

**MALCOLM
PIRNIE**

ARCS II



SDMS Document



113349

Contract No. 68-W9-0051

**FRANKLIN BURNS SITE
FRANKLIN TOWNSHIP, NEW JERSEY**

Work Assignment No. 027-2LAJ

**SUPERFUND ACCELERATED CLEANUP MODEL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
DRAFT FINAL FIELD SAMPLING PLAN**

**Remedial Planning Activities at Selected
Uncontrolled Hazardous Substance Disposal Sites
USEPA Region II (NY, NJ, PR, VI)**

**Malcolm Pirnie, Inc.
2 Corporate Park Drive
White Plains, New York 10602**

February 1994

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February 17, 1994

Ms. Kelley A. Chase
U.S. Environmental Protection Agency, Region II
26 Federal Plaza, 7th Floor, Room 759
Jacob Javits Federal Building
New York, NY 10278

Re: Transmittal of Draft Final Field Sampling Plan
ARCS Contract No. 68-W9-0051
Work Assignment No. 027-2LAJ
Franklin Burns Site, Franklin Township, NJ

Dear Ms. Chase:

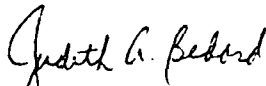
Malcolm Pirnie is pleased to submit one unbound copy and 12 bound copies of the Draft Final Field Sampling Plan (FSP) for the Superfund Accelerated Cleanup Model (SACM) Remedial Investigation/Feasibility Study (RI/FS) to be conducted at the Franklin Burns Site in Franklin Township, Gloucester County, New Jersey.

This Draft Final FSP incorporates a response to all of the USEPA's November 23, 1993, comments on the July 1993 Draft FSP, and, in general, provides an update of the Draft Final FSP consistent with the February 1994 Draft Final Work Plan.

If you have any questions or require additional information, please feel free to call.

Very truly yours,

MALCOLM PIRNIE, INC.



Judith A. Bedard
Site Manager

c: Fernando Rosado, USEPA

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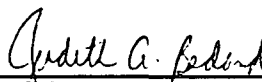
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SITE NAME:
FRANKLIN BURNS SITE
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CONTRACTOR QA/QC SIGN-OFF

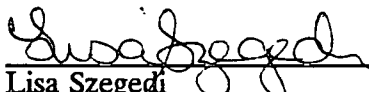
Malcolm Pirnie, Inc. has reviewed this draft document in accordance with the contractor's ARCS II Quality Assurance Procedures Manual SOP (MP-PMOQA-006-12/90, Revision 1) and is submitting it to the USEPA, Region II under Work Assignment No. 027-2LAJ and Contract No. 68-W9-0051.

This document has not been approved by USEPA Region II and is not intended for release to the public.



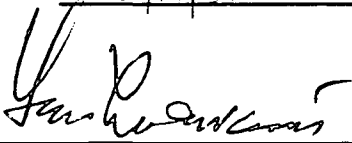
Judith A. Bedard
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Date: 2/17/94



Lisa Szegedi
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Date: 2/15/94

1 - To be signed by the Program Manager or other designated staff.

2 - To be signed by the QA Manager or other designated staff.

USEPA WORK ASSIGNMENT NUMBER: 027-2LAJ
USEPA CONTRACT NUMBER: 68-W9-0051
MALCOLM PIRNIE, INC.

DRAFT FINAL
FIELD SAMPLING PLAN
FOR
SUPERFUND ACCELERATED
CLEANUP MODEL
REMEDIAL INVESTIGATION AND
FEASIBILITY STUDY

FRANKLIN BURNS SITE
FRANKLIN TOWNSHIP, GLOUCESTER TOWNSHIP, NJ

FEBRUARY 1994

NOTICE

The information in this document has been funded by the United States Environmental Protection Agency (USEPA) under ARCS II Contract No. 68-W9-0051 to Malcolm Pirnie, Inc. This document is a draft and has not been formally released by either Malcolm Pirnie or the USEPA. As a draft, this document should not be cited or quoted, and is being circulated for comment only.

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FRANKLIN BURNS SITE
FIELD SAMPLING PLAN

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1.0 INTRODUCTION

This Field Sampling Plan (FSP) describes in detail the field procedures for the Remedial Investigation/Feasibility Study (RI/FS) at the Franklin Burns Site (Site) in Franklin Township, Gloucester County, New Jersey. The purpose of the FSP is to assure that samples are properly collected, handled, and transported to the laboratory and that sampling and handling procedures are fully documented. This is designed to avoid cross-contamination of samples, samples being improperly preserved and samples not being analyzed for the appropriate constituents. The sampling and data collecting methods described in the FSP are consistent with the U.S. Environmental Protection Agency's (USEPA) "A Compendium of Superfund Field Operations Methods" (EPA/540/P-87/001, OSWER Direction 9355.0-14, December 1987), the Region II CERCLA Quality Assurance Manual, Final Copy, Revision 1, October 1989 and Malcolm Pirnie's Standard Operating Procedures.

Each member of the field team will be required to read this document and to understand the procedures that he or she is to follow in the field before beginning work at the Site. In addition, each field team member will be required to read and to indicate that he/she understands the Site Health and Safety Plan (HASp) before initiating field activities.

It is recognized that field conditions may differ from those expected. As a result, it may be necessary to change some of the procedures described in the FSP. The Malcolm Pirnie Site Quality Assurance Officer, the ARCS II PMO QA Manager/Deputy Manager and the USEPA will be advised of any need to change procedures. After the changes have been agreed to, the revised procedures will be documented and attached to the FSP as an addendum. Copies of the FSP (minimum of one) will be kept at any field office at all times.

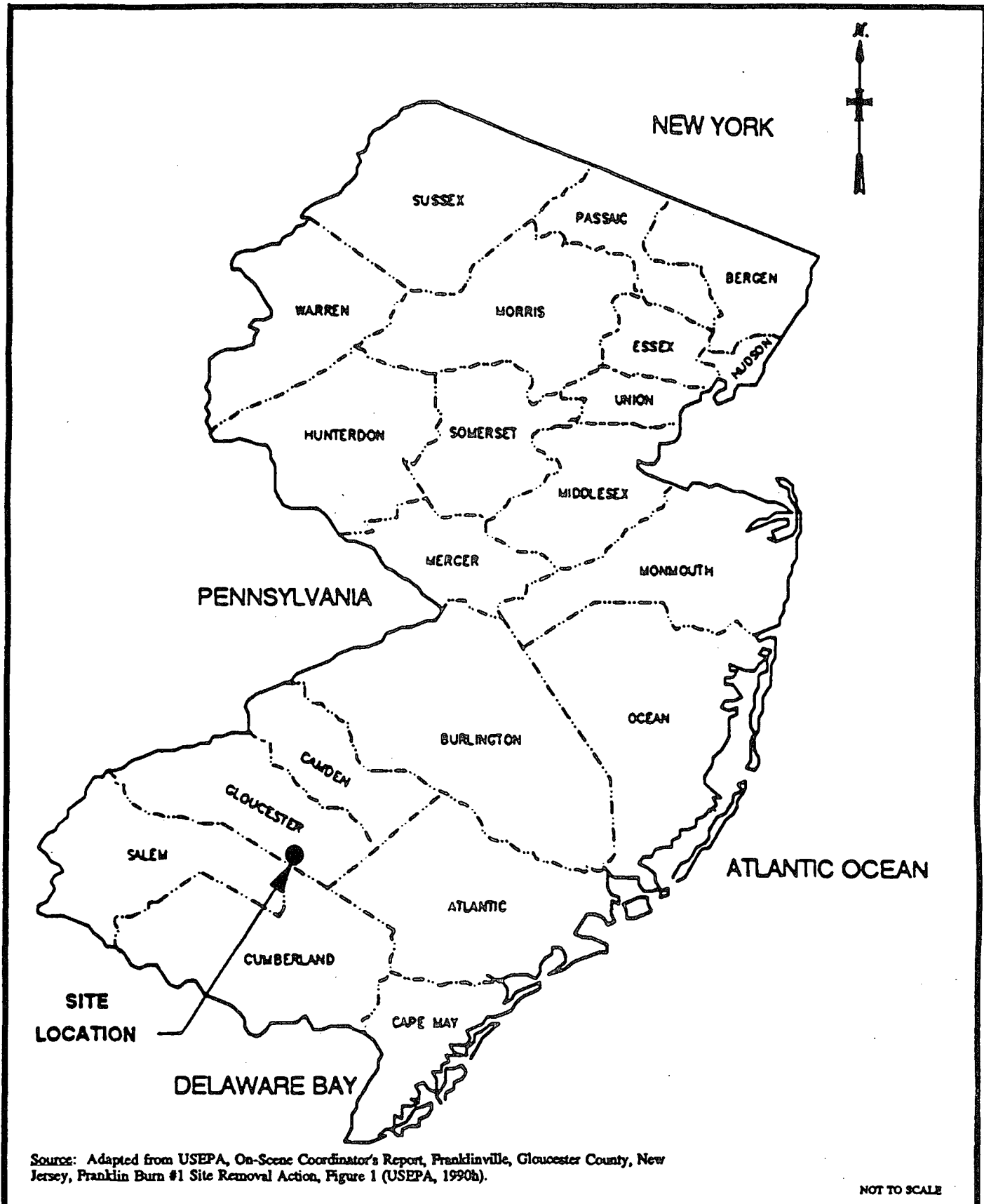
2.0 SITE BACKGROUND

A comprehensive review of background information used to design the field investigation is presented in the Draft Final Work Plan for this Site dated February 1994. A summary of the important aspects of that background research is presented below.

2.1 SITE DESCRIPTION

The Site consists of seven separate land parcels in rural residential areas, referred to as Subsites 1 through 7, located in Franklin Township, Gloucester County in the State of New Jersey, as shown in Figures 2-1 and 2-2. The subsites were used for the burning of insulated wire and possibly other electrical components, including transformers and capacitors, for the recovery and sale of copper. The burning operations resulted in the generation of ash piles containing significant concentrations of metals, and in some cases PCBs, and/or dioxins and furans. Of the seven subsites, five are located in close proximity to each other along a portion of the Hayes Branch (Subsites 1, 3, 4, 5 and 6), with the remaining two subsites at approximately 3 miles (Subsite 2) to the north and approximately 2 miles (Subsite 7) to the northeast of the clustered subsites. All of the seven subsites are located within the following geographic coordinates: latitude 39° 35' 00" north to 39° 39' 00" north and longitude 75° 1' 00" west to 75° 2' 30" west.

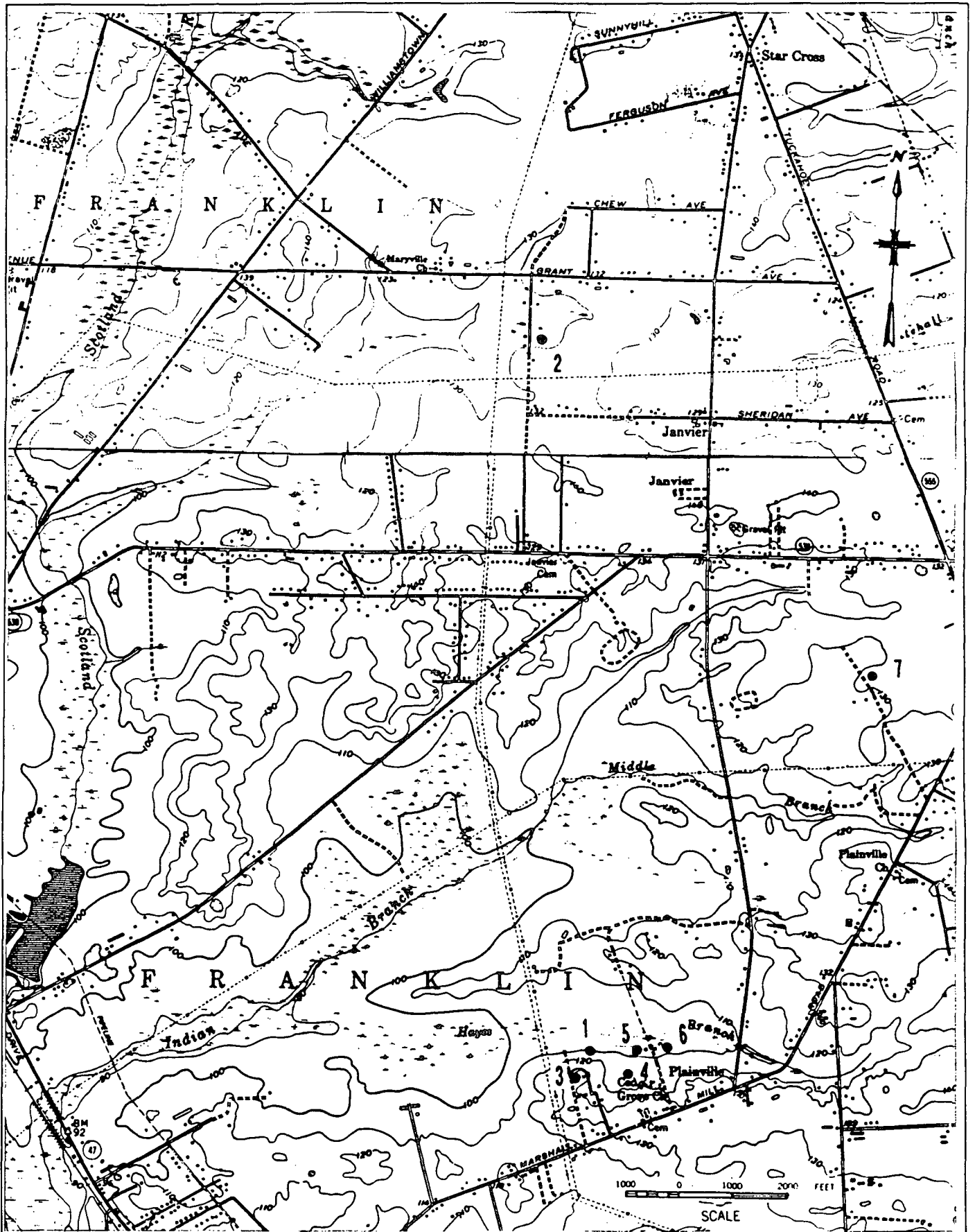
The Site is located in the Atlantic Coastal Plain Physiographic Province, which is a gently undulating plain with low topographic relief. Ground elevations at the Site range from 90 to 150 feet above mean sea level (MSL). In the vicinity of Subsites 1, 3, 4, 5 and 6, surface water drains to the north towards the Hayes Branch and adjoining wetlands (Figure 2-2). In the vicinity of Subsite 2, surface water flows toward the Jericho Branch in a west-southwest direction (Figure 2-2). Drainage from Subsite 7 flows to Middle Branch to the southwest of the Site (Figure 2-2). All of these tributaries eventually join the Indian Branch or the Scotland Run, which flow into Malaga Lake. Malaga Lake discharges via the lower reaches of Scotland Run into Willow Grove Lake. Willow Grove Lake feeds into the Maurice River which discharges into the Delaware Bay at Port Norris, New Jersey.



Source: Adapted from USEPA, On-Scene Coordinator's Report, Franklinville, Gloucester County, New Jersey, Franklin Burn #1 Site Removal Action, Figure 1 (USEPA, 1990b).

NOT TO SCALE

MALCOLM PIRNIE	FRANKLIN BURNS SITE FRANKLIN TOWNSHIP, NEW JERSEY OVERALL SITE LOCATION MAP	MALCOLM PIRNIE, INC. JANUARY 24, 1993
		FIGURE 2-1



**MALCOLM
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FRANKLIN BURNS SITE
FRANKLIN TOWNSHIP, NEW JERSEY
SUBSITE LOCATION MAP

MALCOLM PIRNIE, INC.
FEBRUARY 16, 1994

FIGURE 2-2

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The Site is underlain by unconsolidated water-bearing geologic formations. The formations are approximately 400 feet to greater than 1,300 feet thick and rest on crystalline basement rock. The oldest sediments are the continental deposits of the Potomac Group.

The unconsolidated formations range in age from Cretaceous to Quaternary and consist of clay, silt, sand, and gravel of both marine and nonmarine origin. The unconsolidated formations dip to the southeast and thicken oceanward so that each succeeding younger formation is less inclined than the formation upon which it rests. The sediments unconformably overlie crystalline basement rock which dips generally to the southeast at 80 feet per mile in the region of the Site. The crystalline basement rock is the Wissahickon Formation (Precambrian) that consists largely of schist and gneiss (Hardt and Hilton, 1969). Three regional unconsolidated formations are significant to this study; the Bridgeton Formation, the Cohansey Formation (also known as the Cohansey Sand) and the Kirkwood Formation.

The Pleistocene age Bridgeton Formation lies unconformably over the Cohansey. It is composed of well-sorted fine to coarse-grained quartzose sand and gravel. The Bridgeton Formation ranges from zero to 50 feet in thickness in the County and occurs as the surficial material in topographically higher areas near the Site. The burn areas (Subsites 1 through 7) are all located on the Bridgeton Formation; however, the Cohansey Sand outcrops in low-lying areas between subsites. Wetlands and streams in the Site area are typically found on outcrops of the Cohansey Sand.

The Miocene to Pliocene age Cohansey Sand is predominantly a light-colored quartz sand containing minor amounts of pebbly sand, fine to coarse-grained sand, silty and clayey sand, and interbedded clay (Rhodehamel, 1973). The formation ranges in thickness from a few feet to 130 feet. Some local clay beds within the Cohansey Sand are relatively thick.

The lithology of the Miocene age Kirkwood Formation is variable; however, it is generally finer grained than the overlying Cohansey Sand. In the subsurface updip from the coast, fine to medium sand and silty sand are common and regionally extensive clay beds occur in the basal part of this formation. The Kirkwood Formation ranges in thickness from 50 feet at its outcrop to 160 feet in the southern part of the County. At this time, the depth to the Kirkwood Formation is not well defined for the Site area.

It is suspected that the Site geology is similar to the regional geology in that the lithology of the Miocene age Kirkwood Formation is variable; however, it is generally finer grained than the overlying Cohansey Sand. Regionally, in the subsurface updip from the coast, fine to medium sand and silty sand are common and regionally extensive clay beds occur in the basal part of this formation.

The U.S. Soil Conservation Service (USDA, 1962) has classified soils as the Aura-Sassafras sandy loams and Downer sandy loams. The Sassafras series is described as a poorly-graded sand and silt-sand mixture over silty sand and gravel. Excess water drains through the soil readily. The Downer series contains less clay than the Sassafras series in the subsoil and is also well drained.

The water table at the Site is assumed to occur in either the Bridgeton or Cohansey Formations based on the regional hydrogeology described by Rhodehamel, 1973, and Hardt and Hilton, 1969. Because both of these formations are relatively permeable there is little distinction between their aquifer characteristics and they form a single aquifer (Rhodehamel, 1973). A review of the portions of USGS quadrangles presented in Figure 2-2, indicate that the area is divided by several small streams separated by low ridges. Hardt and Hilton, 1969, have reported that base flow of streams draining the Cohansey Sand, in the outcrop areas, is ground water discharge from the aquifer and, the water table typically mimics the topography and therefore, ground water divides generally coincide with the low ridges (topographic highs). Therefore, as reported, it is expected that ground-water recharge on the topographic highs discharges into the streams below.

Based on a review of the USGS quadrangles, Subsites 1, 3, 4, 5, and 6 are all located in the same shallow flow system. This system, therefore, appears to be controlled by the Hayes Branch and the topographic high along Marshall Mill Road. Precipitation that falls on these five subsites is expected to eventually recharge Hayes Branch. This flow system appears to be a subset of a larger system controlled by the same topographic high and the Indian Branch. If any ground water flowing from this Site area underflows Hayes Branch, it is expected that it will eventually reach the Indian Branch. If there is a downward vertical component, some of the recharge may eventually discharge into deeper aquifers.

Based on a review of the USGS quadrangles, Subsite 2 is in a flow system originating on a small topographic high running north south from Grant Avenue to Sheridan Avenue just east of Lincoln Road. This is the topographic divide between the Maurice River Basin to the west and the Great Egg Harbor River Basin to the east. Subsite 2 is on the west side

of the divide and appears to be in a local ground-water flow system between the divide and Jericho Branch, a tributary of the Scotland Run.

Based on a review of the USGS quadrangles, Subsite 7 is in a small flow system defined by the topographic high between the Indian Branch and the Middle Branch. Precipitation falling in this area is expected to eventually reach one of these two streams. However, Middle Branch discharges into Indian Branch and is a subset of the larger Indian Branch system. Once again, the presence of a downward vertical flow component may contribute some of the recharge in this area to deeper aquifers.

Water levels were measured by ERT in several Geoprobe sampling locations at each subsite (Subsites 1 to 7). This information appears to confirm that the water table in the area mimics topography. Based on this information, at Subsites 1 and 3, ground water appears to be moving northwest towards Hayes Branch. At Subsites 5 and 6, ground water appears to be moving north northwest towards Hayes Branch. At Subsite 7, it appears that ground water flows both to the southwest towards Middle Branch and to the west towards Indian Branch. The ground water at Subsite 2 appears to be moving generally east/southeast towards the Jericho Branch.

2.3 SITE HISTORY

Federal and State investigations of the Site indicate that unpermitted copper reclamation activities occurred at the subsite locations, beginning in or before the early 1960s. Piles of scrap insulated copper wire, and possibly capacitors and/or transformers were placed on the ground surface and ignited to remove paint and insulation so that the remaining copper could be recovered for sale. The burning operations resulted in the generation of hard-packed, black ash piles, which have been determined to contain significant concentrations of metals, and in some cases PCBs, and/or dioxins and furans.

Federal and State investigators have indicated that burn activities at Subsite 1 and Subsite 2 had originated in the early 1960s and late 1960s, respectively (NUS Corporation, 1991a, 1991b). In the late 1970s, the NJDEPE and the New Jersey Division Criminal Justice Department (NJDCJD) initially investigated the burning operations at Subsites 1 and 2. After complaints from several nearby residents were filed, the NJDCJD reinvestigated Subsites 1 and 2, in 1986. The Gloucester County Department of Health (GCDH), the NJDEPE, and the Franklinville Police Department then began to monitor the pile locations,

to determine if the burn operations were continuing. Regulatory actions resulting from these investigations included recording complaints from nearby residents, recording violations, conducting further investigations, issuing criminal indictments, and issuing a directive requiring remediation.

In May 1987, a directive requiring remedial action on the Subsites was issued by the NJDEPE to the owner of the property containing these Subsites. It is reported, however, that according to the owner's attorney, the owner was unable to comply with the directive due to financial considerations (NUS Corporation, 1991b). When four indictment charges were subsequently brought against the owner by the Superior Court of New Jersey, the illegal burning operations are reported to have ceased (NUS Corporation, 1991b).

In February 1989, NJDEPE requested the USEPA assume the lead role in the assessment and remediation of Subsites 1 and 2, since the PRP was financially unable to comply (NUS Corporation, 1990a, 1990b). In May 1989, the USEPA's Removal Action Branch (RAB), in conjunction with the USEPA's TAT, conducted a removal assessment of the ash piles associated with Subsites 1 and 2. Removal actions initiated by the RAB, included the erection of separate perimeter chain-link fencing around Subsite 1 and Subsite 2, and the stabilization of the ash and contaminated soil on these two Subsites with a soil bonding polymer (Semi-pave).

In April 1991, USEPA's FIT personnel initiated site investigation (SI) activities at Subsites 1 and 2, to determine whether off-site contaminant migration was occurring and to assess the potential threat to the environment.

In April 1992, USEPA's ERT and REAC conducted an extent of contamination study at three ash piles (Subsites 3, 4, and 5 (At that time Subsite 5 included what is now identified separately as Subsite 6.)) that were not characterized during earlier RAB and FIT investigations. Subsite 6 was found to include both a visible ash pile as well as two additional areas of ash buried under several feet of fill (USEPA, 1992).

In September 1992, the USEPA requested the USEPA/ERT/REAC to further delineate metals contamination at Subsites 4, 5 and 6, to perform a similar study at a recently discovered site (Subsite 7), to collect samples for the evaluation of ground-water quality, and to collect ground-water elevation data to evaluate the flow direction and gradient (Roy F. Weston, 1993). An additional objective of the investigation was to evaluate the metals content of dust and dirt present inside the residence located adjacent to, or on, Subsite 5 (Roy F. Weston, 1993).

2.4 CURRENT CONDITIONS (as of June 1993)

During recent Site investigations, USEPA has determined that the polymer is no longer effective in controlling dust migration and removal activities were initiated at Subsites 1, 2 and 3. All ash and contaminated soil was excavated and stockpiled on-site and temporary caps were placed over the piles. Drainage controls will be implemented by the USEPA as necessary to divert surface water away from the stockpiles. Post-excavation sampling will be conducted by the USEPA to ensure that the removal activities have been effective in excavated areas in removing the contaminants to the required levels. In addition, removal activities at Subsites 4, 5, 6 and 7 are near completion. At Subsites 4 and 7, all contaminated soil and ash has been excavated and transported to an off-site facility for stabilization and disposal. At Subsites 5 and 6, all contaminated soil above the water table was removed to meet USEPA's cleanup levels, however, residual soil contamination above USEPA cleanup levels remains below the water table. At Subsites 4, 5, 6, and 7, excavated areas have been backfilled with clean soil and re-seeded.

2.5 SUMMARY OF SOURCES AND DISTRIBUTION OF CONTAMINATION

Sources of contamination on each of the seven subsites resulted from the burning of insulated wire, and possibly transformers and/or capacitors, and scrap metal debris. The open-burning of these materials resulted in the formation of piles of black ash and scattered debris. The ash contains both organic and inorganic compounds with variable levels of contamination at each subsite as a result of different burning histories.

To date, investigations have been performed at the Site by NJDCJD in 1986, NJDEPE in 1987, USEPA/RAB/TAT in 1989 (USEPA, 1990a); USEPA/Environmental Services Division (ESD)/FIT in 1991 (NUS Corporation, 1991a; 1991b), USEPA/ERT/REAC in 1992-1993 (Roy F. Weston, 1993). The results of these investigations were used to prepare the following summaries of the understanding of chemical contamination at each subsite prior to any removal or consolidation of soils. (In addition, 1992-1993 Removal Actions have taken place at Subsites 4, 5, 6 and 7 and 1993 Removal Actions have taken place at Subsites 1, 2, and 3. Post-removal data from each of the subsites will be reviewed as part of the Remedial Investigation, but have not been presented here.)

Existing data indicate that some contamination of ground water by metals may exist. In addition, surface water and sediment contamination may exist in the Hayes Branch and associated wetlands located to the immediate north of Subsites 1, 5, and 6. The following provides a description of contamination detected at all of the subsites.

Subsite 1

The results of previous investigations have shown that there is significant metals, PCB, dioxin, and furan contamination associated with the ash pile of Subsite 1. Subsequent to these investigations, ash and contaminated soils at this Subsite have been excavated and stockpiled on-site with a temporary cap placed over the pile. The existence of VOC and BN/AE contamination of the soils has not yet been investigated, and the physical characteristics of the natural soils at the Subsite, such as grain size, total organic carbon (TOC), and cation exchange capacity (CEC) have not been determined.

Results of the initial ground-water investigation conducted in March 1990 which analyzed only for TAL metals and cyanide showed elevated concentrations of metals in the ground water. Results of a second ground-water screening event conducted in September 1992, using a Geoprobe sampler, which analyzed for VOCs, BN/AEs, and inorganics including TAL metals and cyanide, indicated that the ground water contains low concentrations of some metals and organics. However, the organics were qualified as either estimated or found in the laboratory blanks. The results of the investigations have not been confirmed, and the areal extent of the metals has not been definitely determined. In addition, the presence of dioxins and furans in the ground water has not been assessed.

Based on one sampling event, surface water and sediments have been shown to contain metals and very low concentrations of organic compounds both upstream and downstream of the Subsite. There is no information on the presence of dioxins or furans in the surface water or sediments. In addition, there is no information on conventional parameters such as alkalinity, total suspended solids (TSS), total dissolved solids (TDS), biochemical oxygen demand (BOD), chemical oxygen demand (COD), TOC, CEC or grain size of the sediment.

Subsite 2

Previous investigations have shown that the ash pile of Subsite 2 is contaminated with metals, PCBs, dioxins, and furans. Subsequent to these investigations, ash and contaminated soils at this Subsite has been excavated and stockpiled on-Site with a temporary cap placed over the pile. The presence or absence of organic contaminants, VOCs and BN/AEs, is based on very limited data, i.e., analyses of one soils sample. In addition, there is no information on the physical characteristics of the ash and soil.

Results of the initial ground-water investigation conducted in March 1990 which analyzed only for TAL metals and cyanide showed elevated concentrations of metals in the ground water with (estimated, below CRDL but above IDL) beryllium and mercury (estimated) detected at concentrations greater than their respective MCLs, and lead detected at concentrations above its Action Level. Chromium and silver data were not reported for the March 1990 sampling event since these data were rejected as part of the QA/QC validation process. Results of a second ground water screening event conducted in September 1992, using a Geoprobe sampler, which analyzed for VOCs, BN/AEs, and inorganics including TAL metals and cyanide, indicated that the ground water contains low concentrations of organics. However, the organics were qualified as either estimated or found in the laboratory blanks. No metal was detected at a concentration above its primary MCL or its Action Level based on the analytical results reported for the September 1992 Geoprobe sampling event. USEPA has indicated that the presence of dioxins and furans in the ground water is not anticipated and therefore, has not been assessed. Since the results of the September 1992 sampling event indicate that ground water contamination is not a concern at Subsite 2 and because the recent removal action will prevent migration of the contaminants from the soil/ash, USEPA has determined that further ground-water investigation at this Subsite is not warranted. Should the results of future ground-water investigations at other subsites indicate the presence of contaminants not detected by the September 1992 Geoprobe investigation, USEPA may decide to conduct further sampling at Subsite 2.

Subsite 3

The previous soil investigations at Subsite 3 have indicated that the material in the ash pile is contaminated with metals, organics, dioxins, and furans. Several soil borings collected in the ash pile had provided some information on the depth of contamination in

the Subsite. The locations of soil samples collected and analyzed to date had not defined the horizontal extent of soil contamination in all directions. Subsequent to these investigations, ash and contaminated soils at this Subsite has been excavated and stockpiled on-site with a temporary cap placed over the pile. VOCs and BN/AEs were detected at relatively low concentrations in the ash based on analysis of one sample. In addition, physical characteristics of the soil and ash have not been determined.

Results of a ground-water screening event conducted at Subsite 3 using a Geoprobe sampler have indicate that the ground water in the vicinity of Subsite 3 contains (1) low concentrations of metals with lead detected at a concentration above its Action Level, and (2) some organics; however, organics were also detected in the laboratory blanks. These screening results have not been confirmed, and the ground water has not been analyzed for dioxins and furans.

Subsite 4

Previous soil investigations have indicated that approximately 335 cubic yards of material contaminated with metals and very low concentrations (less than 0.01 ppb TEF equivalent concentration, see Table 3-14 of the February 1994 Draft Final Work Plan) of dioxins and furans existed at Subsite 4. The extent of the contamination has been characterized and Subsite 4 is undergoing an USEPA removal action which has included the removal of the ash pile to an off-Site facility for stabilization and disposal. Results of the ground water screening event conducted in September 1992, using a Geoprobe sampler, which analyzed for VOCs, BN/AEs, and inorganics including TAL metals and cyanide, indicated that the ground water contains low concentrations of metals. No metal was detected at a concentration above its primary MCL or its Action Level. All detections or organics were qualified or estimated. USEPA has indicated that the presence of dioxins and furans in the ground water is not anticipated. Therefore, since the results indicate that ground-water contamination is not a concern at Subsite 4 and because the recent removal action has removed all contaminated soil/ash above USEPA's risk based cleanup levels, USEPA has determined that further ground-water investigation at this Subsite is not warranted. Should the results of future ground-water investigations at other subsites indicate the presence of contaminants not previously detected by the Geoprobe, USEPA may decide to conduct further sampling at Subsite 4.

Subsite 5

Previous soil investigations at Subsite 5 have indicated that approximately 840 cubic yards of material contaminated with metals, dioxins and furans existed at the Subsite. The extent of the soil contamination has been characterized, and Subsite 5 is currently undergoing an USEPA removal action which has included the removal of the ash pile above the water table to an off-Site facility for stabilization and disposal. However, residual soil contamination above USEPA cleanup levels remains below the water table at this Subsite.

Results of a ground-water screening event conducted at Subsite 5 indicate the presence of low concentrations of metals and possibly organics in the ground water; however organics were also detected in the laboratory blanks. These screening results have not been confirmed, and the ground water has not been analyzed for dioxins and furans.

No investigation of the quality of surface water and sediment in the downgradient Hayes Branch and associated wetlands has been conducted in the vicinity of Subsite 5.

Subsite 6

Soils investigations at Subsite 6 have shown that the ash pile is contaminated with metals. The extent of contamination has been delineated, and Subsite 6 is currently undergoing an USEPA removal action which has included the removal of the ash pile above the water table to an off-Site facility for stabilization and disposal. However, residual soil contamination above USEPA cleanup levels remains below the water table at this Subsite.

Results of a ground-water screening event conducted at Subsite 6, using a Geoprobe sampler, indicate that the ground water contains low concentrations of metals and possibly organics; however, organics were also detected in the laboratory blanks. These results have not been confirmed, and the ground water has not been analyzed for dioxins and furans.

No surface water or sediment investigations have been conducted in the down-gradient Hayes Branch or in the associated wetlands in the vicinity of Subsite 6.

Subsite 7

Previous soils investigations at Subsite 7 indicate that the ash pile is contaminated with metals. The extent of soils contamination has been delineated and Subsite 7 is currently undergoing an USEPA removal action which has included the removal of the ash pile to an off-Site facility for stabilization and disposal.

Results from a ground-water screening event conducted at Subsite 7, using a Geoprobe sampler, indicate that the ground water in the vicinity of Subsite 7 contains low levels of (1) metals, with antimony and chromium detected at concentrations above their respective MCLs and lead detected at a concentration above its Action Level, and (2) possibly organics; however, organics were also detected in the laboratory blanks. These results have not been confirmed, and the ground water has not been analyzed for dioxins and furans.

A summary of the historical analytical data available for all of the Subsites is presented in Subsections 3.1.7.1 through 3.1.7.5 (Tables 3-1 through 3-36) of the February 1994 Draft Final Work Plan for the Franklin Burns Site.

2.6 PRELIMINARY IDENTIFICATION OF POTENTIAL EXPOSURE PATHWAYS

Historical information and available Site data indicate seven sources of contamination: Subsites 1, 2, 3, 4, 5, 6, and 7. In each case, the primary release mechanism is direct drainage to surface water or seepage into the underlying soils. The underlying soils may then become a secondary source for releases to ground water.

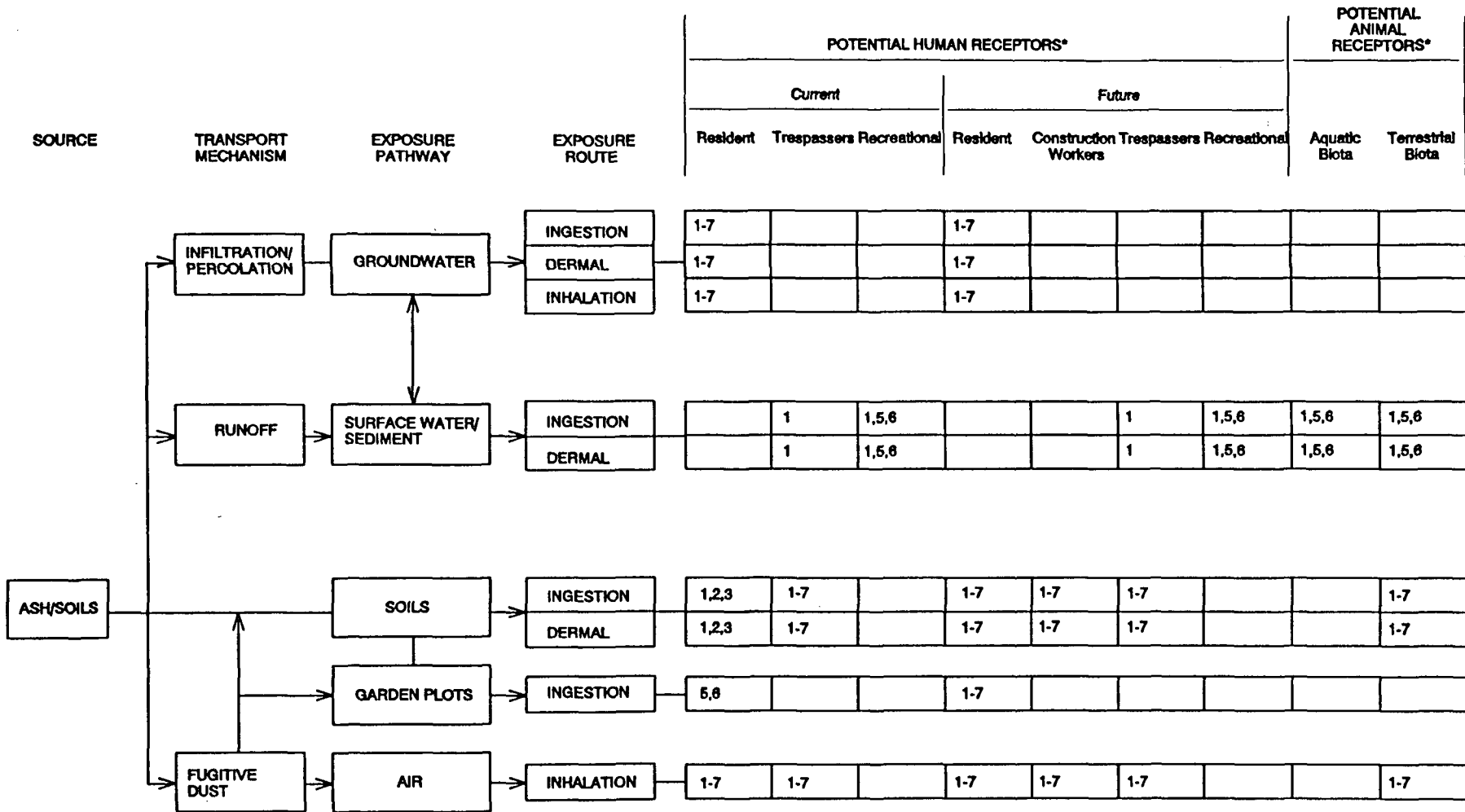
Potential exposure pathways exist in the soil, ground water, surface water, sediments and air. Preliminary identified pathways are presented in Figure 2-3, Conceptual Site Model. Contaminants released from the ash/soil may be carried to surface water bodies by runoff, carried into the air on dust particles, or may infiltrate to the ground water. People residing in the vicinity of the Site may come into direct contact with the soil and may be exposed through dermal contact, incidental ingestion and/or inhalation of dust, and/or ingestion of potentially affected foods from garden plots.

Contaminants following the ground water pathway may travel through the sandy aquifer to private potable water wells, resulting in area residents ingesting contaminated water. Area residents may be further exposed to contaminants in ground water through ingestion and/or dermal contact and inhalation while washing or bathing.

Users of the surface water bodies may include adults and children living in the area, that may be exposed to contaminants in surface water and sediments through dermal contact.

Wildlife inhabiting in the vicinity of the Site may also be exposed to Site contaminants via direct contact with soil, sediments and surface water, as well as through ingestion

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*Number Indicates subsites with potential receptors.

of these media or ingestion of vegetation growing in contaminated areas. Site biota may also be exposed to contaminants transported into the food chain via contaminated soil, surface water/sediments, or air. Inhalation of wind-blown dust or soil particles may also be an exposure route for biota inhabiting the area.

3.0 SAMPLING OBJECTIVES

The purpose of field activities proposed for the Site is to characterize the nature of contamination in the consolidated soil/ash piles on Subsites 1, 2 and 3, and the nature extent of contamination in sediment, surface water and shallow ground water on the Site and to estimate ground-water flow directions and rates as well as other patterns of contaminant migration. The proposed field activities will be conducted using the procedures discussed in this document.

Selective ash/soil boring samples will be collected to characterize the contamination in the stockpiles of ash and soil. Surface water and sediment samples will be collected from the Hayes Branch, to the north of Subsites 1, 5, and 6, to assess if contaminants are migrating into the surface water and/or sediment. New monitoring wells (shallow), piezometers, and staff gages will be installed across the site. Ground water samples will be collected from the monitoring wells and homeowner wells to assess migration of contaminants in the ground water. Ground-water and surface-water levels will be measured to estimate ground-water flow directions and hydraulic gradients and assess whether the surface water bodies are recharge or discharge points for ground water. Real time air monitoring for organic vapors, particulates and radionuclides will be conducted in an initial survey of each Subsite, and as appropriate, in accordance with the HASP, thereafter, to assess the presence of airborne contaminants.

The results of these investigations will be used to assess the potential risks that contamination at the Site presents to human health and the environment and to evaluate feasible remedial alternatives to mitigate any risks that are identified. As a result, the data generated during field activities and by the laboratory must be carefully collected and analyzed.

Table 3-1 presents of summary of issues of concern, additional data needs and approach to solution for each of the seven Subsites.

TABLE 3-1

FRANKLIN BURNS SUMMARY OF ISSUES OF CONCERN,
ADDITIONAL DATA NEEDS AND APPROACH TO SOLUTION

Subsite	Issues of Concern	Data Needs	Solution
1	<ul style="list-style-type: none"> - Metals contamination in soil/ash exists. The contaminated soils and ash have been consolidated and temporarily covered. - No characterization of VOCs or BN/AEs in ash or soil; - Additional characterization of PCBs and dioxin/furan contamination is warranted; - Nature and extent of groundwater, surface water and sediment contamination not sufficiently delineated; - No characterization of physical parameters for soil or ash; and - Groundwater flow regime is unknown. - An assessment of the environmental and human health risk associated with post-removal conditions needed. 	<ul style="list-style-type: none"> - Characterization of the chemical and physical characteristics of the contaminated soil/ash as required for treatability studies and remedial alternative evaluation; - Further delineation and characterization of shallow groundwater contamination. Deep groundwater and expanded area of shallow groundwater will be investigated in a Phase II study, if warranted; - Characterization of the hydrogeologic conditions to determine direction of shallow groundwater movement; and - Further characterization and delineation of surface water and sediment contamination in Hayes Branch and the associated wetlands, and in the small pond located on Subsite 1; and - Obtaining results of post-removal (post excavation) sampling from USEPA for the Risk Assessment Evaluation 	<ul style="list-style-type: none"> - Conduct soil/ash sampling in the consolidated soil/ash piles and analyze for parameters of concern. Analysis to include VOCs, BN/AEs, TAL metals, cyanide, phenols, PCBs/pesticides, dioxins, furans, TOC, CEC, RCRA characteristics, moisture content, grain size distribution and bulk density. - Conduct surface water and sediment sampling in Hayes Branch. Surface water analyses to include: VOCs, BN/AEs, TAL metals (total), TAL metals (filtered), cyanide, phenols, PCBs/pesticides, dioxins, furans, TSS, TDS, BOD, COD, pH, alkalinity, dissolved oxygen, temperature, specific conductance, and total hardness. Sediment samples will be analyzed for VOCs, BN/AEs, TAL metals, cyanide, phenols, PCBs/pesticides, dioxins, furans, RCRA characteristics, TOC, grain size distribution, CEC, moisture content, and bulk density. The data will be used for the risk assessment and in evaluation of remedial alternatives. - Conduct a groundwater investigation by installing shallow groundwater monitoring wells and piezometers and staff gages to determine groundwater flow (horizontally). Further characterize groundwater contamination. Staff gages will be used in conjunction with piezometers to determine if Hayes Branch is a discharge zone. Groundwater samples will be collected from the monitoring wells and selected residential wells. Analysis will consist of TAL metals (total), PCBs/pesticides, cyanide, phenols, dioxins, and furans. - If warranted, conduct a Phase II groundwater investigation including pumping tests. - Conduct a Risk Assessment.

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TABLE 3-1 (continued)

FRANKLIN BURNS SUMMARY OF ISSUES OF CONCERN,
ADDITIONAL DATA NEEDS AND APPROACH TO SOLUTION

Subsite	Issues of Concern	Data Needs	Solution
2	<ul style="list-style-type: none"> - Metals, PCB and dioxin/furan contamination exist. Additional characterization is warranted; the contaminated soils and ash have been consolidated and temporarily covered. - High PCB contamination in soil/ash exist; - Nature of VOCs and BN/AEs in soil/ash not sufficiently known; - No characterization of physical characteristics for soil or ash; and - An assessment of the environmental and human health risk associated with post-removal conditions needed. 	<ul style="list-style-type: none"> - Characterization of the chemical and physical characteristics of the contaminated soil/ash as required for treatability studies and remedial alternative evaluation; and - Obtaining results of post-removal (post excavation) sampling from USEPA for the Risk Assessment Evaluation 	<ul style="list-style-type: none"> - Conduct soil/ash sampling in the consolidated soil/ash piles and analyze for parameters of concern. Analysis to include VOCs, BN/AEs, TAL metals, cyanide, phenols, PCBs/pesticides, dioxins, furans, TOC, CEC, RCRA characteristics, moisture content, grain size and bulk density. - Conduct a Risk Assessment

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TABLE 3-1 (continued)

FRANKLIN BURNS SUMMARY OF ISSUES OF CONCERN,
ADDITIONAL DATA NEEDS AND APPROACH TO SOLUTION

Subsite	Issues of Concern	Data Needs	Solution
3	<ul style="list-style-type: none"> - Metals and dioxin/furan contamination exists. Further characterization of these contaminants is warranted; the contaminated soils and ash have been consolidated and temporarily covered. - Contamination of ash or soils by VOCs, BN/AEs and PCBs not confirmed; - No determination of physical characteristics of soil or ash; - Nature and extent of groundwater contamination not sufficiently delineated; and - Groundwater flow regime unknown. - An assessment of the environmental and human health risk associated with post-removal conditions needed. 	<ul style="list-style-type: none"> - Characterization of the chemical and physical characteristics of the contaminated soils/ash as required for treatability studies and remedial alternative evaluation; - Further determination and characterization of shallow groundwater contamination. Deep groundwater and expanded area of shallow groundwater will be investigated in a Phase II study, if warranted; and - Characterization of the hydrogeologic conditions to determine direction of groundwater movement. 	<ul style="list-style-type: none"> - Conduct soil/ash sampling in the consolidated soil/ash piles and analyze for parameters of concern. Analysis to include VOCs, BN/AEs, TAL metals, cyanide, phenols, PCBs/pesticides, dioxins, furans, TOC, CEC, RCRA characteristics, moisture content, grain size and bulk density. - Conduct a groundwater investigation by installing shallow groundwater monitoring wells and piezometers and staff gages to determine groundwater flow (horizontally). Further characterize groundwater contamination. Staff gages will be used in conjunction with piezometers to determine if Hayes Branch is a discharge zone. Groundwater samples will be collected from the monitoring wells and select residential wells. Analysis will consist of TAL metals (total), PCBs/pesticides, cyanide, phenols, dioxins, and furans. - If warranted, conduct a Phase II groundwater investigation including pumping tests. - Conduct a Risk Assessment.

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TABLE 3-1 (continued)

FRANKLIN BURNS SUMMARY OF ISSUES OF CONCERN,
ADDITIONAL DATA NEEDS AND APPROACH TO SOLUTION

Subsite	Issues of Concern	Data Needs	Solution
4	- An assessment of the environmental and human health risks associated with post-removal conditions needed.	- Obtaining results of post-removal (post excavation) sampling from USEPA for the Risk Assessment Evaluation.	- Conduct a Risk Assessment.

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TABLE 3-1 (continued)

FRANKLIN BURNS SUMMARY OF ISSUES OF CONCERN,
ADDITIONAL DATA NEEDS AND APPROACH TO SOLUTION

Subsite	Issues of Concern	Data Needs	Solution
5	<ul style="list-style-type: none"> - Nature and extent of groundwater contamination not sufficiently delineated; - Groundwater flow regime unknown; - Nature and extent of surface water contamination in Hayes Branch not fully delineated; - Nature and extent of sediment contamination in Hayes Branch and associated wetlands not sufficiently delineated; and - An assessment of the environmental and human health risks associated with post-removal conditions needed. 	<ul style="list-style-type: none"> - Further determination and characterization of shallow groundwater contamination. Deep groundwater and expanded area of shallow groundwater will be investigated in a Phase II study, if warranted; - Characterization of the hydrogeologic conditions to determine direction of groundwater movement; - Further characterization and delineation of surface water and sediment contamination in Hayes Branch and the associated wetlands; and - Obtaining results of post-removal (post excavation) sampling from USEPA for the Risk Assessment Evaluation. 	<ul style="list-style-type: none"> - Conduct surface water and sediment sampling in Hayes Branch. Surface water analyses to include: VOCs, BN/AEs, TAL metals (total), TAL metals (filtered), cyanide, phenols, PCBs/pesticides, dioxins, furans, TSS, TDS, BOD, COD, pH, alkalinity, dissolved oxygen, specific conductance, and total hardness. Sediment samples will be analyzed for TAL metals, cyanide, phenols, PCBs/pesticides, dioxins, furans, RCRA characteristics, TOC, grain size, CEC, moisture content, and bulk density. The data will be used for the risk assessment and in evaluation of remedial alternatives. - Conduct a groundwater investigation by installing shallow groundwater monitoring wells and piezometers and staff gages to determine groundwater flow (horizontally). Further characterize groundwater contamination. Staff gages will be used in conjunction with piezometers to determine if Hayes Branch is a discharge zone. Groundwater samples will be collected from the monitoring wells and selected residential wells. Analysis will consist of TAL metals (total), PCBs/pesticides, cyanide, phenols, dioxins, and furans. - If warranted, conduct a Phase II groundwater investigation including pumping tests. - Conduct a Risk Assessment.

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TABLE 3-1 (continued)

FRANKLIN BURNS SUMMARY OF ISSUES OF CONCERN,
ADDITIONAL DATA NEEDS AND APPROACH TO SOLUTION

Subsite	Issues of Concern	Data Needs	Solution
6	<ul style="list-style-type: none"> - Nature and extent of groundwater contamination not sufficiently delineated; - Groundwater flow regime unknown; - Nature and extent of surface water contamination in Hayes Branch not sufficiently delineated; - Nature and extent of sediment contamination in Hayes Branch and associated wetlands not sufficiently delineated; and - An assessment of the environmental and human health risks associated with post-removal conditions needed. 	<ul style="list-style-type: none"> - Further determination and characterization of shallow groundwater contamination. Deep groundwater and expanded area of shallow groundwater will be investigated in a Phase II study, if warranted; - Characterize the hydrogeologic conditions to determine direction of groundwater movement; - Further characterization and delineation of surface water and sediment contamination in Hayes Branch and the associated wetlands; and - Obtaining results of post-removal (post excavation) sampling from USEPA for the Risk Assessment Evaluation. 	<ul style="list-style-type: none"> - Conduct surface water and sediment sampling in Hayes Branch. Surface water analyses to include: VOCs, BN/AEs, TAL metals (total), TAL metals (filtered), cyanide, phenols, PCBs, pesticides, dioxins, furans, TSS, TDS, BOD, COD, pH, alkalinity, dissolved oxygen, specific conductance, and total hardness. Sediment samples will be analyzed for TAL metals, cyanide, phenols, PCBs/pesticides, dioxins, furans, RCRA characteristics, TOC, grain size, CEC, moisture content, and bulk density. The data will be used for the risk assessment and in evaluation of remedial alternatives. - Conduct a groundwater investigation by installing shallow groundwater monitoring wells and piezometers and staff gages to determine groundwater flow (horizontally). Further characterize groundwater contamination. Staff gages will be used in conjunction with piezometers to determine if Hayes Branch is a discharge zone. Groundwater samples will be collected from the monitoring wells and select residential wells. Analysis will consist of TAL metals (total), PCBs/pesticides, cyanide, phenols, dioxins, and furans. - If warranted, conduct a Phase II groundwater investigation including pumping tests. - Conduct a Risk Assessment.

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4.0 SAMPLE LOCATIONS, FREQUENCY AND DESIGNATION

4.1 INTRODUCTION

Field sampling activities are proposed to define the nature (consolidated soil/ash piles, groundwater, surface water, sediments), and extent (groundwater, surface water, sediments) of the contamination on the Site. Samples of soil/ash, sediment, surface water, and ground water will be collected for chemical analysis. Baseline water quality and sediment quality data will be collected (in one sample of surface water/sediment) for the surface water body (Hayes Branch) near the northern border of Subsites 1, 5, and 6. This section identifies each sampling event and includes the locations and number of samples to be collected and the constituents to be analyzed. The scope of work has been developed to support the data needs for subsequent FS activities. However, should the results of the field investigations show that the extent and nature of the contamination are not sufficiently defined to support the risk assessment and FS, it will be recommended that an additional investigation be implemented.

Quality assurance/quality control (QA/QC) samples will be collected for each matrix in order to provide a basis for determining if the data meet the necessary quality objectives. Table 4-1 summarizes the number of environmental samples to be collected. Tables 4-2, 4-3, 4-4, and 4-5 summarizes the number of QA/QC samples to be collected and constituents for which analyses will be performed. This section also describes each type of QA/QC sample, the number of QA/QC samples to be collected, and the numbering system to be used to identify each sample. Detailed sampling procedures are provided in Section 5.0.

4.2 SAMPLE LOCATIONS AND FREQUENCY

4.2.1 Consolidated Soil/Ash Boring Sampling

Soil/ash pile borings will be conducted for the purpose of collecting soil/ash samples to define the nature of contamination in the stockpiles of soil and ash. Figures 4-1, 4-2, and 4-3 show consolidated soil/ash piles locations.

TABLE 4-1
SUMMARY OF PHASE I RI SAMPLING AND ANALYSIS PROGRAM
FRANKLIN BURNS SITE⁽¹⁾

MEDIUM	TYPE OF INVESTIGATION	LOCATION OF INVESTIGATION	DATA USES	DATA QUALITY LEVEL	ANALYSIS	NUMBER OF SAMPLES
SUBSITE 1						
Soil Phase I	Consolidated Soil/Ash Pile Sampling:		Site Characterization			
	Soil/ash characterization of VOCs by HNu/OVA screening	All sampling locations in the consolidated soil/ash pile	Site Characterization	I	HNu/OVA Screening	
	Soil/ash sampling of the consolidated piles		Soil/Ash Pile Characterization, Risk Assessment and Alternatives Evaluation	III	bulk density, CEC, grain size distribution, moisture content, TOC, RCRA characteristics ^o	6
				IV	VOCs (grab samples), BN/AEs (grab samples)	6
				IV ⁽²⁾	VOCs (composited samples), BN/AEs (composited samples) ⁽²⁾	6
IV				PCBs/pesticides, TAL metals, cyanide, phenols	6	
V	dioxins, furans	6				
Groundwater Phase I	Groundwater Well Sampling	On-site monitoring wells (shallow) (3 wells x 2 rounds)	Site Characterization, Risk Assessment, and Alternatives Evaluation	I	pH, specific conductance, temperature, turbidity, dissolved oxygen, Eh.	6
				IV	PCBs/pesticides, TAL metals (total), cyanide, phenols	6
				V	dioxins, furans	6
	Residential wells (2 wells x 2 rounds)	Site Characterization, Risk Assessment, and Alternatives Evaluation	I	pH specific conductance, temperature, turbidity, dissolved oxygen, Eh.	4	
			IV	PCBs/pesticides, TAL metals (total) cyanide, phenols	4	
			V	dioxins, furans	4	

(1) Later phases will be defined after any determination that an additional phase of sampling and analysis is warranted.

(2) Composited samples will also be tested for VOCs and BN/AEs, although it is recognized that these data will have limited use, since due to incorrect sample collection methodology, they can neither be validated or duplicated.

*RCRA Characteristics

- ignitability
- reactivity
- corrosivity (pH)
- toxicity (TCLP)

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TABLE 4-1 (continued)
 SUMMARY OF PHASE I RI SAMPLING AND ANALYSIS PROGRAM
 FRANKLIN BURNS SITE⁽¹⁾

MEDIUM	TYPE OF INVESTIGATION	LOCATION OF INVESTIGATION	DATA USES	DATA QUALITY LEVEL	ANALYSIS	NUMBER OF SAMPLES
SUBSITE 1 (continued)						
Surface Water Phase I	Surface Water Sampling	<ul style="list-style-type: none"> - one sample upstream of original ash pile - one sample downstream of ash pile - one sample in pond 	Site Characterization, Risk Assessment, and Alternatives Evaluation	I	pH, specific conductance, temperature, dissolved oxygen	3
				III	alkalinity, BOD, COD, total hardness, TDS, TSS	3
				IV	VOCs, BN/AEs, PCBs/pesticides, TAL metals (total), TAL metals (filtered), cyanide, phenols	3
				V	dioxins, furans	3
Sediment Phase I	Sediment Sampling	<ul style="list-style-type: none"> - one sample upstream of original ash pile - two samples by original ash pile - one sample downstream of original ash pile - one sample in pond 	Site Characterization, Risk Assessment, and Alternatives Evaluation	III	bulk density, CEC, grain size distribution, moisture content, TOC, RCRA characteristics*	5
				IV	VOCs, BN/AEs, TAL metals, cyanide, phenols, PCBs/pesticides	5
				V	dioxins, furans	5

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- (1) Later phases will be defined after any determination that an additional phase of sampling and analysis is warranted.
 (2) Composited samples will also be tested for VOCs and BN/AEs, although it is recognized that these data will have limited use, since due to incorrect sample collection methodology, they can neither be validated or duplicated.

*RCRA Characteristics

- ignitability
- reactivity
- corrosivity (pH)
- toxicity (TCLP)

TABLE 4-1 (continued)
SUMMARY OF PHASE I RI SAMPLING AND ANALYSIS PROGRAM
FRANKLIN BURNS SITE⁽¹⁾

MEDIUM	TYPE OF INVESTIGATION	LOCATION OF INVESTIGATION	DATA USES	DATA QUALITY LEVEL	ANALYSIS	NUMBER OF SAMPLES
SUBSITE 2						
Soil Phase I	Composite soil/ash pile characterization of VOCs by HNu screening	All sampling locations in the consolidated soil/ash pile	Site Characterization	I	HNu/OVA Screening	
	Soil/ash sampling of the consolidated piles		Soil/Ash Pile Characterization Risk Assessment and Alternatives Evaluation	III	bulk density, CEC, grain size distribution, moisture content, TOC, RCRA characteristics*	8
				IV	TAL metals, cyanide, phenols, PCBs/pesticides	8
				IV	VOCs (grab samples), BN/AEs (grab samples)	8
				V	VOCs (composited samples), BN/AEs (composited samples) ⁽²⁾ dioxins, furans	8
Groundwater Phase I	Groundwater Well Sampling	Residential wells (6 wells x 2 rounds)	Site Characterization, Risk Assessment, and Alternatives Evaluation	I	pH, specific conductance, temperature, turbidity, dissolved oxygen, Eh.	12
				IV	PCBs/pesticides, TAL metals (total), cyanide, phenols	12
				V	dioxins, furans	12

(1) Later phases will be defined after any determination that an additional phase of sampling and analysis is warranted.

(2) Composited samples will also be tested for VOCs and BN/AEs, although it is recognized that these data will have limited use, since due to incorrect sample collection methodology, they can neither be validated or duplicated.

*RCRA Characteristics

- ignitability
- reactivity
- corrosivity (pH)
- toxicity (TCLP)

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TABLE 4-1 (continued)
 SUMMARY OF PHASE I RI SAMPLING AND ANALYSIS PROGRAM
 FRANKLIN BURNS SITE⁽¹⁾

MEDIUM	TYPE OF INVESTIGATION	LOCATION OF INVESTIGATION	DATA USES	DATA QUALITY LEVEL	ANALYSIS	NUMBER OF SAMPLES
SUBSITE 3						
Soil Phase I	Consolidated soil/ash pile characterization of VOCs by HNu/OVA screening	Screening of each soil sample collected in the consolidated soil/ash pile	Site Characterization	I	HNu/OVA screening	
	Soil/ash sampling of the consolidated piles		Soil/Ash Pile Characterization, Risk Assessment, and Alternatives Evaluation	III	bulk density, CEC, grain size distribution, moisture content, TOC, RCRA characteristics*	1
				IV	PCBs/ pesticides, TAL metals, cyanide, phenols	1
				IV	VOCs (grab samples), BN/AEs (grab samples)	1
					VOCs (composited samples), BN/AEs (composited samples) ⁽²⁾	1
V	dioxins, furans	1				
Groundwater Phase I	Groundwater Well Sampling	On-site monitoring wells (shallow) (2 wells x 2 rounds)	Site Characterization, Risk Assessment, Alternatives Evaluation	I	pH, specific conductance, temperature, turbidity, dissolved oxygen, Eh.	4
				IV	PCBs/pesticides, TAL metals (total), cyanide, phenols	4
				V	dioxins, furans	4

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- (1) Later phases will be defined after any determination that an additional phase of sampling and analysis is warranted.
 (2) Composited samples will also be tested for VOCs and BN/AEs, although it is recognized that these data will have limited use, since due to incorrect sample collection methodology, they can neither be validated or duplicated.

*RCRA Characteristics
 - ignitability - reactivity
 - corrosivity (pH) - toxicity (TCLP)

TABLE 4-1 (continued)
 SUMMARY OF PHASE I RI SAMPLING AND ANALYSIS PROGRAM
 FRANKLIN BURNS SITE⁽¹⁾

MEDIUM	TYPE OF INVESTIGATION	LOCATION OF INVESTIGATION	DATA USES	DATA QUALITY LEVEL	ANALYSIS	NUMBER OF SAMPLES
SUBSITE 5						
Groundwater Phase I	Groundwater Well Sampling	On-site monitoring wells (shallow) (3 wells x 2 rounds)	Site Characterization, Risk Assessment, Alternatives Evaluation	I	pH, specific conductance, temperature, turbidity, dissolved oxygen, Eh.	6
				IV	PCBs/pesticides, TAL metals (total), cyanide, phenols	6
				V	dioxins, furans	6
		Residential wells (1 well x 2 rounds)	Site Characterization, Risk Assessment, Alternatives Evaluation	I	pH, specific conductance, temperature, turbidity, dissolved oxygen, Eh.	2
				IV	PCBs/pesticides, TAL metals (total), cyanide, phenols	2
				V	dioxins, furans	2
Surface Water Phase I	Surface Water Sampling	<ul style="list-style-type: none"> - one sample upstream of original ash pile - one sample downstream of original ash pile 	Site Characterization, Risk Assessment, Alternatives Evaluation	I	pH, specific conductance, temperature, dissolved oxygen	2
				III	alkalinity, BOD, COD, total hardness, TDS, TSS	2
				IV	VOCs, BN/AEs, PCBs/pesticides, TAL metals (total), TAL metals (filtered), cyanide, phenols	2
				V	dioxins, furans	2

300038

- (1) Later phases will be defined after any determination that an additional phase of sampling and analysis is warranted.
 (2) Composited samples will also be tested for VOCs and BN/AEs, although it is recognized that these data will have limited use, since due to incorrect sample collection methodology, they can neither be validated or duplicated.

*RCRA Characteristics
 - ignitability - reactivity
 - corrosivity (pH) - toxicity (TCLP)

TABLE 4-1 (continued)
 SUMMARY OF PHASE I RI SAMPLING AND ANALYSIS PROGRAM
 FRANKLIN BURNS SITE⁽¹⁾

MEDIUM	TYPE OF INVESTIGATION	LOCATION OF INVESTIGATION	DATA USES	DATA QUALITY LEVEL	ANALYSIS	NUMBER OF SAMPLES
SUBSITE 5 (continued)						
Sediment Phase I	Sediment Sampling	- one sample upstream of original ash pile	Site Characterization, Risk Assessment, Alternatives Evaluation	III	bulk density, CEC, grain size distribution, moisture content, TOC, RCRA characteristics ²	4
		- two samples by original ash pile		IV	VOCs, BN/AEs, TAL, metals, cyanide, phenols, PCBs/pesticides	4
		- one sample downstream of original ash pile		V	dioxins, furans	4

300039

- (1) Later phases will be defined after any determination that an additional phase of sampling and analysis is warranted.
 (2) Composited samples will also be tested for VOCs and BN/AEs, although it is recognized that these data will have limited use, since due to incorrect sample collection methodology, they can neither be validated or duplicated.

²RCRA Characteristics
 - ignitability
 - reactivity
 - corrosivity (pH)
 - toxicity (TCCLP)

TABLE 4-1 (continued)
 SUMMARY OF PHASE I RI SAMPLING AND ANALYSIS PROGRAM
 FRANKLIN BURNS SITE⁽¹⁾

MEDIUM	TYPE OF INVESTIGATION	LOCATION OF INVESTIGATION	DATA USES	DATA QUALITY LEVEL	ANALYSIS	NUMBER OF SAMPLES
SUBSITE 6						
Groundwater Phase I	Groundwater Well Sampling	On-site monitoring wells (shallow) (2 wells x 2 rounds)	Site Characterization, Risk Assessment, Alternatives Evaluation	I	pH, specific conductance, temperature, turbidity, dissolved oxygen, Eh.	4
				IV	PCBs/pesticides, TAL metals (total), cyanide, phenols	4
				V	dioxins, furans	4
Surface Water Phase I	Surface Water Sampling	<ul style="list-style-type: none"> - one sample upstream of original ash pile - one sample by original ash pile - one sample downstream of original ash pile - one background sample 	Site Characterization, Risk Assessment, Alternatives Evaluation	I	pH, specific conductance, temperature, dissolved oxygen	3
				III	alkalinity, BOD, COD, total hardness, TDS, TSS	3
				IV	VOCs, BN/AEs, PCBs/pesticides, TAL metals (total), TAL metals (filtered), cyanide, phenols	3
				V	dioxins, furans	3

(1) Later phases will be defined after any determination that an additional phase of sampling and analysis is warranted.

(2) Compositing samples will also be tested for VOCs and BN/AEs, although it is recognized that these data will have limited use, since due to incorrect sample collection methodology, they can neither be validated or duplicated.

*RCRA Characteristics

- ignitability
- reactivity
- corrosivity (pH)
- toxicity (TCLP)

300010

TABLE 4-1 (continued)
SUMMARY OF PHASE I RI SAMPLING AND ANALYSIS PROGRAM
FRANKLIN BURNS SITE⁽¹⁾

MEDIUM	TYPE OF INVESTIGATION	LOCATION OF INVESTIGATION	DATA USES	DATA QUALITY LEVEL	ANALYSIS	NUMBER OF SAMPLES
SUBSITE 6 (continued)						
Sediment Phase I	Sediment Sampling	- one sample upstream of original ash pile	Site Characterization, Risk Assessment, Alternatives Evaluation	III	bulk density, CEC, grain size distribution, moisture content, TOC, RCRA characteristics*	5
		- two samples by original ash pile		IV	VOCs, BN/AEs, TAL, metals, cyanide, phenols, PCBs/pesticides	5
		- one sample downstream of original ash pile		V	dioxins, furans	5
		- one background sample				

300041

- (1) Later phases will be defined after any determination that an additional phase of sampling and analysis is warranted.
 (2) Composited samples will also be tested for VOCs and BN/AEs, although it is recognized that these data will have limited use, since due to incorrect sample collection methodology, they can neither be validated or duplicated.

*RCRA Characteristics

- ignitability
- reactivity
- corrosivity (pH)
- toxicity (TCLP)

TABLE 4-1 (continued)
 SUMMARY OF PHASE I RI SAMPLING AND ANALYSIS PROGRAM
 FRANKLIN BURNS SITE⁽¹⁾

MEDIUM	TYPE OF INVESTIGATION	LOCATION OF INVESTIGATION	DATA USES	DATA QUALITY LEVEL	ANALYSIS	NUMBER OF SAMPLES
SUBSITE 7						
Groundwater Phase I	Groundwater Well Sampling	On-site monitoring wells (shallow) (3 wells x 2 rounds)	Site Characterization, Risk Assessment, Alternatives Evaluation	I	pH, specific conductance, temperature, turbidity, dissolved oxygen, Eh.	6
				IV	PCBs/pesticides, TAL metals (total), cyanide, phenols	6
				V	dioxins, furans	6

300042

- (1) Later phases will be defined after any determination that an additional phase of sampling and analysis is warranted.
 (2) Composited samples will also be tested for VOCs and BN/AEs, although it is recognized that these data will have limited use, since due to incorrect sample collection methodology, they can neither be validated or duplicated.

*RCRA Characteristics

- ignitability
- reactivity
- corrosivity (pH)
- toxicity (TCLP)

TABLE 4-2
QC SAMPLE SUMMARY
FRANKLIN BURNS SITE

MATRIX	ANALYSIS	NUMBER OF SAMPLES	NUMBER OF FIELD DUPLICATES	NUMBER OF FIELD BLANKS ⁽⁴⁾	NUMBER OF TRIP BLANKS ⁽⁷⁾	NUMBER OF MS/MSD ⁽⁸⁾ OR MS/MD ⁽⁹⁾ SAMPLES
Soil (Soil/Ash) Phase I	TCL VOCs/BN/AEs	30	2	2	NA	2 ⁽⁸⁾
	TCL Pesticides/PCBs	15	1	1	NA	1 ⁽⁸⁾
	TAL Metals	15	1	1	NA	1 ⁽⁹⁾
	Cyanide	15	1	1	NA	1 ⁽⁹⁾
	Physical Parameters ⁽¹⁾	15	1	NA	NA	NA
	Total Organic Carbon (TOC)	15	1	NA	NA	1 ⁽⁸⁾
	RCRA Characteristics ⁽²⁾	15	1	NA	NA	NA
	Phenols	15	1	1	NA	1 ⁽⁸⁾
	Dioxin and Furans ⁽³⁾	15	1	1	NA	1 ⁽⁹⁾
Ground Water Monitoring Well Boring Soils Phase I	Physical Parameters				NA	NA
	(a) Grain Size Distribution	5	NA	NA	NA	NA
	(b) Vertical Hydraulic Conductivity	5	NA	NA	NA	NA
Ground Water Phase I (2 Rounds)	TCL Pesticides/PCBs	44	4	2	NA	4 ⁽⁸⁾
	TAL Metals (total) ⁽⁵⁾	44	4	2	NA	4 ⁽⁹⁾
	Cyanide	44	4	2	NA	4 ⁽⁹⁾
	Phenols	44	4	2	NA	4 ⁽⁹⁾
	Dioxin and Furans ⁽³⁾	44	4	2	NA	4 ⁽⁹⁾
						5
Surface Water Phase I	TCL VOCs/BN/AEs	10	1	1	NA	1 ⁽⁸⁾
	TCL Pesticides/PCBs	10	1	1	NA	1 ⁽⁹⁾
	TAL Metals (total) ⁽⁵⁾	10	1	1	NA	1 ⁽⁹⁾
	TAL Metals (filtered) ⁽⁵⁾	10	1	1	NA	1 ⁽⁹⁾
	Cyanide	10	1	1	NA	1 ⁽⁹⁾
	Water Quality Parameters ⁽⁴⁾	10	1	NA	NA	NA
	Phenols	10	1	1	NA	1 ⁽⁸⁾
	Dioxin and Furans ⁽³⁾	10	1	1	NA	1 ⁽⁹⁾
						NA
Sediment Phase I	TCL VOCs/BN/AEs	14	1	1	NA	1 ⁽⁸⁾
	TCL Pesticides/PCBs	14	1	1	NA	1 ⁽⁹⁾
	TAL Metals	14	1	1	NA	1 ⁽⁹⁾
	Cyanide	14	1	1	NA	1 ⁽⁹⁾
	Physical Parameters	14	1	NA	NA	NA
	Total Organic Carbon	14	1	NA	NA	1 ⁽⁸⁾
	RCRA Characteristics ⁽²⁾	14	1	NA	NA	NA
	Phenols	14	1	1	NA	1 ⁽⁸⁾
	Dioxin and Furans ⁽³⁾	14	1	1	NA	1 ⁽⁹⁾
						NA

FOOTNOTES:

- (1) Physical Parameters – Bulk Density, Cation Exchange Capacity, Grain Size Distribution, and Moisture Content
(2) RCRA Characteristics – Ignitability, Corrosivity, Reactivity, and Toxicity (TCLP)
(3) In addition to QC samples, Performance Evaluation (PE) samples should be ordered by the Region II QAO at the request of the USEPA WAM.
(4) Water Quality Parameters – Alkalinity, BOD, COD, Dissolved Oxygen, Total Hardness, TDS, and TSS
(5) TAL metals ground-water samples will not be filtered. TAL metals surface water samples will be filtered and unfiltered.
(6) Number is estimated – actual number of QA/QC samples will depend on the field conditions and program schedule.
(7) Number is estimated – trip blanks are for VOC analysis only.
(8) MS/MSD – triple volume is required for one field aqueous sample per 20. No extra volume is required for soil samples.
(9) MS/MD – double volume is required for one field aqueous sample per 20. No extra volume is required for soil samples.
NA – Not Applicable

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**TABLE 4-3
TARGET COMPOUND LIST/TARGET ANALYTE LIST
CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)⁽¹⁾**

FRANKLIN BURNS SITE

TCL	CRQL	
Volatiles	Water (ug/l)	Low Soil/Sediment ^(2,3) (ug/kg)
Chloromethane	10	10
Bromomethane	10	10
Vinyl Chloride	10	10
Chloroethane	10	10
Methylene Chloride	10	10
Acetone	10	10
1,1-Dichloroethene	10	10
1,1-Dichloroethane	10	10
1,2-Dichloroethene (total)	10	10
Carbon Disulfide	10	10
Chloroform	10	10
1,2-Dichloroethane	10	10
2-Butanone	10	10
1,1,1-Trichloroethane	10	10
Carbon Tetrachloride	10	10
Bromodichloromethane	10	10
1,1,2,2-Tetrachlorethane	10	10
1,2-Dichloropropane	10	10
cis-1,3-Dichloropropene	10	10
Trichloroethene	10	10
Dibromochloromethane	10	10
1,1,2-Trichloroethane	10	10
Benzene	10	10
Trans-1,3-Dichloropropene	10	10
Bromoform	10	10
2-Hexanone	10	10
4-Methyl-2-pentanone	10	10
Tetrachloroethene	10	10
Toluene	10	10
Chlorobenzene	10	10
Ethyl Benzene	10	10
Styrene	10	10
Xylenes (Total)	10	10

TABLE 4-3 (Continued)
TARGET COMPOUND LIST/TARGET ANALYTE LIST
CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)⁽¹⁾

FRANKLIN BURNS SITE

TCL	CRQL	
Semivolatiles	Water (ug/l)	Low Soil/Sediment ^(2,3) (ug/kg)
Phenol	10	330
bis(2-Chloroethyl) ether	10	330
2-Chlorophenol	10	330
1,3-Dichlorobenzene	10	330
1,4-Dichlorobenzene	10	330
1,2-Dichlorobenzene	10	330
2-Methylphenol	10	330
2,2'-oxybis (1-Chloropropane)	10	330
4-Methylphenol	10	330
N-Nitroso-di-n-propylamine	10	330
Hexachloroethane	10	330
Nitrobenzene	10	330
Isophorone	10	330
2-Nitrophenol	10	330
2,4-Dimethylphenol	10	330
bis(2-Chloroethoxy) methane	10	330
2,4-Dichlorophenol	10	330
1,2,4-Trichlorobenzene	10	330
Napthalene	10	330
4-Chloroaniline	10	330
Hexachlorobutadiene	10	330
4-chloro-3-methylphenol	10	330
2-Methylnaphthalene	10	330
Hexachlorocyclopentadiene	10	330
2,4,6-Trichlorophenol	10	330
2,4,5-Trichlorophenol	25	800
2-Chloronaphthalene	10	330
2-Nitroaniline	25	800
Dimethylphthalate	10	330
Acenaphthylene	10	330

TABLE 4-3 (Continued)
 TARGET COMPOUND LIST/TARGET ANALYTE LIST
 CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)⁽¹⁾

FRANKLIN BURNS SITE

TCL	CRQL	
Semivolatiles (Continued)	Water (ug/l)	Low Soil/Sediments ^(2,3) (ug/kg)
2,6-Dinitrotoluene	10	330
3-Nitroaniline	25	800
Acenaphthene	10	330
2,4-Dinitrophenol	25	800
4-Nitrophenol	25	800
Dibenzofuran	10	330
2,4-Dinitrotoluene	10	330
Diethylphthalate	10	330
4-Chlorophenyl Phenyl Ether	10	330
Fluorene	10	330
4-Nitroaniline	25	800
4,6-Dinitro-2-methylphenol	25	800
N-nitrosodiphenylamine	10	330
4-Bromophenyl Phenyl Ether	10	330
Hexachlorobenzene	10	330
Pentachlorophenol	25	800
Phenanthrene	10	330
Anthracene	10	330
Carbazole	10	330
Di-n-butylphthalate	10	330
Fluoranthene	10	330
Pyrene	10	330
Butylbenzylphthalate	10	330
3,3'-Dichlorobenzidine	10	330
Benzo(a)anthracene	10	330
Chrysene	10	330
bis(2-ethylhexyl)phthalate	10	330
Di-n-octylphthalate	10	330
Benzo(b)fluoranthene	10	330
Benzo(k)fluoranthene	10	330
Benzo(a)pyrene	10	330
Indeno(1,2,3-cd)pyrene	10	330
Dibenzo(a,h)anthracene	10	330
Benzo(g,h,i)perylene	10	330
	10	330

TABLE 4-3 (Continued)
TARGET COMPOUND LIST/TARGET ANALYTE LIST
CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)⁽¹⁾

FRANKLIN BURNS SITE

TCL	CRQL	
Pesticides/PCBs	Water (ug/l)	Low Soil/Sediment ^(2,3) (ug/kg)
alpha-BHC	0.05	1.7
beta-BHC	0.05	1.7
delta-BHC	0.05	1.7
gamma-BHC (Lindane)	0.05	1.7
Heptachlor	0.05	1.7
Aldrin	0.05	1.7
Heptachlor Epoxide	0.05	1.7
Endosulfan I	0.05	1.7
Dieldrin	0.10	3.3
4,4'-DDE	0.10	3.3
Endrin	0.10	3.3
Endosulfan II	0.10	3.3
4,4'-DDD	0.10	3.3
Endosulfan Sulfate	0.10	3.3
4,4'-DDT	0.10	3.3
Methoxychlor	0.50	17.0
Endrin Ketone	0.10	3.3
Endrin Aldehyde	0.10	3.3
alpha-chlordane	0.05	1.7
gamma-chlordane	0.05	1.7
Toxaphene	5.00	170.0
Aroclor-1016	1.0	33.0
Aroclor-1221	2.0	67.0
Aroclor-1232	1.0	33.0
Aroclor-1242	1.0	33.0
Aroclor-1248	1.0	33.0
Aroclor-1254	1.0	33.0
Aroclor-1260	1.0	33.0

TABLE 4-3 (Continued)
 TARGET COMPOUND LIST
 CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)⁽¹⁾

FRANKLIN BURNS SITE

PCDD/PCDF ⁽⁴⁾	CRQL ⁽⁵⁾	
	Water (ng/L)	Soil (ug/Kg)
2378-TCDD	10	1
2378-TCDF	10	1
12378-PeCDF	25	2.5
12378-PeCDD	25	2.5
23478-PeCDF	25	2.5
123478-HxCDF	25	2.5
123678-HxCDF	25	2.5
123478-HxCDD	25	2.5
123678-HxCDD	25	2.5
123789-HxCDD	25	2.5
234678-HxCDF	25	2.5
123789-HxCDF	25	2.5
1234678-HpCDF	25	2.5
1234678-HpCDD	25	2.5
1234789-HpCDF	25	2.5
OCDD	50	5.0
OCDF	50	5.0

- (4) The total concentration of all detected PCDDs & PCDFs will be reported. However, because of the number of non-2,3,7,8-substituted isomers that might be detected in a sample is unpredictable, it is not possible to assign CRQLs to the total homolog concentrations.
- (5) All CRQL values listed here are based on the wet weight of the sample.

TABLE 4-3 (Continued)
 TARGET COMPOUND LIST/TARGET ANALYTE LIST
 CONTRACT REQUIRED DETECTION LIMITS (CRDL)⁽¹⁾

FRANKLIN BURNS SITE

TAL	CRDL
Inorganics	Contract Required ⁽⁴⁾ Detection Level (ug/l)
Aluminum	200
Antimony	60
Arsenic	10
Barium	200
Beryllium	5
Cadmium	5
Calcium	5000
Chromium	10
Cobalt	50
Copper	25
Iron	100
Lead	3
Magnesium	5000
Manganese	15
Mercury	0.2
Nickel	40
Potassium	5000
Selenium	5
Silver	10
Sodium	5000
Thallium	10
Vanadium	50
Zinc	20
Cyanide	10

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TABLE 4-3 (Continued)
TARGET COMPOUND LIST/TARGET ANALYTE LIST
CONTRACT REQUIRED QUANTITATION/DETECTION LIMITS (CRQL/CRDL)⁽¹⁾

FRANKLIN BURNS SITE

Notes:

- (1) Specific quantitation/detection limits are highly matrix dependent. The quantitation/detection limits listed herein are provided for guidance and may not always be achievable.
- (2) Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, as required by the contract, will be higher.
- (3) Medium Soil/Sediment Contract Required Quantitation Limits (CRQL) for Volatile TCL Compounds are 125 times the individual Low Soil/Sediment CRQL.

Medium Soil/Sediment Contract Required Quantitation Limits (CRQL) for Semivolatile TCL Compounds are 60 times the individual Low Soil/Sediment CRQL.

Medium Soil/Sediment Contract Required Quantitation Limits (CRQL) for Pesticide/PCB TCL Compounds are 15 times the individual Low Soil/Sediment CRQL.
- (4) The total concentration of all detected PCDDs & PCDFs will be reported. However, because of the number of non-2,3,7,8-substituted isomers that might be detected in a sample is unpredictable, it is not possible to assign CRQLs to the total homolog concentrations.
- (5) All CRQL values listed here are based on the wet weight of the sample.
- (6) These CRDL are the instrument detection limits obtained in pure water. The detection limits for samples may be considerably higher depending on the sample matrix.

**TABLE 4-4
SPECIAL ANALYTICAL SERVICES PARAMETERS
FRANKLIN BURNS SITE**

Soil (Soil/Ash)	Physical Parameters ⁽¹⁾
	RCRA Characteristics ⁽²⁾
	Total Organic Carbon
	Phenols
	Dioxins and Furans
Soil (Ground Water Monitoring Well Boring Soils)	Selected Physical Parameters⁽³⁾
Sediment	Physical Parameters ⁽¹⁾
	RCRA Characteristics ⁽²⁾
	Total Organic Carbon
	Phenols
	Dioxin and Furans
Groundwater	Phenols
	Dioxins and Furans
Surface Water	Water Quality Parameters ⁽³⁾
	Phenols
	Dioxins and Furans

- (1) Physical Parameters - Bulk Density, Cation Exchange Capacity, Grain Size Distribution, and Moisture Content.
 (2) RCRA Characteristics - Ignitability, Corrosivity, Reactivity, and Toxicity (TCLP).
 (3) Selected Physical Parameters - Grain Size Distribution, Vertical Hydraulic Conductivity (if appropriate).
 (4) Water Quality Parameters - Alkalinity, BOD, COD, Total Hardness, TDS and TSS.

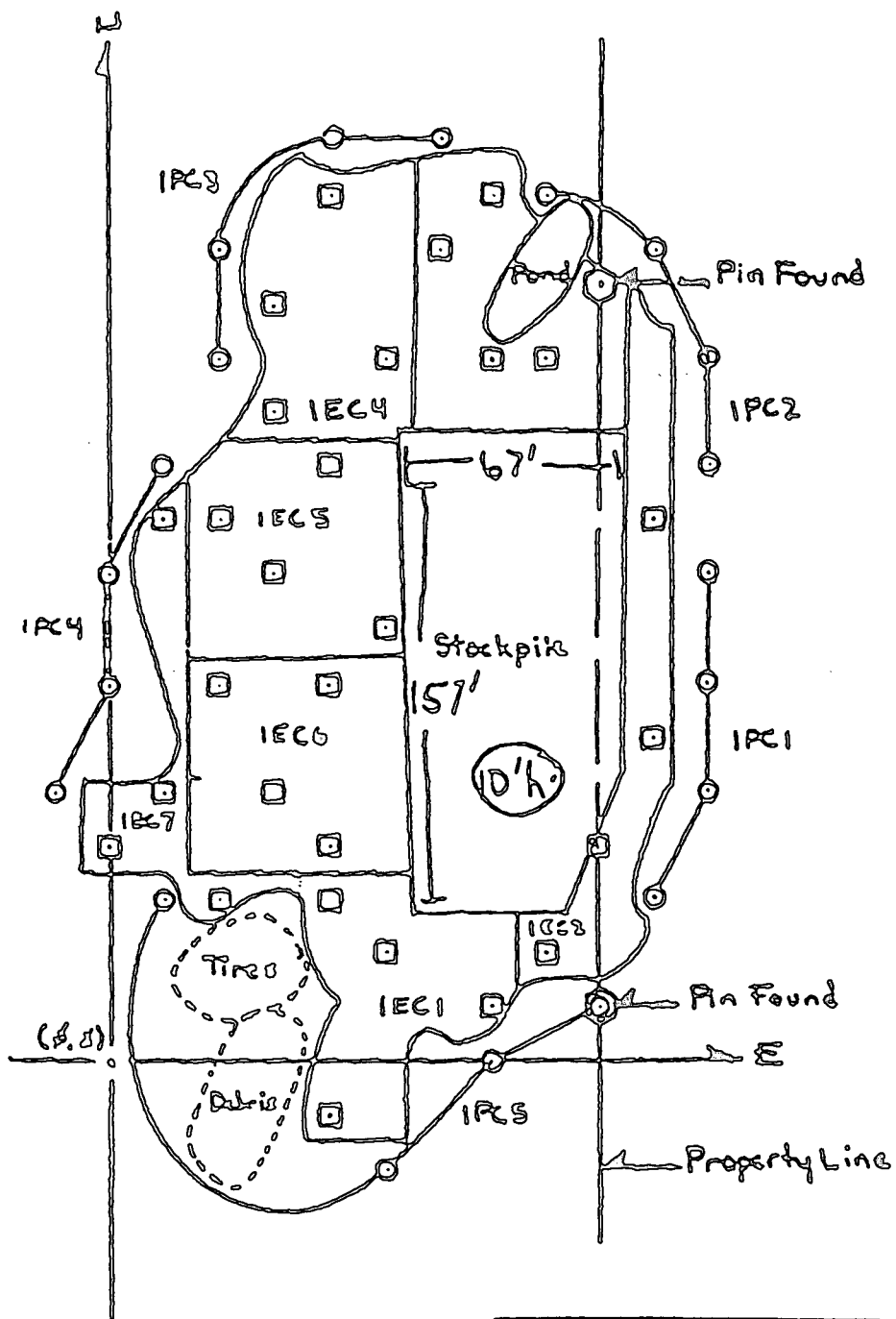
TABLE 4-5
TOXICITY CHARACTERISTIC CONSTITUENTS
FRANKLIN BURNS SITE

Arsenic	5.0
Barium	100.0
Benzene	0.5
Cadmium	1.0
Carbon Tetrachloride	0.5
Chlordane	0.03
Chlorobenzene	100.0
Chloroform	6.0
Chromium	5.0
o-Cresol*	200.0
m-Cresol*	200.0
p-Cresol*	200.0
Cresol	200.0
2,4-D	10.0
1,4-Dichlorobenzene	7.5
1,2-Dichloroethane	0.5
1,1-Dichloroethylene	0.7
2,4-Dinitrotoluene	0.13
Endrin	0.02
Heptachlor	0.008
Hexachlorobenzene	0.13
Hexachloro-1,3-butadiene	0.5
Hexachloroethane	3.0
Lead	5.0
Lindane	0.4
Mercury	0.2

* If o-, m-, p-Cresol cannot be differentiated, total Cresol is to be used.

TABLE 4-5 (continued)
TOXICITY CHARACTERISTIC CONSTITUENTS
FRANKLIN BURNS SITE

Methoxychlor	10.0
Methyl ethyl ketone	200.0
Nitrobenzene	2.0
Pentachlorophenol	100.0
Pyridine	5.0
Selenium	1.0
Silver	5.0
Tetrachloroethylene	0.7
Toxaphene	0.5
Trichloroethylene	0.5
2,4,5-Trichlorophenol	400.0
2,4,6-Trichlorophenol	2.0
2,4,5-TP (Silvex)	1.0
Vinyl Chloride	0.2



□ Excavation Sample Location
 ○ Perimeter Sample Location
 Scale: 1" = 50'

 N/S grid lines run parallel to eastern property boundary.

**MALCOLM
PIRNIE**

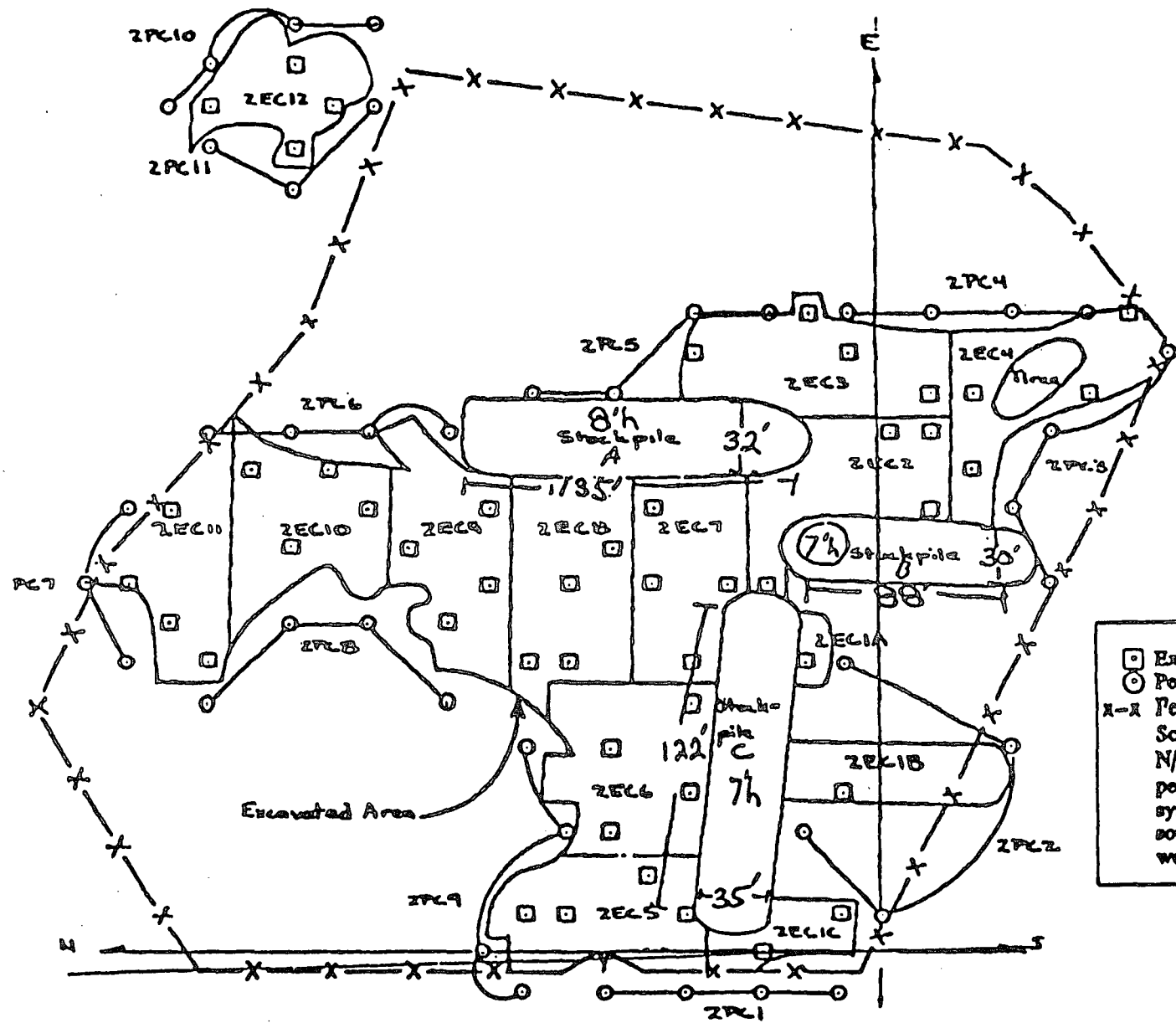
FRANKLIN BURNS SITE NO. 1
MAY 12, 1993

MALCOLM PIRNIE, INC.

FIGURE 4-1

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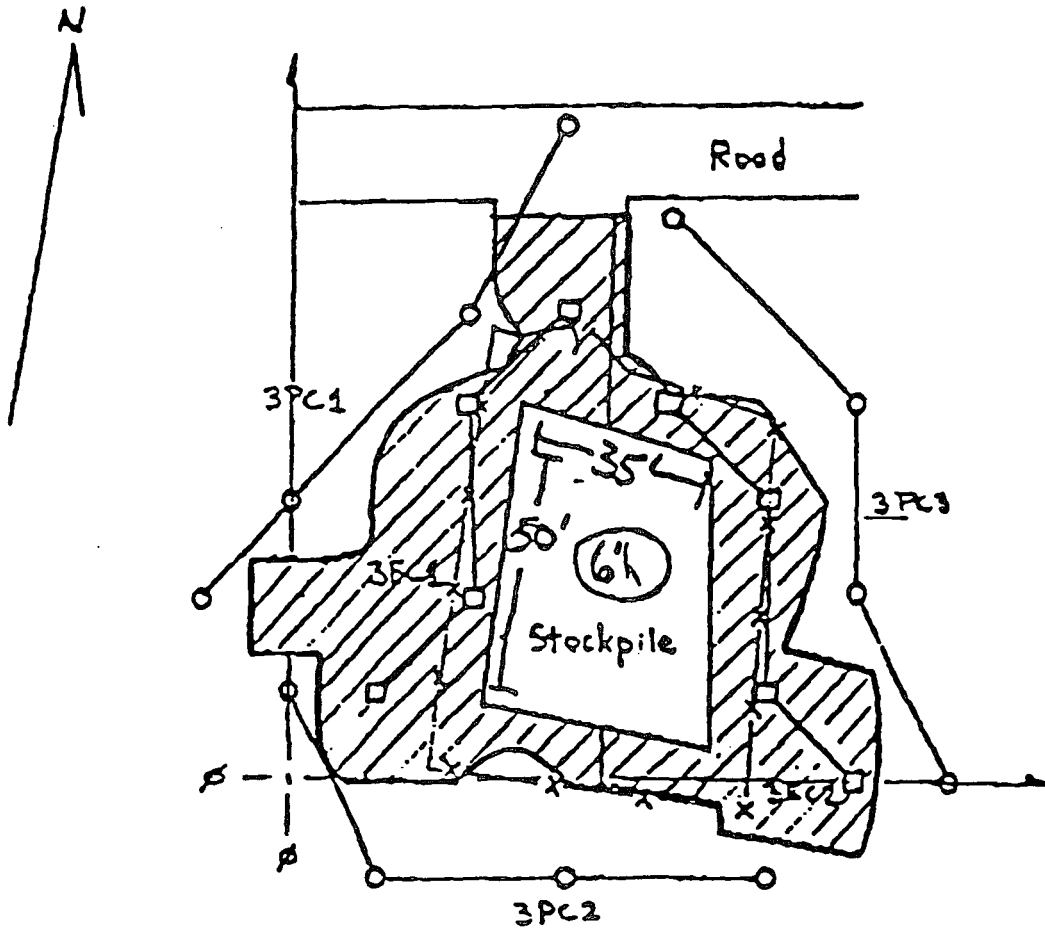
□ Excavation Sample Location
 ○ Perimeter Sample Location
 x-x Fence Line
 Scale: 1"=50'
 N/S grid lines run parallel to eastern perimeter fence line. Origin of grid system is located 7.5' east and 7.5' south of south corner post of western perimeter fence.

**MALCOLM
PIRNIE**

FRANKLIN BURNS SITE NO. 2
MAY 12, 1993

MALCOLM PIRNIE, INC.

FIGURE 4-2



□	Excavation Sample Location
○	Perimeter Sample Location
x-x	Fence Line
▨	Excavated Area
Scale: 1"=30'	

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**MALCOLM
PIRNIÉ**

FRANKLIN BURNS SITE NO. 3
MAY 5, 1993

MALCOLM PIRNIÉ, INC.

FIGURE 4-3

The USEPA has completed removal activities at Subsite 1, 2 and 3 in which contaminated soil and ash have been stockpiled at each of these Subsites and covered with a temporary cap. The USEPA has indicated that it has conducted post-excavation sampling activities at each of these Subsites and has identified the nature and extent of soil/ash contamination (excluding the consolidated soil/ash piles) as a result of these activities. The USEPA has determined that all soil/ash contained in each consolidated soil/ash pile will be treated and/or disposed of in the same manner, i.e., by a method consistent with the most restrictive data collected relative to that material. Therefore, the USEPA has determined that at this time no representative characterization of the extent of contamination throughout any of the waste piles is warranted; rather, a focused, limited sampling program as described in this Subsection is to be performed.

This approach assumes that the results will indicate that soils in each consolidated soil/ash pile are (a) RCRA hazardous wastes based on the results of RCRA characteristic analysis, and (b) either (1) regulated under TSCA due to the confirmation of, or expectation of possible PCB concentrations of 50 ppm or greater or (2) not regulated under TSCA due to the absence of PCBs, or the relative absence of PCBs in relation to the regulating limit of 50 ppm. Therefore, only limited sampling of the consolidated soil/ash stockpiles of Subsites 1, 2 and 3 will be done initially, focused on providing data needed to evaluate treatment and disposal options, based on the assumptions described above.

Should analytical data from the soil sampling program indicate that (1) material in a consolidated soil/ash pile is not RCRA-hazardous waste or (2) material in an individual consolidated soil/ash pile cannot be characterized as either TSCA-regulated or non-TSCA-regulated, or should any separate handling or materials be warranted or other change occur in the current approach to characterizing the consolidated soil/ash piles, the need for a broader Phase II soils analysis program will be assessed.

Soil Investigations

Investigations into soil contamination in the consolidated soil/ash piles at Subsites 1, 2, and 3 will address PCB/pesticide, TAL metals, dioxin, and furan contamination. This information is necessary for determination of appropriate remedial alternatives and estimation of the costs of remediation. In addition, volatile organic compounds (VOCs) and base/neutral/acid extractables (BN/AEs) have not been analyzed in previous samples collected at these Subsites. VOCs and BN/AEs are suspected contaminants because of the

possibility that supplemental fuel was used to start the fires. These categories of chemicals are suspected by-products of the burning of wire insulation. However, the temperatures involved in the burning process and the subsequent exposure of the resulting ash piles to the atmosphere, may limit the concentrations of any VOCs remaining in the ash piles. To address the lack of VOC and BN/AE data, soil samples collected during these investigations will be analyzed for VOCs and BN/AEs. In general, all soil/ash pile samples sent for laboratory analyses will be composited samples. VOC/BN/AE sampling is an exception to this general approach, since sampling protocol requires the use of grab samples. The procedure for selecting grab samples for VOC/BN/AE soil/ash analyses are as follows. Individual samples collected during these investigations for inclusion into composited soil/ash samples will be screened with an HNu/OVA to assess the presence of VOCs. The location of the grab sample with the highest HNu/OVA readings from among all of the individual samples comprising a single composite sample, will be resampled, and the new grab sample (collected at a location adjacent to the location of the screened sample found to have the highest HNu/OVA reading) will be collected and screened using a HNu/OVA, to confirm the presence of VOCs, and, if the presence of VOCs is confirmed, this new grab sample will be sent to a CLP laboratory for VOC and BN/AE analyses. Iterations of this process may be required to obtain one appropriate VOC/BN/AE grab sample for each composited soil/ash sample. If no HNu/OVA readings are encountered, random grab samples will be sent to a CLP laboratory for VOC analysis from each of these three Subsites. If HNu screening of the samples indicate that there is VOC contamination greater than 5 ppm, then work will stop and a Work Plan revision, addressing the change of scope, will be prepared.

As requested by USEPA, each composite soil/ash sample will also be analyzed for VOCs and BN/AEs.

Total organic halide contamination will be approximated by summing the concentrations of the halogenated organics analyzed for as part of the RI.

The following sections describe the sampling approach at Subsites 1, 2 and 3.

Subsite 1

Review of the data from previous soil investigations indicates significant concentrations of lead, copper and zinc in the ash at this Subsite. PCB, dioxin and furan contamination is also present. The existence of BN/AEs and VOCs have not been addressed at this Subsite.

The contaminated soils and ash on Subsite 1 have been excavated and stockpiled in one common area. Figure 4-1 shows the location of the stockpile relative to the original ash pile. The stock pile is approximately 67 feet by 151 feet by 10 feet high at its center and is estimated by USEPA to contain approximately 3000 cubic yards of material. To further characterize the consolidated soil/ash pile for treatment and disposal options, additional sampling and analysis will be conducted.

Six composite samples will be collected from the stockpile. It is proposed that a grid of six areas (approximately 33 feet x 50 feet) be delineated and that within each grid a composite sample will be collected. The composite sample will be made up of three randomly selected borings within the grid. USEPA may, based on their knowledge of the construction of the consolidated soil/ash pile, adjust the location of one or more of these randomly selected boring locations in order to bias the boring locations to areas of higher contamination. At each boring, continuous split-spoon samples will be collected through the pile to a depth of approximately ten feet or until no fine soils are encountered. The approximately four-inch interval of each split-spoon sample which by visual inspection appears to have the highest concentration of ash will be selected for inclusion in the composite sample. Therefore, approximately five split-spoon samples per boring will be collected for a total of approximately 15 samples per composite. Each split-spoon sample will be screened with a photoionization detector (HNU) for volatile organic vapors. The area in which the highest HNU reading was recorded will be resampled by driving a split spoon adjacent to the boring and resampling the interval of the highest HNU reading. This sample will be screened to confirm the presence of VOCs. After obtaining a confirmed HNU reading, the grab sample will then be sent to a laboratory for VOC and BN/AE analyses. This process will be repeated within each of the grid areas.

The composite sample will be sent to a laboratory for the following analysis: VOCs, BN/AEs, PCBs/pesticides, dioxins, furans, TAL metals, cyanide, phenols, and RCRA characteristics for determining treatment and/or disposal options. These composite samples will also be analyzed for total organic carbon (TOC), cation exchange capacity (CEC), grain

size distribution, bulk density and moisture content. These analyses will be used in the feasibility assessment of remedial alternatives. The total number of samples and the analyses as summarized in Table 4-1.

A tripod mounted split-spoon sampler will be used to collect the samples from the consolidated soil/ash pile. Care will be taken to avoid puncturing the temporary cap by placing plywood (or other suitable material) under the legs of the tripod. The split-spoons and driving rods will only be decontaminated between composites (i.e. after each composite is collected).

Subsite 2

The contaminated soil and ash at Subsite 2 have been excavated and stockpiled in three piles. Review of the data from previous soil sampling of Subsite 2 indicates metals contamination. The previously collected samples, however, were not analyzed for BN/AEs and VOCs. Figure 4-2 shows the location of the stockpiles relative to the original ash pile. Stockpile A is approximately 8 feet high by 32 feet by 135 feet and is estimated by USEPA to contain approximately 1100 cubic yards of material. Stockpile B is approximately 7 feet high by 30 feet by 88 feet and is estimated by USEPA to contain approximately 600 cubic yards. Stockpile C is approximately 7 feet high by 35 feet by 122 feet and is estimated by USEPA to contain approximately 950 cubic yards of material.

The sampling approach to be used at Subsite 2 will be similar to that to be used at Subsite 1. It is proposed that at Stockpile A, a grid of three areas (32 feet x 45 feet) be delineated and within each area a composite sample be collected for a total of three composite samples. Each composite sample will be made up of three random selected borings within the grid. USEPA may, based on their knowledge of the construction of the consolidated soil/ash pile, adjust the location of one or more of these randomly selected boring locations in order to bias the boring locations to areas of higher contamination. At each boring, continuous split-spoon samples will be collected to a depth of eight feet or until no fine soils are encountered. The approximately four-inch interval of each split-spoon sample which by visual inspection appears to have the highest concentration of ash will be selected for inclusion in the composite sample. Therefore, approximately four split-spoon samples per boring will be collected for a total of approximately 12 samples per composite.

Stockpile B will be divided up into two grids (30 feet x 44 feet) and one composite will be collected from each grid for a total of two composites. Each composite will consist

of three borings with approximately three split-spoons per boring collected for a total of nine split-spoons per sample. The process of boring location identification and sample identification within each split spoon sample will be the same as described for Stockpile A.

Stockpile C will be delivered with three grids (35 feet x 40 feet) and within each grid a composite will be collected for a total of three composites. Each composite will consist of three borings with approximately three split-spoon samples collected per boring for a total of nine split-spoon samples per composite. The process of boring location identification and sample identification within each split spoon sample will be the same as described for Stockpile A.

A total of eight composite samples will be collected from the stockpiles at Subsite 2. For each composite sample, a grab sample to be analyzed for VOCs and BN/AEs will be collected as described above for Subsite 1. Sample collection, decontamination and sample analysis will be the same as described for Subsite 1. The total number of soil/ash samples and their respective analyses are summarized in Table 4-1.

Subsite 3

The contaminated soil and ash at Subsite 3 have been excavated and stockpiled in one common area. Figure 4-3 shows the relative position of the consolidated soil/ash pile relative to the original ash pile. The stockpile is approximately 6 feet by 35 feet by 50 feet and is estimated by USEPA to contain approximately 300 cubic yards of material.

Based on a review of the data collected during previous soil sampling events at Subsite 3, metals, dioxins, and furans contamination are present at this Subsite. The soil samples collected from Subsite 3 were not analyzed for BN/AEs and VOCs.

To characterize the material in the consolidated soil/ash pile on Subsite 3, it is proposed that one composite sample be collected from four random boring locations in the pile. USEPA may, based on their knowledge of the construction of the consolidated soil/ash pile, adjust the location of one or more of these randomly selected boring locations in order to bias the boring locations to areas of higher contamination. These split-spoon samples will be collected from each boring for a total of 12 samples to make up the composite. The approximately four-inch interval of each split-spoon sample which by visual inspection appears to have the highest concentration of ash will be selected for inclusion in the composite sample. One grab sample will be collected for VOC and BN/AE analysis following the procedure described for Subsite 1. Sample collection, decontamination, and

sample analysis will be the same as described for Subsite 1. Table 4-1 summarizes the number of soil/ash samples and their respective analyses.

Site Soils

Split spoon samples will be visually described and classified by a geologist according to both the Unified Soil Classification System (USCS) and the Modified Burmister System. Headspace of each sample will be analyzed with an ionization detector in the field.

4.2.2 Surface Water and Sediment Sampling

Surface water and sediment samples will be taken from Hayes Branch and its associated wetlands at points upstream, downstream and adjacent to or on Subsites 1, 5 and 6, as shown in Figure 4-4. Sample locations will be verified in the field.

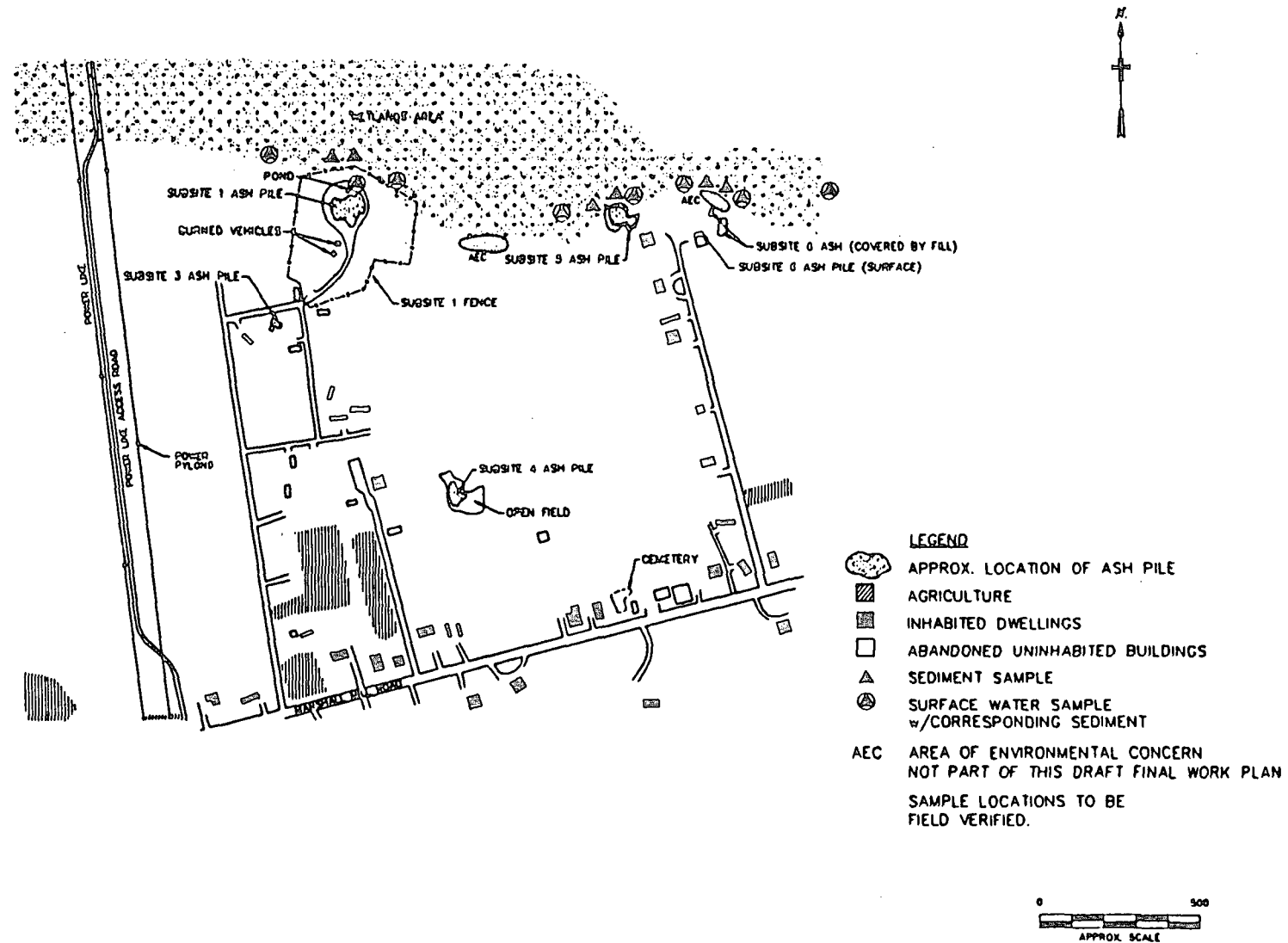
At Subsite 1, one surface water and one sediment sample will be collected upstream of the previous ash pile location, two sediment samples will be collected adjacent to the location of the previous ash pile, and one surface water and one sediment sample will be collected downstream of the location of the previous ash pile. In addition, from the small pond located on Subsite 1, one surface water and one sediment sample will be collected.

At Subsite 5, one surface water and one sediment sample will be collected upstream of the location of the previous ash pile, two sediment samples will be collected adjacent to the location of the previous ash pile, and one surface water and one sediment sample will be collected downstream from the original ash pile.

At Subsite 6, one surface water and one sediment sample will be collected upstream of the location of the previous ash pile, two sediment samples will be collected adjacent to the location of the previous ash pile, and one surface water and one sediment sample will be collected downstream of the location of the previous ash pile. A reference location (background) for the Site, upstream of the entire cluster of Subsites (1, 3, 4, 5, and 6), will also be sampled. This sample location will be selected after the groundwater portion of the study is complete and points of contaminant discharge into the Hayes Branch can be identified.

All surface water and sediment samples will be analyzed for VOCs, BN/AEs, TAL metals, cyanide, phenols, PCBs/pesticides, dioxins and furans. Surface water samples will also be analyzed for alkalinity, BOD, COD, total hardness, TDS, and TSS. In addition, field parameters including pH, specific conductance, dissolved oxygen, and temperature will be measured at the time of surface water sample collection. Sediment samples will also be

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SOURCE: ADAPTED FROM AJS CORPORATION FINAL DRAFT SITE INSPECTION REPORT, FRANKLIN BURNS SITE, FIGURE 3 (AJS CORPORATION, 1991c)

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FRANKLIN BURNS SITE
FRANKLIN TOWNSHIP, NEW JERSEY

PROPOSED SURFACE WATER AND SEDIMENT SAMPLE LOCATION MAP FOR SUBSITES 1, 5 AND 6

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JULY 7, 1993

FIGURE 4-4

analyzed for bulk density, CEC, grain size distribution, moisture content, RCRA characteristics (ignitability, corrosivity (pH), reactivity, and toxicity (TCLP)) and TOC.

4.2.3 Ground Water Sampling

A hydrogeologic investigation is proposed to assess ground-water quality and the effect of the ash piles on the shallow ground water, to delineate the horizontal extent of shallow ground-water contamination, and to refine the understanding of the ground-water flow systems.

Monitoring Well Locations






Monitoring wells will be installed at Subsites 1, 3, 5, 6 and 7 to collect ground-water samples for chemical analysis, and to measure ground-water elevations used to estimate the directions of ground-water movement. A total of 13 shallow monitoring wells will be installed for the ground-water investigation. The preliminary locations of the wells are shown on Figures 4-5 and 4-6 for Subsites 1, 3, 5 and 6 and on Figure 4-7 for Subsite 7. Actual well locations will be finalized in the field with USEPA's approval. Additionally, three staff gages and two piezometers will be installed along the Hayes Branch to assist in the characterization of groundwater flow. The proposed locations of the staff gages and piezometers are presented in Figure 4-8.

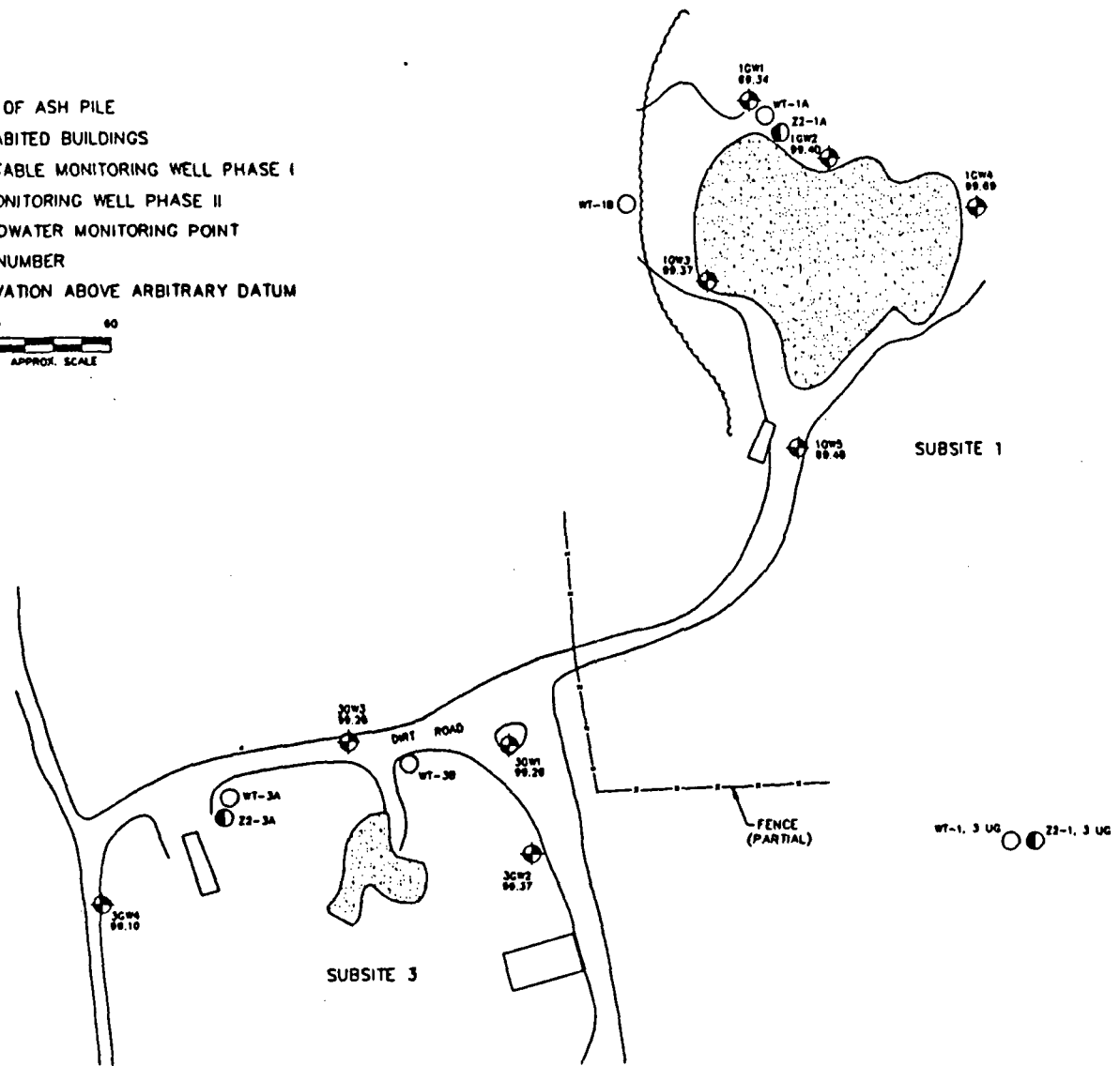
The investigation will consist of the installation of one shallow well (water table well) upgradient of each Subsite to assess upgradient water quality and to aid in defining the flow system. Subsites 1 and 3 will share an upgradient well, as will Subsites 5 and 6. This rationale results in a total of three upgradient shallow wells. In addition, two downgradient shallow wells will be installed at each of the five subsites (Subsites 1, 3, 5, 6 and 7) for a total of 10 downgradient wells.

Monitoring Well Borings

Spilt spoons will be used to continuously collect soil cores from the construction of the shallow monitoring wells. The cores will be used to define the stratigraphy by visual observation. Figures 4-5, 4-6, and 4-7 shows the proposed location of the monitoring wells. Final monitoring well locations will be verified in the field. Split spoon sampling will be conducted continuously until the water table is reached, and every five (5) feet thereafter. The well borings will be drilled with hollow stem auger rig using six-inch or greater diameter flighted augers. If clay beds thicker than two feet are encountered, the next deeper soil sample, assuming it will be clay, will be collected in a Shelby tube that will be sent for

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- LEGEND**
-  APPROX. LOCATION OF ASH PILE
 -  ABANDONED UNINHABITED BUILDINGS
 -  PROPOSED WATER TABLE MONITORING WELL PHASE I
 -  PROPOSED DEEP MONITORING WELL PHASE II
 -  TEMPORARY GROUNDWATER MONITORING POINT
 - 1GW SAMPLE LOCATION NUMBER
 - 100.00 GROUNDWATER ELEVATION ABOVE ARBITRARY DATUM



SOURCE: ADAPTED FROM ROY F. WESTON, INC., SUPPLEMENTAL EXTENT OF CONTAMINATION IN SOIL AND PRELIMINARY GROUNDWATER ASSESSMENT, FRANKLIN BURN SITE FIGURE 3 (ROY F. WESTON, 1993)

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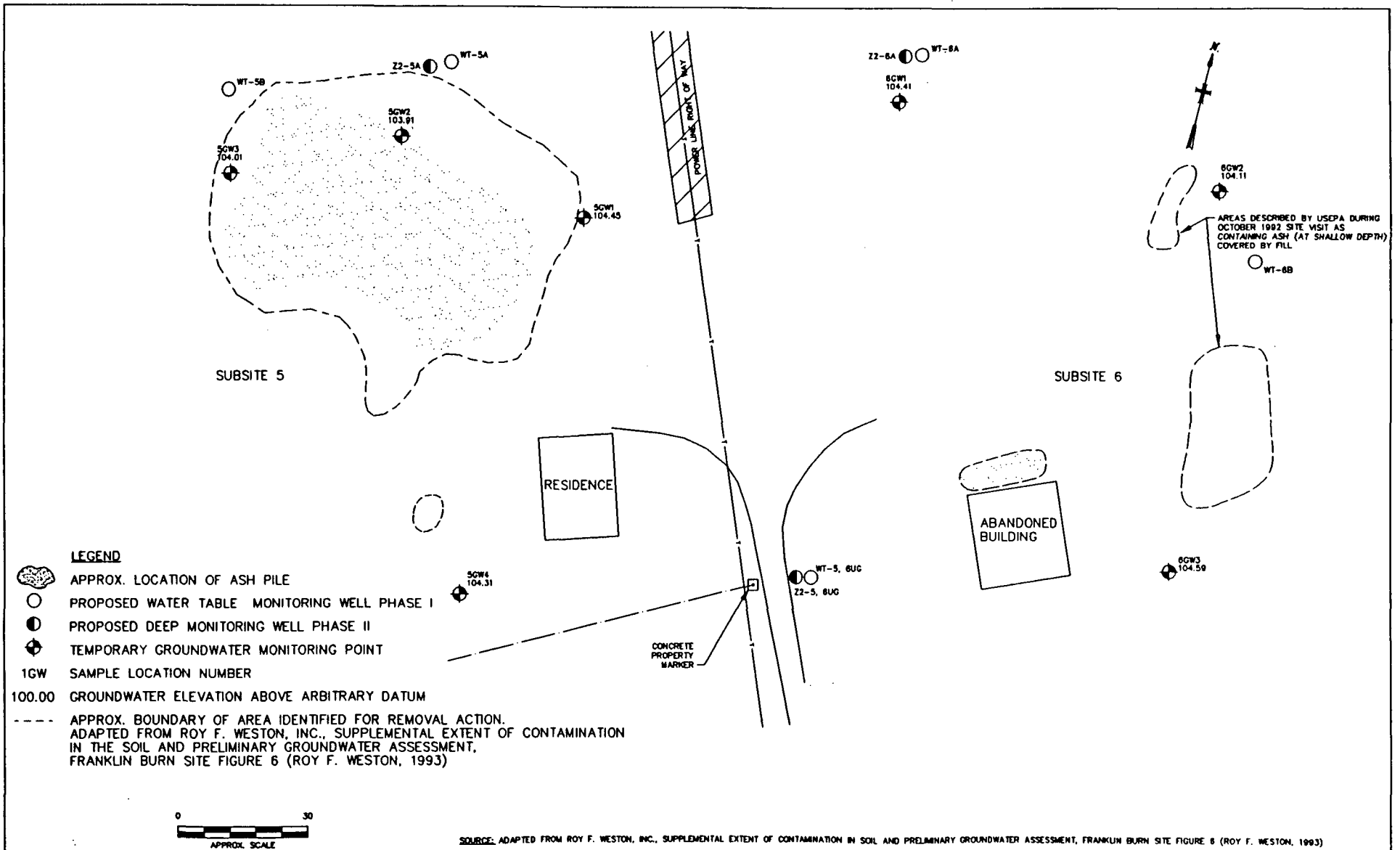
FRANKLIN BURNS SITE
FRANKLIN TOWNSHIP, NEW JERSEY

PROPOSED MONITORING WELL LOCATION MAP FOR SUBSITES 1 AND 3

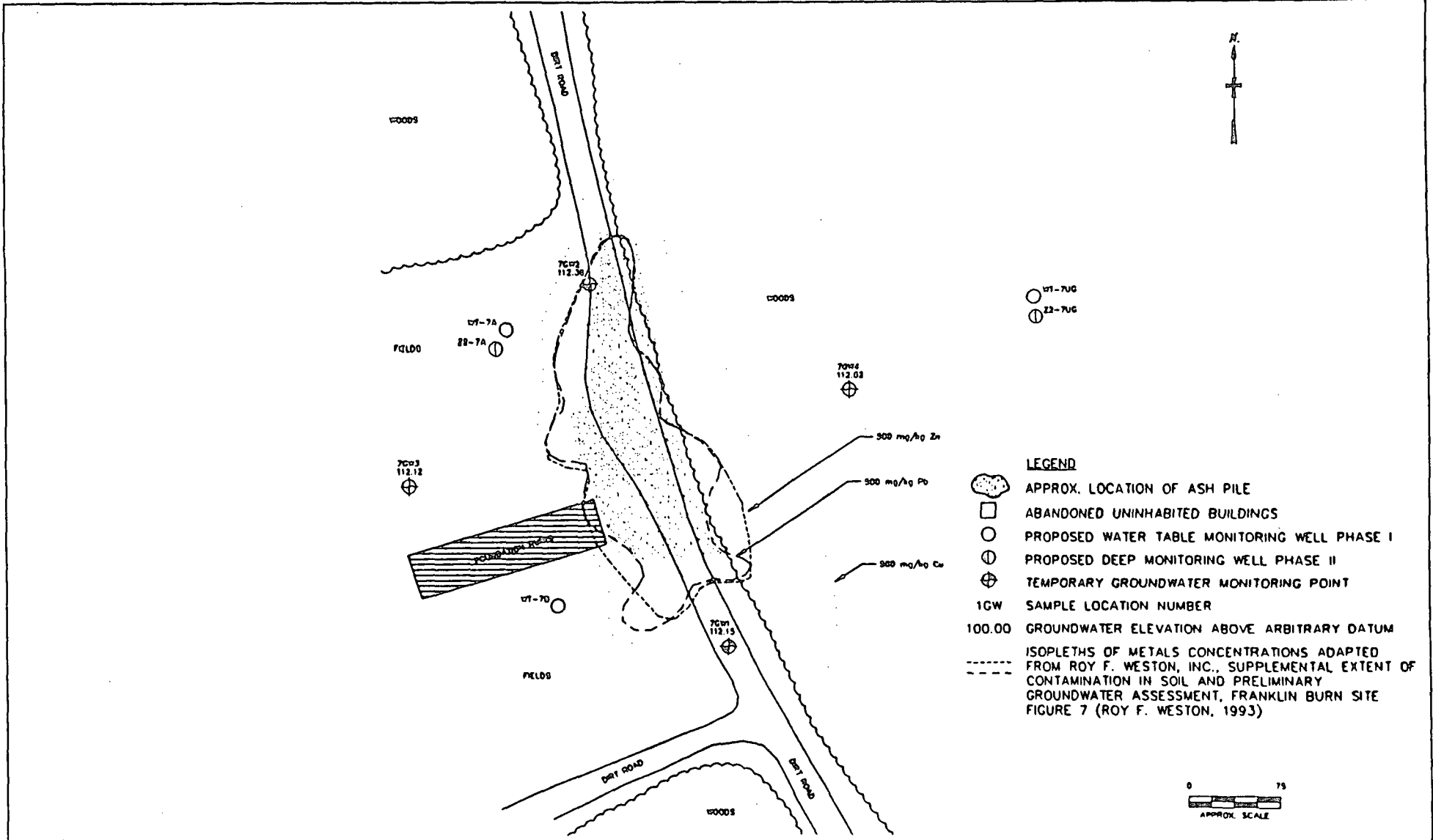
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JULY 7, 1993

FIGURE 4-5

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SOURCE: ADAPTED FROM ROY F. WESTON, INC., SUPPLEMENTAL EXTENT OF CONTAMINATION IN SOIL AND PRELIMINARY GROUNDWATER ASSESSMENT, FRANKLIN BURN SITE FIGURE 7 (ROY F. WESTON, 1993)

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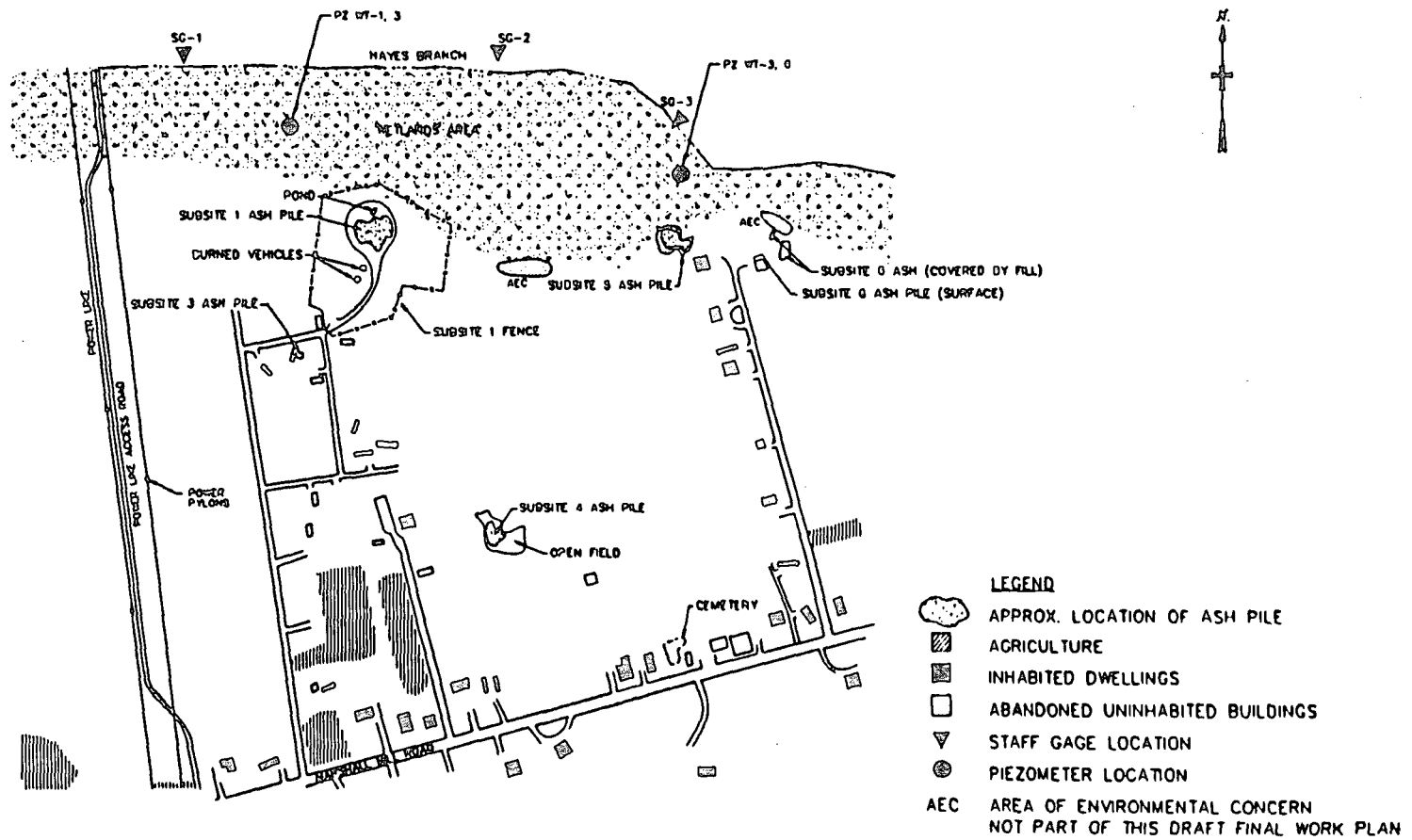
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PROPOSED MONITORING WELL LOCATION MAP FOR SUBSITE 7

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FIGURE 4-7

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SOURCE: ADAPTED FROM HUS CORPORATION FINAL DRAFT SITE INSPECTION REPORT, FRANKLIN CURN SITE, FIGURE 3 (HUS CORPORATION 1991a)

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PROPOSED STAFF GAGE AND PIEZOMETER LOCATION MAP

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JULY 7, 1993

FIGURE 4-8

laboratory analysis of vertical hydraulic conductivity. Samples will be archived and stored on-Site in labeled, clean, glass jars for the duration of the project. Upon completion of the project, samples will be sent to USEPA WAM.

Groundwater Sampling and Analysis

Up to two rounds of groundwater samples will be collected from the newly installed monitoring wells (all thirteen, but beginning no earlier than two weeks after well installation) and the residential wells previously sampled by the USEPA, and analyzed to obtain data on groundwater quality on, and around, the Site. The residential wells which will be sampled are those previously sampled by the USEPA. This includes wells NJGY-GW1 and NJGY-GW2 at Subsite 1 (Figure 4-9) and wells NJDZ-GW1, NJGZ-GW2, NJGZ-GW3, NJGZ-GW4, NJGZ-GW5, NJGZ-GW6 and NJGZ-GW7 at Subsite 2 (Figure 4-10). An additional residential well, located next to Subsite 5 will also be sampled (Figure 4-9). After reviewing the results of the first round of groundwater sampling, USEPA will determine if a second round of groundwater sampling will be required.

Specific conductance, pH, groundwater temperature, turbidity, dissolved oxygen and Eh will be measured at each well volume during purging using field instruments. Groundwater samples collected will be analyzed for TAL metals (total), cyanide, phenols, PCBs/pesticides, dioxins and furans. Ground-water samples will not be filtered.

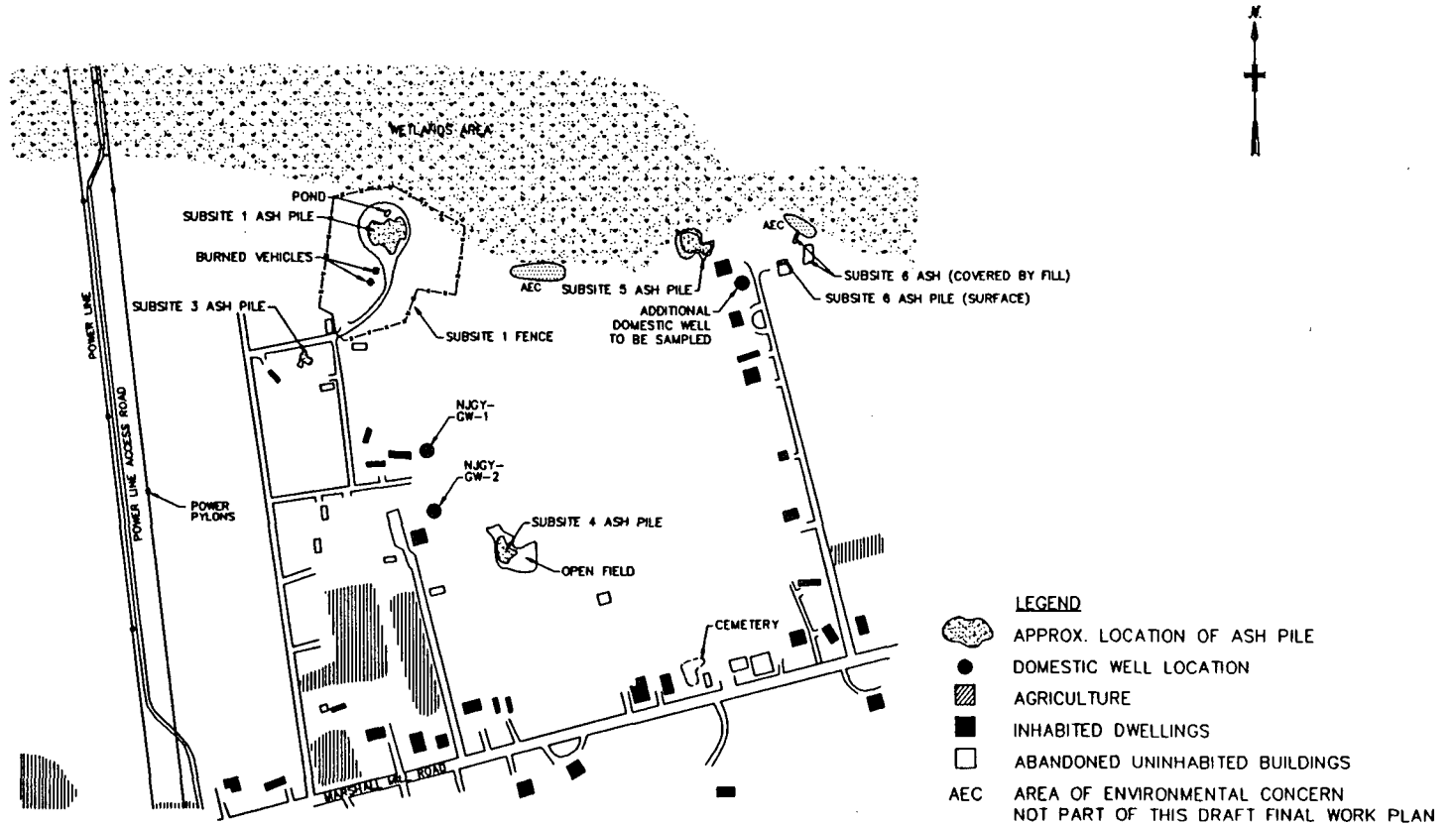
4.3 QUALITY CONTROL SAMPLES

Quality control procedures will be employed to check that sampling, transportation and laboratory activities do not impact sample integrity and/or quality. Trip blanks, field rinse blanks, duplicate samples, matrix spike samples and matrix spike duplicate samples will be collected to assist in validating the analytical data. A summary of the anticipated QA/QC samples for each of the media is included in Table 4-2.

4.3.1 Blank Water

Blank water used in this project will be demonstrated analyte-free, based on the USEPA Region II criteria presented in this Subsection, prior to the start of sample collection through the performance of analytical testing to demonstrate concentration of each USEPA Region II criterion. For the sampling at the Site, the blank water will be deionized water obtained from the Malcolm Pirnie Inc. Environmental Laboratory.

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SOURCE: ADAPTED FROM NUS CORPORATION FINAL DRAFT SITE INSPECTION REPORT, FRANKLIN BURN SITE, FIGURE 3 (NUS CORPORATION, 1991a)

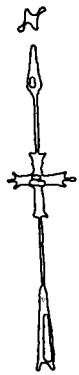
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DOMESTIC WELL GROUNDWATER SAMPLE LOCATION MAP FOR SUBSITES 1, 3, 5 AND 6

MALCOLM PIRNIE, INC.
FEBRUARY 18, 1994

FIGURE 4-9



UTILITY POLE G-2804

RESIDENTIAL PROPERTIES

UTILITY POLE G-2806

UTILITY POLE G-8868

LINCOLN AVENUE

GW-3

S-1

S-2

GW-2

GW-1

S-3

BLACK ASH

DEBRIS REFUSE PILE

POWER LINES

POWER LINES

CLEAR WAY

ZONE

S-4,5

LEGEND

OPEN GRASS FIELD

PROPERTY BOUNDARY

WOODED AREA

TOWER

SOIL SAMPLE

GROUNDWATER SAMPLE

RESIDENTIAL PROPERTIES

GW-4,5

GW-6

GW-7

SHERIDAN AVENUE

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DOMESTIC WELL SAMPLE MAP
SUBSITE 2

Source: Adapted from NUS Corporation, Final Draft Site
Inspection Report, Franklin Burn Site No. 2

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FIGURE 4-10

Malcolm Pirnie will provide analytical results for each lot of deionized water demonstrating that the water meets USEPA Region II requirements. The blank water will be obtained from the laboratory in certified clean containers and will be stored in coolers which are to be kept separate from sources of possible contamination. The results, including copies of all documentation, will be submitted to the USEPA Region II Quality Assurance Officer (QAO) for this Site prior to the start of field sampling. A copy of the analytical results will be provided to the Site Manager for Site files. A copy will also be brought to the field.

The USEPA Region II criteria for analyte-free is as follows:

Purgeable Organics	<10 ppb
Semi-Volatile Organics	<CRQL
Pesticides	<CRQL
PCBs	<CRQL
Inorganics	<CRDL

Specifically for the common laboratory contaminants listed below, the allowable limits are ten times the respective CRQLs (see Table 4-3).

Methylene Chloride
Acetone
Toluene
2-Butanone
Phthalates

4.3.2 Trip Blanks

Trip blanks will be taken for each aqueous medium being sampled for volatile analysis at a minimum frequency of one per day. Trip blanks will not be required unless aqueous VOC samples are collected. When necessary a trip blank will be prepared each sampling day in the field by filling two 40-ml vials (with Teflon-lined septums) with demonstrated analyte-free blank water, leaving no head space or air bubbles. The trip blank will accompany the day's sample containers at all times. One trip blank will be returned to the laboratory with each day's shipment of samples scheduled for analysis. The trip blank will be analyzed for volatile organic compounds to detect possible contamination during shipment.

4.3.3 Field Rinse Blanks

A field rinse blank is prepared by starting with an empty set of certified demonstrated analyte-free sample containers based on USEPA Region II criteria presented above. At the field location, demonstrated analyte-free blank water is poured over decontaminated sampling equipment and into the empty set of sample containers for analysis of the parameters indicated in Table 4-3. One field rinse blank will be collected for each type of equipment used each day a decontamination event is carried out. The same aliquot of water will be used on all equipment associated to a particular sample matrix for analysis of semi-volatile organics, pesticides, PCBs and inorganics. This rinse will be performed sequentially on all sampling equipment. However, a separate field rinse blank will be collected for each piece of equipment associated to a particular sample matrix which will be analyzed for volatile organics.

The field rinse blank will be collected at the beginning of the day prior to the sampling event and the blank will accompany those samples which were taken that day.

4.3.4 Matrix Spike/Matrix Spike Duplicate Samples

Matrix spike and matrix spike duplicate (MS/MSD) sample pairs are analyzed by the laboratory to provide a quantitative measure of the laboratory's precision and accuracy. The required minimums for MS/MSD sample collection in a sample delivery group (SDG) are based upon the following, as appropriate:

- i. One per each case of field samples or
- ii. One per each 20 field samples within a case, or
- iii. One per each 14 calendar-day period during which field samples in a case are received (said period beginning with the receipt of the first sample in the SDG).

Aqueous samples require that three times the volume of the sample selected for each MS/MSD sample be collected and submitted to the laboratory for organics analysis. A double volume of inorganic aqueous samples is required for each sample selected for MS/MD (Matrix Spike/Matrix Duplicate) analysis. MS/MD samples are selected in the field by the Field Operations Leader. No additional volume of sample (i.e., a single volume) is needed for MS/MSD or MS/MD samples for soil or sediment.

4.3.5 Field Duplicate Samples

For each sample matrix, a field duplicate sample will be collected at a frequency of one sample per 20 environmental samples. The duplicate sample is collected at the same location as the environmental sample. The field duplicate sample is then given a false identification using the sample designation system described in Section 4.4. The identity of the field duplicate is not revealed to the laboratory. The analytical results of the environmental sample will be compared to those of the field duplicate sample to evaluate the precision of the field sampling procedures.

4.3.6 Performance Evaluation Samples for Dioxins/Furans

Based upon the USEPA WAM's request and the Region II Quality Assurance Officer's order, the following performance evaluation samples will be collected for every 24 samples or less collected over a period of one week, whichever comes first, and analyzed by the same laboratory:

- One performance evaluation sample fortified with tetra- through octachloro dioxin and furan (PCDD/PCDF) and 2,3,7,8-TCDD. The concentration of this sample must also satisfy the requirement of the selected method of analysis when low or high resolution mass spectrometry is used.
- One performance evaluation interference fortified blank. This sample will be designated by the sampling team to the laboratory as "for spiking" with the appropriate volume of the matrix spiking solution specified in the analytical protocol. This sample must be analyzed in addition to the environmental matrix spike sample.
- One performance evaluation blank. An aliquot of uncontaminated sand or soil which must be identified by the sampling team as "Field Blank". This PE blank is required for sediment and soil samples only.

4.4 SAMPLE DESIGNATION

A sample numbering system will be used to identify each sample. This system will provide a tracking procedure to allow retrieval of information about a particular sample and will assure that each sample is uniquely numbered. The sample identification will consist of at least three components as described below.

- **Project Identification:** The first component consists of a two-letter and one-number designation which identifies the project site and the subsite number. For this project, the two letter designation will be FB and Subsite numbers will be 1, 2, 3, 4, 5, 6, or 7.
- **Sample Type:** The second component, which identifies the sample type or event, will consist of a two letter code as follows:

- SA - Consolidated Soil/Ash Pile Boring
- SB - Soil Boring (Monitoring Well Drilling Only)
- GW - Ground Water
- SW - Surface Water
- SD - Sediment

- **Sample Location:** The third component either identifies the sample location or identifies the sample as a trip blank or field rinse blank. The monitoring well number will be used to identify ground-water sample locations. A two digit number will be used to identify each soil, sediment and surface water sampling location. TB will be used to identify a trip blank and FB will be used to identify a field rinse blank.
- **Sample Identification:** The fourth component will be used for soil/ash boring samples, soil boring samples, trip blanks, and field rinse blanks as described below:

Soil/Ash Pile Borings: A two-digit number will be used to indicate the interval (ft. below top of consolidated soil/ash pile) from which the sample was collected.

Soil Borings: A two-digit number will be used to indicate the interval (ft. below ground) from which the sample was collected.

Trip Blanks and Field Rinse Blanks: A two-digit number will be used to indicate the sequence of the sample.

- **Quality Assurance/Quality Control Samples** will be labeled with the following suffixes:

- MS - Matrix Spike
- MSD - Matrix Spike Duplicate

Duplicate samples will be numbered uniquely as if they were samples. A record of identification for duplicate samples will be maintained.

Examples of identification numbers are given below:

FB1 - GW - WT-1A: Ground-water sample collected at Subsite 1 from monitoring well WT-1A.

FB3 - SA - 02-8: Consolidated soil/ash pile boring, sample collected at Subsite 3 at location number 2 from 8 feet below the top of the pile.

FB1 - SB - WT-1A-8: Soil boring, sample collected at Subsite 1 from boring of monitoring well WT-1A from 8 feet below grade.

FB3 - SA - FB-02: The second field rinse blank collected at Subsite 3 during the consolidated soil/ash pile boring sampling event.

5.0 SAMPLING PROCEDURES AND EQUIPMENT

5.1 INTRODUCTION

The following sections provide step-by-step instructions for each type of field activity to be conducted at the Site. These procedures are to be followed by the field team.

5.2 MOBILIZATION AND DEMOBILIZATION

5.2.1 Overview

This subtask will consist of field personnel orientation, equipment mobilization, field reconnaissance, the preliminary staking of sampling locations, and demobilization. Each field team member will attend an on-Site orientation meeting to become familiar with the history of the Site, health and safety requirements, and field procedures. Underground utilities in areas subject to intrusive sampling will be marked. Locations of subsurface utilities will be accomplished by contacting the Underground Location Service by phone at 1-800-272-1000. In addition, the portion of the October 14, 1993, project schedule related to field activities as presented in the February 1994 Draft Final Work Plan will be updated and provided to the Field Operations Leader.

5.2.2 Equipment Mobilization

Equipment mobilization will entail the ordering, purchase, and if necessary, fabrication of all sampling equipment needed for the field investigation. A confirmation of equipment available at the PMO equipment facility will be conducted prior to initiating field activities. Any additional equipment required will be secured. If it is determined that a field office trailer is required, a field office trailer will be set up and necessary utility hookups will be made as part of the mobilization effort. Equipment mobilization may include (but will not be limited to) sampling equipment, drilling subcontractor equipment, health and safety decontamination equipment, and field office trailer and utility hookups (if deemed necessary).

5.2.3 Field Reconnaissance

In order to determine if a hazard due to chemical or radioactive materials exists on the Site, a survey will be conducted using an HNu or an OVA, a Miniram (respirable dust meter), and Ludlum Micro R (radiation meter) instruments. Prior to any field work, an operator will walk over all areas of the Site where field activities will occur. At each location where there is a reading above background, the operator will place a numbered stake in the ground and record the stake number and reading in the field book. If the initial survey determines there may be a hazard, the USEPA WAM will be notified immediately.

Field reconnaissance will be conducted within the limits of the Site to aid in the preparation of Cultural Resource Survey (CRS) and a Stage 1A (Literature Search and Sensitivity Study) Survey. An initial walk-over reconnaissance and surface inspection will be completed, and the effect of prior ground disturbance on the probability of identifying cultural resources assessed.

Off-site reconnaissance will be conducted prior to residential well and surface water/sediment sampling described in Subsections 5.10.5 and 5.11.3-5, respectively. This work will involve observation of residential water supply systems to determine if ground-water sampling and/or water level monitoring is feasible and, if so, to identify the steps that would be needed to sample prior to any in-line home filtration or treatment devices. This inspection will occur only after the USEPA has secured access agreements for each of the potentially affected households.

5.2.4 Location of Sampling Points

Preliminary locations for the consolidated soil/ash pile soil borings and/or samples, ground-water monitoring wells, piezometers, staff gages, and surface water/sediment sampling stations will be marked at the start of the Site operations. These locations will be measured from existing landmarks and provisions will be made to accommodate activities currently in progress. Should subsequent information show that marked areas are unsuitable, the locations will be modified as required (see discussion in Section 5.3).

5.2.5 Support Facilities

The following facilities will be provided prior to the start of the field work:

- Temporary decontamination pad;

- Staging area for equipment, supplies, and drums to temporarily store drill cuttings, disposable clothing and other contaminated materials;
- Wind Socks - One wind sock (or other appropriate device) will be set up at a central location and will be located five feet above ground surface. A second, portable wind sock (or other device such as surveyor's tape tied to a stake) will be deployed in work areas where the centrally located sock is not visible. These will be used to determine the prevailing wind direction during air monitoring;
- Portable Wind Vane/Anemometer - A portable wind vane/anemometer will be also be centrally located on-site. This instrument will supplement the wind socks during on-site activities and provide hard data regarding local wind speed and direction for use in risk assessments; and
- Field office trailer with necessary utility hookups (if deemed necessary).

5.2.6 Demobilization

Equipment will be demobilized at the completion of each phase of field activities as necessary. Equipment demobilization may include (but will not be limited to) sampling equipment, drilling subcontractor equipment, health and safety decontamination equipment, and field office trailer and utility hookups (if utilized).

Decontamination solutions, well development water and purge water generated during field operations will be stored at Subsite 1 in Department of Transportation (DOT)-approved 55-gallon drums. The drums will be permanently numbered with the Subsite of generation and an inventory of their contents will be maintained. Decontamination solutions will go into separate drums and will not be mixed with well development or purge water. Development water and purge water from each well will be placed in drums designated for each particular well. Drums containing liquid will be sampled and classified for disposal. Drums classified as hazardous will be shipped off-site for disposal. Non-hazardous liquids will be discharged back to the ground surface in such a manner as to allow for infiltration. Drill cuttings from each subsite will be incorporated into the stockpile at Subsite 1.

Personal protective clothing and other disposable sampling and health and safety equipment will also be stored on Subsite 1 in the area used for this purpose during the removal activities, until all field activities are completed.

The disposal of well development water, decontamination water, purge water, and health and safety equipment previously stored at Subsite 1 will be accomplished at the end

of the field investigation by a licensed waste hauler. Off-site disposal of wastes generated during the RI/FS field activities, that are determined as hazardous, will be carried out by Malcolm Pirnie under the contractual provisions of indemnification.

5.3 SURFACE FEATURES INVESTIGATION

5.3.1 Investigation Objectives

To the extent that existing data do not fully characterize the surface features at the Site, a surface features investigation will be performed. The surface features investigation will include a Site reconnaissance and field verification of previously identified features. Particular attention will be given to sources and migration routes of contaminants, such as the original ash pile locations, the consolidated soil/ash piles, and the Hayes Branch, as well as features which would limit site access. Access to monitoring well, piezometer, and staff gage locations will also be investigated as well as surface water/sediment locations and access to residential wells.

A topographic base map will be prepared which will show the location and elevation of the surface features. Monitoring wells, piezometers, and staff gages installed during the field investigation, new sampling locations and a few selected earlier sampling locations (Residential wells) will be flagged and incorporated onto an updated map.

5.3.2 Required Equipment

The following equipment will be required during the surface features investigations:

- Brunton Compass
- 300-foot tape measure
- Camera and film
- Field Notebook and pen
- Site base map
- Schonstedt Model GA-52B Magnetic Locator

5.3.3 Investigation Procedures

Personnel conducting reconnaissance will identify surface features which indicate contaminant sources, migration pathways, and potentially affected receptors, including waste disposal areas, drainage ways, pipes, culverts and other notable features on a copy of the Site base map utilizing measurements from previously mapped features.

Personnel will identify and/or field verify areas which appear to have been used for waste disposal; evidence including visible waste material, stained or disturbed soil, uneven grading and stressed or the lack of well established vegetation will be sought to characterize these areas.

A reconnaissance of the Hayes Branch will be conducted to locate and map any tributary streams or swales along the Site boundary and the branch. Potential locations for staff gauges on the Hayes Branch shall be investigated and photographed. Where possible, staff gauges will be located at, or adjacent to, hydraulic control points, areas with regular cross-sections, and areas with easy access for periodic readings. Physical access to residential well locations secured by the USEPA, will also be conducted.

Following completion of the Site reconnaissance, the flagging of all consolidated soil/ash pile boring locations, ground-water monitoring well and piezometer locations, surface water and/or sediment sampling locations, and locations for staff gauges will be conducted.

5.4 AIR MONITORING

5.4.1 Monitoring Objectives

An initial monitoring survey will be performed on each Subsite for volatiles, respirable dust and radiation. A limited, periodic ambient air monitoring program will be undertaken to determine whether respirable dust particles are present or generated during RI field activities.

Although volatile organics are not suspected at the Site, monitoring for volatile organic vapors will be conducted periodically, using an HNu photoionization meter and/or an OVA flame-ionization meter during well installation and consolidated soil/ash pile sampling activities as appropriate in accordance with the provisions of the Health and Safety Plan. Periodic monitoring for airborne respirable particulate matter will be conducted using a Miniram particulate meter (a respirable dust meter) during on-Site activities. Also, radiation is not suspected at the Site. However, radiation monitoring will be conducted using a Ludlum Micro R meter as part of an initial Site walk through on all seven Subsites.

The purpose of the air monitoring is to evaluate contaminant levels in the workers' breathing zone in order to select appropriate personal protective equipment, and to measure on-site radiation exposure, as described in the Site Health and Safety Plan (HASp). In

addition, an HNu and an OVA will be used as a screening tool to identify the presence of VOCs during consolidated soil/ash pile sampling. In addition, baseline monitoring of exposure to lead and cadmium particulates during soil/ash pile sampling activities at Subsites 1, 2 and 3 in accordance with OSHA regulations will be conducted. The monitoring will be conducted on one Malcolm Pirnie employee on the Site field team working on tasks representative of the field team's exposure. A total of three lead and cadmium monitoring samples will be collected, one each from Subsites 1, 2 and 3 as indicated in Section 6.0 of the HASP. The selection of the employee to be monitored and the dates on which the monitoring will be performed will be at the discretion of the Site Health and Safety Officer.

5.4.2 Monitoring Equipment

- HNu Systems, Inc., PI-101 Photoionization Detector (HNu) - 10.2 eV probe
- Foxboro Organic Vapor Analyzer (OVA 128)
- Ludlum Micro R radiation meter
- MIE, Inc., Miniram Model PDM-3 (Miniram)
- Lead and cadmium personal air samplers, minimum of three
- Field notebook and pen

In addition, a portable wind vane/anemometer will be set up in a location(s) applicable for each relevant Subsite during the intrusive phases of the RI to estimate the wind direction and speed.

5.4.3 Monitoring Procedures

During monitoring well drilling operations, collection of soil boring samples and collection of ground-water samples, completing of borings into the consolidated soil/ash piles and collection of soil/ash pile samples, air monitoring of volatiles (HNu or OVA) will be conducted at the following locations and time intervals:

- Workers' breathing zone (approximately every 15 minutes)
- At the well head space (approximately every 15 minutes)

Respirable dust will be measured in the worker's breathing zone using the Miniram approximately once every hour during field activities, and if windy or dusty conditions occur, then more frequently, i.e., approximately every 15 minutes.

The HNu photoionization meter or an OVA flame-ionization meter will be used to measure levels of volatile organic vapors, the Miniram will be used to measure respirable dust levels, and the Ludlum Micro R will be used to measure radiation levels during the initial Site walk through. The direction of wind movement will be recorded by observing the wind socks or the wind vane located at the subsite. For each measurement, the date, time, location, instrument readings, and direction of wind will be recorded in a field notebook.

Should appreciable levels of organic vapors or respirable dust be encountered such that the levels of personal protective equipment need to be upgraded, the Site Health and Safety Officer will order an evacuation of the Subsite until levels return to background. Further detail regarding health and safety issues may be found in the HASP. If significant air borne dust/particulate matter is detected by the respirable dust meters, further meteorological data such as temperature, relative humidity, and barometric pressure, will be collected for the purpose of conducting the health risk assessment for each Subsite.

The calibration procedures for each instrument are provided in Appendix A. Each instrument will be calibrated at the start of each day. In addition, each instrument will be recalibrated before use if it is turned off during the day.

5.5 COLLECTION OF CONSOLIDATED SOIL/ASH PILE BORING SAMPLES

5.5.1 Sampling Objectives

The consolidated soil/ash pile boring investigation is to be conducted to collect soil/ash samples for chemical and physical analyses, and to perform a limited assessment of the nature of contamination in the stockpiles of ash and soil on Subsites 1, 2, and 3. The USEPA has determined that representative characterization of the extent of contamination throughout any of the waste piles is not warranted; rather, a focused, limited sampling program is to be performed.

5.5.2 Sampling Equipment

The following equipment will be needed to drill soil borings and to collect soil samples for analysis:

- 2-inch diameter, 2-foot long split spoons
- Stainless steel trowels or spoons
- Stainless steel bowl
- Sample containers (see Table 6-1)

- Sample labels
- Coolers and ice
- Camera and Film
- Roll of polyethylene sheeting
- HNu PI-101 photoionization detector (HNu) - 10.2 eV probe
- Foxboro Organic Vapor Analyzer (OVA 128) with methane filter
- MIE, Inc., Miniram Model PDM-3 (Miniram)
- Lead and cadmium personal air samplers, minimum of three
- Field notebook and field logs
- Personal protective equipment
- Glass bottles for archiving soil samples
- Tripod
- Cap repair material
- Sealant compound
- Scissors

5.53 Sampling Procedures

Each location will first be located and labeled with the boring identification number. A tripod mounted split spoon sampler will be used to collect the samples from the consolidated soil/ash pile(s). Care will be taken to avoid puncturing the temporary cap by placing plywood (or other suitable material) under the legs of the tripod. The split spoon samplers, and any other equipment that will be in contact with the consolidated soil/ash piles will be decontaminated before the commencement of boring activities. It will also be necessary to decontaminate the split spoon sampler between borings for separate composite samples. It will not be necessary to decontaminate the split spoon sampler when sampling borings to be used for the same composite sample. The split spoon sampler will be decontaminated by steam cleaning. The residual water will be collected in 55-gallon drums for temporary storage on-site. Sampling equipment, such as split spoons, trowels, spoons and bowls will be decontaminated as described in Appendix A.

Prior to the collection of samples, a six-inch square hole within the grid areas will be cut out off the temporary cap covering the consolidated soil/ash pile, for access to the random boring location. At each boring location, split spoon soil samples will be collected from the top of the ash pile to the depth specified, using ASTM Standard D 1586-84. The split-spoon sampler will be driven by dropping a 140-lb hammer from a height of 30 inches. The number of blows required to advance the sampler over each six inches will be recorded.

After a sample is collected, the split-spoon sampling tool will be opened and laid on a piece of clean polyethylene sheeting. The field personnel will immediately screen the sample for organic vapors by passing the probe of an HNu and an OVA over the length of

the sample. Soils from the split-spoon will be emptied into a stainless steel bowl, sealed with aluminum foil, taped, and allowed to stand for one-half hour in order to allow time for the organic vapors to off-gas and accumulate in the bowl. After one-half hour, the headspace in the bowl will be monitored for organic vapors by piercing the aluminum foil with the probe from the HNu and OVA. Excess soil and samples which are not submitted for laboratory analysis will be deposited into the stockpile at Subsite 1. The six-square holes in the temporary cap covering the piles will be repaired by using patch material of a similar quality. The process will involve pre-cutting an eight-inch square of the repair material and applying a sealant compound along all edges. The repair patch will then be placed over the six-inch square, removed to gain access to the borehole location.

Photographs will be taken of selected samples. Each photograph will include a card showing the Site name, Subsite number, sample identification number, date, and initials of the sampling team and a scale for comparison. Soil/ash sample descriptions will also be noted. Soils will be visually classified according to both the Unified Soils Classification System (USCS) and the Modified Burmister System.

Disposable gloves will be worn by the sampling personnel and changed between samples. While performing any equipment decontamination, phthalate-free gloves (neoprene or natural rubber) will be worn in order to prevent phthalate contamination of the sampling equipment by interaction between the gloves and the organic solvent(s).

Data to be recorded in the field notebook and/or boring log will include the following:

- Name and location of job
- Subsite number
- Well and sample identification numbers
- Date of drilling
- Method of drilling and sample acquisition
- Blow counts
- Soil description
- Photograph numbers and description
- Organic Vapor Concentrations (by HNu and OVA), indicate use of methane filters on OVA

General

In general, all soil/ash pile samples sent for laboratory analyses will be composited samples. VOC/BN/AE sampling is an exception to this general approach, since sampling

protocol requires the use of grab samples. The procedure for selecting grab samples for VOC/BN/AE soil/ash analyses are as follows. Individual samples collected during these investigations for inclusion into composited soil/ash samples will be screened with an HNu/OVA to assess the presence of VOCs. The location of the grab sample with the highest HNu/OVA readings from among all of the individual samples comprising a single composite sample, will be resampled, and the new grab sample (collected at a location adjacent to the location of the screened sample found to have the highest HNu/OVA reading) will be collected and screened using a HNu/OVA, to confirm the presence of VOCs, and, if the presence of VOCs is confirmed, this new grab sample will be sent to a CLP laboratory for VOC and BN/AE analyses. Iterations of this process may be required to obtain one appropriate VOC/BN/AE grab sample for each composited soil/ash sample. If no HNu/OVA readings are encountered, random grab samples will be sent to a CLP laboratory for VOC analysis from each of these three Subsites. If HNu screening of the samples indicate that there is VOC contamination greater than 5 ppm, then work will stop and a Work Plan revision, addressing the change of scope, will be prepared.

As requested by USEPA, each composite soil/ash sample will also be analyzed for VOCs and BN/AEs.

The following sections describe the sampling approach at Subsites 1, 2 and 3.

Subsite 1

Six composite samples will be collected from the stockpile. It is proposed that a grid of six areas (approximately 33 feet x 50 feet) be delineated and that within each grid a composite sample will be collected. The composite sample will be made up of three randomly selected borings within the grid. USEPA may, based on their knowledge of the construction of the consolidated soil/ash pile, adjust the randomly selected location of one or more of these borings in order to bias the boring locations to areas of higher contamination. At each boring, continuous split-spoon samples will be collected through the pile to a depth of approximately ten feet or until no fine soils are encountered. The approximately four-inch interval of each split-spoon sample which by visual inspection appears to have the highest concentration of ash will be selected for inclusion in the composite sample. Therefore, approximately five split-spoon samples per boring will be collected for a total of approximately 15 samples per composite. Each split-spoon sample will be screened with a photoionization detector (HNu) for volatile organic vapors. The area in which the highest

HNu reading was recorded will be resampled by driving a split spoon adjacent to the boring and resampling the interval of the highest HNu reading. This sample will be screened to confirm the presence of VOCs. After obtaining a confirmed HNu reading, the grab sample will then be sent to a laboratory for VOC and BN/AE analyses. This process will be repeated within each of the grid areas.

The composite sample will be sent to a laboratory for the following analysis: VOCs, BN/AEs, PCBs/pesticides, dioxins, furans, TAL metals, cyanide, phenols, and RCRA characteristics for determining treatment and/or disposal options. These composite samples will also be analyzed for total organic carbon (TOC), cation exchange capacity (CEC), grain size distribution, bulk density and moisture content. These analyses will be used in the feasibility assessment of remedial alternatives. The total number of samples and the analyses as summarized in Table 4-1 .

A tripod mounted split-spoon sampler will be used to collect the samples from the consolidated soil/ash pile. Care will be taken to avoid puncturing the temporary cap by placing plywood (or other suitable material) under the legs of the tripod. The split-spoons and driving rods will only be decontaminated between composites (i.e. after each composite is collected).

Subsite 2

The sampling approach to be used at Subsite 2 will be similar to that to be used at Subsite 1. It is proposed that at Stockpile A, a grid of three areas (32 feet x 45 feet) be delineated and within each area a composite sample be collected for a total of three composite samples. Each composite sample will be made up of three random selected borings within the grid. USEPA may, based on their knowledge of the construction of the consolidated soil/ash pile, adjust the randomly selected location of one or more of these borings in order to bias the boring locations to areas of higher contamination. At each boring, continuous split-spoon samples will be collected to a depth of eight feet or until no fine soils are encountered. The approximately four-inch interval of each split-spoon sample which by visual inspection appears to have the highest concentration of ash will be selected for inclusion in the composite sample. Therefore, approximately four split-spoon samples per boring will be collected for a total of approximately 12 samples per composite.

Stockpile B will be divided up into two grids (30 feet x 44 feet) and one composite will be collected from each grid for a total of two composites. Each composite will consist

of three borings with approximately three split-spoons per boring collected for a total of nine split-spoons per sample. The process of boring location identification and sample identification within each split spoon sample will be the same as described for Stockpile A.

Stockpile C will be delivered with three grids (35 feet x 40 feet) and within each grid a composite will be collected for a total of three composites. Each composite will consist of three borings with approximately three split-spoon samples collected per boring for a total of nine split-spoon samples per composite. The process of boring location identification and sample identification within each split spoon sample will be the same as described for Stockpile A.

A total of eight composite samples will be collected from the stockpiles at Subsite 2. For each composite sample, a grab sample to be analyzed for VOCs and BN/AEs will be collected as described above for Subsite 1. Sample collection, decontamination and sample analysis will be the same as described for Subsite 1. The total number of soil/ash samples and their respective analyses are summarized in Table 4-1.

Subsite 3

To characterize the material in the consolidated soil/ash pile on Subsite 3, it is proposed that one composite sample be collected from four random boring locations in the pile. USEPA may, based on their knowledge of the construction of the consolidated soil/ash pile, adjust the location of this randomly selected boring in order to bias the boring location to an area of higher contamination. These split-spoon samples will be collected from each boring for a total of 12 samples to make up the composite. The approximately four-inch interval of each split-spoon sample which by visual inspection appears to have the highest concentration of ash will be selected for inclusion in the composite sample. One grab sample will be collected for VOC and BN/AE analysis following the procedure described for Subsite 1. Sample collection, decontamination, and sample analysis will be the same as described for Subsite 1. Table 4-1 summarizes the number of soil/ash samples and their respective analyses.

5.6 INSTALLATION OF MONITORING WELLS

5.6.1 Objectives

Monitoring wells will be installed to assess ground water quality and the effect of the ash piles on the shallow ground water, to delineate the horizontal extent of shallow ground water contamination, and to refine the understanding of the ground water flow systems. Monitoring wells will be installed at Subsites 1, 3, 5, 6 and 7 to collect ground water samples for chemical analysis, and to measure ground water elevations used to estimate the directions of ground water movement.

5.6.2 Equipment

The following equipment will be needed for the drilling and installation of the monitoring wells:

- Truck-mounted hollow stem auger drilling rig
- 2-inch diameter Schedule 40 PVC flush-joint casing pipe, with threaded cap
- 2-inch diameter Schedule 40 PVC screen with 0.01 and 0.02 inch slots (ten feet long), with bottom cap
- Clean, Morie No. 0,1, and 2 sand, filter pack material
- Bentonite pellets
- Bentonite-cement grout
- 6-inch diameter protective steel casing with locking cap
- HNu Systems, Inc., PI-101 photoionization detector (HNu) - 10.2 eV probe or an Foxboro Organic Vapor Analyzer (OVA 128)
- MIE, Inc., Miniram Model PDM-3 (Miniram)
- Personal protection equipment
- Portable Turbidimeter
- pH meter (Orion SA 250)
- Temperature/conductivity meter (YSI Model 33)
- Field notebook and pen
- Camera and film
- Roll of polyethylene sheeting
- Glass jars for archiving samples

5.6.3 Installation Procedures

5.6.3.1 General

A Malcolm Pirnie geologist will be in the immediate vicinity of installation operations when drilling is being performed.

At each monitoring well location, continuous split-spoon samples will be collected from the ground surface to the water table in the first well drilled.

The use of drilling methods employing mud will be avoided. During drilling utilizing downhole air, a high-efficiency carbon filter preceded by an appropriate fabric filter on the compressor discharge line will be used to prevent oil or other contaminants from the drill rig from being blown into the borehole. During drilling operations monitoring with the HNu or OVA and the Miniram will be conducted.

All monitoring wells will be fitted with locking, steel protective casings, set in concrete well aprons, with a surveyor's pin embedded in them. Monitoring wells will be marked with permanent reference points. These points will be surveyed for vertical and horizontal control using MSL datum. Vertical elevations will be surveyed to within 0.01 feet MSL. For wells, vertical elevations include top of protective casing, top of riser, well apron and ground surface. Horizontal locations will be surveyed to within 0.5 feet and will be reported in eastings and northings using the New Jersey State Plane Coordinate System using a topographic bench mark located in the vicinity of the Site and in latitude and longitude. This information will be included on the Site base map proposed under Section 5.3.3.

Procedures for the protection of a borehole or well that cannot be completed in a single day will be as follows:

- the drill rig will be secured over the hole to prevent unauthorized entry to the augers; or
- a locking cover will be placed over the auger, casing or any drill tools that remain in the hole when the drill rig cannot be secured over the well/borehole.

Figures 5-1 and 5-2 provide examples of a typical boring log and a typical sample collection log.

5.6.3.2 Shallow Monitoring Wells

The well borings will be drilled with hollow stem auger rig using six-inch or greater diameter flighted augers. Split spoons will be used to continuously collect soil cores from the construction of the shallow monitoring wells. Below the water table, split-spoon samples will be collected every five feet. One split-spoon sample collected below the water table from each subsite (Subsites 1, 3, 5, 6 and 7) will be sent to a laboratory for grain size

PROJECT:					PROJECT NO:					
DATE:					LOCATION:					
ELEVATION:					DATUM:					
SAMPLE				DEPTH	STRATY	SOIL DESCRIPTION			WELL CONSP.	REMARKS
no.	depth	recov ery %	blows per 6"			M. COMP., TEX., C., 2nd COMP., TEX.				
						C.: 3rd COMP., ETC., MOIST., OTHER *				
				5						
				10						
				15						
				20						
				25						
				30						
				35						
				40						
NOTES:										

* NOTE: M. COMP. = MAJOR COMPONENT, TEX. = TEXTURE, C. = COLOR,
COMP. = COMPONENT, MOIST. = MOISTURE

FIGURE 5-1

PROJECT # _____ DATE _____

PROJECT NAME _____ SAMPLERS _____

SITE LOCATION _____

SAMPLE COLLECTION LOG

WELL ID _____

WELL PURGING EQUIPMENT _____
TIME PURGING FINISHED _____ TIME SAMPLING STARTED _____
SAMPLING EQUIPMENT _____

WELL DEPTH (FT. FROM TOC) = _____
DEPTH TO WATER (FT. FROM TOC) = _____ TIME _____
HEIGHT OF WATER IN WELL (FT) = _____
ONE WELL VOLUME (GALLONS) = _____
VOLUME WATER REMOVED (GALLONS) = _____

SAMPLE APPEARANCE _____

FIELD PARAMETERS	FIRST	SECOND	THIRD	FOURTH	FIFTH
TEMP (°C)					
SPEC COND. (umhos/cm)					
pH					
VOLUME PURGED (gal)					

SAMPLES COLLECTED (PARAMETERS AND PRESERVATIONS) _____

WEATHER CONDITIONS _____

OTHER NOTES _____

CASING DIAMETER (IN.)

CASING VOLUME (GALLONS/LINEAR FT.)

1.25	0.0637
1.50	0.0918
2	0.1632
2.5	0.2550
3	0.3672
3.5	0.4998
4	0.6528
6	1.4687

FIGURE 5-2

distribution analysis. In addition, if clay beds thicker than two feet are encountered, the next deeper soil sample, assuming it will be clay, will be collected in a Shelby tube that will be sent for laboratory analysis of vertical hydraulic conductivity. Soil samples will be archived and stored on-Site in protective lockers. The samples will be labeled, and stored in clean, glass jars for the duration of the project. Upon completion of the project, samples will be sent to the USEPA WAM.

SOP 17 in Appendix D refers to split spoon sampling.

Monitoring well design and installation will conform with USEPA and NJDEPE requirements. The monitoring wells will be constructed with two-inch polyvinyl chloride (PVC) casings and PVC well screens. Screen slot size will be determined in the field by a hydrogeologist based upon visual inspection of the grain size of the interval to be screened. A 10-foot length of screen will be used in each well with a sand filter pack extending not more than one foot below and two feet above the screen. The water table monitoring wells will be installed so that the tops of the monitoring well screens are set just below the seasonal low water table to prevent fouling of the screen and potential alteration in the screened interval due to exposure to air. A three-foot PVC sump will be placed at the bottom of the screen to collect sediments without clogging the screen. A two-foot thick activated bentonite pellet seal will be placed above the filter pack and cement/bentonite slurry will be tremie-grouted in place above the bentonite seal up to the frost line. The remaining annular space will be sealed with expanding cement and a locking six-inch protective casing will be placed over the riser pipe and seated in the cement. The riser pipe will be capped with a threaded, flanged, or compression seal well cap and a one-quarter-inch-diameter vent hole will be drilled in the casing just below the cap. A permanent surveyor's mark will be placed on the concrete well apron and on the top of the riser pipe for use as measuring points.

5.6.4 Well Development

Development of wells improves the hydraulic connection between the well and the saturated zone and removes drill cuttings and fine particles from the well. Wells completed will be developed by pumping with the pump inlet located within the screened interval. During well development, turbidity, pH, specific conductance, and ground-water temperature will be monitored using field instruments. Development will continue for two hours or until samples of discharge water have a concentration of 50 nephelometric turbidity units (NTUs)

or less. If a turbidity level of 50 NTUs has not been achieved after one hour of development, development will continue up to two additional hours in an effort to achieve: a level of 50 NTUs or less in the discharge water; or, less than 10 percent variation in specific conductance, pH, and temperature measurements, monitored and recorded at approximately five-minute intervals during well development. At the end of three hours, the final NTU reading will be recorded. The USEPA WAM will be notified as soon as possible of any well which does not meet the 50 NTU criteria and alternative development procedures may be implemented upon approval by the USEPA WAM.

5.6.5 Disposition of Material Generated During Drilling

All decontamination solutions, well development, and purge water resulting from the installation and development of monitoring wells will be stored on Site in DOT-approved 55-gallon drums at Subsite 1. Drums containing water will be permanently numbered and an inventory of their contents maintained and the point of origin identified (i.e., Subsite No., Well No., etc.). The method of disposal will be determined after analytical results have been obtained. Liquids determined to be hazardous will be disposed of properly. All other liquids will be returned to the ground. Drill cuttings generated during the installation process will be incorporated into the consolidated soil/ash pile on Subsite 1. Malcolm Pirnie will be responsible for the appropriate disposal of all drummed water wastes under full indemnification from the USEPA. The method of disposal will be determined after analytical results have been obtained. Additional analyses for TCLP may be required for disposal options.

5.7 INSTALLATION OF PIEZOMETERS

5.7.1 Objectives

Two piezometers will be installed at the Site to measure the ground water level elevations in areas of the Site where monitoring wells are not proposed. Piezometers will be installed in the wetlands midway between the previous locations of the ash piles at Subsites 1, 3, 5 and 6 and the Hayes Branch (also shown on Figures 4-5 and 4-6). As with the upgradient monitoring wells, Subsites 1 and 3 will share a piezometer and Subsites 5 and 6 will share a piezometer. This will provide a ground-water monitoring network needed to

determine the water table gradient and the ground-water flow directions and rates in the water bearing zone.

5.7.2 Equipment

The following equipment will be needed for the installation of the piezometers:

- Drive weight/mechanical vibrator
- 2-inch diameter steel casing pipe, with threaded cap
- 2-inch diameter steel screen with 0.01 and 0.02 inch slots (two feet long)
- Personal protective equipment
- Field notebook and pen
- Camera and film

In addition, the following equipment will be available (for use, if warranted):

- HNu Systems, Inc., PI-101 photoionization detector (HNu) - 10.2 eV probe or an Foxboro Organic Vapor Analyzer (OVA 128)

5.7.3 Installation Procedures

The piezometers will be installed as drive points. Piezometers will be constructed with two-inch diameter steel casing and screen. A two-foot length of screen will be used. The maximum depth of the drive points are estimated to be 10 feet. The drive points will be driven to a completion depth with a sledge hammer, drive weight or mechanical vibrator, whichever is appropriate based on the conditions encountered. The screens will be set so that they bridge the water table. A filter pack will be placed no greater than one foot below and two foot above the screen. A surveyor's mark will be placed on the concrete well apron and the top of casing for use as a measuring point. The location and elevations of measuring points on the piezometers will be surveyed at the same time as the monitoring wells and in the same manner and will be included on the base map.

5.7.4 Piezometer Development

Piezometers will be developed by pumping with a centrifugal pump and clean polyethylene tubing. Development will continue for one hour or until samples of discharge water have a concentration of 50 NTUs or less. At the end of one hour, the final NTU reading will be recorded. Piezometers will be used for collecting water level data and not for ground-water sampling therefore, the presence of turbid water will not compromise the data collected.

5.8 INSTALLATION OF STAFF GAGES

5.8.1 Objectives

The ground water surface may be measured directly at the streams by staff gages. Staff gages will be installed at three locations in Hayes Branch near Subsites 1, 3, 5 and 6. The information gained from this will aid in determining the potential migration routes of contaminants found in the ground water.

5.8.2 Equipment

The following equipment will be needed for the installation of the staff gages:

- Enameled staff
- Anchor bolts
- 4 x 4 inch posts

5.8.3 Installation Procedures

Staff gages will consist of a graduated enameled staff securely attached by anchor bolts to a permanent timber or abutment. If an existing timber or abutment does not exist near the proposed staff gage locations, a four-inch by four-inch post will be driven into place as an anchor for the staff gage. The staff gage should be situated in order to collect measurements of the stream stage directly from the gage. The locations and elevations of the measuring points on the staff gages will be surveyed at the same time as the monitoring wells and in the manner described above and included on the base map.

5.9 COLLECTION OF WATER LEVEL MEASUREMENTS

5.9.1 Objectives

Four rounds of synoptic water level measurements will be collected in the wells, piezometers, and staff gauges that will be installed during the RI. The purpose of collecting the water level measurements is to evaluate the direction of ground-water movement and the vertical hydraulic gradient, and to evaluate the hydraulic connection between the ground water and surface water bodies around the Site.

5.9.2 Equipment

The following equipment will be used to collect surface and ground-water level measurements:

- Electronic water level indicator (Solinst Model 101)
- Wooden tape measure
- Field notebook and pen
- Personal protection equipment

In addition, the following equipment will be available (for use, if warranted):

- HNu Systems, Inc., PI-101 photoionization detector (HNu) - 10.2 eV probe or an Foxboro Organic Vapor Analyzer (OVA 128)

5.9.3 Procedures

After the monitoring wells and piezometers have been installed and allowed to equilibrate with the aquifer, synoptic water levels will be measured in all the newly installed wells, piezometers and staff gage locations at the Site.

At each monitoring well and piezometer location, the locking steel protective cap and internal well cap will be removed. The organic vapor level escaping from the well will be monitored using an HNu and an OVA and the reading recorded in the field log. The battery of the electronic water level indicator will be checked by pushing the battery check button and waiting for the audible signal to sound. The instrument will then be turned on, and the probe will be slowly lowered into the well until the signal is heard and the instrument light goes on, indicating that the sensor in the probe has made contact with the water surface in the well.

The depth of water will be recorded to the nearest one-hundredth of a foot, from the surveyed mark at the top of the stainless steel casing. The date, time, well number and depth to water will be recorded. All domestic wells which are sampled will be surveyed for location and elevation and will be sounded to determine which portion of the aquifer they tap prior to measuring their water levels. The cable and probe of the water level indicator will be decontaminated between use at each well by washing with Alconox and rinsing with tap water. This will be followed by a rinse with deionized water.

Surface water levels will also be measured at each staff gage location during the synoptic rounds. At each staff gauge, the distance from the surveyed mark at the top of the staff to top of the surface water will be recorded, to the nearest one-hundredth of a foot,

using a wooden tape ruler. The date, time, staff gauge number and depth to water will be recorded. Refer to SOP 3 in Appendix D for additional information.

5.10 COLLECTION OF GROUND-WATER SAMPLES

5.10.1 Sampling Objectives

Up to two rounds of ground-water samples will be collected from all new monitoring wells (thirteen total) and nearby residential wells to obtain data on ground-water quality in and around the Site. After reviewing the results of the ground-water sampling, USEPA will determine if a second round of ground-water sampling will be required.

5.10.2 Sampling Equipment

The following equipment will be needed to collect ground-water samples for analysis:

- Electronic water level indicator (Solinst Model 101)
- Stainless steel variable rate submersible pump (Grundfos Redi-Flo)
- Polyethylene tubing (ASTM Drinking Water Grade)
- Laboratory cleaned stainless steel bailer
- Teflon-coated leader cord
- Nylon bailer cord
- Sample containers (see Table 6-1)
- Calibrated containers
- Coolers and ice
- Roll of polyethylene sheeting
- pH meter (Orion SA250)
- Temperature, and specific conductance meter (YSI Model 33)
- Personal protective equipment
- Field notebook, sampling logs and pen

In addition, the following equipment will be available (for use, if warranted):

- HNu Systems, Inc., PI-101 photoionization detector (HNu) - 10.2 eV probe or an Foxboro Organic Vapor Analyzer (OVA 128)

5.10.3 Monitoring Well Purging Procedures

At each location, the locking steel cap and internal well cap will be removed and the concentration of volatile organic vapors will be measured by placing an HNu or an OVA above the well casing. The HNu or OVA will be calibrated at the start of each day by

following the procedures described in Appendix B. If the instrument is turned off during the day, it will be recalibrated before being reused.

The depth to water will be measured with an electronic water level indicator. The cable and probe of the water level indicator will be decontaminated between use at each well by washing with Alconox and rinsing with tap water. This will be followed by a rinse with deionized water.

The water volume in the casing will be calculated using the following equation:

$$V = 23.50 (r^2h)$$

where:

V	=	standing water volume (gallons)
23.50	=	$\pi \times 7.48$ gallons/cu.ft.
r	=	well casing radius (feet)
h	=	height of water column (feet)

The type of pump used will be a variable rate submersible pump (i.e., Grundfos Redi-Flo). Polyethylene tubing will be used for the discharge pipe. Prior to insertion of the submersible pump into the well, the pump will be decontaminated in accordance with the procedures identified in Appendix A. The pump will be lowered into the well to just above or within the screened interval to initiate water removal. The pump will be placed so that the intake lies just below the surface of the water in the well and lowered as the water level decreases to ensure that evacuated water is completely replaced with fresh groundwater from the surrounding aquifer. The discharge of water will be monitored using a HNu or OVA for volatile organic gases. The pumping rate shall be measured frequently with a calibrated container and stopwatch. Measurements of field parameters during purging will be conducted to provide an indication of ground-water equilibration and stabilization at the sampling point. Field parameters to be monitored include turbidity, temperature, specific conductance, pH, Eh, and dissolved oxygen. See Appendix B for information concerning the operation and calibration of the field instruments. After each of the field parameters stabilizes (i.e., not more than 10 percent variation between two consecutive readings), the total volume of water removed will be recorded and the well will be sampled. If the field parameters do not stabilize, purging will continue until five volumes of water are removed. The purge water will be collected in drums and stored on Subsite 1.

Refer to SOP 3 in Appendix D for additional information.

5.10.4 Monitoring Well Sampling Procedures

Sample collection will be conducted by filling the sample containers directly from the discharge line (i.e., polyethylene tubing) of the submersible pump. Sampling will follow purging without interruption of the submersible pump flow rate in order to minimize the disturbance of the overlying stagnant water column in the well. All samples will be collected a minimum of two weeks after the newly installed monitoring wells have been developed to allow time for stabilization.

A piece of polyethylene sheeting will be laid on the ground beside each well and the sampling equipment and sample bottles will be placed on the polyethylene sheeting. All sample bottles will be filled to the shoulder. Those samples requiring preservation will be tested and appropriately preserved in the field (see Table 6-1). Samples will be collected in the following order:

1. Field measurements: specific conductance, pH, temperature, turbidity, Eh, and dissolved oxygen;
2. PCBs/pesticides;
3. Dioxins/furans;
4. TAL metals (total);
5. Cyanide;
6. Phenols;

The sample bottles will be placed into coolers with ice and sent to a laboratory for analysis. Sample handling procedures are detailed in Section 6.0.

The equipment entering the well will be handled with phthalate-free (natural rubber or neoprene) gloves to prevent phthalate contamination. The submersible pump will be decontaminated between sampling locations as described in Appendix A, and the polyethylene tubing used on the submersible pump, bailers, gloves, and polyethylene sheeting will be changed between sampling locations to prevent cross contamination.

Data to be recorded in the field logbook and/or sampling logs will include the following:

- Name and location of job
- Subsite Number
- Well and sample identification numbers
- Date and time of sample collection
- Depth to water
- Volume of water removed during purging

- pH, Eh, temperature and specific conductance, turbidity and dissolved oxygen measurements
- Organic vapor levels

Refer to SOP 3 in Appendix D for additional information.

5.10.5 Residential Well Purging and Sampling Procedures

Sampling of residential wells, for which access has been arranged by the USEPA, will take place concurrently with the monitoring well sampling. As described in Standard Operating Procedure (SOP) - 1 Appendix D, the water supplies will be flushed for 15 minutes or until three to five well volumes have been removed (if the well construction and standing volume are known). Active homeowner wells will be sampled directly from the water supply pipe as close to the source as possible using an existing tap prior to any treatment devices and/or surge vessels. If such a tap does not exist, the sample will be taken in accordance with SOP-1 Appendix D, and the conditions of the sample collection will be communicated to the USEPA WAM through the Site Manager.

5.11 COLLECTION OF SURFACE WATER AND SEDIMENT SAMPLES

5.11.1 Sampling Objectives

Surface water and sediment samples will be collected to assess the presence and nature of contamination in the surface water bodies draining the Site, and to evaluate the health and environmental risks associated with potential surface water and sediment contamination. The objective of the proposed surface water and sediment sampling is to determine if Site-generated contaminants have been transported into Hayes Branch and its associated wetlands, and are inhibitory to normal growth and production of indigenous flora and fauna. Sediment sampling will also enable an assessment of whether food-chain transfer via benthic infauna and rooted macrophytes represents a potential exposure route to other components of the wetland ecosystem.

5.11.2 Sampling Equipment

The following equipment will be needed for surface water and sediment sampling:

- Stainless steel trowel, auger or dredge
- Field notebook and pen
- Personal protection equipment

- Sample containers (see Table 6-1)
- Sample filtering equipment (surface water TAL metals (filtered) samples) and filters
- Coolers and ice
- Stop watch
- Float
- Ruler

5.113 Surface Water Sampling Procedures

The surface water samples will be collected from near the bank of the stream or pond. These locations will be staked so that the same locations can be sampled during each sampling event. When surface water samples are being taken in conjunction with sediment samples, the water samples will be taken first. Samples will be collected first from the furthestmost downstream location, and then, sequentially, in an upstream direction.

The samplers will approach the location from the downstream direction with the sample container pointed upstream to ensure collection of an undisturbed sample. The surface water samples will be collected by carefully dipping the sample bottles into the stream, as described below. All sample bottles will be filled to the shoulder.

Those samples requiring preservation will be tested and appropriately preserved in the field. To ensure that samples have been properly preserved, an aliquot of preserved sample will be poured over pH paper. pH paper will not be inserted into the sample container to determine pH.

Both a filtered and an unfiltered (total) TAL metals surface water sample will be collected. All other surface water samples will be unfiltered. Filtered samples will be obtained using a disposable filtering device.

The procedures for surface water sampling are presented in SOP 2 of Appendix D.

Samples will be collected in the following order:

1. Field measurements: temperature, pH, specific conductance;
2. PCBs/pesticides;
3. Dioxin/Furans;
4. TAL metals (total);
5. TAL metals (filtered);
6. Cyanide;
7. Phenols;
8. Alkalinity;
9. Total Hardness;
10. Total Dissolved Solids;
11. Total Suspended Solids;

12. Biochemical Oxygen Demand;
13. Chemical Oxygen Demand;
14. VOCs; and
15. BN/AEs.

The sample bottles will be placed into coolers with ice and will be sent to a USEPA CLP laboratory for analysis. Sample handling procedures are detailed in Section 6.0.

The sample containers will be handled with phthalate-free gloves which shall be changed between each sample location to prevent phthalate and cross contamination.

Field Instrumentation will be calibrated before they are used following the calibration procedures provided in Appendix B.

Data to be recorded in the field logbook will include the following:

- Name and location of job
- Subsite number
- Sample identification number
- Method of sample collection
- Weather conditions
- Date of sample collection
- Description of sampling location including stream depth
- Photograph number and description
- pH, temperature, dissolved oxygen and specific conductance measurements
- Observed conditions which might impact the sample chemistry

Each sampling location will be photographed, described, assigned a unique identification number and marked with a fixed stake or buoy.

5.11.4 Stream Discharge Measurement Procedures

Following surface water sample collection, the flow rate of the stream will be measured, if possible. First, a stream velocity will be measured by placing a floating object in the stream above the sampling location. The time required for the object to float unobstructed for approximately 50 feet will be measured. This time will be divided into the distance to obtain a stream velocity in feet per second.

Next, the cross-sectional area of the stream will be determined at the sampling point. Depth measurements will be collected at one-foot intervals across the stream bed. The depth will be measured by lowering a ruler or weighted line into the water. The depth measurements will be averaged.

The discharge of the stream will then be calculated using the following formula:

$$Q = wdu$$

where Q = discharge, in cubic feet per second
w = width of the stream, in feet
d = average depth of the stream, in feet
u = velocity, in feet per second

The discharge measurements collected during each sample event will be compared to determine when the lowest flow conditions occurred.

5.11.5 Sediment Sampling Procedures

Sediment samples will be collected with a stainless steel gravity corer equipped with a lexan liner. At each station, a 12-inch sediment core will be obtained, if possible. The top six inches of the core will be placed in a labelled glass jar (employing methods described in SOP-5 (Appendix D), as appropriate). Sampling instruments will be decontaminated before use following the procedures outlined in Appendix A.

Samples will be collected in the following order:

1. PCBs/Pesticides;
2. Dioxins/Furans;
3. TAL Metals;
4. TOC;
5. Cyanide;
6. Phenols.
7. RCRA characteristics (ignitability, corrosivity (pH), reactivity, and toxicity (TCLP));
8. Bulk Density;
9. CEC;
10. Grain Size Distribution;
11. Moisture Content;
12. VOCs; and
13. BN/AEs.

The sample bottles will be placed into coolers with ice and will be sent to a USEPA CLP laboratory for analysis. Sample handling procedures are detailed in Section 6.0.

The sample containers will be handled with phthalate-free gloves which shall be changed between each sample location to prevent phthalate and cross contamination.

Field Instrumentation will be calibrated before they are used following the calibration procedures provided in Appendix B.

Data to be recorded in the field logbook will include the following:

- Name and location of job
- Subsite number
- Sample identification number
- Method of sample collection
- Weather conditions
- Date of sample collection
- Description of sampling location including stream depth
- Photograph number and descriptions
- Observed conditions which might impact the sample chemistry

Each sampling location will be photographed, described, assigned a unique identification number and marked with a fixed stake or buoy.

Refer to SOP 5 in Appendix D for more information.

5.12 ENVIRONMENTAL ASSESSMENT

5.12.1 Objectives

The purpose of the environmental assessment is to characterize and inventory existing Site natural resources and to identify potential biological receptors. The area to be investigated is each of the Subsites and immediately adjacent areas, and includes downslope wetland areas in the Hayes Branch in the vicinity of or on Subsites 1, 5, and 6, determination of types of flora and fauna present in the Site vicinity, and identification of regional agricultural lands. Data generated from the wetland delineation will provide a baseline reference on existing conditions prior to the initiation of on-Site remedial activities. Should Site remediation have an impact on delineated wetland(s), the functional values of the affected wetlands will be qualitatively assessed by application of the U.S. Army Corps of Engineers (USACE) Wetland Evaluation Technique, Version 2.0 (WET). Data generated by the WET program will be used to prepare a restoration/mitigation plan that will create a wetland system with functional values equal to or greater than the wetland values identified by the WET program.

5.12.2 Equipment

The following equipment will be needed for surface water and sediment sampling:

- Soil auger and spade
- Sighting compass

- Field logbook and pen
- Camera and film
- Tape measure
- Field data forms
- Clip board
- Munsell soil color chart
- Aerial photograph or base map
- Federal interagency plant list
- Flags and Flagging tape

Other equipment which will be available on-Site (for use if warranted) is:

- HNu Systems, Inc., PI-101 photoionization detector (HNu) - 10.2 eV probe or an Foxboro Organic Vapor Analyzer (OVA 128)

5.12.3 Procedures

A survey of the Site and downgradient areas will be conducted to determine the presence of wetlands inclusive of water courses and drainage ways. Areas that meet the federal wetland criteria for vegetation, soils and hydrology will be delineated using the methodology outlined below:

The wetlands will be delineated at all Subsites using the Routine Method, Plant Community Assessment Procedure in compliance with the Corps of Engineers Wetlands Delineation Manual (Army, 1987). The Routine Method will be employed because the known wetland areas appear to be well defined and the vegetation communities do not appear to have high species diversity. Areas that meet the federal wetland criteria for vegetation, soils, and hydrology will be delineated using the methodology outlined below:

- Review available United States Geological Survey (USGS) topographic mapping, National Wetland Inventory mapping, Soil Conservation Service mapping for the County, and Site and Subsite base maps.
- Apply the federal criteria for the Routine Method, Plant Community Assessment Procedure to identify hydrophytic vegetation, hydric soils, and hydrology in wetland areas.
- Identify and flag wetland/nonwetland boundary. Flags will be sequentially numbered and keyed to a base map for all Subsites. In addition, the location of soil borings and vegetation community sampling will also be keyed to a base map for all Subsites. A photographic log will be prepared to document the delineated boundaries of each identified wetland.

In addition, field determination of the classes of wetlands systems (i.e., forested, scrub-shrub, emergent, etc.) will be conducted to determine which are present in the Site's

vicinity. The life forms of the Palustrine wetland systems (predominant in Site vicinity) - trees, shrubs, emergents, emergent mosses, and lichens - are used to define classes and will be characterized in the field. Submerged or floating-leaved rooted vascular plants, free-floating vascular plants, submergent mosses and algae will be noted for the determination of the Aquatic Bed class.

Flora and Fauna Inventory

Additional data that will be collected during the wetland delineation includes observing and recording data on vegetation communities and wildlife. The team will record observations of mammals, birds, reptiles and amphibians. Observation data will include location of sighting, habitat type, taxonomic class, number of individuals and observed activity, (i.e. feeding, roosting, nesting). Emphasis will be placed on observing and recording wildlife utilization of the known wetlands adjacent to Subsites 1, 5 and 6. Vegetation communities will be recorded, and observations of the vigor and growth patterns of on-Site vegetation will be assessed and compared to similar vegetation communities off-Site.

Investigation of Agricultural Land

The presence of agricultural land on or adjacent to each subsite area will be determined. Agricultural land will be identified by consulting with the Gloucester County Soil Conservation Service. In the event that agricultural land is present, an assessment will be conducted to assess potential impacts generated by on-Site contamination, and an evaluation of remedial action alternatives on agriculture will also be conducted. These tasks will be conducted in compliance with the Farmland Protection Policy Act.

6.0 SAMPLE HANDLING

6.1 GENERAL

Representative sampling of environmental matrices for chemical analysis depends on proper collection, preservation, shipping, custody, and preparation techniques. Unpreserved or improperly shipped samples may jeopardize sample integrity and reduce data quality. To endeavor to achieve sampling data that are reliable, Malcolm Pirnie will adhere to procedures described in the following sections and in the Quality Assurance Project Plan prepared for the investigation. All samples collected for analysis by the USEPA CLP will be labeled, packaged and preserved according to CLP procedures which are described in the "Users Guide to the Contract Laboratory Program", EPA/540/8-89/012, January 1991.

6.2 PROCUREMENT AND PREPARATION OF SAMPLE CONTAINERS

Malcolm Pirnie will purchase certified clean, approved sample containers from a USEPA approved supplier. All sample containers will be prepared in accordance with SOP 16 in Appendix C, and will meet the QA/QC requirements of OSWER Directive #9240.0-05A, "Specifications and Guidance for Contaminant-Free Sample Containers" (USEPA 1992). All sample containers will have a certificate of analysis, by Lot Number, that verifies the purity of the containers. Copies of these certifications will be kept in Site files, the PMO QA files, and brought on-Site while sampling for review by field audit personnel. Malcolm Pirnie will label the sample containers prior to field sampling events, when possible.

6.3 LABELING OF SAMPLES

Each sample collected at the Site will be identified with a Malcolm Pirnie sample label and a Malcolm Pirnie sample tag. The sample label will be attached to each bottle and will be covered with clear plastic tape to assure that the label does not peel off or become damaged. A unique sample number will be assigned to each sampling location and marked on the label and the tag. The sample tag will be attached to the sample bottle with wire or

string. In addition to the Malcolm Pirnie label and tag, all samples submitted to the CLP Laboratory will be identified with EPA CLP numbers which are provided by the CLP Laboratory.

All samples labels and tags will contain the following information:

1. Project number
2. Subsite number
3. Field ID or sample station number
4. Date and time of collection
5. Designation of sample as grab or composite
6. Sample matrix
7. Sample preservation notes
8. Analytical parameters
9. Signature of sampler

The project number is used instead of the site name in order to preserve the anonymity of the Site. The bottles will be pre-numbered according to the numbering scheme described in Subsection 4.4.

The sample label and tag will be checked by the laboratory to verify that they are identical and then will be cross-referenced to the chain-of-custody form. Any inconsistencies will be noted on the chain-of-custody form. All identifying tags, data sheets, and laboratory records will be retained as part of the permanent record.

6.4 SAMPLE PRESERVATION/HOLDING TIMES

The analytical laboratory will analyze samples for the constituents given in Tables 4-1 and 4-2. The samples will be analyzed by following USEPA CLP/RAS and SAS methodologies. Preservation of samples will be performed in the field at the time of sample collection in accordance with procedures contained in the USEPA Region II CERCLA QA Manual, Revision 1, October, 1989. Information on sample containers, preservation techniques, and holding time limits is presented in Table 6-1.

6.5 SAMPLE SHIPPING AND CHAIN-OF-CUSTODY

The sample handling and sample custody procedures described below will be followed during all sampling events. A chain-of-custody form will be initiated at the

laboratory and will accompany the sample bottles from the laboratory into the field. Upon receipt of the bottles and cooler, the sampler will sign and date the first "received" blank space. After each sample is collected and appropriately identified, entries will be made on the chain-of-custody form which will include: sampler names and signatures, sampling station identification, date, time, type of sample and the required analysis. In addition, the USEPA CLP Traffic Report Forms and SAS Packing List will be initiated at the time of sample collection in the field and copies are shipped with the samples. Copies of these forms are provided in Appendix C.

After sampling has been completed, the sample containers will be cleaned, sample tags will be attached, custody seals will be placed around the sample vial and cap and the containers will be placed into coolers. Ice packs will be placed in the coolers to keep the samples cold. A sufficient number of ice packs are to be used to maintain the samples at a temperature of 4°C during shipment as described in SOP 16 in Appendix C. Packing material will be placed in the coolers and around the containers to prevent the sample containers from moving and breaking. The sampler will sign and date the next "relinquished" blank space on the chain-of-custody form.

The samples will either be transported to the CLP Laboratory under custody of Malcolm Pirnie personnel or they will be shipped by an air express service. If the samples are shipped by an air express service, the name of the carrier will be entered under the next "received" blank and the air bill number will be entered on the form. The chain-of-custody form will be placed in a plastic bag and attached to the inside cover of the cooler. Whether transported by Malcolm Pirnie or shipped, two or more custody seals will be signed, dated and placed on each shipping container, located in a manner that would indicate if the container were opened in transit. Wide, clear plastic tape will be placed over the seals, to ensure that seals are not accidentally broken during shipment. After each sample shipment to USEPA CLP Laboratories, the Sample Management Officer (SMO) will be immediately notified by phone.

All samples will be received by the laboratory within 24 hours of collection. Samples will be received by laboratory personnel, who will assume custody of the samples, and sign and date the next "received" blank on the chain-of-custody form. Upon completion of sampling event, a Trip Report will be prepared by Site personnel and submitted to the MPI-RSCC (Regional Sample Control Center).

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8.0 ACRONYMS

ASTM	American Society of Testing Materials
BN/AE	Base Neutrals/Acid Extractables
BOD	Biochemical Oxygen Demand
CEC	Cation Exchange Capacity
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980, also known as Superfund: Amended in 1986 by the Superfund Amendments and Reauthorization Act (SARA).
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
COD	Chemical Oxygen Demand
CRDL	Contract Required Detection Limit
CRQL	Contract Required Quantitation Limit
CRS	Cultural Resource Survey
DOT	Department of Transportation
ERRD	Emergency and Remedial Response Division
ERT	Environmental Response Team
ESD	Environmental Services Division
FIT	Field Investigation Team
FS	Feasibility Study
FSP	Field Sampling Plan
GCDH	Gloucester County Department of Health
HASP	Health and Safety Plan
MPI	Malcolm Pirnie Incorporated
MSL	Mean Sea Level
MS/MD	Matrix Spike/Matrix Duplicate
MS/MSD	Matris Spike/Matris Spike Duplicate
NJDCJD	New Jersey Division of Criminal Justice Department
NJDEP	New Jersey Department of Environmental Protection
NJDEPE	New Jersey Department of Environmental Protection and Energy

ACRONYMS (continued)

NPL	National Priorities List
NTU	Nephelometric Turbidity Unit
OSWER	Office of Solid Waste and Emergency Response
OVA	Organic Vapor Analyzer
PC	Personal Computer
PCB	Polychlorinated Biphenyl
PMO	Program Management Office
PRP	Potentially Responsible Party
PSB	Program Support Branch
PVC	Polyvinyl Chloride
QA	Quality Assurance
QC	Quality Control
QAPjP	Quality Assurance Project Plan
QAPP	Quality Assurance Program Plan
RA	Removal Assessment
RAB	Removal Action Branch
RAS	Routine Analytical Services
RCRA	Resource Conservation and Recovery Act
REAC	Response Engineering Analytical Contract
RI	Remedial Investigation
RSCC	Regional Sample Control Center
SI	Site Investigation
SAP	Sampling and Analysis Plan
SAS	Special Analytical Services
SM	Site Manager
SMO	Sample Management Office
SOPs	Standard Operating Procedures
TAL	Target Analyte List
TAT	Technical Assistance Team
TCL	Target Compound List

ACRONYMS (continued)

TCLP	Toxicity Characteristics Leaching Procedure
TDS	Total Dissolved Solids
TEF	Toxicity Equivalent Factor
TOC	Total Organic Carbon
TOx	Total Organic Halides
TSS	Total Suspended Solids
TSCA	Toxic Substances Control Act
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOC	Volatile Organic Compounds
WAM	Work Assignment Manager
WET	Wetland Evaluation Technique

APPENDIX A
DECONTAMINATION PROCEDURES

DECONTAMINATION PROCEDURES

Sampling Equipment

Any equipment, such as bailers, spoons, trowels, and split-spoon samplers used to collect water, soil, or sediment samples for chemical analysis will be decontaminated following the procedures described below:

1. wash and scrub with nonphosphate detergent (Alconox);
2. rinse with tap water (from potable water supply);
3. rinse with 10% HNO₃, ultrapure rinse;
4. rinse with tap water (from potable water supply);
5. rinse with acetone only or rinse with methanol followed by hexane (pesticide grade or better);
6. thoroughly rinse with deionized, demonstrated analyte-free water (volume used during this rinse must be 3 to 5 times the volume of solvent used in Step 5.);
7. air dry; and
8. wrap in aluminum foil for transport.

When using a split-spoon sampler which is made of carbon steel instead of stainless steel, the nitric acid rinse may be lowered to a concentration of 1% instead of 10% so as to reduce the possibility of leaching metals from the spoon itself.

Split-spoon samplers may, instead of the above, be decontaminated by steam cleaning. Non-interfering containers (such as those made of glass, stainless steel, teflon, or nalgene polyethylene) will be used to transport the acetone, methanol and hexane to the site.

Field instrumentation will be cleaned as per manufacturers instructions. Probes such as those used in pH and conductivity meters will be rinsed after each use with deionized water.

Disposable gloves will be worn by the sampling personnel and changed between sampling events. While performing any equipment decontamination, phthalate-free gloves (neoprene or natural rubber) will be worn in order to prevent phthalate contamination of the sampling equipment by interaction between the gloves and the organic solvent(s).

Electric Water Level Indicator and Data Logger

The electric water level indicator and data logger cable and transducer will be decontaminated before being used in each well by the following procedures:

1. Wash probe/transducer and portion of cable which was submerged with Alconox detergent and tap water.
2. Rinse with distilled water. Allow water to drain into bucket.

Well Evacuation Equipment

The submersible pump and tubing will be decontaminated before each use by pumping 20 gallons of Alconox detergent and then 20 gallons of tap water through the pump and rinsing the outside with deionized water. The spent rinse water will be contained in DOT-approved 55-gallon drums and stored on-site.

Drilling Equipment

All down-hole drilling equipment will be decontaminated prior to the start of drilling operations, between each hole, and before leaving the site. Decontamination will be accomplished with a steam cleaner and will consist of spraying the equipment with high pressure steam. Additionally, the drill rig itself will be decontaminated both before beginning work and prior to leaving the site. Condensate collected from steam cleaning will be contained in DOT-approved 55-gallon drums and stored on-site.

Wash and Rinse Water Disposal

At the end of each day, spent wash water, rinse water, and condensate will be drained into DOT-approved 55-gallon drums for proper disposal. These waters will be stored in separate drums and not mixed with the drill cuttings. The drums will be permanently labeled. An inventory of all drums will be maintained in the field logbook.

APPENDIX B

EQUIPMENT CALIBRATION AND MAINTENANCE PROCEDURES

300120

EQUIPMENT CALIBRATION AND MAINTENANCE PROCEDURES

Calibration and maintenance procedures for the equipment identified below are presented in this Appendix.

- HNu Model PI-101 Photoionization Analyzer
- Foxboro Model OVA 128 Flame Ionization Detector
- Miniram Model PDM-3 Respirable Dust Meter
- Ludlum Model 12S Micro R Meter
- Hach Model 16800 Portable Turbidimeter
- Orion Model SA250 pH Meter
- Platinum Eh Electrode
- YSI Model 33 S-C-T Meter
- Glass-Mercury Thermometer
- YSI Model 51B Dissolved Oxygen Meter
- In-Situ Model SE1000B Hermit Data Logger
- Solinst Model 121 Interface Meter

CALIBRATION AND MAINTENANCE OF HNu PHOTOIONIZATION ANALYZER

Accuracy

The HNu PI-101 is temperature compensated so that a 20 degrees Celsius change in temperature corresponds to a change in reading of less than two percent full-scale at maximum sensitivity. The useful range of the instrument is from 0.2 to 2000 ppm. Response time is less than three seconds to 90 percent of full-scale.

Calibration

Prior to use, the HNu meter will be checked using a pressurized cylinder of isobutylene. The isobutylene will be certified by HNu Systems Inc. to be 100 ppm of isobutylene in air. The HNu meter is calibrated to benzene at the manufacturer. Thus, the 100 ppm of isobutylene check gas should deflect to 63 ppm on the meter scale.

Maintenance

1. If any of the following conditions occur, consult the troubleshooting guide provided in the Instruction Manual:
 - a. No meter response in any switch position (including BATT CHK).
 - b. Meter response in BATT CHK, but reads zero or near zero for all others.
 - c. Instrument reads correctly in BATT CHK and STBY, but not in measuring mode.
 - d. Instrument responds in all positions, but signal is lower than expected.
 - e. Erratic meter movement occurs.
 - f. Instrument response slow or irreproducible.
 - g. Low battery indicator.

Should the troubleshooting techniques fail to resolve the problem, send the instrument to the manufacturer for repair and maintenance.

2. The light source window will be cleaned at a minimum of every two weeks. Cleaning frequency will be based on meter performance when checked against 100 ppm of isobutylene in air.
3. The meter battery will be checked at the beginning and end of each day. If the needle is not within or above the green battery arc on the scale-plate, the battery will be recharged prior to making any measurements.

Data Validation

A daily log will be kept to document equipment and standards utilized. Recorded information for the equipment will include the name, model number, and data of calibration. Standards used in calibration of equipment will be documented by trade name, lot number and expiration date. Any unusual readings and routine maintenance procedures will also be documented.

CALIBRATION AND MAINTENANCE OF OVA FLAME IONIZATION DETECTOR

Foxboro Flame Ionization Detector/Organic Vapor Analyzer (OVA)

Primary calibration of the Organic Vapor Analyzer is accomplished at the factory using methane of known concentrations in air and making adjustments to the four potentiometers located on the circuit board inside the instrument. This primary adjustment is relatively stable over time and should not concern field operators. The primary calibration may be checked during factory maintenance procedures which will be required for each unit. Maintenance schedules will be established by the Project Manager.

All OVAs will be calibrated to methane, and records kept on file to document the procedure. A 5 liter gas sampling bag is filled with "clean" air. One cubic centimeter (cc) of a pure methane gas from a calibration cylinder is injected through the septum of the gas sampling bag. The sampling bag is then agitated to ensure complete diffusion of the sample. The concentration in parts per million (ppm) (volume/volume) will be equal to the sample size in cubic centimeters divided by the volume of the bag in cubic centimeters, times 1,000,000. Therefore,

$$\frac{1 \text{ cc} \times 1,000,000}{5,000 \text{ cc}} = 200 \text{ ppm}$$

Note: 1 liter = 1,000 cc

The outlet of the sampling bag is connected to the air sampling line of the OVA. The GAS SELECT knob is then adjusted until the meter reading on the OVA is 200 ppm.

Since the instrument is calibrated to methane, the concentration read for other compounds must be expressed as "methane equivalent" concentrations. It is possible to calibrate the instrument with other gases by adjusting the GAS SELECT knob on the Sidepack control panel. However, this requires a supply of the gas of interest at a known concentration. Cylinders of various gases are commercially available and should be requested with the gas of interest and the balance as air. The calibration gas should be withdrawn from the cylinder and placed in a sample bag of known volume from which it may be drawn into the OVA. By making the appropriate calculations, samples of known

concentration can be prepared. As the OVA draws in the sample, the GAS SELECT knob is turned until the calibrated concentration of the sample is read on the meter. The instrument is now calibrated to directly read the concentration of the compound of interest.

CALIBRATION AND MAINTENANCE OF RESPIRABLE DUST METER

The Miniram Model PDG-3 has been factory-calibrated using a representative dust, but the user may change the calibration constant of the instrument for a specific type of aerosol if he wishes. Such a calibration should be performed by obtaining a concurrent filter collection (e.g., by means of a personal filter sampler), sampling from the same environment within which the Miniram is placed. The average concentration obtained by the Miniram at the end of the test should be compared with the filter-gravimetric-determined concentration. The ratio of the two concentration values can then be used to correct the Miniram calibration. The comparison run should be replicated several times (to minimize errors) to obtain an average ratio.

To change the Miniram calibration, proceed as follows:

1. Place Miniram in a clean environment (e.g., air conditioned office).
2. Remove battery pack.
3. Disconnect battery connector (remember that all stored data will thus be lost/erased from Miniram memory).
4. While leaving battery pack lying next to Miniram, re-connect the two units (i.e., plug in connector).
5. Immediately observe Miniram display. It will be performing a slow segment-by-segment display checkout. As soon as it displays ".00," press OFF, thus interrupting the initial automatic zero checkout. Wait until the display indicates "OFF" and then press MEAS and wait approximately 36 seconds.
6. Observe 10-second readings (typically in the range of 1 to 3 mg/m³) and record manually a few consecutive readings. Calculate the average of these values.
7. Identify small potentiometer screw (visible through an opening in the foil

shield of the open Miniram) opposite the digital output jack. Adjust this potentiometer, using a fine screw driver, until the average Miniram is increased or decreased (with respect to the average obtained in step 6) by the desired ratio (e.g., as determined by previous gravimetric comparison runs).

8. Shut off Miniram, reposition and secure battery pack, and re-zero instrument. All subsequent concentration readings are now corrected by the desired ratio.

CALIBRATION AND MAINTENANCE OF LUDLUM MODEL 12S MICRO R METER

Description

The Ludlum Model 12S Micro R Meter utilizes an internally mounted 1" x 1" NaI scintillator for counting low level gamma radiation.

Range Multiplier Selector Switch is a 6-position switch marked OFF, BAT, X1000, X100, X10, X1. Turning the range selector switch from OFF to BAT position provides the operator with a battery check of the instrument. A BAT check scale on the meter provides a visual means of checking the battery-charge status. Moving the range selector switch to one of the range multiplier positions (X1000, X100, X10, X1) provides the operator with an overall range of 0 to 3000 Micro R/hr. Multiply the scale reading by the multiplier for determining the actual scale reading.

AUDIO ON-OFF Toggle Switch in the ON position operates the unimorph speaker, located on the left side of the instrument. The frequency of the clicks is relative to the rate of the incoming pulses. The higher the rate, the higher the audio frequency. The audio should be turned OFF when not required to reduce battery drain.

Fast-Slow Toggle Switch provides meter response selection. Selecting the "F" position of the toggle switch provides 90% of the final meter reading in 4 seconds. In "S" position, 90% of the final meter reading takes 22 seconds. Set on "F" for fast response and larger meter deviation. "S" position should be used for slow response and damped meter deviation.

RES Button, when depressed, provides a rapid means to drive the meter to zero.

Range Calibration Adjustments are recessed potentiometers located under the calibration cover on the right side of the front panel. These adjustment controls allow individual calibration for each range multiplier.

DIS Adjustment allows the input sensitivity to be adjusted from 30 to 100 millivolts. The gain is normally set for 40 millivolts at the factory.

Operating Procedures

- Install two "D" size batteries
- Switch range to BAT. Meter should deflect to the battery check portion of the scale.
- Turn instrument range switch to X1000. Expose detector to check source.
- Check calibration.
- Depress RES switch. Meter should zero.

Calibration

The meter should be calibrated annually by either the manufacturer or by a calibration facility.

Calibration controls are located on the front of the instrument under the calibration cover. The controls may be adjusted with an 1/8-inch blade screwdriver.

The high voltage should be set at the minimum value. Connect pulses (negative 40 millivolt pulse) to meter. Set gain for 40 millivolt sensitivity.

NOTE: Measure High Voltage with a Model 500 Pulser or a High Impedance voltmeter with a high meg probe. If one of these instruments is not available, use a voltmeter with a minimum of

1000 megohm input resistance.

A. CPM Calibration

- Provide 360,000 counts per minute (CPM) with meter set on X1000 scale.
- Calibrate meter to read 2 micro R/hr.
- Decrease counts by factors of 10; calibrate X100, X10, and X1 scales to read 2 micro R/hr.
- Turn up high voltage in 50 volt increments.
- Plot HV vs. count rate until detector voltage rating is reached.
- Expose detector to Am-241 source and repeat above procedure.
- Compare both sets of data; select operating voltage to correspond with maximum source count and minimum background count.

B. Cesium Calibration

- Set instrument to X1000 scale.
- Expose to Cs-137 source at 2 Micro R/hr point.
- Adjust calibration pot so that meter reads 2000 Micro R /hr.
- Repeat for each scale at 200, 20 and 2 Micro R/hr.

Maintenance

NEVER STORE THE INSTRUMENT OVER 30 DAYS WITHOUT REMOVING THE BATTERIES. ALTHOUGH THIS INSTRUMENT WILL OPERATE AT VERY HIGH AMBIENT TEMPERATURES, BATTERY SEAL FAILURE CAN OCCUR AT TEMPERATURES AS LOW AS 100 °F. NEGLECTED BATTERY SEAL FAILURE WILL SURELY CAUSE ONE AWFUL MESS.

Instrument maintenance consists of keeping the instrument clean and periodically checking the batteries and calibration.

At three month intervals, the batteries should be removed and the battery contacts cleaned of any corrosion. If the instrument has been exposed to a very dusty or corrosive atmosphere, more frequent battery servicing should be used.

Use a spanner wrench to unscrew the battery contact insulators, exposing the internal contacts and the battery springs. Removing the handle will facilitate access to these contacts.

CALIBRATION AND MAINTENANCE OF TURBIDIMETER

Accuracy

A Hach Model 16800 Portable Turbidimeter will be used for all turbidity measurement. The Hach 16800 will be operated in the range of 0 to 100 nephelometric turbidity units (NTU). A nickel/cadmium battery with approximately ten hours operating time per charge built into the 16800 meter. Readings are repeatable to within $\pm 1\%$ of full scale.

Calibration and Operation

To ensure consistently accurate results, perform standardization before each set of tests.

1. Turn the instrument off and check the mechanical zero setting. Adjust the screwdriver adjustment control on the meter face if necessary to obtain a zero-NTU reading.
2. Press the power switch to ON and perform a battery check by pressing the BATT CHECK switch and verifying that the meter indicates in the BATTERY CHECK area. If not, charge the battery pack.
3. Place the focusing template into the cell holder. The focusing template will block all light from reaching the detector and allow the instrument to be zeroed electronically in Steps 4 and 5.
4. Press the 1.0 range switch and adjust the ZERO control for a reading of zero NTU.

5. Press the 10 range switch and verify that the meter still indicates zero NTU. Readjust the ZERO control if necessary.
6. Remove the focusing template and the 90-NTU turbidity standard into the cell holder. Use the black dot on the standard vial to orient the vessel in the same position each time, thereby eliminating variations due to rotation.
7. Place the light shield over the turbidity standard and allow the meter to stabilize.
8. Adjust the SPAN control for a reading of 90 NTU. Remove the light shield and turbidity standard. The instrument is now ready for use.

Taking the Turbidity Measurement

1. Press the appropriate range switch. Select the range that will exceed the expected turbidity of the sample under test.
2. Place the focusing template into the cell holder and adjust the ZERO control for a reading of zero NTU. Remove the focusing template. In the 100 range, place the cell riser into the cell holder before inserting the test sample.
3. Fill a clean sample cell to the white line with the sample to be measured and placed it into the cell holder. Use the white dot on the sample cell to orient the cell in the same position each time. Cover the sample cell with the light shield and allow the meter to stabilize. Read the turbidity of the sample.

Operational Notes

1. The sample size for all turbidity measurements should be 18 ml. Use the line on the sample cell as a level indicator. Variations in sample volume can affect the accuracy of the determinations.
2. When operating the instrument under bright ambient light conditions, protect the detector between measurements by inserting the focusing template or covering the cell holder with the light shield.

Maintenance

1. The battery pack will be recharged overnight subsequent to its use in the field.
2. Broken or highly scratched sample cells will be replaced. Small, slight scratches may be covered with a light coat of silicone oil. Cells with a build up of matter which cannot be removed will be discarded.

3. Lamp and focusing adjustments are not considered routine maintenance and will be performed only when the instrument readings are suspect.

Data Validation

All instrument calibrations will be documented, indicating the meter readings before and after the meter has been adjusted.

CALIBRATION AND MAINTENANCE OF THE ORION SA 250 pH METER

Accuracy

An Orion SA 250 pH meter will be used for on-site pH and temperature measurement. The SA 250 meter will be equipped with a suitable combination pH electrode and automatic temperature compensation (ATC) probe. Temperature differential between the pH buffer standards and samples is automatically compensated for by the meter. The SA 250 meter has resolution capability to 0.1 or 0.01 standard pH units. Department of Transportation and Mil specifications have been met or exceeded for shock, vibration and moisture.

Check Out Procedure and Calibration

Prior to initial daily use, the SA 250 meter will be checked according to the following procedure.

Meter Check Out Procedure

1. Slide power switch to ON position. Attach BNC Shorting Plug to BNC connector on top of meter. Refer to Figure B-6.1.
2. If LO BAT indicator on LCD remains on, the battery must be replaced.
3. Slide mode switch to mV. Display should read 0 + 0.3.

4. Slide mode switch to temp. Display should read 25.0. If 25.0 is not displayed, using , , and X10 keys, until 25.0 is displayed and press enter.
5. Slide mode switch to pH .01. Press iso. Display should read the letters ISO then a value of 7.00. If 7.00 is not displayed, scroll until 7.00 is displayed and press enter.
6. Press slope. Display should read the letters SLP then a value of 100.0. If 100.0 is not displayed, scroll until 100.0 is displayed and press enter.
7. Press sample. Observe the letters pH then a steady reading of 7.00 + 0.02 should be obtained. If not, press cal and scroll until 7.00 is displayed and press enter. Press sample and observe a reading of 7.00.
8. Remove the shorting plug. After a successful completion of steps 1-8 the meter is ready to use with an electrode.

Electrode Connections

1. Attach electrodes with BNC connectors to sensor input by sliding connector onto input, pushing down and turning clockwise to lock into position. Connect reference electrodes with pin tip connectors by pushing connector straight into reference input.

NOTE: If using a combination electrode with a BNC connector, the reference pin-tip jack is not used.

Calibration

Calibration of the SA 250 meter will be performed using two standard buffer solutions of pH = 7.00 s.u. and pH = 4.01 s.u. Buffer solutions are standardized at 28 degrees Celsius against National Bureau of Standards certified pH = 6.88 and pH = 9.18 reference samples prior to measuring the pH of any sample. The following procedure used for calibrations:

1. Connect electrode(s) to meter. Slide the mode switch to pH.1 4.01.
2. Place electrode(s) into pH₂ 7.00 buffer.
3. Press cal. The display will alternate between .1. and the pH value of the buffer, indicating this is the first buffer and a value has not been entered. Wait for a stable pH display and press enter. The correct display will freeze

for 3 seconds then advance to .2. indicating the meter is ready for the second buffer.

4. Rinse electrode(s) and place into pH = 4.01 buffer. Wait for a stable pH display and press enter .

After the second buffer value has been entered the letters PH will be displayed. The meter is now calibrated and automatically advances to sample mode.

5. Rinse electrode(s), place into sample. Record pH directly from the meter's display.

The use of the ATC probe eliminate the need for temperature calibration.

Maintenance

1. When not in use or between measurements, the pH probe will be kept immersed in or moist with pH = 7.000 buffer solution.
2. The battery will be placed when the "LO BAT" indicator remains on during the instrument check out.
3. The pH electrode will be replaced whenever the probe is cracked or irremovable deposits build up on the junction.
4. If response time or stability problems develop and cannot be corrected the meter will be sent to the manufacturer for maintenance.

Data Validation

All instrument calibrations will be documented, indicating the meter readings before and after the meter has been adjusted. The pH buffers used to calibrate the meter will also be documented. This is important, not only for data validation, but also to establish maintenance schedules and component replacement.

CALIBRATION AND MAINTENANCE OF ORION PLATINUM Eh ELECTRODE

Accuracy

An Orion platinum Eh electrode and the Orion SA 250 PH meter will be used for on-site oxidation-reduction potential (redox) measurement. The SA 250 meter has resolution capability to 1 mV. Refer to previous section for the calibration and maintenance of the SA 250.

Check Out Procedure and Calibration

Checking the electrode is necessary only when there is evidence of malfunction that cannot be traced to other causes. Fill the electrode with ORION Cat. No. 900011 filling solution for checking procedure.

1. Prepare solution A (0.1 M potassium ferrocyanide and 0.05 M potassium ferricyanide): weigh out 4.22 g reagent-grade $K_4Fe(CN)_6 \cdot 3H_2O$ and 1.65 g reagent-grade $K_3Fe(CN)_6$. Place in a 100 ml volumetric flask. Add about 50 ml distilled water and swirl to dissolve solids. Dilute to volume with distilled water.
2. Prepare solution B (0.01 M potassium ferrocyanide, 0.05 M potassium ferricyanide, and 0.36 M potassium fluoride): weigh out 0.42 g reagent-grade $K_4Fe(CN)_6$, 1.65 g reagent-grade $K_3Fe(CN)_6$, and 3.39 g reagent-grade $KF \cdot 2 H_2O$. Place in a 100 ml volumetric flask. Add 50 ml distilled water and swirl to dissolve solids. Dilute to volume with distilled water.
3. Transfer solution A to a 150 ml beaker. Place electrode in the solution and wait until the reading stabilizes. The potential

should be about 234 mV.

4. Rinse electrode and repeat the measurement with solution B. The potential should be about 66 mV greater in solution B than in solution A.

Maintenance

1. When not in use the electrode may be kept in water or air. If left in air, remove salt crystals on the outside of the electrode sleeve by rinsing with distilled water, drain filling solution from chamber, flush out with distilled water, store dry. See cleaning procedure.
2. The electrode can be routinely cleaned without disassembling. To remove precipitate that forms on the outside wall or tip of the electrode, rinse with distilled water. If sample or precipitate clogs the space between the electrode sleeve and the inner cone, clean the chamber by flushing out the filling solution. To do this, invert the electrode to moisten the O-ring. Holding the electrode by the cap with one hand, push the outer sleeve up into the cap with the other hand, allowing filling solution to drain from the chamber. If the chamber is not completely clean, repeat. Fill with filling solution.
3. To remove salt deposits formed inside the electrode:
 - Fill wash bottle to half with distilled water.
 - Invert electrode so that glass membrane points up.
 - Invert the wash bottle so that its bottom points up.
 - Insert nozzle of wash bottle into electrode filling hole and squeeze bottle. Filling solution will drain out of chamber.
 - Fill chamber with distilled water from wash bottle.Repeat steps 2-4.

- Continue to repeat steps 2-5 until all salts have been removed.
4. To change the filling solution in the reference chamber, simply clean the electrode and fill with the new solution, using the following procedure:
- Tip the electrode to moisten the O-ring. Holding the electrode by the cap with one hand, push the sleeve up into the cap with the other hand allowing solution to drain from the chamber.
 - Fill the electrode with distilled water and then drain the reference chamber by retracting the sleeve, as explained above. Now perform this filling and draining procedure twice with the new filling solution.
 - Fill the electrode with the new solution. Although the electrode is ready for use, readings may drift slightly for about a half hour while the electrode equilibrates with the new solution.

Data Validation

All instrument calibrations will be documented, indicating the meter readings before and after the meter has been adjusted. The electrode filling solutions used to calibrate the meter will also be documented. This is important, not only for data validation, but also to establish maintenance schedules and component replacement.

CALIBRATION AND MAINTENANCE OF SPECIFIC CONDUCTANCE METER

Accuracy

The calibrated accuracy of the specific-conductance meter (YSI, Inc. Model 33 S-C-T Meter) ± 4.5 percent; this represents the worst-case error resulting from errors in the instrument and probe combined. Instrument error alone ranges from ± 2.5 to $\pm 3.0\%$.

Calibration

The specific-conductance meter will be calibrated by turning the MODE control to REDLINE and adjusting the REDLINE control so the meter needle lines up with the redline on the meter face. If this cannot be accomplished, the batteries must be replaced. Recalibration should be done at the factory.

Maintenance

The only maintenance required is battery replacement. Two "D" size alkaline flashlight cells, such as Eveready E95 or equivalent, will provide 200 hours of operation. Accuracy will not be maintained if zinc-carbon "D" cells are used. Battery replacement is indicated when the redline adjustment cannot be accomplished.

Replace batteries every six months to reduce the danger of corrosion due to leaky batteries. To replace batteries, remove the screws from the rear cover. The batter holders are color coded. The positive end must contact the red holder.

Data Validation

All instrument calibrations will be documented, indicating the meter readings before and after the meter has been adjusted. This is important, not only for data validation, but also to establish maintenance schedules and component replacement.

CALIBRATION AND MAINTENANCE OF GLASS-MERCURY THERMOMETER

To check the glass-mercury thermometer, both the thermometer and the YSI temperature probe should be immersed into the same beaker of water. Any differences in temperature should be noted and recorded in the field log. The thermometer should be kept clean and protected from breakage in a hard tube or case.

CALIBRATION AND MAINTENANCE OF DISSOLVED OXYGEN METER

Accuracy

The calibrated accuracy of the dissolved oxygen meter (YSI Model 51B Dissolved Oxygen Meter) will be better than ± 0.2 mg/l when calibrated within $\pm 5^\circ\text{C}$ of actual sample temperature. Temperature which can also be measured with this instrument, has an accuracy of $\pm 0.7^\circ\text{C}$ over the full scale temperature range of -5°C to $+45^\circ\text{C}$.

Calibration

- 1) Switch instrument to OFF and adjust meter mechanical zero.
- 2) Switch to ZERO and adjust to "O" on mg/l scale.
- 3) Switch to FULL SCALE and adjust to "15" on mg/l scale.
- 4) Prepare probe for operation, plug into instrument, wait up to 15 minutes for probe to stabilize. Probe can be located in calibration chamber or ambient air.
- 5) Switch to CALIB O₂ and adjust CALIB control until meter indicates local altitude on short scale in upper right corner of meter.

NOTE: It is desirable to calibrate probe in a high humidity environment. See instruction manual for more detail on calibration and other instrument and probe characteristics.

Maintenance

- 1) When not in use or between measurements, keep the dissolved oxygen probe immersed in or moist with deionized water.
- 2) Replace batteries after 1000 hours of operating or if full scale adjustment cannot be made. Use Eveready 935 "C" size or equal.
- 3) Membranes will last indefinitely depending on use. Average replacement is 2-4 weeks. Probe should be stored in humid environment to prevent drying out.
- 4) Calibrate daily.

Data Validation

All instrument calibrations will be documented, indicating the meter readings before and after the meter has been adjusted. Each preparation of probe and method of calibration will also be documented. This is important, not only for data validation, but also to establish maintenance schedules and component replacement.

CALIBRATION AND MAINTENANCE OF THE IN-SITU HERMIT ENVIRONMENTAL DATA LOGGER

Description

An In-Situ HERMIT Environmental Data Logger, Model SE1000B or equivalent, will be used on site in conjunction with an In-situ pressure transducer (PXD-260, PTX-160D or PTX-161D), to record water level changes during pump testing.

The front panel controls of the HERMIT consist of a five digit liquid crystal display and an eight key keypad. The keys are divided into two groups: the white keys for basic operations and the blue keys for data entry and modification. Basic operations include CLOCK, XD (short for transducer) and DATA; each of which can be accessed with a single keystroke. Data modifying operations such as START, STOP and changing test parameters require a sequence of keystrokes to prevent their accidental use.

Maintenance

There are no customer serviceable parts inside the SE1000B. The unit should require no calibration or periodic maintenance during its service life. It should not be necessary to clean the connectors or cable contacts. The action of installing the cables is normally sufficient to clean contamination from the contacts. The front panel may be wiped clean with a soft, damp cloth.

Battery Replacement

The battery pack used in the SE1000B is of special design, requiring that the unit be returned to In-situ's customer service facility for replacement. Permanent damage to the unit can result from improper replacement packs and procedures. When the low battery indicator appears in the display, the unit has approximately ten hours of "wake" time left. External power may be used to supplement battery power until the unit can be returned for a replacement pack.

Service

The SE1000B may need to be returned for service if any of the following symptoms appear:

1. A display of the form "Err.20" indicates that the unit does not pass its internal self tests. The unit will not permit itself to be used for data collection, and data already stored in the unit are inaccessible (upon waking up, the unit will display the error and immediately go back to sleep).
2. An unusually high number of watchdog counts may indicate an intermittent problem. The unit may be used for data collection but should be returned for a checkup as soon as possible.
3. A low battery indication in the display. The unit can probably finish the current test and dump the data. Long term tests should not be started when the unit is in this condition.

If symptoms other than these are apparent, check the cable interconnections and the programming of the SE1000B before requesting service on the unit. One incorrect scale factor or coefficient setting can cause data to appear way off.

CALIBRATION AND MAINTENANCE OF THE SOLINST INTERFACE METER

General Operation

The Solinst Model 121 Interface Meter works with an infra-red circuit that detects the presence of a liquid. A conductivity circuit differentiates between conductive liquid (water) and non-conductive liquid (LNAPL or DNAPL product).

Before commencing any measurements, carry out the following electronics and battery condition checks.

1. Turn the main switch on (Main switch is a toggle switch on reel faceplate). The steady tone and two lights will be activated (as long as the probe switch is off, but the main switch is on).
2. Remove the probe from the holder and turn the probe switch on (Probe switch is the knurled ring at the top of the probe). Steady tone and two lights activate.
3. The infra-red circuit is checked by inserting the cleaning brush into the base of the probe until it reaches the zero measurement point (The zero measurement point is the junction between the stainless steel body of the probe and the brown Teflon/Delrin base plug). This cuts the infra-red beam causing the steady tone and two lights to activate.
4. The conductivity circuit is checked by inserting the probe into normal tap water, as far as the measurement zero point. This causes a single light and intermittent tone to activate.

General Operation

After each use, the tape should be wiped clean and carefully rewound onto the reel. The probe should be cleaned as follows:

1. Wash probe thoroughly withalconox detergent;
2. Use a cleaning brush through the side and base holes to remove all product from the inner part of the probe;

3. Use steel wool to scrub the bottom pin;
4. Rinse the probe thoroughly with distilled water and wipe dry; and
5. Return the probe to the holder, ensuring that both switches are turned off.

- NOTES:**
- Battery will drain rapidly if probe is left on
 - Do not drop probe; damage to probe tip may result
 - O-ring seals may be affected by the use of cleaning fluids other than detergent and water.

To replace batter inside reel:

1. Remove three screws in faceplate and carefully lift to one side to prevent damage to wiring.
2. Replace with specified battery, noting proper polarity.
3. Replace faceplate and three screws, being careful to keep all wires within the hub.

To replace probe battery:

1. Remove three screws (Phillips type) at top of probe.
2. Gently pull body apart to expose the battery holder.
3. Remove and replace battery with type specified.
4. Ensure correct polarity.
5. Check O-rings for damage and replace if necessary.
6. Lubricate O-rings lightly with non-petroleum based lubricant prior to reassembly and push probe body back together ensuring that the three wire connector is placed below the battery in the slot provided prior to reassembly of the probe.
7. Replace Phillips screws but do not over-tighten.

WARNING: LOW BATTERY IN PROBE CAN RESULT IN WATER LIGHT STAYING "ON"

NOTE: ALWAYS REPLACE BOTH BATTERIES AT THE SAME TIME.

APPENDIX C

SAMPLE MANAGEMENT
SAMPLE PRESERVATION

1.0 OBJECTIVE

The objective of these guidelines is to provide general reference information on sample management procedures.

2.0 LIMITATIONS

These limitations apply to all sample management procedures excepting requirements of project-specific sample management plans.

3.0 DEFINITIONS

Contract Laboratory Program (CLP). All samples collected will be analyzed at an approved laboratory within the EPA CLP. The EPA CLP was developed to retain laboratory services that will ensure that all environmental samples collected under the Superfund Program will be analyzed in accordance with recognized EPA laboratory methods and QA/QC procedures.

Target Compound List (TCL). It is a list of chemical substances consisting of 126 organic compounds, 23 metallic elements, and cyanide. The list is broken into four subdivisions: volatiles, semivolatiles, pesticide/PCBs, and total metals and cyanide.

Routine Analytical Services (RAS). Laboratory analysis for substances or parameters shown on the TCL in addition to the analysis for 2,3,7,8-TCDD dioxin, in solid and aqueous samples.

Special Analytical Services (SAS). Laboratory analysis for substances or parameters not shown on the TCL (with the exception of dioxin) and high-concentration samples. Analysis of non-soil/sediment, nonaqueous matrices, and analysis of RAS compounds using non-RAS protocols.

Trip Blanks. Trip blanks are used to check for sample contamination originating from sample transport, shipping, and from site conditions. Trip blanks are necessary when aqueous samples and rinsate blanks are collected for volatile organic analysis.

Rinsate Blanks. Rinsate blanks are used to check sampling equipment decontamination. Rinsates are collected for each type of sampling equipment used on site. Demonstrated analyte-free water is poured over the equipment and collected into containers and analyzed for the analytes of concern.

Environmental Duplicate. These are two separate samples collected at the same sampling point. Environmental duplicates are used to determine field sampling precision and are collected at a frequency of at least 5 percent per matrix.

Matrix Spike/Matrix Spike Duplicates (MS/MSD). The process by which standard mixes of various TCL compounds are added to environmental samples prior to extraction/digestion. The sample is split into duplicates and analyzed. The analysis is used to evaluate the matrix effect of the sample upon the analytical methodology. Volume for MS/MSD analysis is collected at a frequency of at least 5 percent per matrix/concentration.

Low-Concentration Sample. Samples in which a compound may be present at concentration levels less than 10.0 ppm.

Medium-Concentration Sample. Samples in which a compound may be present at concentration levels equal to or greater than 10.0 ppm to as much as 15 percent (150,000 ppm) of the total sample.

High-Concentration Sample. Samples in which a compound may be present at concentration levels greater than 15 percent (150,000 ppm) of the total sample.

4.0 GUIDELINES

The purpose of sample management is to assume that all samples collected during a hazardous waste site investigation sampling episode will be accounted for when the project is completed. The purpose is achieved by adhering to the following procedures that outline a generic method of sample management.

Request for Analytical Services

In anticipation of a sampling episode, RAS requests are to be made using a CLP Data Management Request Sheet, or contact the Malcolm Pirnie, Inc., Regional Sample Control center (MPI-RSCC) Coordinator by 11 am the Tuesday prior to the week of the scheduled sampling event, unless otherwise indicated by MPI-RSCC Coordinator.

Note: SAS requests require a minimum of 4 weeks advance notice to obtain laboratory space. Be sure to contact MPI-RSCC Coordinator as soon as you suspect special sampling requirements for your site, so the proper procedure can be determined. (A minimum of 8 weeks notice is requested.)

RAS Sampling Requests

RAS sampling requests include low- and medium-concentration aqueous and soil/sediment samples for TCL analysis (including cyanide). RAS requests also include dioxin analysis in aqueous and soil/sediment samples.

The laboratories within the CLP are under contract to deliver data based on the latest date of sample receipt in each sample group. Approved RAS requests are issued a case number. Unique case numbers are issued for each sampling project occurring at one site over a specific scheduled time period.

SAS Sampling Requests

SAS sampling requests include the following:

- o High-concentration aqueous and soil/sediment samples for analysis of both TCL and non-TCL parameters.
- o Low- and medium-concentration aqueous and soil/sediment samples for analysis of non-TCL parameters.

In most cases, SAS requests will be made in addition to RAS requests (RAS plus SAS). Additional SAS services may include:

- o Lower detection limits for one or more of the TCL pollutants
- o Additional non-TCL compounds
- o Special sample preparation procedures
- o Inorganic parameters including nitrates, sulfates, ammonia, sulfides, and chlorides
- o Sample filtration procedures for inorganic analysis
- o Fast turnaround of less than 30 days for analysis of TCL parameters
- o Sample homogenization procedures for inorganic analysis
- o Less than 1 ppb detection limit for dioxin (TCDD)

Examples of SAS only requests are as follows:

- o High-concentration samples
- o Analysis for non-RAS (TCL) parameters only, with the exception of dioxin in soil and water
- o Analysis for nonaqueous or non-soil/sediment samples
- o Analysis based on non-RAS methods
- o Analysis of any special matrix sample (air, biota, wipes)
- o Analysis of TCDD by high resolution GC/HRMS or GC/MS/MS
- o Analysis of TCDF (furans)

- o Analysis of TCDD in fish tissue and/or water

Attachment A contains examples of RAS and SAS request forms.

Sample Preparation

Prior to commencement of a sampling episode the proper containers, labels, preservation techniques, and blanks must be prepared. The types of samples to be collected will be the basis for determining the method of sample preparation.

All sample containers must be cleaned and prepared in accordance with OSWER Directive #9240.0-05, "Specifications and Guidance for obtaining Contaminant Free Sample Containers."

Sample Containers

Malcolm Pirnie will purchase certified clean, approved sample containers from an approved supplier. Malcolm Pirnie will label and prepare all bottles and add preservatives at the time of sampling, where necessary. Copies of certifications will be kept in site files and brought to the site while sampling.

Each bottle used to collect a sample must be identified by supplier and lot number to ensure that it is permanently associated with the sample collected in that particular container. This procedure also applies to containers used for quality control blanks such as trip and rinsate blanks, as well as the containers used to carry demonstrated analyte-free water to be used for blank preparation. This is to ensure that for all samples collected, the specific sample bottles used can be traced to the sample container contractor QC and custody records applicable to their identifying lot numbers.

Attachment A lists the sample container requirements for all levels of organic and inorganic sample collections.

Sample Preservation

Sample preservation is required for low-concentration samples. Sample preservation for RAS dioxin aqueous and soil/sediment samples requires that the samples be kept out of direct sunlight. Sample preservation is not required for medium- and high-concentration aqueous and soil/sediment samples. The following sample preservation measures are required for low-concentration samples:

- o Low-concentration aqueous organic samples:
 - Base/neutral/acid (BNA) extractables and pesticides/PCB samples must be cooled to 4°C. Ice must be placed in double zip-lock bags to prevent leakage. The ice bags should be placed by the neck and along the sides of the sample containers.

-
- Volatile organic samples must be preserved with 6 Molar hydrochloric acid (6 M HCl) to pH ≤ 2 . The samples must be cooled to 4°C and air bubbles must not be present in the vials. Hydrochloric acid is dispensed from a disposable glass pipet into the vials. The amount of 6 M HCl to be added to the vials, prior to sample collection, is first determined on a separate volume of sample in a test vial.
 - o Low-concentration aqueous inorganic samples:
 - Total metal samples are preserved with nitric acid (HNO₃) to a pH <2. Nitric acid solution is dispensed from 5-milliliter ampules. Indicator paper sensitive to pH 2 should be used to determine whether enough HNO₃ has been added to the sample to attain the desired pH. In most cases, one 5-mL ampule containing 2 to 3 mLs of HNO₃ per sample will be sufficient.

The indicator paper must not be dipped into the sample container. Instead, pour a few drops of sample onto the paper and let the excess sample volume fall into a 1 liter widemouth polyethylene bottle or another designated container. The excess sample volume will be discarded with the wastewater at the end of the day. The container should be rinsed out and disposed of with dry wastes. The samples must be cooled to 4°C.
 - Cyanide samples are preserved with sodium hydroxide (NaOH) following tests for the presence of oxidizing agents and sulfides (S²⁻) with appropriate test papers. The samples are preserved with approximately 2 mls of sodium hydroxide solution to a pH >12. The samples must be cooled to 4°C.
 - o Low-concentration soil/sediment organic samples:
 - There are no preservation requirements; however, it is required to pack with ice in order for samples to cool to 4°C.
 - o Low-concentration soil/sediment inorganic samples:
 - It is optional to pack with ice and cool total metal samples to 4°C.
 - Cyanide samples must be iced and cooled to 4°C.

Trip Blanks

Trip Blanks for a sampling episode will be prepared in the following manner:

- o One trip blank is required for each day that aqueous environmental samples are collected for volatile analysis.

-
- o Trip blanks are only necessary for aqueous environmental samples. If rinsates are the only aqueous samples collected, then a trip blank is not necessary.
 - o Trip blanks consist of two 40 mL septum vials into which 4-5 drops of 6M hydrochloric acid (HCl) is introduced prior to filling them with demonstrated analyte-free water.
 - o Trip blanks are prepared in, and carried to, the field where aqueous sampling occurs.
 - o Trip blanks are treated as separate aqueous samples and the appropriate paperwork must be completed. The trip blank is described as No. 3 "Leachate" in Column A of the organic traffic report, and the words "trip blank" must appear in Column D under special handling. (Attachment A - Organic Trip Report)
 - o The trip blank must be stored away from solvents and must be preserved, packaged, cooled to 4°C and shipped to the laboratory with the other aqueous samples.

Rinsate Blanks

- o Rinsate blanks should be collected for each type of equipment used each day a decontamination event is carried out. It is permissible to use the same aliquot of water on all equipment associated to a particular matrix for analysis of semi-volatile organics, pesticides, PCBs and inorganics. The rinse must be performed sequentially on all sampling equipment. However, a separate field rinse blank must be collected for each piece of equipment associated to a particular sample matrix which will be analyzed for volatile organics.
- o Rinsate blanks consist of pouring demonstrated analyte-free water over clean equipment and collecting it into sample containers to be analyzed for the analytes of concern.
- o For full TCL/TAL analysis the rinsate will have the same volume as a low concentration aqueous environmental sample and the sample containers are filled in the following order: VOA vials, BNA/Pest./PCB bottles, total metals and Cyanide (if applicable).
- o The rinsate blank is described as No. 3 "Leachate" in Column A of the organic and inorganic traffic report and "rinsate" in Column D under Special Handling. The type of equipment that is rinsed is written in Column D on both the organic and inorganic traffic reports. (Attachment A - Inorganic Traffic Report)
- o Rinsate blanks are preserved, packaged, and shipped in the same manner as low concentration aqueous environmental samples.

- o Environmental duplicates and matrix spike/matrix spike duplicates (see below) are quality control samples taken in the field for each sample group.

The sample group is defined as one of the following whichever occurs more frequently:

- o Each case of field samples received
- o Each 20 samples within a case
- o Each 14-calendar-day period during which field samples within a case are received, beginning with receipt of the first sample in the sample case group.

Environmental Duplicates

- o Samples for duplicate analysis are collected for each matrix sampled at a frequency of at least 1 in 20 samples per matrix.
- o Sufficient quantity of matrix must be collected from the same sample location to fill a duplicate set of sample containers. The duplicate volume is shipped to the laboratory under a separate CLP sample number.
- o For aqueous environmental samples the volatile organic fraction is collected first, then the fraction for extractable organic analysis, followed by the fraction for inorganic analysis of the environmental sample. Next the extractable organics then the inorganic fraction of the environmental duplicate is collected.
- o For soil/sediment samples the volatile organic fraction is collected as colocated grab samples. The nonvolatile fraction is collected into a stainless steel bowl and mixed prior to collecting the fraction for extractable organic analysis and then the fraction for inorganic analysis. Separate bowls should be used to collect the environmental sample and the environmental duplicate.
- o The collected volumes are divided, preserved, packaged and shipped to the lab as separate samples for analysis.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) & Matrix Spike/Matrix Duplicate (MS/MD)

- o The designation of a sample for MS/MSD analysis for organics and MS/MD analysis for inorganics is required for 1 in 20 environmental samples per concentration/matrix.
- o Additional volume must be collected from the same sample location and shipped to the lab using the same CLP numbers.
- o Three times the total volume is necessary for collection of aqueous MS/MSD samples. Two times the total volume is necessary for collection of aqueous MS/MD

samples. The sample containers are filled in the following order: VOA vials, BNA/Pest./PCB bottles, total metals and Cyanide (if applicable).

- o The MS/MSD samples are noted on the organic traffic reports.
- o The MS/MD samples are noted on the inorganic traffic reports.

Custody Procedures

Prior to completion of a sampling episode the care and custody of the samples must be performed. Procedures for the packaging and shipping of samples and the documentation generated during that process is outlined in the following section.

Packaging and Shipping Samples

- o Decontaminate and towel dry the outside of the sample container (Alconox and tap water rinse). Make sure the caps are tightly sealed prior to decontamination.
- o Apply custody seal (signed and dated) (Attachment A) to container and cap. Septum vials should not be covered over the top. Apply seals around the circumference of the vial.
- o Tape the container and cap using masking tape. Again, do not cover septums.
- o Attach the sample tags to each sample (Attachment A).
- o Place the containers in ziplock bags. The two 40 ml vials may be placed in one bag with extra air space eliminated.
- o Segregate organic and inorganic fractions of samples. Put 1-2 inches of vermiculite in the bottom of the coolers. 1-10 samples may be written on each Traffic Report/Chain of Custody (TR/COC). A minimum of one form is necessary for each cooler of samples. Do not split samples, other than separating organic and inorganic fraction, into separate coolers.
- o When enough samples have been collected to fill a cooler, prepare the TR/COC. Many times these forms can be partially completed in the office. If more than one TR/COC form per cooler is necessary than number them 1 of 2, 2 of 2 etc. However, each TR/COC must only represent samples collected on one date.
- o Each cooler requires one address label on the outside. Tape label to top of cooler lid using clear tape. Leave room on one cooler for the Federal Express Airbill/Window for the shipment of coolers to each lab.
- o Place the last two copies of the TR/COC's in the cooler in a ziplock bag, these copies do not have the site name on them, and tape it to the inside lid of the cooler.

Retain the remaining paperwork and send to the MPI-RSCC Coordinator. The site manager must attempt to complete the Receipt for Samples (Attachment F) and have the site representative sign it.

- o When all paper work is filled out and the samples packed in their respective coolers, recheck documentation with the site manager. Fill the cooler with vermiculite and secure the containers from movement within the coolers.
- o Apply custody seals to the cooler. Place two custody seals diagonally across from each other where the cooler lid meets the cooler on both the hinged and unhinged sides. Then apply two or more layers of fiberglass strapping tape around the cooler over the custody seals.
- o Place arrow labels marking "this end up" on opposite sides of the cooler.
- o Fill out RAS/SAS Sample Call-In Form (Attachment A). Call shipping information to the MPI-RSCC Coordinator (609-860-0100), by 4:30 pm or by 9:00 am the following morning and also call shipping information directly to RSCC Viar & Co. at (703) 519-1442 (RAS) or (703) 519-1459 (SAS).
- o Send all remaining paperwork to MPI-RSCC Coordinator for proper distribution.
- o All samples will be shipped by overnight carrier within 24 hours of sample collection.

Documentation

During field activities and prior to completion of the following documentation, field logbooks must be generated. During the sampling episode all duties and activities of concern must be entered into a logbook.

All logbook entries must be dated, legible, and initialed and contain accurate and inclusive documentation of an individual's project activities. Because the logbook forms the basis for the later written reports, it must contain only facts and observations. Language should be objective, factual, and free of personal feelings or other terminology which might prove inappropriate. Entries made by individuals other than the person to whom the logbook was assigned are dated and signed by the individual making the entry. Individuals must sign each logbook assigned to them.

Any information obtained during the sampling episode will then be expressed in the following documents.

Traffic Reports/Chain-of-Custody

The Sample Management Office provides preprinted traffic reports to track the shipment of samples through the CLP. For RAS, multisample traffic reports (TRs) are used.

Multisample TRs reference CLP analytical fractions, not sample containers and volumes, and may be used to document the shipment of 1 to 20 samples under one case number.

RAS CLP sample types are defined by the following analytical programs:

- o Inorganic analysis - Total Metals, Cyanide, or both
- o Organic analysis - Volatile Organics (VOA), Base/Neutral/Acid Extractables (BNAs), Pesticide/PCBs, or any combination of these
- o VOA only - Volatile organics analysis - fast turnaround - 14 days

A CLP sample is collected from one matrix and consists of all the sample volume required for analysis under one RAS analytical program from the sample location. For example, a surface water sample to be analyzed for full TCL parameters would represent two CLP samples - one aqueous sample to be analyzed under the inorganic program (total metals, cyanide, or both), and one aqueous sample to be analyzed under the organic program (volatile organics, BNAs, and pesticides/PCBs).

Unique sample numbers are assigned for each CLP sample. The sample numbers are provided on adhesive labels. The type of analysis is printed on most of these labels. The appropriate label must be applied to the correct container.

Sample numbers for inorganic analysis for Region 2 are in the format MBX 123 and have seven labels per strip: two for total metals, two for cyanide, and three extra.

Organic sample numbers are in the format BX 123 and have ten labels per strip: four for extractables (BNAs, Pesticide/PCBs), two for VOAs, and four blank labels. One sample number must be used for water samples, and another sample number must be used for soil samples; the same sample number must never apply to both types of samples. Unused portions of labels must be destroyed and not reused.

Chain-of-Custody

Custody of a sample is defined by the following:

- o It is in your possession, or
- o It is in your view, after being in your possession, or
- o It was in your possession, and you locked it up, or
- o It is in a designated secure area.

Each person involved with the sample must know Chain-of-Custody procedures. The procedures should be included in the Project Plan or be published and available to all

personnel. Due to the evidentiary nature of sample collecting investigations, the possession of samples must be traceable from the time that samples are collected until they are introduced as evidence in legal proceedings. To maintain and document sample possession, Chain-of-Custody procedures are followed.

The Chain-of-Custody records must be prepared as the sample containers are being packaged for shipping. Since samples are shipped in commercial coolers, a separate Chain-of-Custody record should be prepared for the contents of each cooler. The record must be signed and dated just prior to sealing the coolers for shipment. Enter the actual time at which the COC is prepared. The Chain-of-Custody record used in Region 2 is serialized.

Sample Labels

A sample label must be affixed to each sample container. Information provided on the sample label must include the following:

- o Case number: The case number must be the same as that provided in the top right corner of the traffic report.
- o Sample number: This is the MPI-designated sample number. It is associated with the sample source location on a site map.
- o Date: Indicate the month, day, and year the sample was collected.

All information recorded should be printed on labels using indelible (waterproof) ink. The sample matrix is provided on the preprinted CLP numbered sample tables. Clear, acetate tape must be applied over all labeling to maintain label integrity during decontamination procedures.

Custody Seals

The custody seal has an adhesive side which enables it to stick where it is applied. The custody seal must be signed and dated and is applied to sample containers and coolers in such a manner as to reveal if the container was opened during transit.

Receipt for Samples Form

Upon completion of the site inspection, before the field team leaves the site, the site owner, operator, or agent in charge must be given a completed "Receipt for Samples" form describing the samples collected.

The number and description of samples collected must be provided. The case number must not be indicated on the form. The site owner, operator, or authorized agent is the person the samples are "Transferred by" and must sign accordingly. As a receipt for samples is required by law, it is required that when the owner, operator or authorized agent is not

available to accept the receipt, indicate that fact on the bottom of the document and have it placed in the Sample Management Documentation section of the project file.

Distribution of Documentation

After all sampling and documentation is completed the following outline will be used for the distribution of the documentation generated.

Laboratory

- o Bottom 2 copies of Traffic Report

Site Owner/Representative

- o Top white copy of the Receipt for Samples Form

Site Manager for Project File

- o 1 xerox copy of all the Traffic Reports
- o 1 xerox copy of the airbills
- o Pink copy of the Receipt for Samples

MPI-RSCC Coordinator

- o Top 2 copies of the TR/COC
- o Two copies of the Sampling Trip Report (when completed)
- o Any extra unused CLP labels and paperwork
- o Bottle Lot Number Form
- o Federal Express Airbill Receipts
- o Yellow Copy of Receipt for Samples

MPI-RSCC to Distribute To

RSCC/ESAT Lockheed Environmental Systems

- o 2nd page of all the Organic and Inorganic TR/COCs

Viar & Co.

- o Top copy of the Inorganic and Organic TR/COC

MPI-RSCC Files

- o Sample Trip Report
- o Copy of all TR/COCs
- o Extra Labels and Paperwork

- o Bottle Lot Number Form
- o Federal Express Airbill Receipts
- o Yellow Copy of Receipt for Sample Form

5.0 REFERENCES

U.S. Environmental Protection Agency. Region 2, Environmental Services Division, Monitoring Management Branch, CERCLA Quality Assurance Manual, October 1989, Revision 1.

User's Guide to the Contract Laboratory Program, U.S. EPA Office of Emergency and Remedial Response, January 1991.

Code of Federal Regulations, Title 49, Transportation Revised, October 1, 1986.

USEPA Contract Laboratory Program (CLP) National Functional Guidelines For Organic Data Review, Multi-Media, Multi-Concentration, Doc. No. OLM01.0, Revised June, 1991.

USEPA CLP SOW for Organic Analysis Multi-Media, Multi-Concentration, Doc. No. OLM01.0, Revision OLM01.8 June 1991.

USEPA Contract Laboratory Program (CLP) National Functional Guidelines For Evaluating Inorganic Analysis, Revised October, 1989.

USEPA CLP SOW for Inorganic Analysis, Multi-Media, Multi-Concentration, Doc. No. ILM01.0, December 1990.

ATTACHMENT A

CONTRACT LABORATORY PROGRAM DATA MANAGEMENT REQUEST SHEET

(Shaded Areas for MPI-RSCC Use Only)

Site Name: _____ Site Location: _____ Job Number: _____ Date Requested: _____ Proposed Sampling Date(s): _____ Proposed Shipping Date: _____	SM/FTL: _____ Turnaround Time: Routine _____ Fast _____ # of days _____	Laboratories: Organic: _____ Inorganic: _____ SAS/Other: _____ _____ _____
Actual Start Date: _____ Actual Completion Date: _____	Case Number: _____ SAS Number: _____	

ROUTINE ANALYTICAL SERVICES (RAS)

SAMPLE TYPE	ORGANICS						INORGANICS					
	Full TCL Organics		VOA Only		Other		TAL Only		TAL + Cyanido		Other	
	R	C	R	C	R	C	R	C	R	C	R	C
Trip Blanks:												
Rinsates:												
Soil Sampling Equipment												
Aqueous Sampling Equipment												
Aqueous Environmental Samples:												
Low Concentration												
Medium Concentration												
Solid Environmental Samples:												
Low Concentration												
Medium Concentration												

R= # of Requested Samples C= Actual # Collected

Signature: _____ Date: _____

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SPECIAL ANALYTICAL SERVICES (SAS)

No. of Samples		Concentration	Sample Type/Matrix	Type of Analysis	Suggested Method
R	C				

Additional Comments: _____

R= # of Requested Samples

C= Actual # Collected

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SAS Number

SPECIAL ANALYTICAL SERVICES

Client Request

Regional Transmittal

Telephone Request

- A. EPA Region/Client: _____
- B. RSCC Representative: _____
- C. Telephone Number: () _____
- D. Date of Request: _____
- E. Site Name: _____

Please provide below description of your request for Special Analytical Services under the Contract Laboratory Program. In order to most efficiently obtain laboratory capability for your request, please address the following considerations, if applicable. Incomplete or erroneous information may result in a delay in the processing of your request. Please continue response on additional sheets, or attach supplementary information as needed.

1. General description of analytical service requested: _____

2. Definition and number of work units involved (specify whether whole samples or fractions; whether organics or inorganics; whether aqueous or soil and sediments; and whether low, medium or high concentration):

3. Purpose of analysis (specify whether Superfund (enforcement or remedial action), RCRA, NPDES, etc.): _____

4. Estimated date(s) of collection: _____

5. Estimated date(s) and method of shipment: _____

6. Number of days analysis and data required after laboratory receipt of samples:

7. Analytical protocol required (attach copy if other than a protocol currently used in this program): _____

8. Special technical instructions (if outside protocol requirements, specify compound names, CAS numbers, detection limits, etc.): _____

9. Analytical results required (if known, specify format for data sheets, QA/QC reports, Chain-of-Custody documentation, etc.) If not completed, format of results will be left to program discretion. _____

10. Other (use additional sheets or attach supplementary information, as needed):

11. Name of sampling/shipping contact: _____
Phone: () _____

12. Data Requirements

<u>Parameter</u>	<u>Detection Limit</u>	<u>Precision Desired (±% or Concentration)</u>

13. QC Requirements

<u>Audits Required</u>	<u>Frequency of Audits</u>	<u>Limits (Percent or Concentration)</u>

14. Action Required if Limits are Exceeded

Please return this request to the Sample Management Office as soon as possible to expedite processing of your request for special analytical services. Should you have any questions or need any assistance, please contact your Regional representative at the Sample Management Office.

**HIGH CONCENTRATION SAS REQUEST
REGION II**

Site Name: _____ Site Spill ID No. _____

Site Location (city/state): _____

Sampler: _____ Sampler Contact: _____

Sampler Phone No. _____

INORGANIC SAS NO. 5351-1 Sol No. _____ (Will be completed by SMO Coordinator)

SAMPLE DESCRIPTION

SPECIFY METHODS (if necessary)

Number: _____

Matrix: _____

No. of Phases: _____
(if applicable)

INORGANIC ANALYSIS

- _____ Total Metals
- _____ Total Metals & Cyanide
- _____ Total Metals, Cyanide & Sulfide

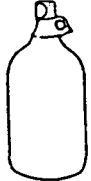
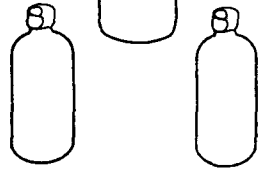
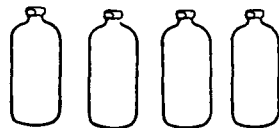
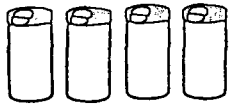

Shipping Date: _____



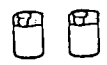
Please confirm receipt of request by SMO with next phone communication.

COMMENTS: _____

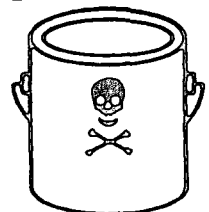
Date Request Mailed to SMO: _____ EPA Region III Contact: _____

ORGANIC SAMPLE COLLECTION REQUIREMENTS

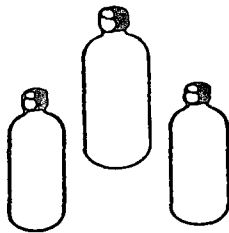

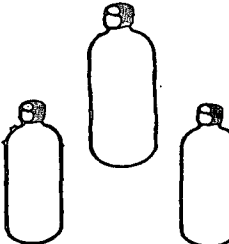

WATER SAMPLES	REQUIRED VOLUME	CONTAINER TYPE
EXTRACTABLE ANALYSIS (LOW LEVEL)	1 GALLON	 1 x 4-LITER AMBER GLASS BOTTLES OR  2 x 80-OZ. AMBER GLASS BOTTLES OR  4 x 1-LITER AMBER GLASS BOTTLES
EXTRACTABLE ANALYSIS (MEDIUM LEVEL ^o)	1 GALLON	 4 x 32-OZ. WIDE-MOUTH GLASS JARS
VOLATILE ANALYSIS (LOW OR MEDIUM LEVEL ^o)	80 ML	 2 x 40-ML GLASS VIALS


SOIL/SEDIMENT SAMPLES	REQUIRED VOLUME	CONTAINER TYPE
EXTRACTABLE ANALYSIS (LOW OR MEDIUM LEVEL ^o)	6 OZ.	 1 x 8-OZ. WIDE-MOUTH GLASS JAR OR  2 x 4-OZ. WIDE-MOUTH GLASS JARS
VOLATILE ANALYSIS (LOW OR MEDIUM LEVEL ^o)	240 ML	 2 x 120-ML WIDE-MOUTH GLASS VIALS

^oALL MEDIUM LEVEL SAMPLES TO BE SEALED IN METAL PAINT CAN FOR SHIPMENT



INORGANIC SAMPLE COLLECTION REQUIREMENTS

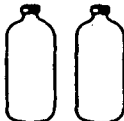
WATER SAMPLES	REQUIRED VOLUME	CONTAINER TYPE
METALS ANALYSIS (LOW LEVEL)	1 LITER	 <p>1 x 1-LITER POLYETHYLENE BOTTLE OR 2 x 500 ML POLYETHYLENE BOTTLE</p>
METALS ANALYSIS (MEDIUM LEVEL*)	16 OZ.	 <p>1 x 16-OZ. WIDE-MOUTH GLASS JAR</p>
CYANIDE (CN ⁻) ANALYSIS (LOW LEVEL)	1 LITER	 <p>1 x 1-LITER POLYETHYLENE BOTTLE OR 2 x 500 ML POLYETHYLENE BOTTLE</p>
CYANIDE (CN ⁻) ANALYSIS (MEDIUM LEVEL*)	16 OZ.	 <p>1 x 16-OZ. WIDE-MOUTH GLASS JAR</p>



SOIL/SEDIMENT SAMPLES	REQUIRED VOLUME	CONTAINER TYPE
METALS AND CYANIDE (CN ⁻) ANALYSIS (LOW OR MEDIUM LEVEL*)	6 OZ.	 <p>1 x 8-OZ. WIDE-MOUTH GLASS JAR OR 2 x 4-OZ. WIDE-MOUTH GLASS JARS</p>

*ALL MEDIUM LEVEL SAMPLES TO BE SEALED IN METAL PAINT CAN FOR SHIPMENT




DIOXIN SAMPLE COLLECTION REQUIREMENTS

WATER SAMPLES	REQUIRED VOLUME		CONTAINER TYPE
2,3,7,8-TCDD ANALYSIS (MULTI-CONCENTRATION)	2 LITERS		2 x 1-LITER AMBER GLASS BOTTLES

SOIL/SEDIMENT SAMPLES	REQUIRED VOLUME		CONTAINER TYPE
2,3,7,8-TCDD ANALYSIS (MULTI-CONCENTRATION)	4 OZ.		1 x 4-OZ. WIDE-MOUTH GLASS JAR
			OR 1 x 8-OZ. WIDE-MOUTH GLASS JAR

HIGH HAZARD SAMPLE COLLECTION REQUIREMENTS

LIQUID OR SOLID SAMPLES	REQUIRED VOLUME		CONTAINER TYPE
ORGANIC AND INORGANIC ANALYSIS	6 OZ.		1 x 8-OZ. WIDE-MOUTH GLASS JAR

*ALL MEDIUM LEVEL SAMPLES TO BE SEALED IN METAL PAINT CAN FOR SHIPMENT



SIGNATURE <i>Jane Doe</i> Date 5-27-83			CUSTODY SEAL 5-28-83 Date <i>Jane Doe</i> Signature
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Custody Seal

Project Code WB5310.001 Z1.5M10.0	Station No. HW 26 SS-11(B)	Monitoring Point S-28-P3	Time 1007	Containers Cans <input type="checkbox"/> Cns <input checked="" type="checkbox"/>	
Station Location Monitoring Well #26 Split Spoon # 11	Sampler Signature <i>Jane Doe</i>				
Tag No. 11502	Lab Sample No. Bottle Lot # 63129	ANALYSES Preservative: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>			
Remarks: case 1746 1P # H E 0637	Bacteriology	Pesticides	Volatile Organics	Priority Pollutants	Organics GC/MS
	Mutagenicity				Oil and Grease
					Cyanide
					Metals
					Mercury
					Phenolics
					CO ₂ , TOC, Nutrients
					Solids (TS, TSS, TSS ₁₅)
					BOD Amion



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Sample Tag



United States Environmental Protection Agency
 Contract Laboratory Program Sample Management Office
 PO Box 818 Alexandria, VA 22313
 703-557-2490 FTS 557-2490

Organic Traffic Report & Chain of Custody Record

(For Organic CLP Analysis)

SAS No.
(If applicable)

Case No.

1. Project Code		Account Code		2. Region No.		Sampling Co.		4. Date Shipped		Carrier		6. Preservative (Enter in Column D) 1. HCl 2. HNO3 3. NaHSO4 4. H2SO4 5. Other (Specify) 6. Ice only N. Not preserved	7. Sample Description (Enter in Column A) 1. Surface Water 2. Ground Water 3. Leachate 4. Rinsate 5. Soil/Sediment 6. Oil (High only) 7. Waste (High only) 8. Other (Specify)																																														
Regional Information				Sampler (Name)				Airbill Number																																																			
Non-Superfund Program				Sampler Signature				5. Ship To																																																			
Site Name				3. Type of Activity				ATTN:																																																			
City, State		Site Spill ID		<table border="0"> <tr> <td colspan="2">Lead</td> <td colspan="2">Pre-Remedial</td> <td colspan="2">Remedial</td> <td colspan="2">Removal</td> </tr> <tr> <td>SF</td><td><input type="checkbox"/></td> <td>PA</td><td><input type="checkbox"/></td> <td>RIFS</td><td><input type="checkbox"/></td> <td>RD</td><td><input type="checkbox"/></td> <td>CLEM</td><td><input type="checkbox"/></td> </tr> <tr> <td>PRP</td><td><input type="checkbox"/></td> <td>SSI</td><td><input type="checkbox"/></td> <td>RA</td><td><input type="checkbox"/></td> <td>O&M</td><td><input type="checkbox"/></td> <td>REMA</td><td><input type="checkbox"/></td> </tr> <tr> <td>ST</td><td><input type="checkbox"/></td> <td>LSI</td><td><input type="checkbox"/></td> <td>NPLD</td><td><input type="checkbox"/></td> <td>OIL</td><td><input type="checkbox"/></td> <td>REM</td><td><input type="checkbox"/></td> </tr> <tr> <td>FED</td><td><input type="checkbox"/></td> <td></td><td></td> <td></td><td></td> <td>UST</td><td><input type="checkbox"/></td> <td></td><td></td> </tr> </table>				Lead		Pre-Remedial		Remedial		Removal		SF	<input type="checkbox"/>	PA	<input type="checkbox"/>	RIFS	<input type="checkbox"/>	RD	<input type="checkbox"/>	CLEM	<input type="checkbox"/>	PRP	<input type="checkbox"/>	SSI	<input type="checkbox"/>	RA	<input type="checkbox"/>	O&M	<input type="checkbox"/>	REMA	<input type="checkbox"/>	ST	<input type="checkbox"/>	LSI	<input type="checkbox"/>	NPLD	<input type="checkbox"/>	OIL	<input type="checkbox"/>	REM	<input type="checkbox"/>	FED	<input type="checkbox"/>					UST	<input type="checkbox"/>						
Lead		Pre-Remedial		Remedial		Removal																																																					
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FED	<input type="checkbox"/>					UST	<input type="checkbox"/>																																																				

CLP Sample Numbers (from labels)	A Enter # from Box 7	B Conc. Low Med High	C Sample Type: Comp./ Grab	D Preservative from Box 6	E RAS Analysis				F Regional Specific Tracking Number or Tag Numbers	G Station Location Number	H Mo/Day/Year/Time Sample Collection	I Sampler Initials	J Corresp. CLP Inorg. Samp. No.	K Enter Appropriate Qualifier for Designated Field QC B = Blank S = Spills D = Duplicate PE = Perform. Eval. -- = Not a QC Sample
					VOA	BNA	Pest/PCB	High only ARO/TOX						

Shipment for Case complete? (Y/N)	Page 1 of _____	Sample used for a spike and/or duplicate	Additional Sampler Signatures	Chain of Custody Seal Number
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CHAIN OF CUSTODY RECORD

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	Is custody seal intact? Y/N/none

EPA Form 9110-2 (Rev. 5-91) Replaces EPA Form (2075-7), previous edition which may be used
 DISTRIBUTION:
 Blue - Region Copy Pink - SMO Copy White - Lab Copy for Return to Region Yellow - Lab

Split Samples Accepted (Signature)
 Declined

300168

Organic Sample Collection Requirements

This form replaces both the individual Traffic Report and EPA Chain of Custody Record. If the sampling team elects to use an alternative chain-of-custody form, cross out the bottom portion of this record and indicate that chain-of-custody information is recorded on an alternative form."

Water Samples	Required Volume	Container Type
Extractable Analysis (Low Level)	1 Gallon	1 X 4-Liter Amber Glass Bottle OR 2 X 80-oz Amber Glass Bottle OR 4 X 1-Liter Amber Glass Bottles
Extractable Analysis (Medium Level*)	1 Gallon	32-oz Wide-Mouth Glass Jars
Volatile Analysis (Low or Medium Level*)	80 ml	2 X 40-ml Glass Vials



*All Medium and High Level Samples to be Sealed in Metal Can for Shipment

Sed/Sediment Samples	Required Volume	Container Type
Extractable Analysis (Low or Medium Level*)	6 oz	1 X 8-oz Wide-Mouth Glass Jar OR 2 X 4-oz Wide-Mouth Glass Jar
Volatile Analysis (Low or Medium Level*)	240 ml	2 X 120 ml Wide-Mouth Glass Vial*

*Sed VOA Vials under study, subject to change, check to ensure proper sealing

HIGH CONCENTRATION SAMPLE COLLECTION REQUIREMENTS

Liquid or Solid Samples	Required Volume	Container Type
Extractable and Volatile Analysis	6 oz	1 X 8-oz Wide-Mouth Glass Jar

1. Organic Sample Collection Requirements

- Please indicate sample to spike and/or duplicate.
- Ship medium and high concentration samples in paint cans.
- Aqueous samples require one triple-volume sample per twenty for Matrix Spike/Matrix Spike Duplicate.
- Oily samples must be analyzed under the Special Analytical Services (SAS) program.
- Confirmatory analysis and Special Analytical Services (SAS) parameters may require extra volume: for SAS consult specified SAS methods for requirements.
- Additional sample volume not required for method OLC01.

2. Cooler and Sample Documentation

- Complete all sections of the Traffic Report/Chain of Custody Form - Press firmly with a ball point pen to ensure that carbon copies are legible. Check the information and correct any errors.
- Please remember to complete the Chain of Custody information on the form.
- Seal the two sets of laboratory Traffic Report/Chain of Custody form copies in a plastic bag. Include a return address for the cooler. Tape bag under cooler lid.
- Overlap the lid and bottle of each sample container with custody seals.
- Seal each container in a plastic bag.
- Pack medium and high concentration samples in metal cans.
- Cool low waters to 4° C. Cooling of low soils is optional. Do not cool medium or high concentration waters and soils.
- Separate and surround cooler contents with vermiculite or equivalent packaging.
- Seal the cooler, overlapping the lid and body with custody seals.
- FAX SMO a copy of the Traffic Report/Chain of Custody Form as soon as possible. Send SMO the pink copy of the Traffic Report within 5 days.
- In column E RAS analysis indicate number of sample bottles sent for analysis.

3. Sample Shipment Reporting

- PHONE IN ALL SHIPMENTS IMMEDIATELY TO SMO (or to RSCC, if instructed)

Required information:

Case (and/or SAS) Number
Date shipped
Number of samples by concentration and matrix
Carrier and airbill number
Next planned shipment

- Leave your name and a number where you can be reached.

- Information for SATURDAY DELIVERIES must be phoned in by 3:00 PM (Eastern) the preceding FRIDAY.
- Report any delays or changes of scope (i.e., changes in number of samples to be collected, matrix changes, etc.)
- CALL IF YOU HAVE ANY QUESTIONS

USEPA Contract Laboratory Program

Sample Management Office

P.O. Box 818

Alexandria, VA 22313

Phone: (703) 557-2490

(703) 684-5678

FAX: (703) 683-0378



States nmen ector y
 Contract Laboratory Program Sample Management Office
 PO Box 818 Alexandria, VA 22313
 703-557-2490 FTS 557-2490

Regional Transfer Receipt & Chain of Custody Record
 (For Inorganic CLP Analysis)

S. (If applicable)

No.

1. Project Code		Account Code		2. Region No.		Sampling Co.		4. Date Shipped		Carrier		6. Preservative (Enter in Column D) 1. HCl 2. HNO3 3. NaOH 4. H2SO4 5. K2CR2O7 6. Ice only 7. Other (Specify) N. Not preserved		7. Sample Description (Enter in Column A) 1. Surface Water 2. Ground Water 3. Leachate 4. Rinse 5. Soil/Sediment 6. Oil (High only) 7. Waste (High only) 8. Other (Specify)					
Regional Information				3. Type of Activity				5. Ship To											
Non-Superfund Program				Remedial				Removal											
Site Name				Lead				Pro-Remedial				RIFS				CLEM			
City, State				PRP				PA				RA				REM			
Site Spill ID				ST				SSI				O&M				OIL			
				FED				LSI				NPLD				UST			
ATTN:																			

CLP Sample Numbers (from labels)	A Enter # from Box 7	B Conc. Low Med High	C Sample Type: Comp./Grab	D Preservative from Box 6	E - RAS Analysis							F Regional Specific Tracking Number or Tag Numbers	G Station Location Number	H Mo/Day/Year/Time Sample Collection	I Sampler Initials	J Corresp. CLP Org. Samp. No.	K Enter Appropriate Qualifier for Designated Field QC B = Blank B = Spike D = Duplicate PE = Perform. Eval. -- = Not a QC Sample
					Metals		Low Conc. only		High only								
					Total	Dissolved	Cyanide	Nitrate	Nitrite	Fluoride	pH						
C-28																	

Shipment for Case complete? (Y/N)	Page 1 of ____	Sample used for a spike and/or duplicate	Additional Sampler Signatures	Chain of Custody Seal Number
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CHAIN OF CUSTODY RECORD

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	Is custody seal intact? Y/N/none

EPA Form 9110-1 (Rev. 5-91) Replaces EPA Form (2075-6), previous edition which may be used

DISTRIBUTION:
 Green - Region Copy Pink - SMO Copy White - Lab Copy for return to Region Yellow - Lab Copy for Return to SMO

Split Samples Accepted (Signature) Declined

SEE REVERSE FOR ADDITIONAL STANDARD INSTRUCTIONS

347901

300170

10-91

Inorganic Sample Collection Requirements

This form replaces both the individual Traffic Report and EPA Chain of Custody Record. If the sampling team elects to use an alternative chain-of-custody form, cross out the bottom portion of this record and indicate that chain-of-custody information is recorded on an alternative form."

Water Samples	Required Volume	Container Type
Metals Analysis (Low Level)	1 Liter	1 X 1-Liter Polyethylene Bottle OR 2 X 500-ml. Polyethylene Bottle
Metals Analysis (Medium Level*)	16 oz.	1 X 16-oz. Wide-Mouth Glass Jar
Extractable Analysis (Medium Level*)	1 Liter	1 X 1-Liter Polyethylene Bottle OR 2 X 500-ml. Polyethylene Bottle
Volatile Analysis (Low or Medium Level*)	16 oz.	1 X 16-oz. Wide-Mouth Glass Jar

Soil/Sediment Samples	Required Volume	Container Type
Metals and Cyanide (CN ⁻) Analysis (Low or Medium Level*)	6 oz.	1 X 8-oz. Wide-Mouth Glass Jar OR 2 X 4-oz. Wide-Mouth Glass Jars

HIGH CONCENTRATION SAMPLE COLLECTION REQUIREMENTS

Liquid or Solid Samples	Required Volume	Container Type
Metals and Cyanide* Analysis	6 oz.	1 X 8-oz. Wide-Mouth Glass Jar



*All Medium and High Level Samples to be Sealed in Metal Can for Shipment

1. Inorganic Sample Collection Requirements

- Aqueous samples require one double-volume sample per twenty for Matrix Spike/Matrix Spike Duplicate.
- Preserve low level water samples:
 - Total metals Preserve with HNO₃ to pH ≤ 2.
 - Dissolved metals Preserve with HNO₃ to pH ≤ 2. No further digestion required.
 - Cyanide Preserve with 10 NaOH to pH ≥ 12.
- Oily samples must be analyzed under the Special Analytical Services (SAS) program.
- Ship medium and high concentration samples in paint cans.

2. Cooler and Sample Documentation

- Complete all sections of the Traffic Report/Chain of Custody Form - Press firmly with a ball point pen to ensure that carbon copies are legible. Check the information and correct any errors.
- Please remember to complete the Chain of Custody information on the form.
- Seal the two sets of laboratory Traffic-Report/Chain of Custody form copies in a plastic bag. Include a return address for the cooler. Tape bag under cooler lid.
- Overlap the lid and bottle of each sample container with custody seals.
- Seal each container in a plastic bag.
- Pack medium and high concentration samples in metal cans.
- Separate and surround cooler contents with vermiculite or equivalent packaging.
- Seal the cooler, overlapping the lid and body with custody seals.
- Send SMO the pink copy of the Traffic Report within 5 days.
- In column E RAS analysis indicate number of sample bottles sent for analysis.

3. Sample Shipment Reporting

- **PHONE IN ALL SHIPMENTS IMMEDIATELY TO SMO (or to RSCC, if instructed)**

Required information:

Case (and/or SAS) Number

Date shipped

Number of samples by concentration and matrix

Carrier and airbill number

Next planned shipment

Leave your name and a number where you can be reached.

- Information for SATURDAY DELIVERIES must be phoned in by 3:00 PM. (Eastern) the preceding FRIDAY.
- Report any delays or changes of scope (i.e., changes in number of samples to be collected, matrix changes, etc.)
- **CALL IF YOU HAVE ANY QUESTIONS**

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FAX: (703) 683-0378



United States Environmental Protection Agency
 Contract Laboratory Program Sample Management Office
 PO Box 818 Alexandria, VA 22313
 703-557-2490 FTS 557-2490

Special Analytical Service

Packing List/Chain of Custody

SAS No. _____

1. Project Code	Account Code	2. Region No.	Sampling Co.	4. Date Shipped	Carrier	6. Sample Description (Enter in Column A) 1. Surface Water 2. Ground Water 3. Leachate 4. Rinsate 5. Soil/Sediment 6. Oil 7. Waste 8. Other (Specify)	7. Preservative (Enter in Column C) 1. HCl 2. HNO ₃ 3. NaHSO ₄ 4. H ₂ SO ₄ 5. NaOH 6. Other (Specify) 7. Ice only N. Not preserved																																	
Regional Information		Sampler (Name)		Airbill Number																																				
Non-Superfund Program		Sampler Signature		5. Ship To																																				
Site Name		3. Type of Activity																																						
City, State	Site Spill ID	<table border="0"> <tr> <td></td> <td>Lead</td> <td>Pre-Remedial</td> <td>RIFS</td> <td>CLEM</td> <td></td> </tr> <tr> <td>SF</td> <td><input type="checkbox"/></td> <td>RD</td> <td><input type="checkbox"/></td> <td>REMA</td> <td><input type="checkbox"/></td> </tr> <tr> <td>PRP</td> <td><input type="checkbox"/></td> <td>PA</td> <td><input type="checkbox"/></td> <td>RA</td> <td><input type="checkbox"/></td> </tr> <tr> <td>ST</td> <td><input type="checkbox"/></td> <td>SSI</td> <td><input type="checkbox"/></td> <td>O&M</td> <td><input type="checkbox"/></td> </tr> <tr> <td>FED</td> <td><input type="checkbox"/></td> <td>LSI</td> <td><input type="checkbox"/></td> <td>NPLD</td> <td><input type="checkbox"/></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>UST</td> <td><input type="checkbox"/></td> </tr> </table>			Lead	Pre-Remedial	RIFS	CLEM		SF	<input type="checkbox"/>	RD	<input type="checkbox"/>	REMA	<input type="checkbox"/>	PRP	<input type="checkbox"/>	PA	<input type="checkbox"/>	RA	<input type="checkbox"/>	ST	<input type="checkbox"/>	SSI	<input type="checkbox"/>	O&M	<input type="checkbox"/>	FED	<input type="checkbox"/>	LSI	<input type="checkbox"/>	NPLD	<input type="checkbox"/>					UST	<input type="checkbox"/>	
	Lead	Pre-Remedial	RIFS	CLEM																																				
SF	<input type="checkbox"/>	RD	<input type="checkbox"/>	REMA	<input type="checkbox"/>																																			
PRP	<input type="checkbox"/>	PA	<input type="checkbox"/>	RA	<input type="checkbox"/>																																			
ST	<input type="checkbox"/>	SSI	<input type="checkbox"/>	O&M	<input type="checkbox"/>																																			
FED	<input type="checkbox"/>	LSI	<input type="checkbox"/>	NPLD	<input type="checkbox"/>																																			
				UST	<input type="checkbox"/>																																			

Sample Numbers	A Matrix Enter from Box 6	B Conc Low Med High	C Preservative Used from Box 7	D Analysis	E Regional Specific Tracking Number or Tag Number	F Station Location Identifier	G Mo/Day/Year/Time Sample Collection	H Sampler Initials	I Designated Field QC
1.									
2.									
3.									
4.									
5.									
6.									
7.									
8.									
9.									
10.									

Shipment for SAS complete? (Y/N)	Page 1 of ____	Sample Used for Spike and/or Duplicate	Additional Sampler Signatures	Chain of Custody Seal Number
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CHAIN OF CUSTODY RECORD

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	Is custody seal intact? Y/N/none

EPA Form: 9110-3 (7/91)
 DISTRIBUTION: White - Region Copy Yellow - SMO Copy Gold - Lab Copy for Return to Region
 Pink - Lab Copy for Return to SMO
 See Reverse Side for Additional Standard Instructions

Split Samples Accepted (Signature)
 Declined

C-30
300122

00001101

1. Sample Collection Requirements

Note: Confirmatory analysis and Special Analytical Services (SAS) parameters may require extra volume.

2. Cooler and Sample Documentation

- Complete all sections of the SAS Packing List/Chain of Custody Form
 - Press firmly with a ball point pen to ensure that carbon copies are legible. Check the information and correct any errors.
- Please remember to complete the Chain of Custody information on the form.
- Seal the two sets of laboratory SAS Packing List/Chain of Custody form copies in a plastic bag. Include a return address for the cooler. Tape bag under cooler lid.
- Overlap the lid and bottle and bottle of each sample container with custody seals.
- Seal each container in a plastic bag.
- Pack medium and high concentration samples in metal cans.
- Cool low waters to 4° C. Cooling of low soils is optional. Do not cool medium or high concentration waters and soils.
- Separate and surround cooler contents with vermiculite or equivalent packaging.
- Seal the cooler, overlapping the lid and body with custody seals.
- Send SMO the yellow copy of the SAS Packing List/Chain of Custody Form within 3 days.

3. Sample Shipment Reporting

- PHONE IN ALL SHIPMENTS IMMEDIATELY TO SMO (or to RSCC, if instructed)

Required information:

SAS (and/or Case) number
Date shipped
Number of samples by concentration, matrix, and analysis
Carrier and airbill number
Next planned shipment

Leave your name and a number where you can be reached.

- Information for SATURDAY DELIVERIES must be phoned in by 3:00 p.m. (Eastern) the preceding FRIDAY.
- Report any delays or changes of scope (i.e., changes in number of samples to be collected, matrix changes, etc.)

• CALL IF YOU HAVE ANY QUESTIONS

USEPA Contract Laboratory Program
Sample Management Office
P.O. Box 818
Alexandria, VA 22313
Phone: (703) 557-2490
(703) 684-5678
FAX: (703) 683-0378

RECEIPT FOR SAMPLES AND DOCUMENTS

DATE OF SAMPLE COLLECTION			
NAME OF FACILITY			
FACILITY LOCATION			
RECEIPT OF THE DOCUMENT(S) AND/OR SAMPLE(S) DESCRIBED IS HEREBY ACKNOWLEDGED:			
NO.	DESCRIPTION		
TRANSFERRED BY (Signature)		RECIPIENT SIGNATURE	
NAME		NAME	
TITLE	DATE SIGNED	TITLE	DATE SIGNED

NOTIFICATION OF SAMPLE SHIPMENT

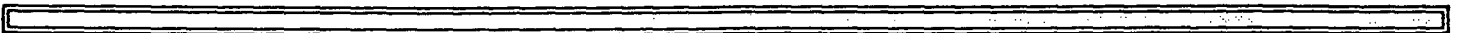
Case No. _____ Caller's Name _____ Phone # _____

SAS No. _____ Date of Call / / Region _____

Lab Name	No./Matrix Concentration of Samples (e.g. 10 LW)	Ship Date	Airbill No.	Shipping Complete?
				Y / N
				Y / N
				Y / N
				Y / N

Comments: _____

Message Taker: _____



NOTIFICATION OF SAMPLE SHIPMENT

Case No. _____ Caller's Name _____ Phone # _____

SAS No. _____ Date of Call / / Region _____

Lab Name	No./Matrix Concentration of Samples (e.g. 10 LW)	Ship Date	Airbill No.	Shipping Complete?
				Y / N
				Y / N
				Y / N
				Y / N

Comments: _____

Message Taker: _____

1.0 OBJECTIVE

The objective of these guidelines is to provide general reference information on the accepted methods of sample preservation.

2.0 LIMITATIONS

The scope of these guidelines applies to all methods of sample preservation, except for those requirements of project-specific plans related to the methods of sample preservation.

3.0 MATERIALS

Preservatives:

- a. HCl:DIH₂O - 1:1 (Hydrochloric Acid/Deionized Water)
- b. HNO₃ - full strength (Nitric Acid)
- c. NaOH - 10 N (Sodium Hydroxide)
- d. H₂SO₄ - full strength (Sulfuric Acid)

Additional Materials:

- a. Disposable Pasteur pipettes
- b. Pipette pumps - 10 ml or 2 ml
- c. Latex pipette bulbs
- d. Squeeze bottle with deionized water
- e. 1L clear wide mouth glass jar for water pipette
- f. Paper towels
- g. Box of Chemwipes
- h. Lead acetate paper
- i. Cadmium nitrate or cadmium carbonate
- j. Potassium iodide - starch test paper (KI-starch paper)
- k. Filter paper
- l. Filter funnels (disposable or decontaminated)
- m. pH paper

Safety Materials:

- a. 2 pair safety glasses
- b. 2 pair solvex gloves
- c. 2 labcoats
- d. MSDS sheets
- e. Eyewash

4.0 DISCUSSION

Complete and unequivocal preservation of samples, either domestic sewage, industrial wastes, or natural waters, is a practical impossibility. Regardless of the nature the sample's complete stability for every constituent can never be achieved. At best, preservation techniques can only retard the chemical and biological changes that inevitably continue after the sample is removed from the parent source. The changes that take place in a sample are either chemical or biological. In the former case, certain changes occur in the chemical structure of the constituents that are a function of physical conditions. Metal cations may precipitate as hydroxides or form complexes with other constituents; cations or anions may change valence states under certain reducing or oxidizing conditions; other constituents may dissolve or volatilize with the passage of time. Metal cations may also adsorb onto surfaces (glass, plastic, quartz, etc.), such as, iron and lead. Biological changes taking place in a sample may change the valence of an element or a radical to a different valence. Soluble constituents may be converted to organically bound materials in cell structures, or cell lysis may result in release of cellular material into solution. The well known nitrogen and phosphorus cycles are examples of biological influence on sample composition. Therefore, as a general rule, it is best to analyze the samples as soon as possible after collection. This is especially true when the analyte concentration is expected to be in the low ug/l range.

Methods of preservation are relatively limited and are intended generally to (1) retard biological action, (2) retard hydrolysis of chemical compounds and complexes, (3) reduce volatility of constituents, and (4) reduce absorption effects. Preservation methods not outlined below are generally limited to pH control, chemical addition, refrigeration, and freezing.

5.0 GUIDELINES

The following procedure has been developed for preserving aqueous samples for volatile organic analysis.

Volatile Organic Analysis (VOA)

Hydrochloric acid (6 M) should be transferred on site from a 1-liter plastic-coated glass bottle to one 40-mL amber glass vial by using a glass funnel. This should be performed at the command post, with the vial filled one-half full. Hand and eye protection must be worn during the transfer and handling of hydrochloric acid. Field personnel must attempt to keep the 40 ml vial in an upright position during field sampling.

The 1-liter plastic-coated bottle must be kept at the command post, with the additional vial kept in a plastic ziplock bag. If additional acid is required for sampling, this additional 40 ml vial must be used. The vial should not be refilled once field personnel have entered the "hot" zone.

Field personnel should take the following materials for VOA sample preservation to the sampling locations:

- o 40-mL VOA test vial for each aqueous sample to be collected.
- o One 40-mL VOA vial containing 6 M HCl.
- o Plastic ziplock bag containing pH indicator strips for each sampling location.
- o Plastic ziplock bag for disposal of used pH indicator strips and latex gloves.
- o Latex gloves
- o Eye protection

Prior to acidifying environmental samples, field personnel must evaluate a number of parameters which include initial pH, color, clarity (particulate presence or absence), and temperature. This evaluation process must be recorded in the field logbook. The decision to acidify or not to acidify samples will be based on this evaluation and must be fully documented in the field logbook.

- 1) For each aqueous sample to be collected, use one 40-ml VOA vial as a test vial. Fill the test vial one-half full with the sample matrix to be collected. Note the color and clarity of the sample. If the sample is clear and colorless, proceed to Step 2. If the sample is turbid, colored, or highly particulate, document this in the field logbook and do not acidify the sample. Collect the sample in 40-ml VOA vials without HCl preservation. This information must be fully documented in the field logbook. The field SMO must be informed which samples are collected without acidification. The field SMO must write "No HCl" in Column G, the Station Location Column of the Organic Traffic Report/Chain-of-Custody (OTR/COC).
- 2) If the sample appears clear and colorless and has been documented as such, test the pH by inserting one pH paper strip into the test vial. If the pH is less than 2.0, as indicated by a blue color on the strip, collect the sample without acidifying. Document this in the field logbook. The field SMO must also document "No HCl", pH < 2" in Column G of the OTR/COC. If the pH is greater than 2.0, continue to Step 3. The pH indicator paper strip should be put into a plastic bag for later disposal.
- 3) Dispense 10 drops of 6 M hydrochloric acid from the glass pipet. Tap the vial gently to mix. NOTE: If color develops, precipitates form, effervescing occurs, or an exothermic reaction (heat generation determined by holding the vial firmly) occurs, do not acidify the sample and document the reason for not acidifying in the field logbook. If this information about the reaction cannot be written on the organic traffic report, it should be written on a separate piece of paper and be submitted to the lab with the sample management paperwork. Empty the contents of the test vial

into a 1-liter widemouthed polyethylene container to be later disposed of with other liquid investigation-derived wastes.

If none of the following reactions occurs, proceed to the next step.

- o Effervescing
 - o Color development
 - o Precipitative reactions
 - o Exothermic reactions (heat release)
- 4) Test the pH of the sample. If the pH is less than 2.0, proceed to Step 5. If the pH is greater than 2.0, add HCl a few drops at a time until the pH is less than 2.0; then proceed to Step 5.
- 5) Fill the test vial with sample until the vial is nearly full to the top. Gently tap the side of the vial to mix, and test the pH of the sample. If the pH is less than 2.0 proceed to the next step.

If the pH is greater than 2.0, again add HCl a few drops at a time until the pH falls below 2.0. Proceed to the next step.

- 6) Note the amount of 6 M HCl added to the test vial. Add this amount of 6 M HCl, using the same glass pipet, after collecting the samples, and before capping the 40 ml vials. To avoid cross contamination, the sampler must be extremely cautious not to touch the glass pipet to the sides of the vial or the sample. Document the approximate quantity of 6 M HCl added to each sample. These samples are then packaged and cooled to 4°C prior to shipping to the CLP laboratory.

Total Metals and Cyanides

For low level inorganic water samples, a one liter volume is required for metals analysis and a one liter volume is required for cyanide analysis. These samples should be collected in a 1-liter polyethylene bottle. For medium level inorganic water samples, a sixteen ounce volume is required for metals analysis and a sixteen ounce volume is required for cyanide analysis. These samples should be collected in a 16-ounce glass jar. For low/medium level soil samples, a six ounce sample volume is required for both metals and cyanide analyses. These samples should be collected in an 8-ounce glass jar.

Different preservation techniques apply to the metals and cyanide portions of low level water samples. For "total" metals analysis, the sample is acidified to pH < 2 with HNO₃, ("Total" meaning inclusion of particulate and dissolved fractions). For dissolved metals analysis, the sample is filtered and then acidified to pH < 2 with HNO₃ at the laboratory.

If the sample contains a significant particulate fraction, acidification without filtration could result in deceptively high metal values for the water sample. Varying amounts of particulate matter can also give large differences in metal values for duplicate acidified water samples.

The following guidelines should be utilized for the cyanide aliquot:

1. Test a drip of sample with potassium iodide-starch test paper (KI-starch paper). A resulting blue color indicates the presence of oxidizing agents and the 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.

Optionally, all samples may be tested by means of testing a drop of sample on lead acetate paper. Darkening of the paper indicates the presence of S_2^{2-} . If S_2^{2-} is present, add powdered cadmium carbonate or cadmium nitrate until a drop of the treated solution does not darken the lead acetate test paper. Filter the solution before raising the pH.

2. Preserve samples with 2 mL of 10 N sodium hydroxide per liter of sample (pH > 12) for stabilization.
3. Store the samples at 4°C until the time of analysis.

No chemical preservation is required for medium level water samples or for low/medium level soil samples unless otherwise directed.

If it is not certain whether a sample should be categorized as low or medium concentration, volume should be collected and the sample preserved as specified for low level samples. Packaging and shipment procedures should be followed as designated for medium level samples. For water samples, one field blank should be supplied for each Case. Soil blanks are currently not available, and the user should not submit soil field blanks for analysis. If the user submits a rinsate blank with a Case of soil samples, the blank will be treated as a separate aqueous matrix sample with full QC, and accordingly, a sufficient volume for analysis should be provided to the laboratory.

Semi-Volatiles/Pesticides/PCBs

Base/neutral/acid (BNA) extractables and pesticides/PCB samples must be cooled to 4°C. Ice must be placed in double ziplock bags to prevent leakage. The ice bags should be placed by the neck and along the sides of the sample containers.

Recommendation for Sampling and Preservation
of Samples According to Measurement⁽¹⁾

<u>Measurements</u>	<u>Vol. Req. (mL)</u>	<u>Containers²</u>	<u>Preservatives^{3,4}</u>	<u>Holding Time⁵</u>
100				
<u>Physical Properties</u>				
Color	50	P,G	Cool, 4°C	48 hrs.
Conductance	100	P,G	Cool, 4°C	28 Days
Hardness	100	P,G	HNO ₃ to pH < 2	6 mos.
Odor	200	G only	Cool, 4°C	24 hrs.
pH	25	P,G	None Req.	Analyze Immediately
Residue				
Filterable	100	P,G	Cool, 4°C	7 days
Non-Filterable	100	P,G	Cool, 4°C	7 days
Total	100	P,G	Cool, 4°C	7 days
Volatile	100	P,G	Cool, 4°C	7 days
Settleable Matter	1000	P,G	Cool, 4°C	18 hrs.
Temperature	1000	P,G	None Req.	Analyze Immediately
Turbidity	100	P,G	Cool, 4°C	48 hrs.
200				
<u>Meters</u>				
Dissolved	200	P,G	Filter on site HNO ₃ to pH < 2	6 mos.
Suspended	200		Filter on site	6 mos. ⁽⁸⁾
Total	100	P,G	HNO ₃ to pH < 2	6 mos.
Chromium ^{*6}	200	P,G	Cool, 4°C	24 hrs.

Sample Preservation

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<u>Measurements</u>	<u>Vol. Reg. (mL)</u>	<u>Containers²</u>	<u>Preservatives^{3,4}</u>	<u>Holding Time⁵</u>
Mercury dissolved	100	P,G	Filter HNO ₃ to pH < 2	28 days
Total	100	P,G	HNO ₃ to pH < 2	28 days
300 <u>Inorganics, Non Metallics</u>				
Acidity	100	P,G	Cool, 4°C	14 days
Alkalinity	100	P,G	Cool, 4°C	14 days
Bromide	100	P,G	None Req.	28 days
Chloride	50	P,G	None Req.	28 days
Chlorine	200	P,G	None Req.	Analyze Immediately
Cyanides	500	P,G	Cool, 4°C NaOH to ph > 12 0.6g ascorbic acid ⁶	14 days ⁷
Fluoride	300	P,G	None Req.	28 days ⁷
Iodide	100	P,G	Cool, 4°C	24 hrs.
Nitrogen				
Ammonia	400	P,G	Cool, 4°C H ₂ SO ₄ to pH < 2	28 days
Kjeldahl, Total	500	P,G	Cool, 4°C H ₂ SO ₄ to pH < 2	28 days
Nitrate plus Nitrite	100	P,G	Cool, 4°C H ₂ SO ₄ to ph < 2	28 days
Nitrate ⁹	100	P,G	Cool, 4°C	48 hrs.
Nitrite	50	P,G	Cool, 4°C	48 hrs.
Dissolved Oxygen Probe	300	G bottle/top	None Req.	Analyze Immediately

<u>Measurements</u>	<u>Vol. Reg. (mL)</u>	<u>Containers²</u>	<u>Preservatives^{3,4}</u>	<u>Holding Time⁵</u>
Winkler	300	G bottle/top	Fix on site and store in dark	8 hrs.
Phosphorus Ortho-phosphate, Dissolved	50	P,G	Filter on Site, Cool, 4°C	48 hrs.
Hydrolyzable	50	P,G	Cool, 4°C H ₂ SO ₄ to pH < 2	28 days
Total	50	P,G	Cool, 4°C H ₂ SO ₄ to pH < 2	28 days
Total, Dissolved	50	P,G	Filter on Site Cool, 4°C H ₂ SO ₄ to pH < 2	24 hrs.
Silica	50	P only	Cool, 4°C	28 days
Sulfate	50	P,G	Cool, 4°C	28 days
Sulfide	50	P,G	Cool, 4°C add 2 ml zinc acetate plus NaOH to ph > 9	7 days
Sulfite	50	P,G	None Req.	Analyze Immediately
400 <u>Organics</u>				
BOD	1000	P,G	Cool, 4°C	48 hrs.
COD	50	P,G	Cool, 4°C H ₂ SO ₄ to pH < 2	28 days
Oil and Grease	1000	G only	Cool, 4°C H ₂ SO ₄ to pH < 2	28 days
Organic carbon	25	P,G	Cool, 4°C H ₂ SO ₄ or HCl to pH < 2	28 days
Phenolics	500	G only	Cool, 4°C H ₂ SO ₄ to pH < 2	28 days
MBAS	250	P,G	Cool, 4°C	48 hrs.
NTA	50	P,G	Cool, 4°C	24 hrs.

APPENDIX D
STANDARD OPERATING PROCEDURES (SOPs)

300184

1.0 OBJECTIVE

The objective of these guidelines is to provide general reference information on tap-water sampling where the domestic water supplies are obtained from a well.

2.0 LIMITATIONS

These guidelines are for information only and are not to take precedence over the requirements of project-specific plans for tap-water sampling.

The complete evacuation of three to five volumes of the well may be impractical. The guideline suggests allowing the water to run 15 to 30 minutes. It is important to, wherever possible, collect the tap-water sample before the incoming water is processed through a filtration system or softener. Some homes may not have a valve before in-line treatment of the water by water softeners or filters.

3.0 DEFINITIONS

The following terminology is applicable to tap water sampling activities.

Tap Water Samples. Samples of ground water collected from a well providing domestic water supply. Usually tap samples are collected from the spigot nearest the well.

Holding-Tank. An in-house well water reservoir to provide a limited reserve-water supply and to equalize water pressure throughout the plumbing system. Most well holding-tanks have an average volume of 30 gallons.

Water Softener. A calcium-salt filter to remove calcium (CA^{++}) and magnesium (Mg^{++}) ions from potable water to reduce the hardness of the water supply.

4.0 GUIDELINES

Tap water sampling is usually conducted in private residential areas. Consequently, direct contact with the general public (i.e., the homeowner or concerned citizens) is inevitable. Keeping this in mind, members of the sampling team must present themselves in the utmost professional manner. Permission to collect the tap sample should be obtained in advance. At the time of sampling, Letter(s) of Introduction should be presented to the homeowner and permission to enter the household to collect the sample must again be requested. At no time should the sampling team enter a dwelling when an adult representing the head of the household is not present. Once sampling is completed the homeowner should be notified as to where and when to obtain the sampling results.

The well depth, casing size, and holding-tank volume should be obtained to calculate the standing volume of the system. The system is evacuated by removing three to five volumes by letting a tap run. If the well depth, casing size, or holding-tank volume is not readily available or is unknown, a tap is opened and allowed to run for 15 to 30 minutes.

Samples are to be collected in containers in accordance with the sampling guidelines from a point as close to the well as possible and before any storage tanks or before the water is processed through any water-treatment devices (e.g., softeners or filters). In many cases this may not be possible. When samples must be collected after the filtration or softener system, the situation must be documented in the logbook. The exact type of filtration system or softener in use is to be recorded. To determine whether desorption of the filters is occurring, samples may be collected after water has passed through treatment devices.

If samples are taken from direct water main connections, the spigot should be flushed for 2 to 3 minutes (15 to 30 minutes is not necessary) to clear the service line.

Samples are not collected from spigots after treatment (except as noted above) or from spigots that leak around their stems or that contain aeration devices or screens within the faucet.

For private wells equipped with hand or mechanical pumps, the water should be pumped for 5 minutes before the sample is collected directly from the discharge line.

Fill the appropriate sample containers directly from the spigot, with samples for VOA analysis filled first. Latex gloves should be worn during sample collection to avoid possible cross-contamination of the tap water samples.

The sample collection must be documented adequately in the project logbook. Use of the well record shown in Figure 1-1 is recommended.

Note: As it may be costly to completely purge a domestic supply system, the owner must be advised of this requirement in advance.

5.0 REFERENCES

Standard methods for the examination of water and wastewater. Fifteenth edition. pp. 36, 749, 786, 794. American Public Health Association, Washington D.C. 1981.

WELL RECORD

Date _____, 19__ Record by _____

Project _____ or Name _____ Well No. _____

Source of date _____

1. Location: State _____ County _____
Map _____

2. Owner: _____ Address _____
Tenant _____ Address _____
Phone No. _____
Driller _____ Address _____

3. Topography _____

4. Elevation _____ ft. above _____

5. Type: Dug, drilled, driven, bored, jetted

6. Depth: Reported _____ ft. Measured _____ ft.

7. Casing: Diam _____ in., to _____ in., Type _____
Depth _____ ft., Finish _____

8. Chief aquifer _____ From _____ ft. To _____ ft.
Others _____

9. Water level _____ ft. (measured) _____ (reported) Date _____
above

WELL RECORD (Continued)

10. Pump: Type _____ Capacity _____
Power: Kind _____ Horsepower _____
11. Yield: Flow _____ gal/min. Pump _____ gal/min. (Meas., Rept. Est. _____
_____ Drawdown _____ ft. after _____ hours pumping _____ gal/min
12. Use (Dom., Stock, PS., R.R., Ind., Irr., Obs.): _____
Adequacy, permanence _____
13. Quality _____ Temp. _____ F
Taste, odor, color _____ Sample (no) _____
Unfit for _____
14. Remarks: (Log, Analysis, Treatment, Storage Tank, Etc.)

15. Attached Sketch Maps/Profiles (yes) (no)

1.0 OBJECTIVE

The objective of these guidelines is to provide general reference information on surface water sampling.

2.0 LIMITATIONS

These limitations apply to all surface water sampling activities excepting requirements of project specific-plans for sampling.

3.0 DEFINITIONS

The following terminology is applicable to surface water sampling activities.

Surface Water. Streams, ponds, rivers, lakes, or other water-filled impoundments open to the atmosphere. Surface waters flow over or rest on the land.

Environmental Surface Water Samples. Portions of the aquatic environment that are collected to represent that environment for the purposes of analyzing for contaminant characterization.

Grab Sample. A discrete surface water sample representative of a specific location at a given point in time.

Composite Sample. A nondiscrete surface water sample composed of more than one specific aliquot collected at various locations or at different points in time.

Head Space. The amount of free space remaining above an aqueous sample in the sample container.

Transfer Device. Any instrument or vessel that contacts the sample during collection or transport (e.g., stainless steel dipper, modified Kemmerer sampler). Transfer devices are used in most sampling situations; except where aeration must be eliminated (samples for volatile organic analysis) or where significant material may be lost due to adhesion to the transfer container.

Modified Kemmerer Sampler. The Kemmerer sampler is a messenger-activated water sampling device. In the open position, water flows easily through the body of the sampler. Once lowered to the desired sampling depth, a messenger is dropped down the guy line, tripping the release mechanism and closing the bottle. In the closed position, the bottle is sealed, both on top and bottom, from any additional contact with the water column prior to sample retrieval.

4.0 GUIDELINES

Collection of surface water samples upstream and downstream of a hazardous waste site may be required to document an observed release to the surface water migration pathway. Selection of representative sampling locations will depend on many factors including stream dimensions, shape, flow rate, stream influents, and stream discharge. In addition, surface water samples may be collected on site from surface impoundments or recharge basins to document the presence and quantity of hazardous waste.

Samples from shallow depths can be readily collected by merely submerging the sample container. Preservatives must not be present in the container when it is lowered into the water. This method is advantageous when the sample might be significantly altered during transfer from a collection vessel into another container. Though a simple sampling method, representative, and generally free from substantial sample disturbance, a shortcoming is that the exterior of the container must be decontaminated after sample collection.

Depth and composite samples can be collected by using a transfer device, either disposable or constructed of a nonreactive material such as glass or stainless steel. The transfer device should have a capacity of at least 500 mL to minimize the number of times the surface water must be disturbed, thus reducing the risk of agitating any sediment layers. Use of the Kemmerer sampler is limited however by the incompatibility of its various construction materials with some analytical techniques. Proper selection of the Kemmerer construction will overcome this deficiency.

The following considerations should be taken into account during surface water sampling activities.

- o Avoid collecting surface water samples at the air-water interface, as film or debris at the surface may result in the collection of an unrepresentative sample.
- o Avoid turbulence when filling sample bottles.
- o Collect downstream samples before upstream samples.

- o Collect the surface water sample before the sediment sample if both media are to be sampled at the same location.
- o When sampling static surface water, consider thermal stratification which retards mixing and could possibly concentrate contamination at specific depths.
- o Do not stand in the surface waters being sampled, but downstream of location.

The following procedures may be employed for the collection of surface water samples at hazardous waste sites: (1) in-situ sampling; (2) sampling surface water using a dipper or other transfer device; and (3) collection of water samples from depth with a Kemmerer type sampler.

Procedure For In-Situ Surface Water Sampling

- o Submerge the sample container. For flowing waters, position the sample container so that the mouth faces upstream.
- o Remove the cap from the sample bottle while allowing the mouth to remain submerged.
- o For VOA samples, remove the cap and septum from the sample vial, invert the vial so that the mouth is facing straight down, submerge the vial, and turn the mouth up to fill.
- o Continue delivery of the sample until the bottle is almost completely filled. Except for VOA samples leave adequate head space to allow for sample expansion and sample preservation.
- o Decontaminate the exterior of the sample container.

Procedure For Sampling Surface Waters Using A Dipper Or Other Transfer Device

- o Submerge a pre-cleaned stainless steel dipper or other suitable transfer device with minimal surface disturbance.
- o Allow the device to fill slowly and continuously.
- o Retrieve the dipper/transfer device from the surface water with minimal disturbance.

- o Remove the cap from the sample bottle and slightly tilt the mouth of the bottle below the dipper/transfer device edge.
- o Continue delivery of the sample until the bottle is almost completely filled. Leave adequate ullage to allow for sample expansion and sample preservation.

Procedure For Collection Of Water Samples Using A Kemmerer Sampler

Procedures for use of the Kemmerer sampler are as follows:

- o Inspect the Kemmerer sampler for thorough cleaning and ensure that the drain valve is closed.
- o Measure and then mark the sampler guy line at the desired sampling depth.
- o Securely fasten the guy line to a stable, immovable object.
- o Open sampler by lifting upper stopper-trip head assembly.
- o Gradually lower sampler until the desired sampling depth is reached.
- o Place messenger on sample line and release.
- o Retrieve sampler; hold sampler by center rod to prevent accidental opening of the bottom stopper.
- o Rinse off the exterior of the sampler body with de-ionized water.
- o Recover sample by grasping the lower stopper and sampler body with one hand and transfer the sample by holding the drain valve over the sample container and opening the valve.
- o Allow sample to flow slowly down the side of the sample bottle with minimal disturbance. Except for VOA samples leave adequate ullage to allow for sample expansion and sample preservation.

Procedures for Filtering Surface Water Samples

- o Obtain a disposable filtering device constructed of polyethylene, polypropylene, or borosilicate glass, with a cellulose-based membrane filter of 0.45 μm nominal size.

- o Collect the metals fraction (filtered) of the surface water sample by either submerging the top portion of the filtering device or using a transfer device. If a transfer device is utilized, collect the sample into the transfer device and transfer to the filtering device.
- o Once the sample is collected in the filtering device, assemble the device and pass the sample through. As this process may vary with different manufacturers, follow the method included with the device.
- o Collect the sample into the proper sample container.
- o Continue collecting and filtering the surface water until the sample container is almost completely filled. Leave adequate head space to allow for sample expansion and sample preservation.
- o Clearly state on the paperwork for the laboratory that the sample has been field filtered.

5.0 REFERENCES

EPA, 1984 Characterization of hazardous waste sites -- A methods manual, Volume 11, Available sampling methods, Second edition, Section 3.2.1, Method III-1: Sampling surface waters using a dipper or other transfer device, p. 3-5. Section 3.2.4, Method III-4: Collection of water samples from depth with a Kemmerer bottle, pp. 3-14 to 3-16. Environmental Monitoring Systems Laboratory, Office of Research and Development. U.S. Environmental Protection Agency, Las Vegas, Nevada. EPA-600/4-84-076. December 1984.

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1.0 OBJECTIVE

The objective of these guidelines is to provide general reference information on groundwater sampling.

2.0 LIMITATIONS

These limitations apply to all groundwater sampling activities excepting requirements of project-specific plans for groundwater sampling.

3.0 DEFINITIONS

The following terminology is applicable to groundwater sampling activities.

Groundwater Samples. An aqueous sample that is representative of the groundwater contained in an underlying aquifer.

Aquifer. A geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield economical quantities of water to wells and springs.

Aquitard. A geologic formation, group of formations, or part of a formation of low permeability that can store groundwater and also transmit it slowly from one aquifer to another.

Aquiclude. A saturated geologic unit that is incapable of transmitting significant quantities of water under ordinary hydraulic gradients.

Water Table. A surface in an aquifer where groundwater pressure is equal to atmospheric pressure.

Static Water Level. The level of water in a well that is not being affected by withdrawal of groundwater.

Recharge. The addition of water to the zone of saturation.

Porosity. The percentage of the bulk volume of a rock or soil that is occupied by space, whether isolated or connected.

Permeability. The capacity of a porous rock, sediment, or soil to transmit a fluid; it is a measure of the relative ease of fluid flow under unequal pressure.

Hydraulic Conductivity. The rate of flow of water in gallons per day through a cross-section of one square foot under a unit hydraulic gradient at the prevailing temperature. Units: gpd/ft².

Equipotential Line. A contour line on the water table, i.e., a line along which the pressure head of groundwater in an aquifer is the same. Fluid flow is normal to these lines in the same direction of decreasing fluid potential.

Transmissivity. The rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient. Transmissivity values are given in gallons per minute through a vertical section of aquifer 1-foot wide and extending the full saturated height of an aquifer under a hydraulic gradient of 1.

Centrifugal Pump. A shallow-well suction pump with a centrifugal impeller to create suction which draws groundwater from a monitoring well through an inlet hose. The use of centrifugal pumps is limited by the depth of the water column within the well. The total lift, including the well stick-up above ground surface, cannot exceed 28 feet. In most cases, centrifugal pumps will not operate efficiently if the lift is greater than 20-22 feet; as the water-level of the well drops, so does pumping efficiency.

Submersible Pump. A deep-well impeller pump, submerged within the water column of a well, which forces water up through the outlet hose.

Bailer. A tall, narrow, stainless steel or teflon bucket equipped with a check valve on the bottom. The check valve allows water to enter from the bottom as the bailer is lowered, then prevents its release when the bailer is raised.

Popper. A metal cylinder that is 1 to 1 1/2 inches in diameter and 2 to 3 inches long with a concave undersurface; the popper is fastened to the end of a stainless steel measuring tape. When the popper is raised a few inches and dropped to hit the groundwater surface, it makes a distinct "pop". Depth to groundwater is determined by adjusting the length of tape to the point at which the popper just hits the water.

Electronic Water Level Indicator. An electronic sounder used to measure the depth to water in a well. The Electronic Water Level Indicator consists of a milliammeter, a measured electrical cable to determine depth, and a contact electrode. When the electrode contacts the groundwater, an electronic circuit is completed that registers on the milliammeter. Upon contact, depth to groundwater is determined from the measured electrical cable.

Weighted Steel Tape. A steel tape with a weight attached used to determine depth to the bottom of the well. A distinct impact is felt when the weight hits the bottom of the well. Depth to bottom is measured directly from the tape adjusted for the length of the weight.

Well Casing. Stainless steel, or PVC pipe used to keep the well borehole open.

Well Screen. Pipe with openings such as slots or holes open to the aquifer to allow groundwater into the well.

Riser Pipe. The well casing extending from the well screen to the ground surface.

Stick-up. Well casing that extends above the ground surface; also, the distance that the well casing extends above the ground surface.

Protective Casing. A short length of oversized diameter steel pipe with a locking cap to cover and protect the well stick-up.

4.0 GUIDELINES

Collection of groundwater samples from monitoring wells on or near a hazardous waste site may be required to document an observed release to the groundwater migratory pathway. To properly document groundwater contamination, a minimum of three well sampling points are required (i.e., one upgradient well to identify ambient groundwater quality and two downgradient wells to document contamination of the groundwater aquifer). The selection of monitoring wells for groundwater sampling is determined by the hydraulic gradient within the local aquifer. In order to determine the hydraulic gradient of the groundwater prior to sampling, water level measurements can be obtained from published groundwater surveys by the U.S. Geological Survey (USGS), from State agencies (i.e., New Jersey Department of Environmental Protection, Division of Water Resources), from County and local health departments, and from local well drillers.

In general, the following factors should be considered during selection of a monitoring well as a groundwater sampling point.

- o Regional groundwater flow direction
- o Depth of the aquifer of concern
- o Well location and accessibility
- o Topography of the site and well elevations
- o Physical condition of well and well construction
- o Analytical problems caused by contaminant interaction with well construction materials
- o Presence of fixed samplers or pumps
- o Well depth and water levels

Once monitoring wells have been chosen for sample collection, proper sampling procedures must be employed to obtain a sample that is representative of the groundwater at the location and to ensure that the sample is neither altered nor contaminated by the sampling and handling procedures.

To obtain a representative groundwater sample, the volume of stagnant water within the monitoring well must first be removed. After the initial static water level within the

monitoring well has been determined, the acceptable procedure to purge the well is to pump three to five volumes of standing water from the well prior to sampling, or to pump the well dry. A recommended method that may be used to verify the collection of a representative groundwater sample is to purge the well until measurements of pH and conductivity have stabilized over three to five well volumes.

Once the monitoring well has been properly purged, groundwater samples should be collected as soon as sufficient volume has recharged into the well to permit sampling. Groundwater entering the well for periods longer than 2 to 3 hours may render samples unrepresentative of groundwater contained in the aquifer system. Whenever full recovery exceeds 3 hours, groundwater samples should be collected in order of their volatility, with the VOA fraction collected within 3 hours of purging. Parameters that are not pH sensitive or subject to loss through volatilization should be collected last.

Generally, the following considerations should be taken into account during groundwater sampling activities.

- o Monitor well headspace for volatile organic vapors using a photoionization detector (PID) or flame ionization detector (FID).
- o All equipment entering the well should be cleaned with appropriate decontamination solutions and should be kept clean by staging the equipment on polyethylene plastic.
- o Plastic sheeting should be placed around the monitoring well to prevent sampling equipment from coming into contact with the ground.
- o All down-hole equipment must be constructed of Teflon, stainless steel, or polypropylene.
- o Bailers and pumps should have either polypropylene monofilament, stainless steel, or teflon coated wire for retrieval lines, or at a minimum, leaders of these materials.
- o Do not allow bailers or pumps to drop freely into the well.
- o Do not allow the bailer to rest against the outside well casing or scrape along the interior of the well.
- o Outer gloves should be changed before sampling or handling clean equipment.
- o Attempt to sample the mid-screen area of the well.
- o Be cognizant of the water level in the well. Drawdown in the well may slow the pump discharge rate. Overpumping the well will aerate the groundwater.
- o Be sure the well cap is closed after sampling.

The following procedures govern groundwater sampling activities at hazardous waste sites.

Two methods may be employed to establish the static water level within a monitoring well: (1) determining the water level using a Popper; and (2) determining the water level using an Electronic Water Level Indicator.

Procedure for Determining Depth to Groundwater Using a Popper

Figure 1 depicts a Popper. Procedures for use of the Popper to determine the water level within a monitoring well are as follows.

- o Clean the stainless steel measuring tape and Popper according to established decontamination procedures.
- o Open the well cap and measure the height of the stick-up.
- o Carefully lower the Popper attached to the end of the measuring tape until Popper contacts the groundwater surface. When the Popper is raised a few inches and dropped to hit the water surface, it will make a distinct popping sound.
- o Adjust the length of the measuring tape to where the Popper just hits the water surface. Record the depth from the top of the stick-up to the groundwater surface.
- o To determine depth to groundwater, subtract the height of the stick-up, from the depth to groundwater from the top of the stick up.

Procedure for Determining Depth To Groundwater Using an Electronic Water Level Indicator

Figure 2 depicts an Electronic Water Level Indicator. Procedures for use of an Electronic Water Level Indicator to determine the water level within a monitoring well are as follows.

- o Clean the Water Level Indicator according to established decontamination procedures. Be sure that the contact electrode is dry before attempting to take a water level measurement.
- o Open the well cap and measure the height of the stick-up.
- o Carefully lower the contact electrode until the electrode touches the groundwater surface. At that point, the electronic circuit of the Water Level Indicator will be complete and a positive deflection will be notable on the needle of the milliammeter. Record the depth from the top of the stick-up to the ground water surface.
- o To determine depth to groundwater, subtract the height of the stick-up, from the depth to groundwater from the top of the stick-up.

Once the depth to groundwater has been determined, the following procedure may be employed to determine the volume of water necessary to purge the monitoring well prior to sampling.

Procedure to Determine the Volume of Standing Water in a Monitoring Well

Prior to collection of groundwater samples from a monitoring well, three to five volumes of standing water must be removed from the well to ensure that the samples collected are representative of the groundwater in the aquifer of concern. The procedure for determining the volume of standing water in a monitoring well is as follows.

- o Clean all down-hole equipment according to all established decontamination procedures.
- o Measure the depth to groundwater from the top of the stick-up using a steel tape with weight attached.
- o Measure the diameter of the well; determine the radius.
- o Determine the depth of the water column in the well by subtracting the depth to the bottom of the well from the depth to groundwater.
- o Determine the volume of standing water in the well using the following equation:

$$V = \pi * r^2 * L_w * (7.48 \text{ gallons (of liquid)/cubic feet})$$

V = volume of the well

π = 3.14

r^2 = radius of the well in feet, squared

L_w = depth of the water column in feet (depth to well - depth to water)

- o Multiply the volume of standing water in the well (V) by 5 to calculate the volume of water that must be evacuated from the well prior to sampling.

An alternate method to calculate the volume of standing water that must be evacuated from a monitoring well prior to sampling simply involves reading the water column volume from a well casing-volume conversion chart.

Table 1 presents a Well Casing-Volume Conversion Chart. This chart provides a fast, infield method to determine the volume of standing water in a well. Once the diameter of the well has been measured, and the depth of the water column has been established using the aforementioned procedures, well casing-volume can be determined using Table 1. For example, a 6-inch diameter well with an 8 foot water column would require removing 11.7 gallons of water to purge 1 well volume.

Once the volume of water required to properly purge a monitoring well prior to sampling has been determined, the following procedures may be employed to purge the well.

TABLE 1
 WELL CASING-VOLUME
 CONVERSION CHART (Gallons)

WELL CASING DIAMETER (INCHES)

	1.0	1.5	2.0	3.0	4.0	6.0	8.0	10.0	12.0	14.0	16.0	18.0	24.0	36.0	48.0
1	0.04	0.09	0.16	0.37	0.65	1.5	2.6	4.1	5.9	8.0	10.4	13.2	23.5	52.9	94.0
5	0.2	0.5	0.8	1.3	3.3	7.3	13	20	2.9	4.0	5.2	6.6	11.7	26.4	47.0
10	0.4	0.9	1.6	3.7	6.5	1.5	2.6	4.1	5.9	8.0	10.4	13.2	23.5	52.9	94.0
20	0.8	1.8	3.3	7.3	13	2.9	5.2	8.2	11.7	16.0	20.9	26.4	47.0	105.8	188.0
40	1.6	3.6	6.5	15	2.6	5.9	10.4	16.3	23.5	32.0	41.8	52.9	94.0	211.5	376.1
60	2.4	4.5	9.8	2.2	3.9	8.8	15.7	24.5	35.3	48.0	62.7	79.3	141.0	317.3	564.1
80	3.3	7.3	13	2.9	5.2	11.7	20.9	32.6	47.0	64.0	83.6	105.8	188.0	423.1	752.2
100	4.1	9.2	1.6	3.7	6.5	14.7	26.1	40.8	58.8	80.0	104.5	132.2	235.1	528.9	940.2

Procedure to Purge Monitoring Wells

Methods used to purge monitoring wells are dependent upon the depth of the well. Wells under 28 ft. in depth from the top of the stick-up to the bottom of the well may be evacuated using surface-positioned centrifugal pumps, or hand-bailed. Wells with a depth greater than 28 ft. from the top of the stick-up to the bottom of the well may be purged using submersible pumps, or hand-bailed.

Procedure to Confirm Proper Purging of Monitoring Wells

When at least three volumes of groundwater have been purged from a monitoring well and there is any doubt as to the adequacy of well purge, the purging procedure should be confirmed with field parameter readings (i.e., of dissolved oxygen, Eh, pH, specific conductance, and temperature) of three consecutive additional well volumes. The following procedure may be employed to confirm proper purging of a monitoring well. If the well is pumped dry, and obviously purging is confirmed, field parameter readings for this purpose are not necessary and the following procedure will not apply.

- o Using a 250 ml beaker, collect a sample of the well volume being evacuated from the monitoring well.
- o Determine the field parameter levels of the sample.
- o Record the field parameter readings of the initial well volume.
- o Collect samples from the second and third consecutive volumes purged from the monitoring well. Measure and record the field parameters.
- o If the final two well volumes are representative of the groundwater in the aquifer, all field parameter readings will not vary more than 10 percent between consecutive readings.
- o If the field parameter measurements are stable, sufficient quantity of standing water has been purged from the monitoring well to ensure collection of a representative groundwater sample.

After the proper purging of a monitoring well, groundwater samples may be collected using the following procedure.

Procedure for Groundwater Sampling Using a Bailer

Figure 3 depicts a stainless steel bailer. Procedures for the collection of groundwater samples using a bailer are as follows.

- o Clean the stainless steel bailer according to the requirements for the analytical parameters to be measured.

- o Attach a 3 ft stainless steel wire leader to the top of the sampler using 5/8-inch stainless steel U-bolts.
- o Attach a solid braided 3mm (1.8 inch) nylon guy line to the stainless steel teflon coated leader.
- o Securely fasten the guy line to a stable immovable object.
- o Carefully lower the bailer into the well to mid-screen depth to collect the sample. NOTE* Do not allow the bailer to freely drop into the well or scrape the sides of the well casing when collecting the sample.
- o Carefully raise the bailer from the well, coiling the bailer guy line as the sample is retrieved. NOTE* Do not allow the bailer guy line or other sampling equipment to come in contact with the ground surface.
- o Immediately collect the VOA sample. Transfer the remaining sample into appropriate sample containers. Repeat the sampling procedure until sufficient sample quantity has been collected for the BNA, pesticide/PCB, and inorganic sample fractions.

In the event that a bailer is lost down a monitoring well, the bailer can be easily retrieved using a 1 1/2 oz. Diamond Jig (obtained from a Sporting Goods store) attached to either a length of the bailer guy line or to a length of monofilament fishing line.

Low Rate Purging and Sampling using a Variable Rate Submersible Pump

Under special field conditions and when requested by the reviewing agency (i.e., USEPA) the collection of groundwater samples will be conducted using the low rate (less than 500 ml/min) purging and sampling procedure recommended by recent researchers to minimize physical or chemical alteration of the sample during withdrawal (i.e. Puls et al., Hazardous Waste and Hazardous Materials, V.9, No. 2, 1992).

The procedure for the low rate purging and sampling is made up of the following steps:

- o Refer to the Procedure for Determining Depth to Groundwater Using an Electronic Water Level Indicator for the first step of the procedure (see page 5 of 13)
- o Lower variable rate submersible pump (i.e., Grundfos Redi-Flo 2) into the well to just above or within the screened interval and begin water removal. Monitor discharge water using a PID or FID for volatile organic gases. Collect or dispose of discharge water in an acceptable and approved manner.
- o Measure pumping rate frequently. A calibrated container and stopwatch are most commonly used.

- o Monitor and record measurements of field parameters during purging to provide an indication of groundwater equilibration and stabilization at the sampling point. Field parameters to be monitored include, temperature, specific conductance, pH, Eh, and dissolved oxygen.
- o After each of the field parameters have stabilized (i.e., not more than 10 percent variation between two consecutive readings), the total volume of water removed will be recorded and the well will be sampled. If the field parameters do not stabilize, purging will continue until five volumes of water are removed.
- o Sample collection will be conducted by filling the sample containers directly from the discharge line. Sampling will follow purging without interruption of the submersible pump flow rate in order to minimize the disturbance of the overlying stagnant water column in the well.

5.0 REFERENCES

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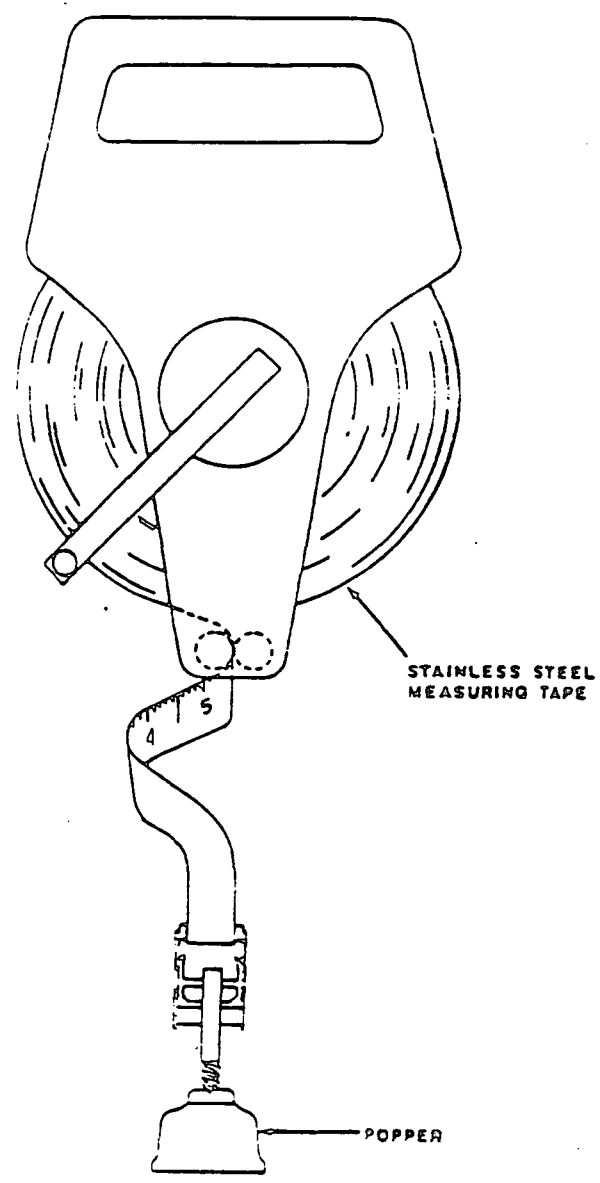


FIGURE NO. 1 SCHEMATIC OF THE POPPER

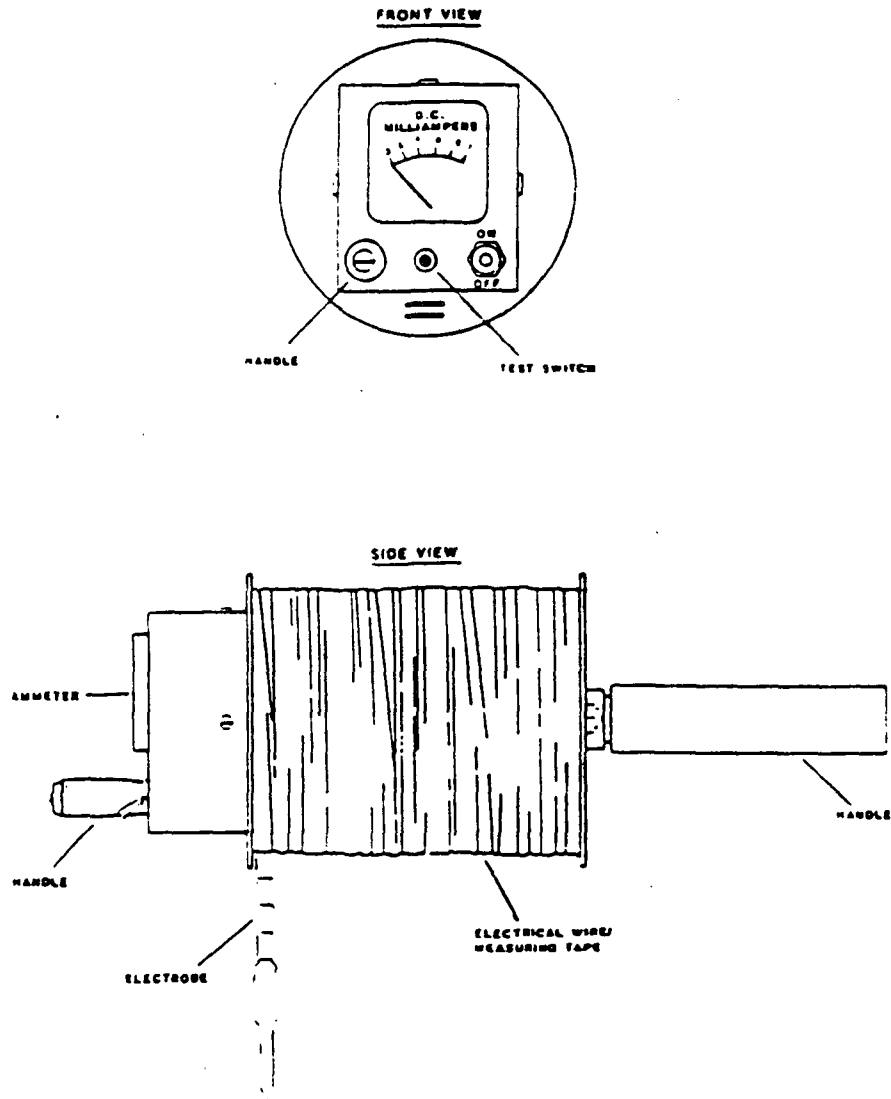


FIGURE NO. 2 SCHEMATIC OF THE ELECTRONIC WATER LEVEL INDICATOR
D-21

300205

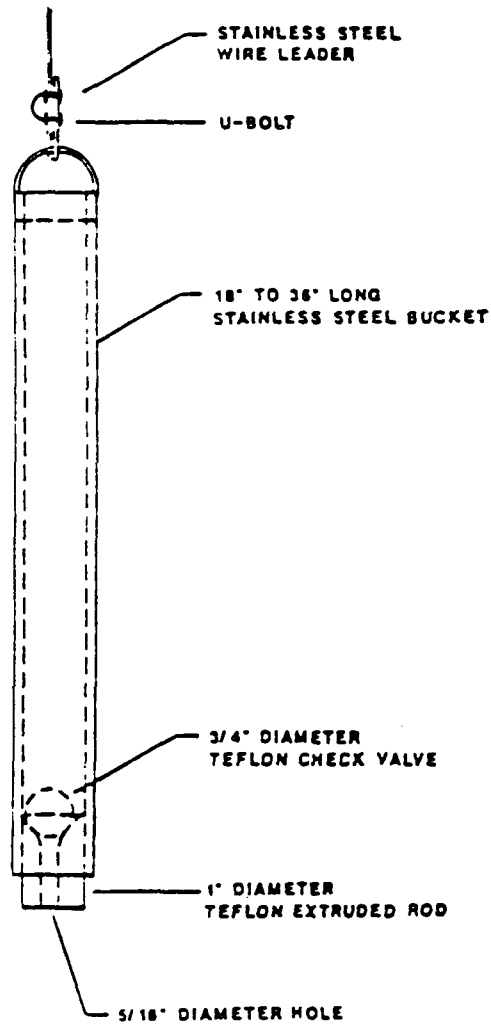


FIGURE NO. 3 SCHEMATIC OF A BAILER

1.0 OBJECTIVE

The objective of these guidelines is to provide general reference information on sediment sampling.

2.0 LIMITATIONS

These limitations apply to all sediment sampling activities excepting requirements of project-specific plans for sediment sampling.

3.0 DEFINITIONS

The following terminology is applicable to sediment sampling activities.

Sediment Samples. Materials of geologic origin (i.e., silts, sands, soils, and gravels) and/or organic matter deposited by water.

Environmental Samples. Samples with mid or low-concentration contamination, such as sediment samples from streams, ditches, or surface impoundments, that are collected at some distance from direct sources of contaminants.

Grab Sample. A discrete sediment sample representative of a specific location at a given point of time.

Composite Sample. A nondiscrete sediment sample composed of more than one specific aliquot collected at various locations or at different points in time.

Transfer Device. Any instrument or vessel that contacts the sample during collection or transport (eg. stainless steel trowel, Eckman dredge, Ponar dredge, stainless steel mixing bowl).

Eckman Dredge. A spring-activated clamshell-type scoop. The dredge is first lowered beneath the surface water in the open position and set upon the top layer of the sediment deposit. When the messenger is dropped down the guy line, the spring is tripped and closes the clamshell.

Ponar Dredge. A clamshell-type scoop activated by a counter-lever system. The shell is opened, latched in place, and slowly lowered to the bottom. When tension is released on the lowering cable, the latch releases and the lifting action of the cable on the lever system closes the clamshell.

Hand Corer. A thin-wall cover modified by the addition of a handle and a check valve on top. The corer is lowered beneath the surface water and driven through the sediment in a continuous motion. Once filled to capacity the corer is twisted in the sediment prior to removal.

Gravity Corer. A metal tube with a replaceable tapered nose piece on the bottom and a ball or check valve on top. Attached to a sample line, the corer free falls through the liquid into the sediment. Retrieval requires lifting the corer in a smooth continuous motion.

4.0 GUIDELINES

Collection of sediment samples upstream and downstream of a hazardous waste site may be required to document an observed release to the surface water migratory pathway. Sediments are examined to measure whether contaminants are concentrating along stream bottoms, creating hot spots that may have high concentrations of heavy metals, pesticides, or low-solubility organic matter. Further, streams, lakes, and impoundments will likely demonstrate significant variations in sediment composition with respect to distance from inflows, discharges, or other disturbances. Therefore, the exact sampling location must be documented by means of triangulation with stable references on the banks of the stream or impoundment. In addition, the presence of rocks, debris, and organic material may complicate sampling and preclude the use of or require modification to sampling techniques.

Sediment samples near shore or above the water line are easily collected using a simple stainless steel trowel, scoop, or hand corer. If sediments are to be collected from deeper, larger streams or surface impoundments, clamshell scoops, such as the Eckman dredge or the Ponar dredge or a gravity corer may be used to obtain samples.

In general, the following considerations should be taken into account during sediment sampling activities.

- o Collect the sediment sample after the surface water sample if both media are to be sampled at the same location.
- o Collect downstream sediment samples before upstream samples.
- o Do not stand in the sediment deposits being sampled.
- o If collected as a composite, collect at least three small, equal-sized sediment sample aliquots from several points along the sediment deposition area. Carefully composite the sample in a stainless steel mixing bowl prior to filling the sample jars

The following procedures may be employed for the collection of sediment samples at hazardous waste sites: (1) collection of sediments using a stainless steel trowel or scoop; (2) collection of sediments with an Eckman dredge; (3) collection of sediments with a Ponar dredge; (4) collection of sediments with a hand corer; and (5) collection of sediments with a gravity corer.

Procedure For Sediment Sampling Using A Stainless Steel Trowel or Scoop.

- o Clean the stainless steel trowel or scoop according to the requirements for the analytical parameters to be measured.
- o Insert the stainless steel trowel or scoop into the sediments and remove the sample. First, rocks, twigs, leaves and other debris should be removed if they are not considered part of the sample. The soil is then removed from the sampling device and placed in a stainless steel pan, then thoroughly mixed using a stainless steel spoon. The sediment in the pan should be scraped from the sides, corners and bottom of the pan, rolled to the middle of the pan and initially mixed. The sample should then be quartered and moved to the four corners of the pan. Each quarter of the pan sample should be mixed individually and then rolled to the center of the container and the entire sample mixed again.
- o Composite the sediment sample aliquots in a stainless steel mixing bowl prior to filling the sample jars. However, the sediment VOA sample should be collected directly from the sediment deposit before compositing.
- o Transfer the composited sediment sample into the appropriate sample jars using a stainless steel trowel or spatula.

Procedure for Sediment Sampling Using An Eckman Dredge

Figure 1 shows a schematic of the Eckman dredge. Procedures for use of the Eckman dredge are as follows.

- o Clean the stainless steel Eckman dredge according to the requirements for the analytical parameters to be measured.
- o Attach the necessary length of guy line to the dredge. Solid braided 5 mm (3/16 inch) nylon line is normally used for this purpose.
- o Slip the messenger onto the guy line and securely fasten the guy line to a stable immovable object.
- o Open the sampler jaws one at a time and attach the stainless steel clamshell leader to the trip head.
- o Lower the Eckman dredge to the top layer of the sediment deposit to be sampled.
- o Keeping the guy line slightly taut, drop the messenger down the guy line to release the trip head causing the clamshell jaws to spring shut.
- o Slowly raise the Eckman dredge clear of the surface.

-
- o Place the dredge in a stainless steel mixing bowl.
 - o Open the top lids of the Eckman dredge to collect the sample.
 - o Collect the sample from the center of the dredge to avoid potential cross-contamination of the sediments with the sides of the dredge.
 - o Collect the sediment VOA directly from the dredge using a stainless steel spatula. Composite the remaining sample in a stainless steel mixing bowl. Repeat the sampling procedure until sufficient sample quantity has been collected for the BNA, pesticide/PCB, and inorganic sample fractions.
 - o Transfer the composited sediment sample into the appropriate sample jars using a stainless steel trowel or spatula.

Procedure for Sediment Sampling Using A Ponar Dredge

Figure 2 shows a schematic of the Ponar Dredge. Procedures for use of the Ponar dredge are as follows.

- o Clean the stainless steel Ponar dredge according to the requirements for the analytical parameters to be measured.
- o Attach the necessary length of guy line to the dredge. Solid braided 5 mm (3/16 inch) nylon line is normally used for this purpose.
- o Measure and mark the distance to the top of the sediment deposit on the guy line.
- o Securely fasten the guy line to a stable immovable object.
- o Remove the safety locking pin.
- o Open the clamshell jaws until latched. From this point on, support the Ponar dredge by the guy line, or the sampler will be tripped and the jaws will close.
- o CAUTION Use extreme care in opening the Ponar dredge. Serious injury can result from getting a finger crushed in either the counter levers or the clamshell jaws.
- o Lower the Ponar dredge until contact with the sediment deposit is felt. Use the markings on the guy line to gauge the depth of the sediment deposit.
- o Allow the guy line to slacken to close the jaws of the dredge.
- o Slowly raise the Ponar dredge clear of the surface.

- o Place the dredge in a stainless steel mixing bowl and open the clamshell jaws to remove the sediment sample.
- o Immediately collect the sediment VOA sample. Composite the remaining sample in the stainless steel mixing bowl. Repeat the sampling procedure until sufficient sample volume has been collected for the BNA, pesticide/PCB, and inorganic sample fractions.
- o Transfer the composited sediment sample into the appropriate sample jars using a stainless steel trowel or spatula.

Procedure for Sediment Sampling Using a Hand Corer

Figure 3 shows a schematic of the hand corer. Procedures for the use of the hand corer are as follows.

- o Inspect the corer for proper precleaning.
- o Force corer in with smooth continuous motion.
- o Twist corer then withdrew in a single smooth motion.
- o Remove nosepiece and withdraw sample into a stainless steel or Teflon tray.
- o Transfer sample into an appropriate sample bottle with a stainless steel lab spoon or equivalent.
- o Check that a Teflon liner is present in cap if required. Secure the cap tightly. The chemical preservation of solids is generally not recommended. Refrigeration is usually the best approach supplemented by a minimal holding time.
- o Label the sample bottle with the appropriate sample tag. Be sure to label the tag carefully and clearly, addressing all the categories or parameters. Complete all chain-of-custody documents and record in the field logbook.
- o Place the properly labeled sample bottle in an appropriate carrying container maintained at 4°C throughout the sampling and transportation period.

Procedures for Sediment Sampling Using a Gravity Corer

Figure 4 shows a schematic of the Gravity corer. Procedures for the use of the gravity corer are as follows.

- o Attach a precleaned corer to the required length of sample line. Solid braided 5 mm (3/16 inch) nylon line is sufficient; 20 mm (3/4 inch) nylon, however, is easier to grasp during hand hoisting.

- o Secure the free end of the line to a fixed support to prevent accidental loss of the corer.
- o Allow corer to free fall through liquid to bottom.
- o Retrieve corer with a smooth, continuous lifting motion. Do not bump corer as this may result in some sample loss.
- o Remove nosepiece from corer and slide sample out of corer into stainless steel or Teflon pan.
- o Transfer sample into appropriate sample bottle with a stainless steel lab spoon or equivalent.
- o Check that a Teflon liner is present in cap if required. Secure the cap tightly. The chemical preservation of solids is generally not supplemented by a minimal holding time.
- o Label the sample bottle with the appropriate sample tag. Be sure to label the tag carefully and clearly, addressing all the categories or parameters. Complete all chain-of-custody documents and record in the field logbook.
- o Place the properly labeled sample bottle in an appropriate carrying container maintained at 4°C throughout the sampling and transportation period.

5.0 REFERENCES

EPA, 1984 Characterization of hazardous waste site - A methods manual, Volume 11, Available sampling methods, Second edition, Section 2.3.1, Method II-3: Collection of sludge or sediment samples with a scoop. p. 2-9. Section 2.3.4, Method II-6: Sampling bottom sludges or sediments with a ponar grab. Section 2.3.2, Method 11-4: Sampling sludge or sediments with a hand corer. p. 2-10. Section 2.3.3, Method 11-5: Sampling bottom sludges or sediments with a gravity corer. pp 2-12 to 2-14, pp 2-15 to 2-17. Environmental Monitoring Systems Laboratory, Office of Research and Development. U.S. Environmental Protection Agency, Las Vegas, Nevada. EPA-600/4-84-076. December 1984.

EPA, 1987. A compendium of Superfund field operations methods. Section 10.2.6.3: Methods and applications: Sediments and sludges, pp. 10-40 to 10-43; p.10-47. Office of Emergency and Remedial Response, Office of Waste Programs Enforcement. U.S. Environmental Protection Agency, Washington, D.C. EPA/540/P-87/001. December 1987.

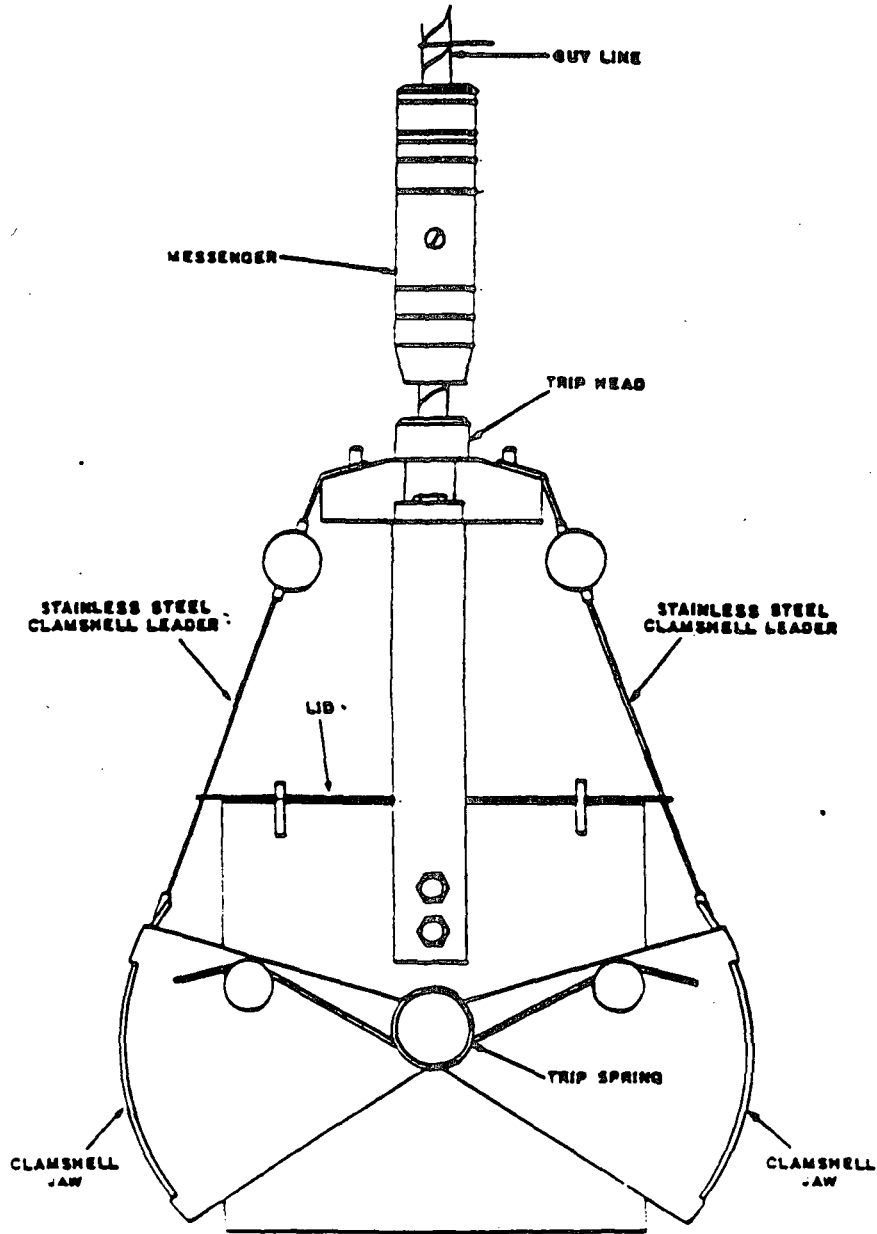


FIGURE NO. 1 SCHEMATIC OF THE ECKMAN DREDGE
D-30

300214

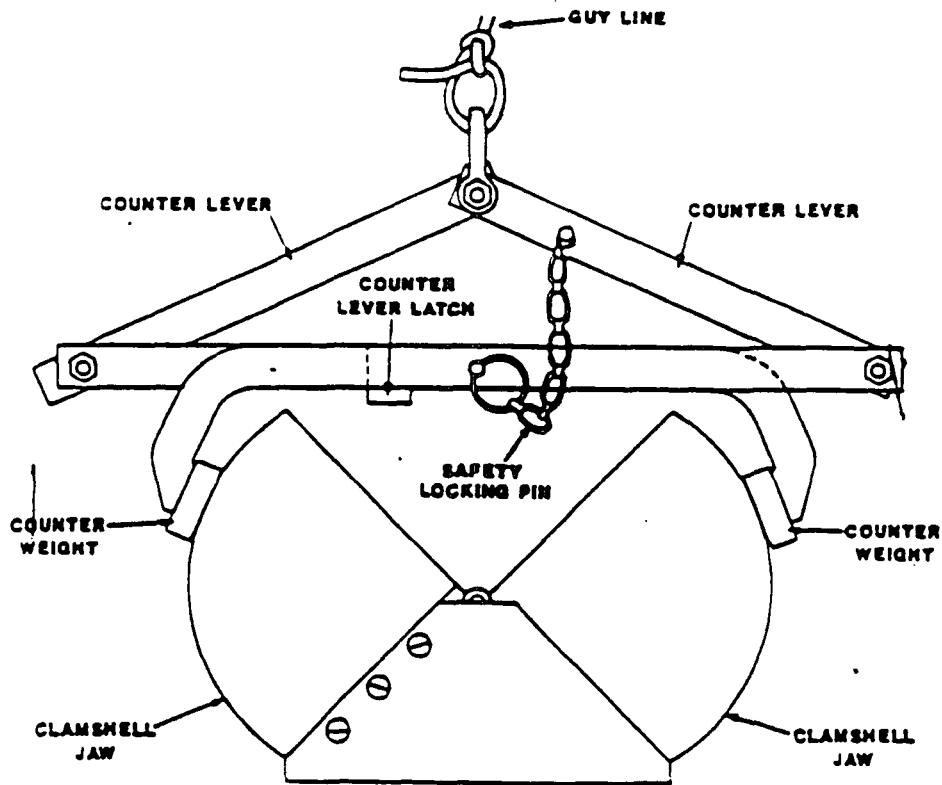


FIGURE NO. 2 SCHEMATIC OF THE PONAR DREDGE

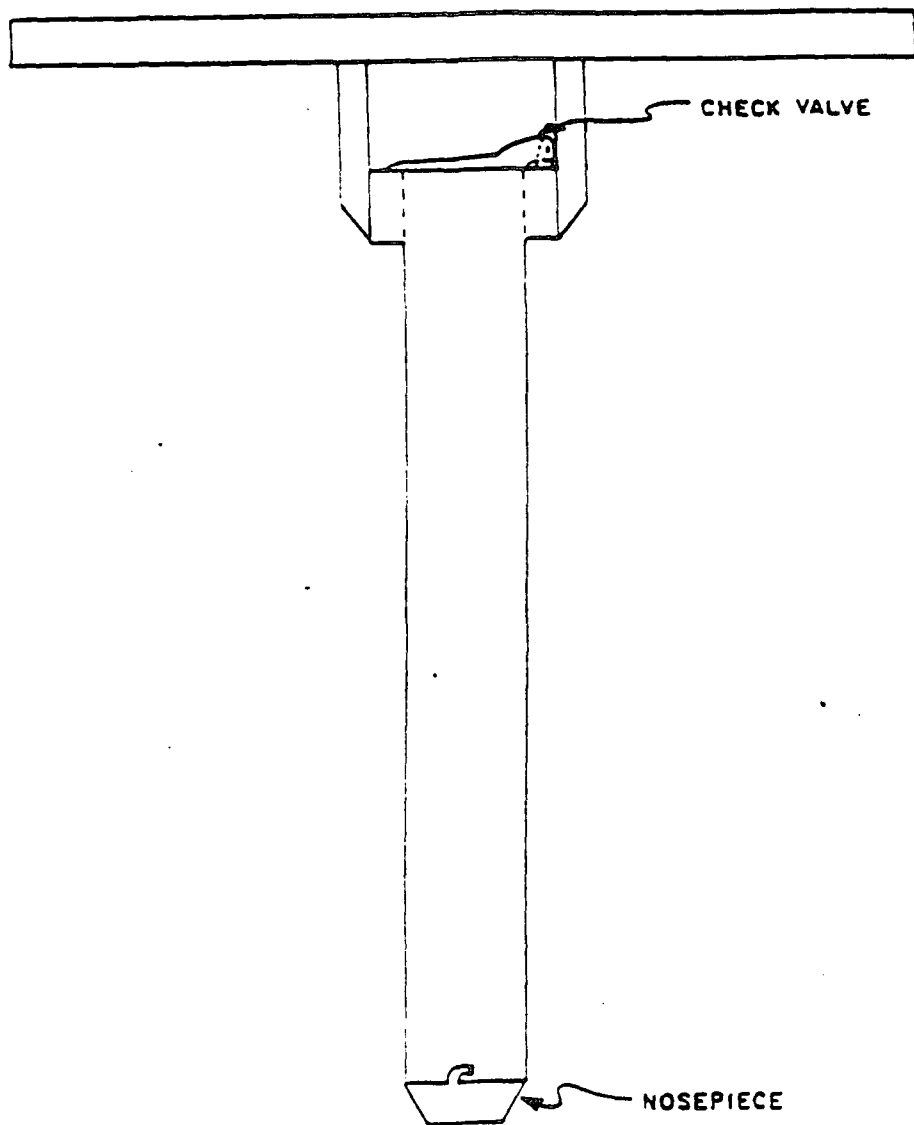


FIGURE NO. 3 SCHEMATIC OF THE HAND CORER
D-32

300216

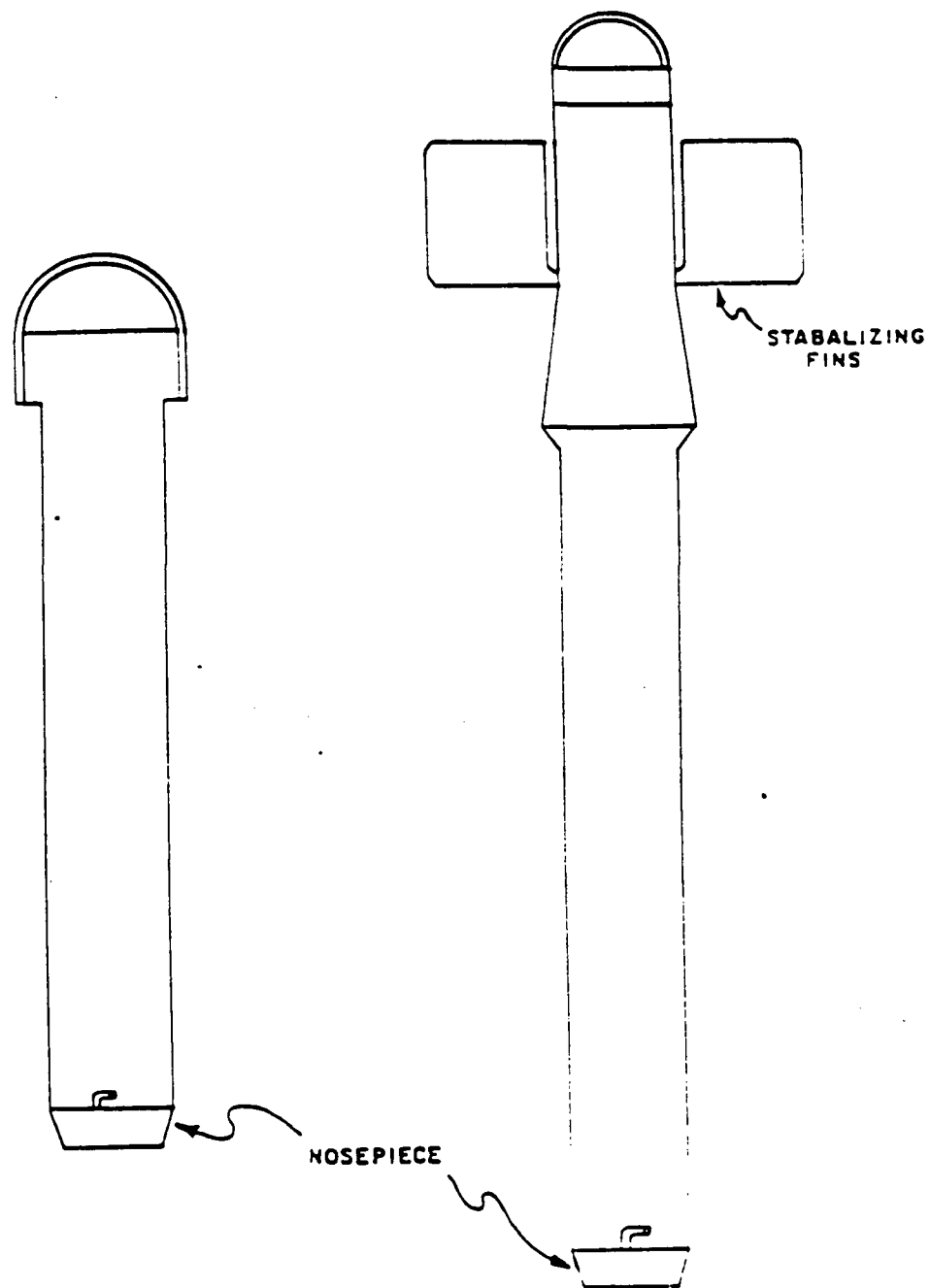


FIGURE NO. 4 SCHEMATIC OF THE GRAVITY CORER

1.0 OBJECTIVE

The objective of these guidelines is to provide general reference information on the aspects of split spoon sampling.

2.0 LIMITATIONS

These limitations apply to all split spoon sampling operations excepting requirements of project-specific plans for split spoon sampling.

3.0 DEFINITIONS

Split Spoon Sampler - The split-spoon sampler is a thick-walled steel tube that is split lengthwise. A cutting shoe is attached to the lower end; the upper end contains a check valve and is connected to a drill rod. The sampler is then driven 18-24 inches into the ground to collect the sample in accordance with a standard penetration test (ASTM 1586).

Soil Samples - Environmental samples of potentially contaminated soil, where soil is defined as a layer of weathered, unconsolidated material; often also may be defined as containing organic matter and being capable of supporting plant growth.

4.0 GUIDELINES

Prior to sampling 0.5 mil polyethylene sheeting shall cover a sturdy workbench to prevent the split-spoon and its contents from coming in contact with the workbench (several layers of sheeting may be placed on the workbench so that they may be removed between each sample or as needed).

The following is an organized approach to split-spoon sampling:

- o Measure the sampling equipment lengths to ensure they conform to specifications. Select additional components as required (i.e., leaf spring core retainer for clays or a sand trap for non-cohesive sands).
- o Remove any drill rods and lower the sampler to the bottom of the auger column and check the depth against length of the rods and the sampler.
- o Attach the drive head and hammer the top of the drill rods without the weight resting on the rods.
- o Mark four 6-inch intervals on the drill rods relative to a drive reference point on the rig. With the sampler resting on the bottom of the hole, drive the sampler with the 140 lb. hammer falling freely over its 30-inch fall until 24 inches have been penetrated or 100 blows applied.
- o Record the number of blows per 6 inches. Determine the "N" value by adding the blows for the 6 to 12 inches and 12 to 18 inch interval of each sample attempt.

- o After penetration is complete, let the sampler sit for a minimum of 3 minutes, then rotate the sampling rods clockwise three full turns and remove the sampler.
- o Place the split-spoon sampler on a clean sheet of 0.5 mil polyethylene, with the cutting shoe oriented toward the right.
- o Unscrew the cutting shoe and head in a counter clockwise direction from the steel tube halves. NOTE: Two 24-inch, 1 1/2 x 3 inch brass jaw Stillson wrenches are usually required to free the threads of the cutting shoe. Place one Stillson wrench, jaws facing up, on the steel tubes of the split-spoon, centering the split of the tube halves between the jaws of the wrench. Place the second Stillson wrench, jaws facing down, on the cutting shoe, pressing downward on the wrench to turn the cutting head free of the split-spoon.
- o Remove the head and carefully open the halves of the split-spoon.
- o Log the soil core using Unified Soil Classification System procedures.
- o Collect samples of the soil core in 6 inch increments using a stainless steel spatula.
- o Immediately collect the soil VOA, and moisture content samples. Composite the remaining sample in a stainless steel mixing bowl.
- o Place VOA and moisture content samples in the appropriate containers and label those containers.
- o Document all properties and sample locations in a Project Field Book.
- o Place soil samples in suitable containers, label and store samples on-site.

5.0 REFERENCES

Driscoll, F.G., 1987, Groundwater and Wells: Johnson Division, St. Paul Minnesota, p. 1098.

ASTM D 1586-84, Standard Method for Penetration Test and Split-Barrel Sampling of Soils.

EPA 1987. A Compendium of Superfund Field Operations Methods. Section 8.1.6.2.1: Split-Spoon Samplers, p. 8.1-20. Office of Emergency and Remedial Response, Office of Waste Programs Enforcement. U.S. Environmental Protection Agency, Washington, D.C. EPA/540/p-87/001. December 1987.