled and sampled in accordance with EMD OP

GT 2 using the continuous core auger method A 3-inch inside diameter sample barrel will be used to collect 2-ft-long soil samples from the borings A sample volume of 2,250 cubic centimeters (approximately 140 cubic inches) will be required to perform the analyses specified in Section 7 5

Recent water level monitoring data, combined with information from alluvial isopach maps, will be used to predict depths to the water table and to bedrock at the various sampling locations If the depth between the trench bottom and the water table or bedrock is less than 5 ft, the mid-depth soil sample will be omitted

The Stage 2 pipeline investigation will be conducted in accordance with all applicable EMD OPs Activities will be governed by OPs as follows

- Prework radiation surveys of soil boring locations will be conducted according to EMD OP FO.16
- Prior to drilling, soil boring locations will be cleared according to EMD OP GT 10
- Soil borings will be drilled and sampled by continuous core auger methods according to EMD OP GT 2
- Soil boring samples will be logged according to EMD OP GT 1
- Cuttings and fluid generated during drilling will be handled in accordance with EMD OP FO 8
- Soil borings will be plugged and abandoned per EMD OP GT 5
- Soil boring locations will be surveyed to achieve final location and elevation accuracies of ±0 1 ft per EMD OP GT 17

7 4 4 3 Stage 3 Investigation

The Stage 3 pipeline investigation may identify areas that warrant further characterization of vadose zone soils contamination In particular, Stage 3 may indicate areas where contamination affects a significant length of pipeline alignment, suggesting a relatively large release from the pipeline. Following the completion of the Stage 3 pipeline investigation, the results of Stage 1 will be summarized in a technical memorandum, and the need for additional investigation will be resolved on a site-by-site basis for each contaminated area Where additional investigation is determined to be appropriate, a Stage 3 pipeline investigation will be performed

The Stage 3 investigation will utilize additional soil borings drilled along the pipeline alignment as necessary to fully determine the extent of contamination in vadose zone soils along the alignment, and in native soil adjacent to the alignment to evaluate any spread of contamination laterally from the pipeline trench into vadose zone soils

Proposed Stage 3 boring locations will be documented through Technical Memorandum 2 which will be approved prior to implementation

The Stage 3 pipeline investigation is designed to fully assess the lateral and vertical extent of contamination in vadose zone soils affected by pipeline releases It is reasonable to expect that Stage 3 will be implemented in stages in order to meet this objective, with borings located increasingly distant from the contaminant source until the lateral extent of vadose zone soils contamination is delineated The extent of contamination will be determined through comparison of analytical results to background values provided in the Final Background Geochemical Characterization Report (EG&G 1991b) or to the most current background data available at the time the FSP is implemented, and to potential ARARs.

7 4 5 Tank Investigation

The sampling design and locations for the tank investigation are discussed below This section details the activities to be conducted during the Stage 1 and Stage 2 tank investigations

Tank locations targeted for investigation under the OU10 Phase I RFI/RI are identified in Figure 7.3-1, and 7.3-15 Only tank locations identified in the Closure Plan are included The decision process used to identify tank investigation activities and sampling locations is discussed below

7 4 5 1 Stage 1 Investigation

As discussed in Section 7 2, the Stage 1 tank investigation is designed to locate areas of contamination in OU10 vadose zone soils, based on conceptual model release scenarios (Section 2.2) and to provide an assessment of the nature of contamination at these locations The following discussion outlines the methods and procedures that will be employed in the Stage 1 tank investigation

The Stage 1 tank investigation will consist of visual inspections, pressure testing, and residue sampling

Tanks that are part of active waste management units will not be investigated Residue samples will not be collected from tanks that have been cleaned and painted since being removed from service.

Stage 1 tank investigation activities will be conducted in accordance with all applicable EMD OPs. Activities will be governed by the EMD OPs as follows

- Tank residue sampling will be performed according to the EMD OP revision presented in Section 11 0 of the Final Phase I RFI/RI Work Plan for Operable Unit 9

- Prework radiation survey of soil boring locations will be conducted according to EMD OP FO 16

- Prior to drilling, soil boring locations will be cleared according to EMD OP GT 10

- Surficial soil samples for radionuclide analysis will be collected according to the EMD OPs listed in Table 7-2

- Soil borings will be drilled and sampled by continuous core auger methods according to EMD OP GT.2

- Soil boring locations will be surveyed to achieve final location and elevation accuracies of ±0 1 ft per EMD OP GT.17

Tank Inspections

Tanks will be inspected to visually assess tank integrity Both the interior and exterior of above-grade and on-grade tanks will be inspected Detailed tank inspection work instructions and a form to document the inspection will be developed by the contractor that implements the OU10 Phase I RFI/RI Observations of poor tank integrity (e g , excessive corrosion, holes, and cracks, and visual indication of contamination) will be documented and used to focus subsequent soil sampling efforts. Where possible, tank inspection will be conducted remotely to mitigate the need for entry into confined spaces Access permits may be required to inspect some tank locations Tank inspection will include pressurization, where possible, to verify visual observations.

Residue Sampling

One residue sample will be collected from each tank that has not been cleaned since removal from process waste service to help characterize wastes In instances where no residue is present, one wipe sample will be taken on the interior surfaces of the tank (preferably at the base of the tank or near pipeline connections) Wipe samples will be collected and tested according to EMD OP FO 16 This will provide a qualitative measure of radionuclide contamination Where possible, residue or wipe samples will be collected remotely, to mitigate the need for entry into confines spaces In addition, inside surface radiological dose rate measurements will be obtained by inserting a low-energy gamma probe radiation detector into the tank These measurements will be useful in verifying tank historical data and allow for future disposal criteria

7 4 5 2 Stage 2 Investigation

Soil Boring Locations

Soil borings will be drilled and sampled during the Stage 2 tank investigation to identify areas of contamination immediately adjacent to the tank location As discussed in the conceptual model release scenario (Section 2 2), contamination is most likely to exist at the following locations around tanks.

- Beneath or near external connections and openings
- Near joints or corners around underground tanks
- Beneath the base of the tank

Areas beneath or near external connections and openings, and near joints or corners around underground tanks, will be targeted as primary soil boring locations "Hot spots" identified through the surface radiation or soil gas surveys will also be targeted as primarily test pit locations. Soil borings will not be drilled for tanks inside or beneath production buildings that are not accessible from outside the building, as this would disrupt building operations

Because tank locations vary widely in size and configuration, a nominal pattern for soil borings is not appropriate. As a general rule, it is proposed that one soil boring be drilled on each accessible side of the tank location If field observations suggest that more or fewer soil borings are needed to adequately characterize the soils immediately surrounding a tank location (i e , for very large or very small tank locations), proposed soil boring locations for the particular site will be documented in technical memoranda and approved prior to implementation In all cases, soil borings will be drilled as close as possible to the tank structure

Sampling of Soil Borings

Nominal soil boring sampling locations for the Stage 2 tank investigation will be addressed in Technical Memorandum 1 One discrete soil sample will be collected at each of the following locations.

- Ground surface (prior to drilling)
- One to 3 ft below the base of below-grade tanks unless base of tank is in bedrock, for above-grade or on-grade tanks, mid-depth between the ground surface and the water table or alluvium/bedrock interface, whichever is encountered first
- Directly above the water table or bedrock/alluvium interface, whichever is encountered first

Regardless of whether the water table is encountered during drilling, a soil sample will be collected if possible from the interval 1 to 3 ft below the base of underground tanks If the base of the tank extends into bedrock, however, a sample will be collected from the alluvium/bedrock interface and drilling will discontinue

Surface soil samples will be collected using the grab method described in EMD OP GT 08 Each surface soil sample will consist of a 6-inch-square area sampled to a depth of 6 inches Soil borings will be drilled and sampled in accordance with EMD OP GT 02 using the continuous core auger method A 3-inch inside diameter sample barrel will be used to collect 2-ft-long soil samples from the borings A sample volume of 2,250 cubic centimeters (approximately 140 cubic inches) will be required to perform the analyses specified in Section 7.5.

Recent water level monitoring data, combined with information from alluvial isopach maps, will be used to predict depths to the water table and to bedrock at the various tank locations If the depth between the ground surface and the water table or bedrock is less than 5 ft at above-grade or on-grade tank locations, the mid-depth soil sample will be omitted

7 4 5 3 Stage 3 Investigation

The Stage 3 tank investigation is designed to determine the horizontal and vertical extent of contamination in vadose zone soils surrounding tank locations identified as contaminated during the Stage 2 tank investigation These tank locations will be further investigated by drilling and sampling additional soil borings

As with Stage 2 soil boring locations, the unique configuration of each tank location makes it impractical to establish a nominal sampling pattern for Stage 3 activities As such, Stage 3 soil boring locations and subsurface sampling frequency will be developed on a case-by-case basis The proposed Stage 3 investigation for each tank location will be documented in Technical Memorandum 2 which will be approved prior to implementation.

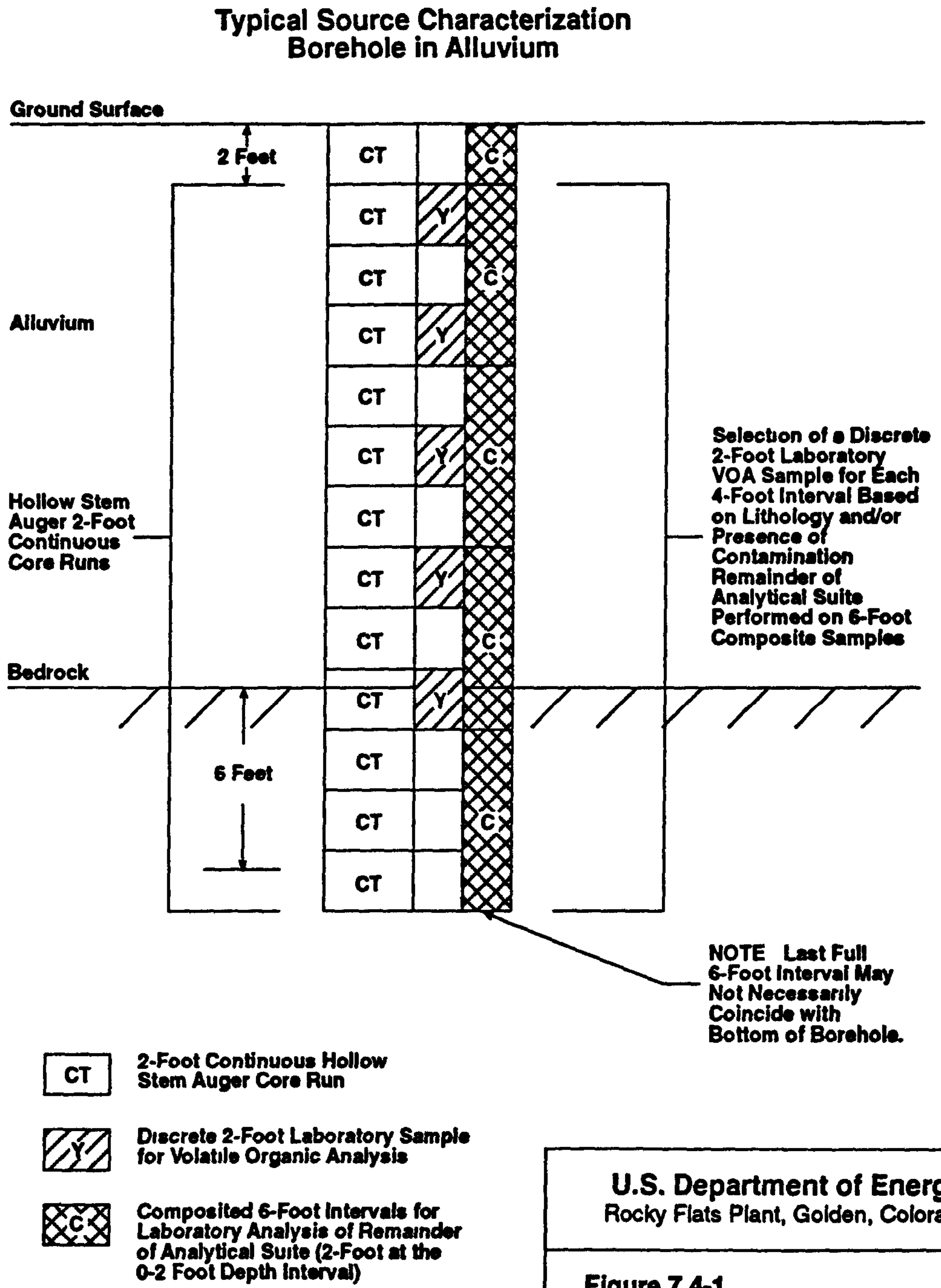
The Stage 3 tank investigation is designed to fully assess the lateral and vertical extent of contamination in vadose zone soils affected by tank releases It is reasonable to expect that Stage 3 will be implemented in tiers in order to meet this objective, with borings located at increasing distance from the contaminant source until the lateral extent of vadose soils contamination is delineated The extent of contamination will be determined through comparison of analytical results to values provided in the Final Background Geochemical Characterization Report (EG&G 1991b), or to the most current background data available at the time the FSP is implemented, and to values specified in potential ARARs

7 4 6 Borehole Drilling, Asphalt Sampling, Concrete Sampling, and Soil Sampling Procedures

Borings will be drilled to determine the geotechnical characteristics of the soil, collect samples for physical and chemical analysis, and install piezometers to determine the elevation of the water table Before any boreholes are drilled, the location will be cleared in accordance with EMD OP GT 10

Drilling will be in accordance with EMD OP GT 02 except where material is impenetrable to this method In the case where auguring is ineffective, rotary drilling will be used in accordance with EMD OP GT 04 Rotary drilling will be used in situations where material is impenetrable, otherwise hollow-stem auguring will be the method of choice The bedrock borings must be completed in accordance with EMD OP GT 03 At locations with shallow borings where the drill rig cannot enter, hand augers will be used in accordance with guidelines in EMD OPs GT 02 and .08

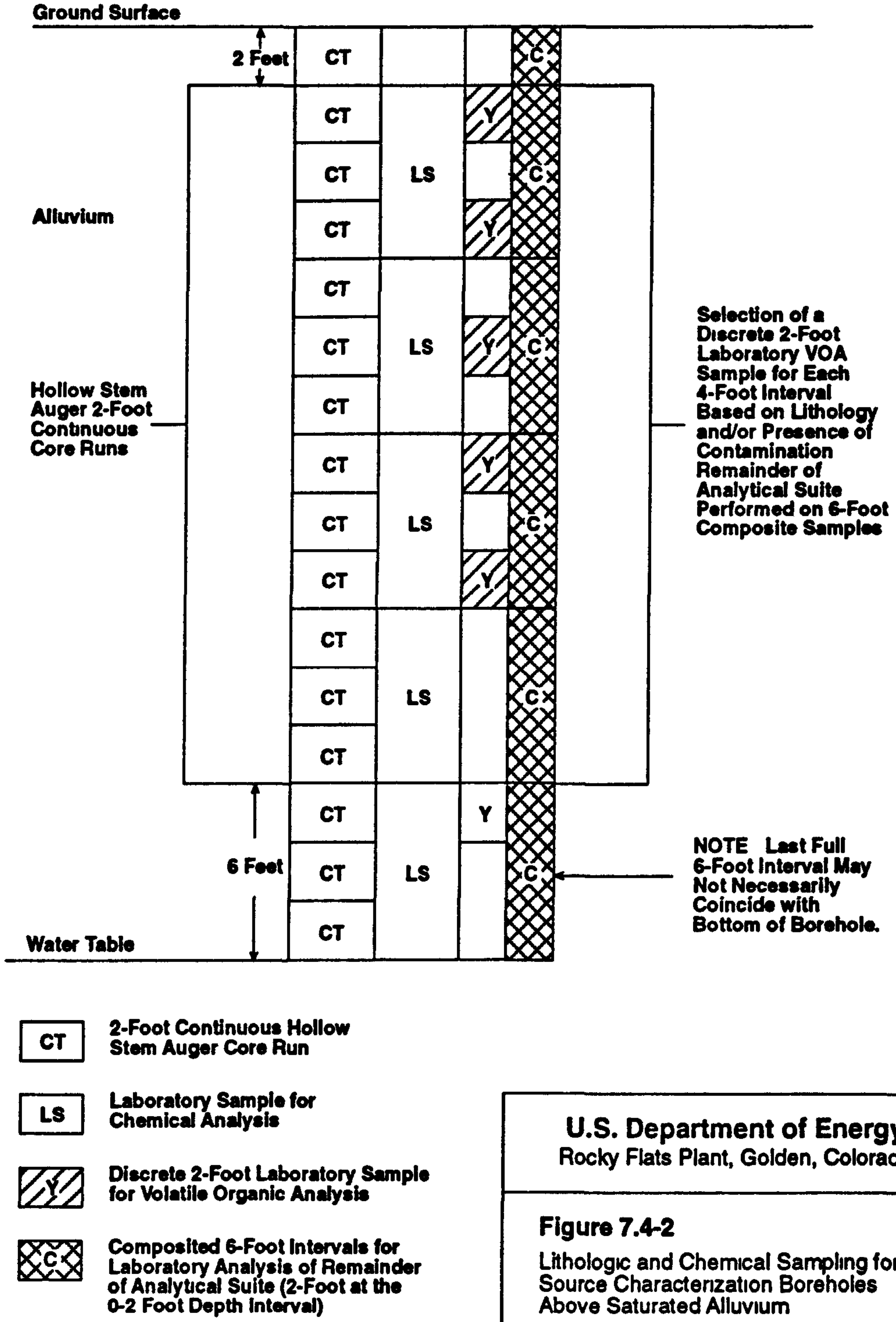
All boreholes will be drilled to groundwater or a depth penetrating bedrock by 6 ft (Figures 7 4-1 and 7 4-2).



U.S. Department of Energy
Rocky Flats Plant, Golden, Colorado

Figure 7.4-1
Lithologic and Chemical Sampling for Source Characterization Boreholes in Alluvium

Typical Source Characterization
Borehole Above Saturated Alluvium



U.S. Department of Energy
Rocky Flats Plant, Golden, Colorado

Figure 7.4-2
Lithologic and Chemical Sampling for Source Characterization Boreholes Above Saturated Alluvium

All drill cuttings and soil samples will be monitored for radionuclides and organic vapors in accordance with EMD OP FO 15 and EMD OP FO 06 These procedures are described in the Health and Safety Plan Investigation-derived wastes, such as drill cuttings and residual samples, will be handled according to guidelines in EMD OPs FO 08 and 09

Before and after drilling and sampling takes place all equipment must be decontaminated in accordance with the procedures outlined in the EMD OPs FO 03 and 04 Decontamination water will be handled according to guidelines in EMD OP FO 07

All of the borings not completed as piezometers will be grouted and abandoned immediately after drilling in accordance with procedures outlined in EMD OP GT 05 Procedures specified in this EMD OPs are designed to prevent vertical migration of contaminants after abandonment

Equipment requirements are listed in EMD OP GT 02, Section 5 1, other applicable EMD OPs are listed in Section 4 2 of this EMD OPs

Soil and bedrock samples will be collected during drilling for visual logging in accordance with EMD OP GT 01 and for chemical and physical analysis in accordance with EMD OPs GT 02 and FO 13 The soil and bedrock samples will be collected using a hollow-stem auger with a continuous core sampler Continuous core will be collected for geologic descriptions for the entire borehole depth. From this core, discrete samples will be submitted for laboratory VOC analysis beginning 2 ft from the ground surface and continuing every 4 ft to the water table In addition, a discrete VOC sample will be submitted to the laboratory if staining, discoloration, odor, or other anomaly is observed during drilling VOC soil samples will be collected in ring samplers that are capped and sealed upon recovery In addition to the VOC samples, linear composite samples from the core will be submitted to the laboratory for analysis of the remaining chemical parameters from every consecutive 6-ft interval to the water table

Soil samples for geotechnical analysis require a minimum amount of disturbance and will be collected in thin-walled metal tubes The thin-walled metal tube will be driven into the undisturbed soils in advance of the hollow-stem auger, removed, and the tube sealed for transport to the laboratory An EMD Standard Operating Procedure Addendum (SOPA) for this procedure is currently under review The EMD SOPA was prepared for the Geological Characterization Program

Soil samples from the vadose zone will be collected for leachability studies during Phase I if radionuclide or nonradionuclide contamination is detected at levels exceeding regulatory thresholds The soil samples will be collected in accordance with EMD OPs GT 02 and FO 13 The soil samples will be collected using a hollow-stem auger with a continuous core sampler A sufficient volume of soil will be collected to split into two fractions, one for sieve analysis to determine if the soil requires particle-size reduction (a minimum of 100 grams), and a second for extraction of semivolatiles, metals, and radionuclides (a minimum of 100 grams) The samples can be collected in glass sampling containers Preservatives will not be added to the samples The extractable portion of the sample will be cooled and stored at 4°C to minimize loss of semivolatile organics and to retard biological activity The sampling intervals and depths will be determined after the nature and extent of nonradionuclide vadose zone contamination has been determined

Asphalt and concrete samples will also be collected at some IHSSs These will consist of two small diameter (approximately 1 inch) core plugs The core plugs will be collected using a core drill prior to the drilling of the borehole The samples will be handled in accordance with EMD OP FO 13 After the asphalt or concrete sample is collected, a rotary hammer will be used to reach the soil surface for sampling

7 4 7 Sediment Sampling Procedure

Sediment samples will be collected from locations identified in Section 7 3 At each of these locations, a core sampler with a core liner will be used to collect the top 2 inches of bed materials for VOC analysis Samples for nonvolatile analysis will be collected with a stainless steel scoop Sampling procedures will follow those outlined in EMD OP SW 6 Sediment materials will be described according to EMD OP GT 01

7 4 8 Surface Water Sampling Procedure

If surface water is present, surface water samples will be collected at the same time that the sediment samples are collected Field parameters will be measured following procedures outlined in EMD OP SW.2 Samples will be collected according to procedures specified in EMD OP SW 3

7 4 9 Installing Piezometers

All piezometers will be constructed through the entire alluvial thickness with new, flush threaded polyvinyl chloride (PVC) (EMD OP GW 6) An auger with an I.D a minimum 4 inches larger than the outer diameter of the well casing will be used to drill the piezometer boreholes to produce a minimum annular space of 2 inches Well construction techniques will follow procedures outlined in EMD OP GT 06 Investigation-derived wastes such as drilling fluids, cuttings, and residual samples will be handled in accordance with guidelines outlined in EMD OP FO 08

Construction techniques for all piezometers will follow procedures contained in EMD OP GT 06 Piezometer casings will be protected by the placement of steel posts around the piezometer, as described in EMD OP GT 06 Pressure grouting procedures will follow guidelines outlined in EMD OP GT 03 Additional equipment and materials that may be needed for piezometer installation are listed in EMD OP GT 06, Section 5 1, other related EMD OPs are cross-referenced in Section 4 2 of this EMD OPs

The piezometers will be developed no sooner than 48 hours and no longer than two weeks after completion Water levels will be measured in all piezometers and recorded as outlined in EMD OP GW 1 and the appropriately cross-referenced EMD OPs listed in Section 4 2 of the EMD OPs. After the water levels reach static conditions, the piezometers will be developed utilizing low-energy methods, such as an inertial pump or bottom discharging bailer Development will follow procedures outlined in EMD OP GW 2

All development and purge water will be handled in accordance with guidelines outlined in EMD OP FO.08.

7 4.10 Surveying of Sample Locations

The locations of all borings and surface sampling points will be paced and/or taped off prior to sampling or drilling After sampling, drilling, or well installation, locations will be surveyed using standard land surveying techniques described in the EMD OP GT 17 Horizontal accuracy will be ±0 5 ft for borings and ±0 1 ft for wells Vertical accuracy will be ±0 1 ft for borings and ±0 01 ft for wells. Three elevations will be determined for each well: ground surface, top of well casing, and top of surface casing

7 4 11 Tensiometer or Equivalent Installation and Monitoring Procedures

Tensiometers equipped with pressure transducers or equivalent devices will be installed to measure matric potential of water in the vadose zone The tensiometers will consist of a porous ceramic cup attached to a rigid plastic tube The internal volume of the system will be completely filled with water The pores in the cup form a continuum with the pores in the soil Water will move either into or out of the tensiometer system, until equilibrium is attained across the ceramic cup Multiple tensiometers allow for the determination of the direction and in some cases, the quantity of water flux from the ground surface to the water table

Tensiometer arrays may be installed at several IHSSs during Stage 4 Each array will consist of multiple tensiometers buried at 2-ft intervals from 1 ft above the water table to within 2 ft of the ground surface To minimize the soil disturbance the tensiometers will be installed by pushing them through the bottom of boreholes drilled with small diameter solid-stem augers The boreholes will be backfilled with natural occurring soils to a compaction slightly greater than the bulk density of the undisturbed soils to reduce surface water infiltration, which results in abnormally low tensions in the backfill and the undisturbed soil

Water used in the tensiometers must be deaerated and on-site purging may be necessary to prevent the formation of bubbles that can prevent accurate data collection Purging time will be kept short to minimize wetting of soil adjacent to the porous tensiometer cup When purging is complete, the system is closed and the soil draws water through the porous cup until equilibrium is established and the pressure is recorded by the pressure transducer and data logger.

The tensiometers will be monitored for at least one annual cycle The EMD OPs for the installation and monitoring of tensiometers is presently under development and will be available after review and approval by EPA and CDH prior to any OU10 Phase I field work

7 4 12 BAT® or Equivalent Groundwater Sampling System

The BAT® Groundwater Sampling System will be used to collect grab groundwater samples from the top of the water table The BAT® sampler consists of a filter tip connected to a hollow extender pipe. Inside the pipe, the filter tip is sealed from the rest of the pipe by a septum A housing is lowered and raised in the extender pipe by wireline The housing contains an evacuated vial in its upper end and a spring-loaded, double-ended needle on the lower end

A sample is collected with the BAT® when the housing is lowered to the filter tip The spring-loaded, double-ended needle assemblage contracts and the needles pierce the filter tip septum and the septum on the vial The vial then fills with water When the vial is filled, it is retrieved with the wireline

The BAT® sampler can be used with a hollow-stem auger A borehole is drilled to within 1 to 2 ft of the water table and the BAT® is driven through the end of the auger into the water table The BAT® sampling will be conducted at locations determined by HNu and OUA screening, outside the IHSS boundaries, downgradient from areas identified as contaminated during the surficial soil sampling

An EMD OPs will be prepared for the BAT® sampling prior to the start of the OU10 field program It will be used only after approval by EPA and CDH.

7 5 SAMPLE ANALYSIS

This section describes the sample handling procedures and analytical program for samples collected during the Phase I RFI/RI investigation It also includes discussions of sample designations, analytical requirements, sample containers and preservation, and sample handling and documentation

7 5 1 Sample Designation

All sample designations generated for the Phase I RFI/RI will conform to the input requirements of the Rocky Flats Environmental Data System (RFEDS) Each sample designation will contain a nine-character sample number consisting of a two-letter prefix identifying the media sample (e g , "SB" for soil borings, "SS" for surface soils), a unique five-digit number, and a two-letter suffix identifying the contractor One sample number will be required for each sample generated, including QC samples In this manner, 99,999 unique sample numbers are available for each sample medium for each contractor that contributes sample data to the database Boring numbers will be developed independently of the sample number for a given boring These sample numbering procedures are consistent with the RFP QAPjP

7 5 2 Analytical Requirements

Generally, samples from the Phase I RFI/RI will be analyzed for some or all of the following chemical and radionuclide parameters

- Uranium 233/234, 235, 236, and 238
- TRU elements (plutonium and americium)
- Gross alpha and gross beta
- Tritium
- Total dissolved solids

- TCL purgeable organics
- TCL base/neutral and acid extractable organics
- TCL PCBs
- TAL metals and cyanide
- Anions (groundwater only)
- pH
- Field parameters (water only)

The analytical suites for each OU10 IHSS were developed according to the type of contamination suspected to be present at each site, as summarized in Table 7-3 Table 7-4 lists the specific analytes in the above groups and their CLP detection/quantitation limits Where sampling and analysis during Stages 1 and 2 indicate the presence of contamination, the quantitation limits of specific analytes should be compared to levels of potential concern in the risk assessment and to ARARs. Subsequent stages of sampling should include special analytical services to attain quantitation limits appropriate for risk assessment and compliance with ARARs These analyte lists and reporting limits will satisfy the risk assessment and other RFI/RI objectives for soil, sediment, surface water, and groundwater contamination, if present Nitrates are included because low-level radioactive wastes with high nitrate concentrations (such as nitric acid) may be present. Metals are suspected at many of the IHSSs in OU10, therefore, all of the TAL analytes have been selected for Phase I RFI/RI analysis Both filtered and unfiltered samples of surface water and groundwater will be collected and analyzed at each location

In addition to these chemical analytical requirements, 10 to 20 percent of the surficial soil samples at each IHSS will be analyzed for moisture content, grain-size distribution, bulk density, specific density, porosity, and saturated hydraulic conductivity to support exposure assessment modeling The actual number of analyses will be determined by field personnel on the basis of apparent grain size variability to ensure the collection of representative data ASTM methods will be used for these physical analyses

The following isotopes have been selected for analysis in the Phase I RFI/RI uranium 233/234, uranium 235, uranium 236, and uranium 238 Plutonium is the only TRU element that is used on the site However, americium, a daughter product of plutonium, has been detected in soil at OU10 Therefore, plutonium and americium have been selected as Phase I radionuclide parameters Tritium analysis will also be conducted for samples from IHSS 206 Gross alpha and gross beta are included as screening parameters because they are useful indicators of radionuclides

VOCs and SVOCs have been detected at concentrations above the detection limit in soil and have historically been stored at most of the OU10 IHSSs Therefore, all VOCs and SVOCs will be included in the Phase I RFI/RI analyses Any soil samples analyzed on site for volatiles will require that 10 percent be analyzed by an off-site laboratory to verify analytical results

The analytical parameters for the soil gas surveys at OU10 are listed in Table 7-5. Table 7-5 also lists the detection limits proposed for these parameters during the soil-gas survey

Soil samples collected for leachability tests will be analyzed using EPA Method 1312, Synthetic Precipitation Leach Test for Soils, or an equivalent method Method 1312 is presented in the EPA Interim Final RCRA Facility Investigation (RFI) Guidance, Volume II of IV, Appendix F.

7 5 3 Sample Containers and Preservation

Sample volume requirements, preservation techniques, holding times, and container material requirements are dictated by the media being sampled and by the analyses to be performed The matrices to be analyzed include soils and sediments, the water matrices for analysis will include surface water and groundwater. Tables 7-6 and 7-7 list the analytical parameters of interest in OU10 for water and soil matrices, along with the associated container size, preservatives (chemical and/or temperature), and holding times Additional specific guidance on the appropriate use of containers and preservatives is provided in EMD OP FO.13

7 5 4 Sample Handling and Documentation

Sample control and documentation is necessary to ensure the defensibility of data and to verify the quality and quantity of work performed in the field Accountable documents include logbooks, data collection forms, sample labels or tags, chain-of-custody forms, photographs, and analytical records and reports Specific guidance defining the necessary sample control, identification, and chain-of-custody documentation is discussed in EMD OP FO 13

7.6 DATA MANAGEMENT AND REPORTING PROCEDURES

Field data will be input to the RFEDS using a remote data entry module Data will be entered within 60 days of the completion of sample analysis The data will undergo a prescribed QC process based on EMD OP FO 14 A sample tracking spreadsheet will be maintained for use in tracking sample collection and shipment.

Table 7-6 Sample Containers, Sample Preservation, and Sample Holding Times for Water Samples

Parameter	Container	Preservative	Holding Time
<u>Liquid Samples - Low to Medium Concentration</u>			
Organic Compounds:			
Purgeable organics (VOCs)	2 x 40 mℓ VOA vials with teflon-lined septum lids	Cool, 4°C[a] with HCL to pH<2	7 days 14 days
Extractable organics (BNAs), pesticides, and PCBs	1 x 4 ℓ amber[b] glass bottle	Cool, 4°C	7 days until extraction, 40 days after extraction
Inorganic Compounds:			
Metals (TAL)	1 x 1 ℓ polyethylene bottle	Nitric acid pH<2, cool, 4°C	180 days[c]
Cyanide	1 x 1 ℓ polyethylene bottle	Sodium hydroxide[d] pH>12, cool, 4°C	14 days
Anions	1 x 1 ℓ polyethylene bottle	Cool, 4°C	14 days
Sulfide	1 x 1 ℓ polyethylene bottle	1 ml zinc acetate sodium hydroxide to pH>9, cool, 4°C	7 days
Nitrate	1 x 1 ℓ polyethylene bottle	Cool, 4°C	48 hours
Total dissolved solids (TDS)	1 x 1 ℓ polyethylene bottle	Cool, 4°C	48 hours
Radionuclides	1 x 1 ℓ polyethylene bottle	Nitric acid pH<2	180 days

a Add 0.008 percent sodium thiosulfate (Na2S203) in the presence of residual chlorine

b Container requirement is for any or all of the parameters given

c Holding time for mercury is 28 days

d Use ascorbic acid only if the sample contains residual chlorine. Test a drip of sample with potassium iodine-starch test paper, a blue color indicates need for treatment. Add ascorbic acid, a few crystals at a time, until a drop of sample produces no color on the indicator paper Then add an additional 0.6 g of ascorbic acid for each liter of sample volume.

Table 7-7 Sample Containers, Sample Preservation, and Sample Holding Times for Soil Samples

Parameter	Container	Preservative	Holding Time
Soil or Sediment Samples - Low to Medium Concentration			
Organic Compounds:			
Purgeable organics (VOCs)	1 x 4 oz wide-mouth teflon-lined glass vials	Cool, 4°C	7 days 14 days
Extractable organics (BNAs), pesticides, and PCBs	1 x 8 oz wide-mouth teflon-lined glass vials	Cool, 4°C	7 days until extraction, 40 days after extraction
Inorganic Compounds:			
Metals (TAL)	1 x 8 oz wide-mouth glass jar	Cool, 4°C	180 days[a]
Cyanide	1 x 8 oz wide-mouth glass jar	Cool, 4°C	14 days
Sulfide	1 x 8 oz wide-mouth glass jar	Cool, 4°C	28 days
Nitrate	1 x 8 oz wide-mouth glass jar	Cool, 4°C	48 hours
Radionuclides	1 x 8 oz wide-mouth glass jar	None	45 days

a Holding time for mercury is 28 days

7 7 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Sample duplicates, field preservation blanks, and equipment rinsate blanks will be prepared Trip blanks will be obtained from the laboratory The analytical results obtained for these samples will be used by the ER Program Project Manager to assess the quality of the field sampling effort and the total sample variance as it affects quantitative contaminant assessment The types of field QC samples to be collected and their application are discussed below Table 7-8 provides the frequency with which QC samples will be collected and analyzed in Stage 1 The numbers of QC samples should be reevaluated according to the variability displayed by Stage 1 data

Duplicate samples will be collected by the sampling team for use as a relative measure of the precision of the sample collection process These samples will be collected at the same time, using the same procedures and equipment, and in the same types of containers as required for the samples They will also be preserved in the same manner and submitted for the same analyses as required for the samples.

Field preservation blanks of distilled water, preserved according to the preservation requirements (Section 7 5 3), will be prepared by the sampling team and will be used to provide an indication of any contamination introduced during field sample preparation These QC samples are applicable only to samples requiring chemical preservation (Table 7-8)

Equipment (rinsate) blanks will be collected from final decontamination rinsate to evaluate the success of the field sampling team's decontamination efforts on nondedicated sampling equipment. Equipment blanks are obtained by rinsing cleaned equipment with distilled water prior to sample collection The rinsate is collected and placed in the appropriate sample containers. Equipment rinsate blanks are applicable to all analyses for water and soil samples (Table 7-8)

Table 7-8 Field QC Sample Frequency

Sample Type	Type of Analysis	Media	
		Solids	Liquids
Duplicates	Organics	1/10	1/10
	Inorganics	1/10	1/10
	Radionuclides	1/10	1/10
Field Preservation Blanks	Organics	NA	NA
	Inorganics	NA	1/20
	Radionuclides	NA	1/20
Equipment Blanks	Organics	1/20	1/20
	Inorganics	1/20	1/20
	Radionuclides	1/20	1/20
Trip Blanks	Organics	1/20	1/20
	Inorganics	NR	NR
	Radionuclides	NR	NR

NA = Not Applicable
NR = Not Required
1/10 = one QC sampler per ten samples collected

Trip blanks consisting of distilled water will be prepared by the laboratory technician and will accompany each shipment of water samples for VOC analysis Trip blanks will be stored with the group of samples with which they are associated Analysis of the trip blank will indicate the migration of VOCs or any problems associated with sample shipment, handling, or storage Information from the trip blanks will be used in conjunction with air monitoring data and other information to assess the influence of ongoing waste operations on the quality of data collected

Procedures for monitoring field QC are provided in the RFP sitewide QAPjP